Woomera’s Women: Rolls and Roles of Film
Camera operators on the Anglo-Australian rocket range
1947-1970

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This thesis is presented for the degree of Doctor of Philosophy
of Murdoch University

College of Arts, Business, Law & Social Sciences

February 2020
Declaration

I declare that:

a. The thesis is my own account of my research, except where other sources are fully acknowledged by referencing or endnotes.

b. The thesis contains as its main content work which has not been previously submitted for a degree at any tertiary education institution.

c. The thesis has been proof-read by a professional editor and complies with the standards set out by the Murdoch Graduate Research Office.

d. The thesis includes work that has been approved by the Murdoch University Human Research Ethics Committee (Approval No. 2017/048) and conducted in accordance with University ethics and fieldwork guidelines.

Stella M. Barber

February 2020
Abstract

With the aftermath of World War II and the onset of the Cold War, Australia hosted with the UK one of the few global centres dedicated to the research, development and testing of rockets, jets and other long-range weapons, including Britain’s atomic warheads. By the mid 1950s a new purpose-built town had been constructed in the Australian desert, named “Woomera”, with a population of 7,000 at its peak. No expense was spared in establishing the testing grounds, laboratories and infrastructure – which included a security cleared film laboratory and production facilities at Salisbury near Adelaide – to support the Anglo-Australian Joint Project’s research and experimentation.

This dissertation examines pioneering work undertaken by women at Woomera and Salisbury within the context of Australia’s broader social history. Women’s roles at Woomera were initially expected to be traditional – supportive wives and mothers. My research features the women who undertook new roles operating the sophisticated kinetheodolites and Vinten cameras that filmed and tracked the rocket firings, and the women referred to as “computers” who assisted in the pre- and post-production process, including data evaluation. Previous studies of Woomera (e.g., Morton, 1989, Southall 1962) exclude any detailed mention of this industrial phenomenon – women as camera operators and data analysts/computers. My dissertation addresses this significant gap in the literature as the first systematic oral history of these secret Cold War undertakings.

The gendered aspects, political economy and unique cohort of this research radically challenges the normative assumptions concerning Australian women and workplaces during what is commonly perceived of as a conservative era. Recent scholarship (e.g., Shetterly 2016) in the United States and the United Kingdom has highlighted work of female mathematicians during World War II and the space race. Given the age of these trailblazing women, it is timely that due attention be given to Australia’s “hidden figures”.

This thesis is dedicated to Laurie East, who was the original source of inspiration for my research, and also to all those who worked on the cameras and have given generously of their time in informing my work.
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<td>ACMI</td>
<td>Australian Centre for the Moving Image</td>
</tr>
<tr>
<td>ASIO</td>
<td>Australian Security Intelligence Organisation</td>
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<tr>
<td>ATS</td>
<td>Auxiliary Territorial Service</td>
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<tr>
<td>DSTG</td>
<td>Defence Science and Technology Group</td>
</tr>
<tr>
<td>DSTO</td>
<td>Defence Science and Technology Organisation</td>
</tr>
<tr>
<td>ELDO</td>
<td>European Launcher Development Organisation</td>
</tr>
<tr>
<td>EMU</td>
<td>Easily Movable Unit</td>
</tr>
<tr>
<td>IWM</td>
<td>Imperial War Museum</td>
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<tr>
<td>LRWE</td>
<td>Long Range Weapons Establishments</td>
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<tr>
<td>MIA</td>
<td>Moving Image Archive (Glasgow)</td>
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<tr>
<td>NAA</td>
<td>National Archives of Australia</td>
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<td>NFSA</td>
<td>National Film and Sound Archive (Australia)</td>
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<td>NLA</td>
<td>National Library of Australia</td>
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<td>NMS</td>
<td>National Museum of Scotland</td>
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<tr>
<td>RAAF</td>
<td>Royal Australian Air Force</td>
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<tr>
<td>WRESAT</td>
<td>Weapons Research Establishment Satellite</td>
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<td>WRETAR</td>
<td>Weapons Research Establishment Target Aircraft Recorder</td>
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<tr>
<td>WRE</td>
<td>Weapons Research Establishment</td>
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<td>WSMR</td>
<td>White Sands Missile Range</td>
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Introduction: Useful and Timely

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The women play a lot of sport, are regular cinema-goers, [...] like poker, will dress up at the whisper of a real party, and are always ready for a picnic or a barbeque in the donga. [...] The women also gossip furiously [...] and] they have more babies than almost any other group in Australia, giving Woomera a birth-rate of about 40 per thousand population, nearly double the 22.86 average.

(McKie, 1958, p. 19)

Laurine Hall, a strapping young woman who rode a motorcycle with her long blonde hair streaming and decorated her Askania post with chintz curtains [...] was a familiar identity in the late 1950s.

(Morton, 1989, p. 264)

1.1 Woomera: The research setting

Ambling down the deserted streets of outback Woomera in South Australia, it is hard to believe that the town was once a thriving community of 7,000 people, the home of what was reputedly the largest bar in the world (when in 1963 the weekly beer consumption was calculated to be 6.5 gallons per head), where you could participate in up to 80 different sports, dance at the Jazza (Junior Ranks Mess), picnic in the sand dunes and cool off at the Olympic pool. Woomera, wearing with pride its badge of honour of being a mecca of sport, leisure and excessive alcohol consumption, was also the scene of unprecedented scientific research and new roles for women. Today it is home to fewer than 300 people. It is now almost inconceivable that once it was the epicentre of Australia’s defence research and saw some of the most important scientific activities in Australia’s history and was also the site of the largest overland rocket range in the Western world (Buchanan & Edwards, 1997, p. 3). Woomera was also the home and workplace of Laurine Hall, aka “Floss”. Laurine Hall (shown at work in Figure 1.1) was also dubbed “a born missile tracker” (Fairley, 1963; Southall, 1962) though was lauded more for her attractive appearance and prowess as a motor-biker than she was for her abilities as a camera operator. Hall, and many young women like her, worked long hours in the scorching heat “down range”. Their stories, lives and the work they did on the Woomera rocket range are the focus of this dissertation.
Chapter One. Introduction: Useful and Timely

Figure 1.1 Still image of Laurine Hall with her Askania Kinetheodolite (still from The Firing of Skylark at Woomera, 1957).

1.2 Research focus

Much has been written about the scientific achievements at Woomera (Donovan, 2007; Morton, 1989). But little is known about the work of Hall and her workmates, who took on new roles operating the cameras that captured on film the performance of rockets and missiles being tested at Woomera during the Cold War. This dissertation seeks to address this deficiency and does so using a case study approach, through a series of interviews with people now in their 70s and 80s who lived and worked at Woomera during the era of the Anglo-Australian Joint Project to test rockets and weapons. These people are coming to the end of their lives; it is timely to ensure their memories are captured and discussed to provide a better understanding of the work that occurred at Woomera during this era and to understand the degree to which roles played at Woomera by women on the rocket range were similar to or different from traditional roles of women of that era. The dissertation offers a nuanced view of women's work in that it has been written through the lens of the women in question. None of the extant major sources are written by women or address women’s work to any serious degree.
1.3 Methodology

Face-to-face interviews were recorded with eight women and four men. Another woman was interviewed by telephone and another through an email exchange. Additionally, another man’s story (he had died prior to the research being undertaken) was told through the testimony of his son, who grew up in Woomera and who also consulted with his mother to answer my questions through an email correspondence as the family resided in England.

Academic convention for historical research is to refer to individuals by their surnames. Long-seated cultural traditions have meant women generally adopt the surname of their husband at marriage, such that during the course of their lives, women may have more than two surnames and this can introduce confusion and ambiguity when writing about women. To avoid such confusion and, because this is their preference, I have chosen to refer to my interview subjects by their given names when discussing their views and experiences in the case study chapters.

All quotations from interviewees derive from the date of their interview which is noted in the respective chapter that the interview is discussed and also set out in the table in Appendix 1. Additional personal communications are cited in the text as per the APA style which is otherwise used throughout the dissertation.

I became a member of the closed Facebook group, Woomera!!, which kept me in almost daily contact with the Woomera community who were always willing to answer questions relating the research and provide clarification on matters relating to the operation of cameras. One member of the group was also interviewed, and we have established a regular “messenger” correspondence. Additionally, further contacts were made, and informal telephone conversations occurred which provided more information that has been of immense value to the work. While the interview case studies form the major body of the research, significant archival research was undertaken in Australia and the United Kingdom. Further details of the Woomera!! Group and the research process are provided in Chapter Two.
1.4 Australian Research Council-funded Discovery Project: “Useful” film

This research is part of an Australian Research Council-funded Discovery Project DP16 to examine Utilitarian filmmaking in Australia 1945–1980. “Utilitarian film” also described as “useful cinema” by Acland and Wasson (2011, p. 4) is an area of historical research that has received scant attention:

It is our contention that the expression “useful cinema” productively captures a dominant feature of cinema, one that has not figured prominently in the historiography of moving images to date.

Utilitarian film is also described as, “primarily for the functional purposes of instruction, surveillance, quantification or record-keeping” (Broderick et al., 2016, p. 1). This definition best defines the film captured by the women in new roles at Woomera. “Useful film” also embraces “data film” which is a part of the subject of this dissertation. Data film refers to film recorded to analyse scientific or industrial phenomena.

The three key investigators of the ARC project are Professor Ross Gibson (University of Canberra), Associate Professor Mick Broderick (Murdoch University) and Associate Professor Deane Williams (Monash University). Each of these scholars has special interests in aspects of utilitarian film analysis. Two fellow PhD candidates have been working on the ARC project, Grace Russell who was awarded her doctorate for her dissertation, A Body of Work: Australian Workplace Safety Films (1955–1980) in January 2020, and Ruby Arrowsmith-Todd who, at the time of writing, is working on a dissertation on the Shell Film Unit 1939–1954. My contribution to the ARC project has been to investigate an aspect of the production of utilitarian or “useful” film as it related to the weapons testing project during the Cold War at Woomera in South Australia.

1.5 Personal suitability for the research focus

My background as an Australian social historian with an interest in the lived experience of women influenced the choice of my major research question and its attendant research sub-questions. My long experience collecting oral histories gave me an important qualification to enable me to gather this new evidence of women’s experience at Woomera, and my research skills acquired over years of work in
Australian history enabled me to locate interview subjects and find pragmatic ways to circumvent the difficulties in accessing government archives; issues that are discussed in detail in Chapter Two. That I was born and spent my early years in England and migrated to Australia as a teenager also assisted me in establishing a strong rapport with my key research subject, Laurine Hall, who is also a British migrant. This British heritage was also helpful in developing an understanding of the imperative of the testing program; my parents and grandparents lived through the Blitz and existing family members have been able to convey first-hand experience of the terror of the V-2 rockets.

1.6 The Anglo-Australian Joint Project

In the aftermath of World War II and with the onset of the Cold War, Australia became one of only a few global centres for the scientific research into the testing of rockets, jets and other long-range weapons, including Britain’s atomic warheads. This testing project came about through a joint project formed between the United Kingdom and Australia. The United Kingdom would largely provide the test vehicles and the bulk of the key scientists and Australia would provide the testing and living facilities and the ancillary staff to run the village, testing range and laboratories at Salisbury, near Adelaide. Britain had considered testing sites in Canada and Libya, but the combination of political stability and almost ideal weather – Woomera had 320 days of “wall-to-wall blue skies” (Hawksley, 1996) – meant that the site in South Australia was chosen, despite the vast distance between the two partners. The enormous costs of the joint project, ratified by both the British and Australian governments in 1947, were shared under the terms of a number of complex funding arrangements. The proportion of the costs borne by each country has never been fully calculated (Morton, 1989, pp. 29–43).

By 1950, a new outback purpose-built town named Woomera, shown in Figure 1.2, had been created in the Great Victoria Desert, Australia’s largest desert. This phenomenal architectural and construction undertaking created thousands of jobs. At its peak Woomera’s population grew to 7,000 and it was believed to have had the highest birth rate in Australia during the mid 1950s and also the largest weapons testing range outside of the USA and USSR (Morton, 1989; Southall, 1962).
Chapter One. Introduction: Useful and Timely

Anecdotally when questioned about Australian cities, people outside of Australia during the 1950s and 1960s would name Sydney and Woomera above all other cities, but today Woomera is associated primarily with its Immigration Reception and Processing Centre that closed amidst controversy in 2003. Woomera is also remembered because of the testing of nuclear weapons close by at Maralinga and Emu Field between 1955 and 1963. It was important to examine in detail the social history of Woomera in relation to the testing program particularly in as much as it involved women. This research is presented in Chapter Three, the Literature Review. The four key texts studied for this background were Southall (1962), Sharpe and Lowther (1965), Morton (1989), and Donovan (2007). A substantial quantity of additional primary and secondary sources was also consulted, analysed in the Literature Review and listed in full in the Reference List. Appendix 5 also documents the Additional references consulted during the research process.

1.7 The testing program and the creation of data film

The testing range extended some 1850km from the centre line at Woomera to Talgarno on the Western Australian coast as shown in Figure 1.3. Britain’s aim was
to develop weapons that could reach targets in the Soviet Union and the distance from Woomera in South Australia to Talgarno in Western Australia was close to that between the UK and the Soviet Union. The trials of these weapons needed to be captured on film, and a workforce was required to ensure this was achieved. Each test generated thousands of images and 50,000 pictures could be created per trial. 30 trials in a busy month could therefore generate 1.5 million pictures (Southall, 1962, p. 124). The images were captured on a variety of cameras, including kinetheodolites – optical tracking instruments that combine a modified theodolite (telescopic instrument used by surveyors) and a recording cine-camera – and a number of specifically developed high-speed cameras (more details of these cameras are given in Chapter Five at section 5.7.2). From the images, mathematical data and formulae were developed that assisted the scientists responsible for the burgeoning weapons program. The data film recorded various aspects of rockets and missiles in flight. The data was reduced to scientific and mathematical statistics, initially by female “Computers” and later by the enormous computing machines that were the forerunners of the computers we know today (Morton, 1989, pp. 376–380). Women played a significant role in operating the cameras that filmed the tests and in the computing of the data derived from this film.

Figure 1.3  Map of the portion of Australia that shows the main sites of the testing program: the Weapons Research Establishment in Salisbury and Woomera (in South Australia) and the Western Australian town of Talgarno, to which the testing range extended (Southall, 1962, p. 168).
Virtually no expense was spared in establishing the testing grounds, laboratories and infrastructure to support the experimental research function, which included a security cleared film laboratory and production facilities at Salisbury near Adelaide in South Australia, headquarters of the Weapons Research Establishment (WRE), established to manage the Australian side of the joint project (Southall, 1962, p. 50). The WRE at Salisbury, which was centered in a former munitions facility was the “brains trust” of the long-range weapons testing program, an essential partner to those performing the work at the Woomera outdoor “laboratory”. National Archives of Australia (NAA) holds some 15,000 items relating to Woomera alone.

These 15,000 NAA items consist of paper-based records, films, photographs and maps that were kept to document Woomera activities, however, this study is most concerned with the production of the thousands of feet of film that was shot during Woomera’s heyday. The film’s primary use was to provide data for the study of missile and other weapons’ behaviour in flight and on re-entry into Earth’s atmosphere. Originally my research was to be based on the examination of this film and the revelations it could provide in terms of its record of Australian fauna, flora, landscape, social customs, fashion, diet, entertainment and a plethora of other possible themes. However, access problems led to a change in the direction of the research to be focused more on the work of the people who captured the data on the film and, even more specifically, on the work of women.

1.8 Research questions

My field of enquiry, major research question and research sub-questions involve studying the work undertaken at Woomera by the women employed as camera operators on the range. Their work is also considered within the context of a broader Australian social and cultural history. Women’s roles at Woomera were initially expected to be traditional – supportive wives and mothers. It was decided early in the occupation of Woomera that the scientists and other men stationed at Woomera would be more productive in their work if their wives and families were with them. Accommodation was subsequently provided for married couples and families, schools were built and an air-conditioned hospital opened by 1954 – the original hospital having been erected in 1951 (Morton, 1989, pp. 131–132). My research sheds light on a number of women who undertook new roles operating the sophisticated kinetheodolites that filmed and tracked
the rocket firings and missile impacts, and women, referred to as “Computers,” who assisted in the production and post-production processes. Questions that were put to women during the oral history interviews included enquiries about the nature of their work, the training they may or may not have undertaken, their working conditions, how they occupied themselves during down-time between testing, what it was like living in Woomera, how they were treated by their male colleagues, why they eventually left Woomera, what they felt about a possible third world war, and the degree to which they have reflected on their work in the years since they left the township.

My major research question then, is: What was, and how important was, the work that women did on the Woomera rocket range during the Cold War? The research sub-questions that need to be answered in order to address the major research question are explored in the ensuing chapters of the dissertation.

1.9 Research boundaries

This research discusses to a far lesser extent the lives of women within the village who did not work on the rocket range, such as those in traditional roles of teachers, nurses, waitresses and shop assistants. The scope of the dissertation prevented a deeper analysis of these women’s work and lives. There were likely to have been more than 60 women who worked operating the cameras on the range; records that might clarify this number are not currently available. The sample size of women interviewed is hence modest and in an ideal world more of the women would have been located and interviewed, but at some point, the research needed to be halted and the dissertation written. Similarly, while there is an awareness of the work of the female human Computers who worked at Salisbury, the core focus of the dissertation is on the work of the women operating cameras at Woomera.

1.10 Value of the research: Contribution to knowledge

The filming work conducted at the Woomera rocket range from 1947 through to the 1980s has received limited academic attention (my investigation is particularly focused on the period 1947–1970.) While major scientific innovations (such as black box recorders and the Jindivik pilotless aircraft) developed as part of the scientific initiatives at the Woomera “outdoor laboratory” and at the sister-site, Salisbury, have
been documented (Donovan, 2007; Morton, 1989), the role of women in these nation-building scientific endeavours has received little academic attention.

This dissertation provides the first systematic recording of oral histories of the secret Cold War undertakings that occurred at Woomera. Previous Woomera histories exclude any serious or detailed mention of this industrial phenomenon, namely the inclusion of women as camera operators and data analysts/Computers. It is timely that this research occurs now as the women in question reach the end of their lives.

The research has had additional value to the women interviewed in that it has revealed to them (explored in detail in Chapters Four and Five) that their work was significant and their contribution to the joint project was important. Ongoing discussions with the women have enabled them to gain a fuller understanding of the importance of their work and has, in most cases, led to a deeper sense of pride in their undertakings, initially considered insignificant. Likewise, the male interviewees have been able to reflect on their work and share their memories with an audience outside of their families. They have also welcomed the opportunity to speak with high regard about the women who reported to them or whose work they observed when carrying out their own work.

The political economy and gendered aspects of this research and its unique cohort of women radically challenges the normative and conventional understandings of Australian women and workplaces during the commonly perceived conservatism of the era. Recent research in the United Kingdom and the United States has highlighted the roles played by women in technology relating to space research. Hicks has shown that the contributions of British women to the development of computer technology in the post-Cold War era have been underplayed and their removal from that working sphere had an adverse impact on the entire success of the British information technology industry (Hicks, 2018). Successful popular movie, *Hidden Figures*, directed by Theodore Melfi (2017), based on the book by Shetterley (2016), explores the work of female African-American mathematicians during the Space Race in Cold War America. It is timely that Australians give due attention to our own “hidden figures”.

My archival research and the oral histories I have collected have found that women did not consider their work as unusual or particularly significant. However, when understood in terms of the era’s general attitudes towards women's roles in
Australian society during the 1950s and 1960s, their specialised work at Woomera is both significant and groundbreaking. This cohort of women recorded data derived from weapons testing on film and analysed this data in the emerging age of computers. To some degree these women were indeed Australia’s “hidden figures”. Without doubt, key women at Woomera contributed substantially to the success of the Anglo-Australian scientific endeavour.

The technical details of the cameras, computers and other ancillary equipment utilised at Woomera have also received relatively little attention and most certainly not in terms of the work of the women who used these scientific apparatuses. My oral histories have revealed details of the utilisation of this equipment through the direct experience of those who worked on the kinetheodolites, Vinten and Baker Nunn cameras and to a lesser extent the work of the human Computers who managed the data derived from their work.

1.11 Limitations of the research

The research was limited by time, budget and access to government film records. A larger sample size would have been preferred. It was time consuming locating the interview subjects, as no ready database of former Woomera camera operators existed. Additionally, the broad geographical spread of Australia hindered the research. Social media, prior genealogical research experience and a sprinkling of good fortune led to successful contact with the women and all but one of them deciding to participate in the gathering of the oral histories. In recent months, additional potential research participants have been located, but lack of resources and a shortage of time have meant they could not all be interviewed. It is hoped that there will be opportunities to interview them in the future, though this is contingent upon the success of grant applications. The work was also limited by the ageing of some of the participants, in that their memories were no longer lucid. As discussed in Chapter Two, the research was also limited by access to Australian Government film archives, although this limitation turned out to be beneficial in that it forced the development of a different focus to the research and led to a rich and fruitful investigation. The study could have been extended, time and budget allowing, to explore some of the correspondence and other paper files held by NAA that might have revealed policy decisions about the employment of women on the rocket range.
1.12 Main findings

This dissertation shows that women played vital roles in the testing program at the centre of the joint project between the United Kingdom and Australia to test weapons at the Woomera rocket range during the Cold War. It is revealed, through primary research using a case study approach, that women became skilled camera operators, largely as a result of work experience rather than formal training and education and that the data they collected was used to develop a number of important defence and space research vehicles. The dissertation considers traditional roles for Australian women in this era and the degree to which the new roles being undertaken at Woomera were unique and significant. It also critiques the representation of women at Woomera in the then contemporary media and in more recent secondary sources, which tends to underplay the work and lives of these women.

1.13 Dissertation structure

Chapter Two considers the methodological issues that arose in addressing the main research question such as: how can an appreciation of women’s roles at Woomera be best understood, and what might be the best approach to reveal their experiences? Chapter Two also explores more deeply the constraints of the study and justifies the case study approach that was adopted as the most suitable method for the research.

Chapter Three, the Literature Review, identifies and assesses gaps in the literature regarding women’s work at Woomera. As part of this review, it was also necessary to examine the literature pertaining to women and work in extant studies of the Cold War, and this chapter also presents an analysis of the already considerable secondary sources addressing the history of the Woomera rocket range, and will reflect on the degree to which women’s lived experience is adequately covered. Chapter Three also provides more detail on the Cold War as a context for the undertakings at Woomera and the background to the establishment of the Anglo-Australian Joint Project.

Chapter Four is the core of the dissertation in that it presents the primary case study of a particular camera operator, Laurine Hall, romanticised in the literature as “a born missile tracker,” and a day in the life of a “Mrs Lawrence”, a housewife who had a part-time job on the range. Research for this chapter involved the exhaustive search to locate Laurine Hall, which resulted in several interviews, numerous email and mail
Chapter One. Introduction: Useful and Timely

correspondence exchanges and an enduring association. Without this liaison, a major opportunity to understand why Hall was mythologised on the range in terms of her feminine qualities and not in terms of her aptitude as a camera operator would have been lost. Chapter Four also explores the search for Mrs Lawrence. Like Laurine Hall, Mrs Lawrence had been the focus of media attention for her unusual work, which was shown not to compromise her primary role as a housewife. Eventually the identity of this woman was discovered in archives held by the National Museum of Scotland.

Chapter Five continues with further comparative case studies of women who have been interviewed about their work at Woomera. Each of the women, discussed in Chapter Five were known to Laurine Hall, although until the research for this dissertation was underway, the women had not kept in contact.

Chapters Four and Five address the research sub-questions: Who were the women who worked tracking missiles and weapons at Woomera? What were their backgrounds? What did they feel about their work at the time and now, at least 50 years later? What did they feel about the threat of a third global conflict and about the rise of communism? How difficult was their work? What training did they receive? How were these women portrayed in contemporary media? and What are these women doing now?

Chapter Six also addresses the research sub-questions through a case-study approach with men to whom women either reported on the range or who worked in associated roles at Woomera.

Chapter Seven: Conclusions and Recommendations provides a summary of the importance of the women and their work and addresses the main research question and the contribution to new knowledge. Chapter Seven also reflects on the importance of the research to the women who participated in the study and concludes with recommendations for further work. Sadly, one of the men interviewed for the dissertation, Bruce Aitken, has since died. It is to Laurine Hall, Bruce Aitken and all the people who have shared their memories about life in Woomera that this work is dedicated.

The following chapter outlines the methodological approach to this dissertation and explains why this approach was considered the best way to come to a clear understanding of the work and roles of women camera operators on the range at Woomera.
Chapter Two

Methodology

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2.1 Research design choices

As a piece of historical research, the methodological foundation was the gathering and interpreting of oral histories of the women camera operators at Woomera, analysed in the context of other primary sources, including films, archival records, Australian and British newspapers and supplemented by key secondary sources. To some degree the scope of this research was dictated by available funding. My research was part of a broader Australian Research Council Discovery Project into Utilitarian Filmmaking in the post-World War II period leading to the introduction of video technology in the 1970s. The project aimed to:

highlight previously unstudied aspects of the media industries … [and was] designed to deliver new knowledge of the skills and subject matter that sustained filmmaking, communication and education in Australia during a time when conventional scholarship assumes there was almost no significant filmmaking.¹

Given the breadth of the Discovery Project it was necessary to select a manageable focus. My interest in women's social history influenced my choice of research, which became “the experience of women involved in utilitarian filmmaking at Woomera”. My review of the literature, presented in Chapter Three also affirmed my choice, given that most of the directly relevant texts (Donovan, 2007; Morton, 1989; Southall, 1962; Sharpe and Lowther, 1965) either focused solely on the male experience or gave only cursory attention to women.²

Furthermore, my own curiosity to gain some understanding of the work of women at Woomera influenced my choice of research design. To a large degree I was embarking on a new study of a topic, that it soon transpired, had received limited research focus.

The prohibitive access to relevant utilitarian film (see section 2.6.1) influenced my pragmatic decision to redirect my focus to the experience of women as revealed through their memories rather than pursuing the original intention to analyse their experience through found film. Despite the issues of access, limited quantities of significant film were located and have been analysed throughout the research project. In hindsight this design choice, using mixed methods, combining the oral history responses, original archival records and contemporary Cold War utilitarian film provided the best opportunity for a detailed and balanced exploration of the topic. The
pragmatic choice was to explore a series of case studies as revealed through oral histories complemented by utilitarian film analysis.

2.2 Major research question and research sub-questions

My major research question is: what was, and how important was, the work that women did on the Woomera rocket range during the Cold War, with a specific focus on the period, 1947–1970. Secondary questions sought to discover details of women's responses to working in non-traditional roles at a time when there were limited career choices for women; to examine the challenges and benefits of these experiences; and to gain a broader understanding of the lives of women at Woomera. Additionally, it was important to study the male response to the work of these women, particularly given the fact that men took on supervisory roles as women were most typically in subordinate roles. Surprisingly, later research revealed that there were in fact a small number of women in senior communications roles on the rocket range as well as women Computers, and so additional questions arose around the work experience of this cohort of women, how their contemporaries viewed them, and the degree to which they have been the subject of recent and current research.  

2.3 Qualitative and case study research: A common-sense pragmatic approach

As noted, the Literature Review shows that there has been little published work on the role of women at Woomera. Women were depicted in documentaries at the time of the missile testing program and in more recent historical documentaries, not specifically in terms of their skilled work on the rocket range, but largely in relation to their novelty value and marital status, as was presented, for instance, in the 1963 interview by British Independent Television Network [ITN] science journalist, Peter Fairley (original interview reproduced in Thomas, 2004). Hence it was pertinent to analyse these documentaries and find film and other media in a range of archival repositories that might reveal more complete experiences of women as workers in skilled occupations.

The most appropriate approach for the research was to broadly apply a qualitative subjective research methodology. According to Guthrie, this is “subjective” research insofar as it is concerned with the consideration of people’s thoughts about object things (Guthrie, 2010, p. 42) – which in this case refers to women’s thoughts about
their work filming weapons and missile tests. Moreover, the research most suited a commonsense and pragmatic approach. “Commonsense” is described by Guthrie in terms of *common*, meaning “shared,” and *sense*, meaning “understanding” (p. 44). Guthrie also identifies the value of philosophical pragmatism, which views knowledge as “useful in terms of its practical effect”. His view that “the value of research methodologies lies in their usefulness in engaging in the real world,” is entirely consistent with my approach (p. 45).

No single methodology suited my study, which was complicated by the exploration of a gamut of sources which included case studies, in-depth interviews, historical archival research, archival film viewing, photographic study, newspaper searches, engagement with a closed community Facebook group (*Woomera!!*), and an examination of limited contemporary sources. Hence mixed methods were applied. A pragmatic approach was utilised not only in making sense of the research findings, it was also required in the true sense of pragmatism – using an approach to finding data (be it on film, in the words of interview participants, or in archival records) in the most efficient, timely and cost-effective way.

A quantitative approach to the subject was initially undertaken through attempting to find records that would reveal and document the number of women working on the cameras at Woomera. It was hoped that records would be available that would provide details about the ages these women began working, and data on the length of their working lives, pay rates and hours of work. Unfortunately, these records were not readily available through the National Archives of Australia (NAA), the repository for most of the data relating to the Woomera rocket range. Thus, the research also embraced a mixed methodology as qualitative research through oral history case studies, which enabled a basic appreciation of some of the data that traditionally would have been sourced through a quantitative approach.

### 2.3.1 Laurine Hall: Primary case study

One particular documentary, *Welcome to Woomera* (Thomas, 2004) viewed early in the research process led to both the shaping of the research methodology and the selection of the primary and pivotal case study for this research. This documentary included an excerpt of an interview that had been recorded in 1963 with a camera operator, Laurine Hall, who worked on the rocket range. Hall, who earned the nickname
“Floss,” gained almost folklore-like status for her unusual mode of transport to work – a motorbike – and her carefree outlook. Her appearance and personality were the subject of contemporary and more recent commentary (Southall, 1962; Morton, 1989), and at least one scientific journal (*Flight International*, November 1963.)

So unusual and interesting was this woman, it became important to discover if she was still alive and whether she would talk about her work, life at Woomera and also about the experience of being interviewed for a television program in 1963. It thus became an essential preliminary part of the research to find Laurine Hall and ask if she would be willing to engage in an in-depth interview about her life and work at Woomera.

Research questions developed according to a consideration of her experience: was she typical of the women who worked at Woomera? To what degree was her personal experience unique? Hence the first case study conducted was based on Laurine Hall in the hope that similar women who worked on the rocket range at Woomera could be found as supplementary case studies.

### 2.4 Case study approach

Case study research, based on oral history interviews triangulated with archival and newspaper research, and using extant film and secondary sources was the most appropriate methodology for gaining an understanding of the experience of this cohort – young, largely unskilled women, marginalised in key texts. Case studies are considered by some as neither a qualitative nor quantitative method but rather a separate method category “used in the comprehensive, detailed and in-depth examination of a phenomenon” (Weerakkody, 2015, p. 228). Case study as a method for this research furthermore enabled an understanding of the multiple realities of the research participants. According to Denscombe (2010, p. 53) and Weerakkody (2015, p. 243), the case study method can provide “a holistic view of the phenomenon under study” and this was borne out by the research.

There is still debate surrounding the validity of case studies in terms of rigour. Thomas Diefenbach argues for more critique of the method and posed the question in his 2009 article, “Are case studies more than sophisticated storytelling?: Methodological problems of qualitative empirical research mainly based on semi-structured interviews”. Diefenbach is particularly concerned with the fallibility of case
study interviewing in an organisational setting, where there is the possibility of interviewees responding with a politically correct comment, or worse still, “being forced by an interviewer to make certain statements” (p. 880). However, in this research, neither the interviewee nor the interviewer were part of a corporate organisation nor linked in any prior way. The triangulation of the findings of the case study interviews with other archival and secondary records has, I feel, provided a rigorous approach to the exploration of the subject. Diefenbach does concede that triangulation does add more rigour to case study research (882).

Despite the arguments presented by Diefenbach, Bent Flyvberg (2006) has shown that the major misunderstandings about, and concerns surrounding such a methodology are largely unfounded. Flyvberg stresses the importance of the case study to develop a “nuanced” view of reality (2006, p. 223) and even argues for the possibility of basing a piece of research on a single case study (2006, p. 228). However, in this research, multiple case studies provided a broader consideration of women's experience on the Woomera rocket range.

Denscombe argues for the validity of the case study approach because it is structured to allow both multiple methods and multiple sources (2010, p. 54). He also stresses the significance of setting practical boundaries and the importance of carefully choosing the subject of “the case” (2010, p. 57). The selection of Laurine Hall as the primary case study was made on the basis that her experience was both “typical” and “extreme” (Denscombe, 2010, p. 57). It was typical in that she was one of many young women who found work operating cameras on the rocket range during the Cold War, and it was “extreme” for that era, given that most women only found employment in traditional occupations such as nursing, teaching, administration – and then, only prior to marriage (Firth, 2004, p. 504; Strachan, 2010, p. 120). Post-World War II policy makers argued for a return to traditional roles for women as homemakers, despite the circumstances of the Second World War having given them the opportunity to “take on new identities outside of wife, mother and lowly paid worker” (Firth, 2004, p. 504). Cold War Woomera offered women a different reality as will be shown in the case studies in Chapters Four and Five. Laurine Hall’s case is also “extreme”, as per Denscombe’s categorisation, because of her outgoing personality, choice of transport to work and reputation for being skilled as a camera operator, dressmaker, sportswoman...
and dog-handler (Southall, 1962; Woomera!! Facebook Community contributions). Laurine Hall was (and remains) intrinsically interesting and a worthy case study subject.

The case study approach is also appropriate where a unique opportunity for specific research arises (Denscombe, 2010, p. 59). One aspect of the context of my research was a renewed interest in space research that resulted in debates about Australia’s new space research centre, the 50th anniversary of the Weapons Research Establishment Satellite (WRESAT) and the first moon landing commemoration. Additionally, the experience of American women in the space program as presented in the book and film, Hidden Figures (Shetterly 2016; Melfi 2017) was timely. It was a unique and appropriate time to explore the experience of Australia’s own “hidden figures” – the women on Woomera’s rocket range.

Weerakkody (2015) presents the three types of case studies as: “exploratory”, “descriptive” and “explanatory” (p. 231). The case studies presented in this dissertation cover each of these classifications. They explore an unusual and under-scrutinised area of historical research; they describe the experience of women in this area, and they explain why these new roles came to occur and how they contributed to British and Australian Cold War weapons testing.

An in-depth exploration of contemporary newspapers and a large number of NAA files contributed to a greater appreciation of the employment and social situation of women in Woomera during the era under consideration. Additionally, a broad range of secondary texts were examined to ensure the research was rigorous and balanced, as is presented in the Literature Review.

2.4.1 Participant sample

The immediate challenge in attempting to conduct case study research through interviews with women who worked at Woomera during the Cold War was first to identify and then to find them. Female interview participants are always more difficult to find than male subjects given the tradition, almost universally followed by women in the Cold War era, to change their surname to that of their husband upon marriage. Eventually, through searching genealogical and NAA migration records, a further difficulty in tracking down Laurine Hall became apparent, as not only did she change her name on marriage, so did her new husband, Victor (Vic) East (formerly Puddle).
The sample of interviewees was dictated to a large degree by the accessibility of the data sources (Weerakkody, 2015, p. 234). The women who worked on the cameras at Woomera who are still alive are in their seventies and eighties, and others have died. The difficulty of locating them was a major factor in limiting access to data sources. I sought to interview any woman who operated cameras at Woomera during the period 1947–1970, who was willing to share her memories with me. Weerakkody (2015, p. 234) recommends no more than four to six cases for a study. This number was exceeded in my work, but this did not compromise the findings. On the contrary, the larger number of interviewees meant that rich details of different aspects of life on the Woomera rocket range were obtained, as well as differences of opinion, perspective and recollection amongst the camera operators, which makes the case studies more representative and balanced.

A modest travel budget meant that location was initially not an impediment to organising the original interviews. However, budgetary limitations made it impossible to interview all former female camera operators as they were only discovered during the course of the research and it was impossible to travel to each one. An option would have been to conduct interviews by phone, Skype or email. However, this much more cost-effective option was discounted because it is vitally important to establish trust and empathy during the interview process. Phone and email exchanges are always a poor choice if a face-to-face interview is otherwise possible. Later interviews were conducted by phone or email once it was no longer possible to travel to meet with participants.

2.5 Oral history: A methodological approach using structured and unstructured interviews

It has been claimed that “history” emerged from the practice of collecting oral histories, in that Homer’s Iliad and Odyssey were generated from oral sources (Keelan, Goodlet & Wiseman, 2014). As Guthrie observes, “interviewing is probably the most common data collection technique in social sciences” (2010, p. 118.) I have been a practitioner of oral history since my undergraduate days in the early 1980s and have conducted hundreds of interviews since that time. Nevertheless, I make no claim to being an expert, becoming an accomplished oral historian can take a lifetime. Armitage observes that learning to be an oral historian is “an incremental process. The more interviews [the historian does], the larger the data bank” (Armitage, 1983, p. 70).
Patricia Leavy (2011, p. 75) notes six main areas in which oral history is apposite: tapping into processes; micro-macro linkages; comprehensive understanding; bearing witness and filling in the historical record; collaboration in the meaning-making process and focusing on the participants’ perspectives. While each of these were considered relevant in my work, bearing witness and filling in the historical record, collaborating in the meaning-making process and focusing on the participants’ perspectives were considered particularly important. Following Leavy’s schema, the oral histories presented in this dissertation will go some way to “filling in the historical record” in terms of women’s utilitarian filmmaking at Woomera. “Collaboration in the meaning-making process” was evident through my facilitating the women interviewed to reconnect with each other to recall events and check the dates and names of people and places. The interview process itself also contributed to the women being able to reframe their experiences of working at Woomera and to recognise, in some cases for the first time, the significance of their work. Their interpretations of events were changed by the collaboration. Furthermore, focusing on the women’s perspectives was essential to ensure their stories were freely told.

Alistair Thomson has written about the importance of personal revelation through the process of oral history interviewing and noted, “the attention and affirmation of a supportive listener provides an opportunity for life review” (2013, p. 128). Yet he adds, “oral history is not therapy,” and as interviewers we have to be conscious to listen empathetically without taking on a formal role of counsellor. In the interviews for this dissertation there was no suggestion that my work was considered therapeutic, but one of collaboration, information gathering, understanding and “an active process of creation of meaning” (Thomson 2013, p. 127).

For oral historian, Alessandro Portelli, one of the major differentiating realities of oral history is that it tells us less about events than it tells us about the meaning of those events for the interview subject (Portelli as cited in Perks & Thomson, 2006, p. 36). According to Anderson and Jack, oral interviews are especially valuable for revealing women’s views on events and experiences, as women’s voices are often suppressed or presented in ways that reflect the male perspective (Anderson & Jack as cited in Perks & Thomson, 2006, p. 129).
Oral history is often used to supplement and add colour to official archival records. This is explored in many of the chapters in Robert Perks and Alistair Thomson’s seminal study, *The Oral History Reader* (2006). In their introduction they note:

> While interviews with members of social and political elites have complemented existing documentary sources, the most distinctive contribution of oral history has been to include within the historical record the experiences and perspectives of groups of people who might otherwise have been ‘hidden’ from history […] through oral history interviews, working-class men and women, indigenous peoples or members of cultural minorities, amongst others, have inscribed their experiences on the historical record, and offered their own interpretations of history. More specifically [and this is especially true of this research] interviews have documented particular aspects of historical experience, which tend to be missing in other sources. (p. ix)

But in this case, there are few available archival records, hence the oral history becomes particularly important. Recognising that such testimony is often questioned as a reliable historical source, it is suggested that in this study, in which there are few (if any) records that document the experience of women operating cameras at Woomera, it is a *primary* and vital source. 

Each interview brings its own challenges but also brings rewards in terms of insights gained and connections made. One of the initial challenges was my limited background in the history of rocket technology and of the raison d’être of Woomera. It was essential to conduct detailed preliminary research on Woomera, including the missile and weapons testing program, the technology utilised there and the experience of women, both as residents of the town and as camera operators. This research is documented in the Literature Review. The advantage of having no specific preconceived views and assumptions about the role of women at Woomera prior to beginning this research, was that my research exploration could be open to any result was never directed at a preconceived or contrived outcome.
2.5.1 Oral histories process

Facebook as a research tool

One online research tool that has only recently been accepted as a credible research tool by historians is the use of social media platforms such as Facebook. Scholars (such as Kosinski et al., 2015) have explored the degree to which Facebook is “rapidly gaining recognition as a powerful research tool,” yet it is not without its pitfalls and ethical considerations. In my research, Facebook was used more as a tool for connecting with possible research subjects and for fact checking (for example, I was able to make direct enquiries of the women who worked at Woomera to check names and dates). I used Facebook not as an observational tool, as described by Kosinski et al. (2015, p. 551), but as a communications and verification tool. Much as traditional online desktop research (and certainly the research for this dissertation) utilises university library catalogues and databases, NAA RecordSearch, the National Library of Australia’s (NLA) magnificent Trove website, and online search engines including Google Scholar to find evidence and information, Facebook can also be utilised as a searching mechanism, particularly where specific groups have been formed around a geographical community or special interest. Posting and messaging through Facebook differs from traditional means of research in that information is often updated hourly or even by the minute. Information can be removed and/or edited at any time, making academic citation and subsequent verification problematic at times. However, if one uses this tool regularly, processes can be implemented to copy and paste responses to research queries and these questions and responses dated and saved for referencing and verification.

Gaiser and Schreiner discuss how instant messaging (as available via Facebook) can be also used to conduct one-on-one interviews (2009, p. 62). They note the advantages of this method of interviewing in that responses can be immediate and the commentaries instantly available as text. I used this process when “conversing” with some of my interview subjects – not for the formal interviews but more as a means of clarifying earlier comments or pursuing an answer to a question arising from the original interview. This process was not accessible to all of my interviewees who due to their age tended not to be computer literate to the extent of using Messenger.
Gaiser and Schreiner (2009) also discuss how the creation of social media platforms such as Facebook have “made it easier for the average person […] to express him or herself to a world-wide audience without having to go through a mediator such as a magazine or book publisher” (p. 82). This change has “empowered people” (p. 83) and has been observed during the course of communicating with the Woomera community in this online domain that was not in existence during the Woomera township’s operation during the timeframe studied.

**The Woomera!! Facebook group**

There is no comprehensive database of people who worked at Woomera. There is, however, a social media community who connect online via the Woomera!! Facebook group (shown in *Figure 2.1*) (*Woomera!!*, n.d.), a closed and moderated group of 4,193 people as of February 2020. The Facebook group was created in July 2006 for people who had lived, worked, or been a family member of someone living in Woomera, from the time of its establishment in 1947 to the present day. Shortly after commencing this research, I applied to join the group and was accepted in August 2016. Having gained ethics approval from Murdoch University, I made an initial post introducing my research and the project to the Woomera community and received some response. I have continued to post updates about my work, and as result, people who at first did not respond began to do so. I have now built up a small network of “ex-Woomerites” who have varying degrees of interest in my dissertation and who have been generous in their willingness to share information and refer me to possible interview subjects.

The site has been a welcome and ongoing resource for contact with Woomera people and some of its members have been highly supportive of this research. In this regard, Facebook has been a valued authenticating research tool that has led to numerous connections that would otherwise not have been possible.

The *Woomera!!* Facebook community includes many members who seem to be regularly online, happy to reply to research questions or refer members on to others who they feel may need answers. A recent example involved the discovery of a “Miss Woomera” lapel badge as shown in *Figure 2.2*. 
I was curious to discover whether the depicted Miss Woomera had in fact been a camera operator. I posted a photo of the badge on the “Woomera!!” page and asked about the background to the pageant. I immediately received responses from both women and men who recalled the pageant and knew of the woman shown on the badge. I was then sent photos of a dinner at which the successful Miss Woomera was presented with her sash, and given information about the pageant – even advised that the sister of this Miss Woomera was in fact a camera operator. Although this is a single example, during the course of my research, a daily check of the “Woomera!!” site enabled me to broaden my knowledge on the history of Woomera beyond the official sources and make contact with people who were eager to contribute their information or stories to the research. Importantly, this type of social media tool offers an inbuilt-triangulation process, crowd-sourced as contributors exchange memories, correct their
accounts in light of the responses of others and offer additional material such as photographs and copies of archival documents saved from their time in Woomera, to supplement their commentary.

**The Woomera Easter reunion: April 2017**

Over the Easter long weekend of 2017, a 70th commemoration of the formation of Woomera was held with a reunion program that included a mass briefing, tours of the range, cake cutting and flag raising celebrations, a dinner dance, movie showings and opportunities to share stories and memories.

700 people registered for the reunion, many of whom had worked at Woomera for decades from the late 1940s to today. I worked as a volunteer on the registration desk, which enabled me to put names to faces as I had already made contact with a number of the attendees on the *Woomera!!* Facebook page. I was given an opportunity to speak about my work at the Woomera Reunion welcome function and to request people who might be willing to be interviewed to come forward.

A family of four sisters heard this request and agreed to an interview. The Trench sisters became the first of my interview subjects, and their stories are discussed in Chapter Four and Five. While working on the registration desk, I met Phil Hall and optimistically asked him if he was related to Miss Laurine Hall. It transpired that he was her much younger brother and Phil promised to get in touch with his sister and ask her if she might be interested in participating in an interview with me. This fortunate meeting with Phil Hall signifies how important it is to be in-situ when researching rather than relying on phone or Skype calls. Had I not been present at the reunion, it would have taken much longer to locate his sister Laurine, if it had been possible at all.

**2.5.2 Locating and travelling to meet the subjects of the minor case studies**

Interview subjects were identified by word of mouth, via the *Woomera!!* Facebook group, and by trawling phone directories and calling numbers in the hope that the person answering the phone was an original camera operator. This was a time-consuming and often frustrating process. I followed name suggestions, searched using the online directory and called multiple numbers across various cities and states. While laborious, this endeavour yielded positive results in that I reached and was able to talk to several
former camera operators, including one woman who was now 100 years old. Answering machines were helpful in a few instances where women returned a call after I had left a message, to either agree to an interview or advise that I had the wrong person.

An online search led to the discovery of a male camera technician who had written a memoir about his life; he was located through this book and his publisher. Another man was located on Kangaroo Island via a woman who thought he had retired there – again a search of the phone directory found him. Long hours spent talking with Laurine Hall also provided many leads to other women who were subsequently interviewed.

One of the challenges of the research was the geographical spread of interview subjects and consequently the resources required to travel to meet them. Interviews were recorded in every state and territory of Australia, other than NSW and the Northern Territory; including at Woomera, Whyalla, Port Pirie, Adelaide and Kangaroo Island (South Australia), Launceston (Tasmania), Melbourne and Warrnambool (Victoria), Canberra (ACT), Toowoomba (Queensland), and Fremantle (Western Australia). Additional archival research (i.e., not pertaining to interviews) was conducted in Sydney, in Edinburgh and Glasgow, and in London. More interview subjects were located during later phases of the dissertation writing. One of the women found at this point took part in a telephone “pre-interview” and another engaged in an email correspondence interview.

### 2.5.3 Interviewing Laurine East (née Hall): Primary case study

During May 2017, I made contact with Laurine Hall, now Mrs Laurie East, and had many long phone conversations with her about her life and work. During these discussions, Mrs East later told me she was “interviewing me,” to see if she would want to talk with me about her life and work. She had never spoken to students or authors about her life at Woomera and stated that she had “moved on” with her life. That we had both been born in the United Kingdom and shared an interest in animals, fashion and needlework, aided her decision to agree to an interview; the subject of the research was almost peripheral to her. But there were non-negotiable conditions. She insisted on picking me up from the airport and I had to agree to stay in her home. This ran counter to my usual preference to maintain a professional distance with my interview subjects. But Mrs East, or “Laurie” as she quickly insisted that I call her, was not interested in my objections. If I wanted the interview to go ahead, I was to
stay with her and allow her to take charge of all transport. So began my now enduring association with Laurie East, aka Laurine Hall, aka “Flossy”, aka, “the born missile tracker” (Fairley, 1963; Southall, 1962).

American historian, Valerie Yow, has observed in relation to oral history, “Events in which there were high levels of mental activity and emotional involvement will be remembered” (2005, p. 70). Yow quotes the work of Charles P. Thompson (1996), who asserts that “in many cases (but not all), atypical events will be more readily recalled than typical events (Thompson as cited in Yow, 2005, p. 64).

The work of Laurie and her colleagues was most certainly “atypical”, both for their time and more broadly as a career for women in any era. Their memories, considered in the light of Thompson’s assertion, are not unsurprisingly vivid and often detailed in terms of recollections of specific work practices.

In June 2017, I travelled to Launceston, Tasmania, to meet with and interview Laurie. Prior to the formal interview we had spent time talking informally and cooking a meal together. This process was something I consider essential, and as Yow (2005, p. 96) has observed, “building rapport” is a time-consuming yet vital part of the interviewing process. As with almost all the women I have interviewed during my career to date, Laurie initially insisted that she would be of little use to me in my work. It took much reassurance, but I was able to finally convince Laurie that her memories and insights were both fascinating and helpful.

Yow (2005) discusses the importance of not “slavishly following an interview guide” (p. 96), but genuinely listening to what the interviewee (or “narrator” as Yow refers to informants) has to say. My interviews took an unstructured approach to allow the interviewee to feel at ease and contribute at her own pace. Guthrie (2010) has observed that interviews that become emotionally rewarding for the interviewee can be difficult to conclude (p. 119). This was indeed a challenge for this research, especially when more than one interview was booked in one day at places some distance apart.

Guthrie has cautioned when conducting oral histories that “interviewing can be emotionally exhausting because of constant exposure to new and different people who might talk about major difficulties in their lives (2010, p. 127).” This was most certainly true of this research as the combination of the unusual subject matter (Cold
War rocket science), the range and ages of people interviewed, and the distances travelled was both physically and emotionally exhausting.

Despite having prepared an interview plan of over 100 potential questions, I did not constantly refer to these, but let Laurie take the discussion where she most wanted it to go, giving her more control of the direction. As Armitage has observed, “adopting the rigid schedule of questions that sociologists are taught is not oral history” (1983, p. 7). Originally, there was no intent to undertake a life study. Yet given the relationship that has formed with Laurie, a life-study has evolved.

Laurie was formally interviewed on two occasions, in June 2017 and January 2018. Additionally, we have engaged in multiple phone conversations, texts and emails. I also recorded a video interview with Laurie talking about her life in which approximately 55 minutes of video were used to create a ten-minute video on Laurie’s life and work at Woomera. Michael Frisch argues for the broader use of oral history in video format to preserve the nuances of speech and gesture in oral testimonies (as cited in Perks & Thomson, 2006, p. 103). While I would concur with this view, not all interviewees are receptive to taking part in a video interview and Laurie was the only participant in the research to agree to this. One interviewee saw me arrive with a video camera and tripod (carried as part of my luggage in a research trip) and exclaimed before we had even exchanged greetings, “you won’t be using that on me.”

The experience of making contact with, meeting and interviewing Laurie East has been central in addressing the research questions of my dissertation. But to me, of equal importance, is making a very real human connection and that my subject feels that her life has been enriched by the experience (as was conveyed during the first interview with her and on numerous occasions since then.) Oral history is more than the recording of stories. It is a collaborative process (Yow, 2005, p.19) that involves a mutual relationship between the parties and evolves over time. Furthermore, this connection with Laurie has led to finding more interview subjects, which has been vital in order to develop a clearer picture of the ranges of experience of women who worked in the utilitarian film making at Woomera in the period 1947–1970.
2.5.4 Oral history: Ethics respect and understanding

Yow has described her passion for biography in terms of enjoying the connection that develops when she explores the lives of others in depth (Yow, 2005, p. 22). I share this passion, not because in this study I am working as a biographer, but because I am genuinely interested in the working lives of women, and in this specific case, women who worked in roles considered unusual or unique.

Yow believes that the more common term “interviewee” used to describe the person being interviewed during an oral history interview is a term that is suggestive of an unequal power relationship, with the interviewer taking most of the power (p. 157). For this reason, Yow employs the term, “narrator”. This seems reasonable, although in my view, simply giving an alternative title for the person who is being interviewed does not necessarily negate a power relationship. It is up to the interviewer to be conscious of the collaborative association developed during an interview and to ensure that she/he does not take advantage of the person, narrator, interviewee, informant, or whatever label we might give them.

Yow suggests that the potential for a power imbalance can be further addressed by the realisation and affirmation that the narrator is validated by the mere fact that she or he is worth listening to (2005, p. 158). In all my interviews I stressed to the person with whom I was talking that their lives and stories are of immense value to historians and students of a particular subject. To me, on this basis at least, the power rests with them. In my study of the experience of women as camera operators at Woomera, the oral history interview is a primary and essential source of information, given the dearth of material on the subject in any media. Recording people’s stories, rather than simply having conversations about their life experiences, lends importance to the narrator and further validates their memories and lives (Yow, 2005, p. 159).

Duncombe and Jessop cited in Miller et al., discuss “informed consent,” which they see as a fluid process, stating: “Some researchers have suggested that consent requires an ongoing process of discussion, reflection, and re-negotiation of trust throughout the interview” (2012, p. 111). It is impossible for a narrator/interviewee to understand to what they are agreeing until they have intellectually and emotionally processed the experience of being interviewed. Consent forms for this research had been designed at the beginning of the project and approved by the Murdoch University
Ethics Committee, and all due Murdoch University ethics processes were followed during the period of study.

Once the research had been given the approval of the Ethics Committee (Human Research Ethics 2017/048), initial contact was made with prospective interviewees by phone, and a follow-up letter outlining the project was sent by mail or email, or sometimes both. Informed consent was obtained at the beginning or end of each interview once I was satisfied that the interviewee fully understood the nature of their consent and had asked any questions of me about the research. Participants can, and are informed of the fact that they can, withdraw from the research project at any time.

In their work, Duncombe and Jessop were researching subjects more intimate than the filming of weapons testing at Woomera, as their research was concerned with interpersonal relationships (2005, pp. 114–116.) However, protocols around the ethics of consent are clearly important to any area of study. Only in one instance was the prospective interviewee somewhat less than willing to participate. Initially one interviewee was pleased to be interviewed and agreed to a pre-interview by telephone. Email correspondence ensued but then the interviewee unexpectedly decided not to go ahead with a formal recorded interview. This was due the nature of the memories that had been stimulated during the telephone discussion. These memories were related to domestic life rather than the working life of that particular camera operator. This instance was the only time a risk to a participant in the study presented itself: that emotional distress could have arisen during the course of the research.

For all the challenges to the oral interviewer that Yow identifies, she does suggest that for the narrator, the oral history interview can be rewarding as it provides the opportunity to “make sense of events” (Yow, 2005, p. 178). This has certainly been the case for my interviews with female camera operators at Woomera. It appears that all of them have enjoyed reflecting on their work and feel pleased that others find their work to have had enduring value.

In terms of analysing and interpreting our work as oral historians, Yow discusses gathering information about “practice” and “feeling” (2005, p. 288). In my work, I am interested in both the practice of filming weapons tests at Woomera and the “feelings” or “understanding” of what this work meant for the women involved. This needs to be appreciated both in terms of meaning at the time and meaning today. For most of the
women I have spoken with thus far, the work was considered “fun” at the time. Only with the passage of time and a better understanding of advances in science since the 1950s and 1960s, have these women been able to fully appreciate how important their work was and remains to be. Part of the value of my research is that it provides these women with a place in history as pioneers and participants in the creation of utilitarian filmmaking in Australia during the Cold War.

It was essential to locate not only Laurie but other women who would talk about their experiences on the Woomera rocket range, so that comparative observations could be made. Thus, further qualitative research was conducted in the form of a series of oral histories with seven women and five men who worked on the Woomera rocket range between 1947 and 1970 and with three female Computers who worked at both Salisbury and Woomera (see Chapters Four, Five and Six and Appendix 2: Female “Computers”). Few of the women had spoken previously in any depth about their work so their testimony was worthy of serious study. Participants were aged between 70 and 82 at the time interviews were conducted.

The women’s oral testimonies are essential to a proper understanding of the lives of women who worked at Woomera. All too often women have been marginalised or even overlooked in official tellings of Australian history. As historian Claire Wright observed in *The Guardian* Australia culture blog, (October 2013):

> Women are central to Australia’s history. Why have we forgotten them? […] The popular imagining of our past remains a stubbornly closed book, refusing to fracture the male, militaristic fairy tale of virile adventure and blood sacrifice.

In the 1970s feminist historians (Dixson, 1976; Kingston, 1975; Ryan & Conlon, 1975; Summers, 1975) offered a new perspective on women’s lives. Their works are now considered the four key texts of Australian women’s history (Foley & Sowerine, 2014). In a 1985 exhibition at Museum Victoria, Elizabeth Willis declared in an introductory text panel, “women have been mostly left out of history,” (Cramer & Witcomb, 2019, p. 128). The 1980s was a transformative decade for feminist historians. Yet as E.P. Mayo asserted in 1994, the study and interpretation of history was still defined through the male experience (Cramer & Witcomb, 2019, p. 131). More recently female curator-historians have drawn on oral sources and personal
written accounts from women to produce exhibits which focus on women’s experience in past eras – such as the 2008 Little Lon exhibit at Museum Victoria which showcased Melbourne’s poorest and marginalised, largely female, inhabitants (Cramer & Witcomb, 2019, pp. 134–35).

American historian and teacher of oral history, Susan Armitage, asserts why oral history is particularly important for the study of women’s experience in history: “Oral history is a basic tool in women’s history because the lives, activities, and feelings of so many women have been overlooked and unrecorded” (Armitage, 1983, p. 4).

Such a view sits uneasily with that expressed by Peter Morton, in his foreword to what is considered the key text in the study of Woomera, *Fire Across the Desert* (Morton, 1989, pp. xv–xvi) who notes in his foreword:

> We are convinced that it is foolish to make a shibboleth of oral evidence. Again and again during our work on this book we have been struck by the fallibility and the treachery of human memory, especially in the case of the elderly when they are looking back thirty or forty years […] our respect for the value of personal reminiscence, especially on technical issues, dropped sharply as we went on.

It is true that the memories recalled during oral testimonies can be fallible. Folklorist, Frank de Caro, has commented that “memory is not a collection of facts, but a process of creating meanings, and indeed memory is both fallible (foolable?) and part of a creative process” (2012, p. 263). Yet this process of creating meaning has led to discoveries that can be confirmed in archival sources in addition to being of value for the interviewees.

If it were not for the gathering of oral evidence, both women’s history and the history of marginalised and minority groups would not be documented to the extent that it deserves to be. As Armitage observed, “an oral historian actually creates new documents: the information she elicits from a narrator is a new contribution to history that would probably not exist otherwise” (1983, p. 6).

It is hoped that this dissertation makes a new and enduring contribution to the history of Woomera, particularly as experienced in the processes of utilitarian filmmaking on the rocket range, through the voices of the women who were there.
It is only now, through gathering oral evidence that a clearer picture of women’s unique role at Woomera is emerging. This dissertation reveals that although time has eroded some memories, over and over again, truths and colour about life in Woomera emerged that would otherwise go unrecorded. Cross-referencing oral evidence with archival and newspaper records (as cited in the Literature Review and in the Case Studies chapters) ensures that the findings are as reliable as possible. It is clear that the deeper one delves, the history of significant and, until now, invisible women who lived and worked at Woomera becomes more apparent.

At this point in time it seems that the only way to access this rediscovered knowledge is through the testimonies disclosed in oral evidence. The more interviews that occur, the more unique pieces of information can be woven together to create a richer tapestry of the lives and work of Woomera’s women. It is timely that this occurs before these women in their seventies and eighties pass on.

2.5.5 Recording the interviews

Prior to all but one of the interviews, phone contact was made with the prospective participants. The project was outlined to them and they were asked if they wished to participate. Sometimes there was further email contact following the phone call. An information sheet about the project was sent to each interviewee by mail and on occasion also by email. A consent form was sent with this letter to enable participants to understand the nature of their participation, as mentioned previously, and to be made fully aware that they could withdraw at any time. As the initial interview with the Trench sisters was spontaneous, there was little prior planning, although a consent form was offered (and signed) and information given about the research prior to beginning the interview.

At the commencement of each interview, several minutes were spent outlining the project and an opportunity was given for participants to ask questions about the research. This time was also used for what Leavy refers to as “rapport building” (2011, p. 76), although to a greater or lesser degree, depending on the interviewees, rapport had already been built prior to their agreeing to an interview day and time and the arranging of my travel. With most of the interviews, there was a brief period of general conversation about Woomera today. Sometimes photographs were shown and discussed as aide memoirs. Some interviewees chatted generally about themselves, their lives, and what they had been doing prior to my arrival, as well as the weather, their health etc.
I am always careful when entering people’s homes to let the interviewee guide the start of the interview. All of the interview subjects were people aged over 70, and most lived alone and welcomed having someone new to talk to. The fact that I was interested in them and their lives was a surprise to most of the women and to some of the men. Some women were nervous, and I needed to reassure them that there were no wrong or right answers to my questions, that I was privileged to learn from them, and that they were being incredibly generous in agreeing to speak with me. None of the males who participated appeared nervous or apprehensive about the process. I think to some degree it was helpful that I am a “mature age” student and have considerable experience as an oral historian. Participants were also advised they could stop the recording at any time and could also ask their own questions of me and interrupt me at any time should they wish to do so.

Each interview was between one to two hour’s duration, with the exception of the multiple interviews conducted with the key subject, Laurie East. All the interviews bar two were recorded in participants’ homes. One interview, the group interview, was recorded at the Woomera reunion and another at the public library in Fremantle. Conducting interviews in participants’ homes made them feel more comfortable, which assisted the narrative process. I have also observed that interviewing participants in their own homes empowers them, as a workplace interview with each person behind a desk lends too much formality to what should be a relaxed process. On entering participants’ homes, I would also ask where the participant generally liked to sit and made sure their comfort was paramount.

After each interview, follow-up emails and text messaging were used to clarify points. I do not share Guthrie’s belief that unstructured interviews do not always need to be recorded (2010, p. 119). Even if an interview is not later used in any detail, recording an interview means the interviewer can remain focused on what the interviewee has to say rather than on taking notes, which can be distracting for both parties. As long as the interviewee agrees to a recorded interview, it is always more respectful and pragmatic to record an interview and stay fully present during the recording and engagement process.
Chapter Two. Methodology

The first interviews were recorded in April 2017 and the last in October 2018. Key themes were noted, and each theme analysed to gain a nuanced appreciation of each interviewee’s experience of being involved in utilitarian filmmaking at Woomera.

2.5.6 Data analysis and interpretation

After completing each interview, where possible, I made notes of particularly significant subjects that arose organically during the course of the interview. MP3 files of the raw data were sent to a professional transcription company that assured professionalism and confidentiality. In most cases the interviews were transcribed very quickly. I would then read through each transcript and make corrections as required and fill in gaps where the transcriber had difficulty spelling the names of places and people. I would then make summary notes in terms of what was most valuable and interesting from each interview, how the interview revealed information about my main research question and research sub-questions, or how the information diverged from the sub-set of themes that had been emerging through the interview process with other interviewees.

No formal coding method was used, but rather I employed a memo writing technique using standard terms relevant to the research. In these memos I noted my impressions about not only the content of the interview, but also the degree of comfort of the participant in discussing the questions I posed. At all times, the comfort and empowerment of the participant were central to my work. Also noted were any follow-up questions that needed to be asked. These would be followed up as promptly as possible by phone or email.

Interviews pertaining to case studies were grouped together and analysed according to key oral research questions that I had designed. Progressive focusing (Weerakkody, 2015, p. 239) developed as new knowledge was layered as the interviews progressed. Observational data was also gathered during the interview process, usually in the form of photographs, which were either offered for loan and copying, or as permanent items to be donated later to the Woomera Heritage Centre. Some interviewees provided copies of archival documents pertaining to their life and work at Woomera. Some of these documents are reproduced in the case studies chapters.

The Literature Review informed data interpretation in terms of discerning whether the experience of women who worked on the rocket range at Woomera was
consistent with that described in contemporary newspapers, in the few written accounts such as the one by Ivan Southall, in the later secondary sources such as that of Peter Morton, as well as in the documentary, publicity and data films created at the time of the range’s operation and in the more recent documentaries created subsequent to the range’s closure.

Thematic linkages were made between participants’ responses by comparing and contrasting their answers to questions about the experience of working on the rocket range, living in the town, rates of pay, work relationships and other questions. Broad headings were then devised for the case studies, presented in Chapters Five and Six.

I was conscious not to allow researcher subjectivity to bias my findings (Weerakkody, 2015, p. 240). It remained important to consider the responses of the women to questions about their work, peers and superiors in terms of the social mores of their era, not according to current work practices, protocols and experiences.

2.5.7 Benefits of the oral history interviews for the participants

The major benefit of the study as expressed by most of the participants, was the opportunity they were given to talk about their working lives in depth – something that had not arisen formally in the past. Most participants were delighted that they had been “chosen” for the research and found it surprising that their memories and commentaries were of interest to someone who was not from Woomera. This contributed to the participants feeling empowered by the experience, which is one of the most significant benefits of oral history as a method, as noted earlier, particularly for researching women's history.

One participant had such a positive experience that her family made contact with me to thank me for “digging her out of a black hole” and giving her a renewed lease of life. Prior to participating in the research this participant had been suffering from depression. Discussing aspects of her life in Woomera proved entirely positive to her. Additionally, although she had been the subject of interviews (with an author and a television journalist) while working at Woomera, she had never seen the results of this particular television interview, and – unsurprising for the era – she had not given informed consent for it to go to air. As a direct result of this dissertation research, she was astounded to see herself at work filming rocket tests on original film and also to
view the interview footage she gave back in 1963, more than 50 years after those recordings had taken place.

The research has also been of benefit to the Woomera community in a number of ways, including that it has led to several people renewing contact with each other after many years. Another has been that it has added to the limited knowledge on women's experience at Woomera and to a significant degree filled a gap in the literature available about women at Woomera, and more specifically women’s roles in the creation of utilitarian film.

As explored in section 2.5.4, it has been shown that it is not unusual that women's history is relegated to second place concerning the study of gendered roles. Given that rocketry has been considered until relatively recent times as almost exclusively a male domain, the fact that women played roles in Australia’s weapons testing program as early as 1947 is surprising to many outside of Woomera. This makes the research doubly empowering for the women interviewed for the case studies: firstly, simply because it is research into women’s lives, and secondly, because it considers women’s roles in a typically male domain.

All participants in this research, male and female, have expressed their empowerment by being given the opportunity to share their personal experiences and by having their specialist knowledge and skills validated. For example, the daughter of one of the male participants was grateful that her father’s memories were considered important outside of the family and was surprised that a doctoral study would note his contribution to the work that occurred at Woomera.

2.6 Film and other research media

2.6.1 Archival film research in Australia

Simultaneous with organising and conducting oral history interviews, my research involved identifying and analysing extant film relating to Woomera. Given the anticipated size of holdings, a pragmatic approach was required for this research, which was initially planned to be primarily an examination of the role of women at Woomera in relation to utilitarian filmmaking. Most of the Australian film related to Woomera is held by the National Archives of Australia (NAA), but there are also relevant film holdings at various Australian repositories including the National Film
and Sound Archive (NFSA) and the Australian Centre for the Moving Image (ACMI). Additionally, there is a substantial quantity of film related to the Anglo-Australian Joint Project held by the Imperial War Museum in London. A major challenge to viewing Australian film was the Australian Government’s changes to access and charging policies, both of which greatly impeded this aspect of the research. These problems led to exploring alternative access options.

Preparatory research undertaken in the latter half of 2016 included an assessment of the quantity and availability of source material held by the NAA relating to the filming initiatives at Woomera from 1947–1970. A number of NAA fact sheets were consulted to assist in understanding the history of documentary filmmaking in Australia leading up to and after World War II. Particularly useful were the fact sheets titled “Films by and About Australia’s Defence Agencies” and “The Commonwealth Film Unit”. Defence films held by the NAA include newsreels, propaganda films, publicity films, recruitment films, information films, training films, historical films, military exercises films, evidential films and ceremonial films (National Archives of Australia, n.d.) There are, of course, many cross overs between each category and the agencies responsible for their creation or inheritance.

Agency and series registration records of the NAA were explored as important background information necessary for understanding the establishment and provenance of the Weapons Research Establishment, its predecessors and antecedents. Thereafter basic searches were conducted using the NAA RecordSearch function using various key terms. This was often a frustrating procedure as so many films were classified as “Not Yet Examined” (NYE). For instance, the search using an intrinsic term to this research, “camera operators”, revealed 22 items, most of which having relevance to Woomera, but none of which having been examined. Hence, to even simply view these files would have incurred a substantial cost and a time lag while they were examined, and if required for access, digitised. A similar search using the two words, “women” and “camera”, revealed 20 items, again none of which had been digitised and only some had been access examined. In terms of defence films, the series A7665: Master Set of Army training films, consisted of 1,903 items with only a few open to view.

The main NAA series of records pertinent to my dissertation research is D4994: (WRE) Documentary Films, consisting of 1,025 items on RecordSearch. There may
also be other films not yet transferred to the NAA or not yet described and annotated, with their details not yet uploaded to RecordSearch. Series D4994 consists of 8-mm, 16-mm and 35-mm cine film in both black & white and colour, as well as some with soundtracks. The series documents the progress of the Defence Science and Technology Organisation, Salisbury, South Australia and its predecessor organisations, its facilities and operational activities. The records cover a wide range of activities including information relating to German rockets, Aboriginal ceremonies, the development of Woomera and scientific trials including the Anglo-Australian Joint Project.

At the time of my researching film relating to Woomera, of the 1,025 items in D4994, only 134 of them had been categorised “open” for access. The rest were mainly “Not Yet Examined” or “closed”. The films that were open could only be viewed in the search room in Sydney. None of the films were available to view either online or in other NAA search rooms, such as in Melbourne.

Due to this prohibitive NAA regime, I sought other avenues of access. Contact was made with the Defence Science and Technology Group (DSTG) in Salisbury and a visit made to meet with its records management staff. The key staff member involved went out of his way to provide copies of open documentary (paper-based) material and suggested that there may be ways to view some of the NAA duplicate film in the DSTG archival repository. However, a problem arose in that there was no viewing equipment available at the DSTG site and various security clearances would still have been required to access material that had not yet been examined by the NAA. Hence, I found myself in yet another stalemate.

There was notation on the NAA website of a film series, D235: Master Negative of Cine film, and its series note revealed (National Archives of Australia, 2019) that it was highly pertinent to the dissertation:

The film is the visual record of observations made utilising optical instruments, such as kinetheodolites, behaviour cameras and airborne cameras. The kinetheodolite film documents a stationary or moving target with the following details: target position, horizontal and vertical angle and time. The behaviour cameras document the behaviour of missiles and targets at launch and during flight. The airborne cameras document inflight information such as missile altitude, target miss distance, etc.
However, none of the contents of D235, series (i.e., the item notes) that may have been highly relevant to this study, are (or were at the time of writing) on RecordSearch. Regardless, the series note itself is useful for the information it provides about the notation used in recording equipment used for filming.

There were also large quantities of NAA records, other than those pertaining to film, that were of relevance to the dissertation, including personnel files, training files and correspondence files. All such material related to the people who worked at Woomera and I was hopeful to access it to assist in the quest to find oral history subjects by accessing records that revealed names and dates of service of women who worked as camera operators at Woomera. Yet most of the series discovered through NAA finding guides once more revealed that many of the index cards and many items in individual series were not on RecordSearch.

The situation described here, of records and item availability at the NAA and elsewhere, became a frustrating, time-consuming and costly reality of this research project. The records are in fact so numerous that a basic search on the NAA web site on the term “Woomera” (with a date range 1947–1975) resulted in 17,465 items, and these may be files, films or photographs. Of these, only 6,574 are “open” and hence accessible. Yet there were a number of files uploaded to RecordSearch that have proved useful. It is impossible to document them all, but one sample is reproduced here.

The file NAA D250, 56/1526 PART 1 is titled, Project – BLUE STEEL – Woomera Part 1 and has a date range, 1958–1964. Although the file, consisting of 152 pages, is located in Sydney, it has been digitised and so is accessible online. This item concerns the important Blue Steel project at Woomera that was central to the testing program. This file contains correspondence concerning how the range was to be equipped to conduct the tests, and the facilities that were required, including facilities for filming. Pages 60–65, 78 and 99 are concerned with the requirements of a darkroom. Pages 88–123 consist of blueprints and plans of the testing and ancillary sites. Page 100, for example, shows the ballistic camera site and page 107 is a plan for the Telemetry Recording Station on Range E. This is reproduced in Figure 2.3 to provide an indication of the detail of these records, some of which have been useful as memory aids for oral history interviewees.
This particular NAA series, D250, consisted of 1,100 items. Reading the item listing via RecordSearch (which required performing an advanced search on the series number, D250), revealed items (files) relating to the Woomera board, range safety, store advisory committee, visits of VIPs, children’s playground, new civic building, hospital, aerial dingo baiting, town planning committee, catering procedures, population studies, women’s hostel accommodation (This file was of interest to the research but was NYE), animal sanctuary, arboretum, amateur boxing, wrestling and judo clubs, transport depots, airfield, ambulance services, ELDO (European Launcher Development Organisation) mess, swimming pool, kindergarten, darts club, school, cricket pitch, mobile fish shop, junior mess, senior mess, water supply, ice-cream factory, petrol bowers, ranges group staff (also of particular interest but also NYE), youth Centre, WRESAT, town band, charter aircraft, library, works & repairs, survey data (most items NYE), fire service, anonymous and eccentric letters, register of assets, bulk fuel installations, parachuting club, flock shop, squash courts and others. As was found with many of the film archives, many of these files had been categorised as NYE. The item listing would, on face value, suggest that the series contains no files.
related specifically to filming at Woomera. But as shown in this single record example, many such files did in fact contain information relating to some part of the filming activities at Woomera.

Of those already digitised, it is evident that despite a file bearing a title with no reference to filming, its contents reveal that many files may contain relevant material. Given that this is the case, in an ideal world, researchers would be able to request each series created by an agency under investigation and call all pertinent records up for examination. However, this approach was not practical due to the limitation of available resources and time for this study.

By this stage of the research project, it had become apparent that the information derived from oral history case studies might more productively form the basis of the dissertation, rather than, as had originally been expected, the analysis of film content and the industrial modes governing its recording.

2.6.2 Archival research in the United Kingdom

In June 2017, utilising my contacts on the Woomera!! Facebook group, I was made aware of a substantial collection of films believed to have been produced concerning the development, launch and testing, of the Blue Streak rocket at Woomera.\textsuperscript{10} Women I have interviewed took part in the filming of the Blue Streak test program. I was keen to learn more about these films and attempt to view them. These films were located in Edinburgh, under the care of the National Museum of Scotland (NMS).\textsuperscript{11} I was informed that the collection consisted of some 2,000 items in both 16-mm and 35-mm format. It was not obvious how many of these had been shot in Woomera, but it was clear from the existing listings that several hundred had been.

An initial impediment to viewing these films was the fact that the NMS no longer had a Steenbeck [a flatbed film editing and viewing machine] or another editing or viewing desk on which the films could be viewed. However, the Moving Image Archive (MIA), a sister organisation to the National Library of Scotland, did have a machine and it was negotiated that I would be able to use it during my research visit. At the time of planning my research trip to the United Kingdom (which I added to an already planned holiday to visit relatives), 195 films relating to Blue Streak were held in Australia by the NAA. Of these only 34 had been assessed as “open.” Most of the
others were categorised “NYE”. It was ironic that at this stage of my research, I would have far more chance of viewing films outside of Australia than seemed possible given the access provisions and costs levied by the NAA.

Research at the NMS enabled me to piece together the provenance of the films. The entire collection had been produced by the Conquest Film Unit, a division of Hawker Siddeley Dynamics. The collection had been deposited at the Museum of Scotland in 1974 sometime after Conquest had become a part of the British Aerospace Organisation and ceased to make films about the work at Woomera. It remains uncertain why the NMS was the chosen repository, but it is likely to be due to the fact that a former curator of the collection at Hawker Siddeley had a personal connection with a curator at the NMS.

I spent a full day examining the disposition and content of the films at the NMS, which are shown on the shelves in Figure 2.4 and during the first few hours examined provenance records, after which, an assessment was made of the films to be selected to take to Glasgow for viewing at MIA. Prior to traveling to the United Kingdom, I had noticed a film, from the lists the NMS provided, that seemed particularly relevant: *Space Research Facilities at Salisbury and Woomera*, pictured in Figure 2.5.

In London, I examined Woomera-related material at the Imperial War Museum (IWM) film collection, located a short distance from the main museum site in Lambeth North. I had sought access to these films prior to leaving Australia, observing all advance ordering protocol of the IWM. These films are listed in the Appendix 4. The visit to examine film at the IWM was fruitful in that I found and ordered a copy of part of a 16-mm film, *The Firing of Skylark at Woomera* (1957) that included footage (at 4:18) of Laurine Hall (Laurie East) at work on the cameras in Woomera.
Some of the *Blue Streak* films at the National Museum of Scotland (note rusted cans under the bottom shelf and films in old “tea bags” on the upper shelves), (Barber, 2017).

The can of film entitled, *Space Research Facilities at Salisbury and Woomera*, found among the shelves of material at the National Museum of Scotland (Barber, 2017).
2.6.3 National Library of Australia manuscripts

Broad searches were made for all possible relevant records at the National Library of Australia (NLA) in Canberra. The Ivan Southall papers are held by the NLA and this manuscript collection consists of 124 boxes, of which four relate specifically to Southall’s work on his 1962 book, *Woomera*, which is discussed at length in Chapter Three. These papers include not only Southall’s rough drafts of his manuscript but also WRE archival material not otherwise available (not being categorised as “open”) at the NAA. Thus, examining this manuscript collection at the NLA provided another means to bypass NAA prohibitive access provisions.

2.6.4 Pragmatism and good fortune

As the research progressed a friendship was developed with Heather Cleland, a resident of Woomera and manager of the Woomera Heritage Centre, who had been on duty at the reunion and later took over the operation of the small Woomera Local Post Office. Cleland became deeply interested in my research and was always willing to give advice and suggest people who may have been able to assist with various aspects of it. In return I contributed to the local Woomera newspaper, *Gibber Gabber*, with a monthly article on some aspect of Woomera history that I had uncovered in the course of my research, on subjects peripheral enough to my work to ensure that it remained original and unpublished prior to examination. In late 2018, Heather mentioned that she had a box of videos of “old film” that had been left at the post office some years back. She wasn’t sure what was on the videos and had had no time to view them and she entrusted them to my care. NFSA staff in Melbourne kindly transferred the seven videos to DVD for later viewing.

It was evident to me that the videos consisted of copies of original films that had been on reels of film shot at Woomera over a period as early as 1948 and as late as 1970 – the period of my research focus. Most of the footage related to the 1960s. Some of the film was shot in colour, most were shot in black and white and some had sound.

Reel 5 was most relevant to my work and was made up of four films: *The Blue Streak Rocket Launcher* (c. 1964), *This is Woomera*, ITN with Peter Fairley (1963), *Europa Rocket Fired at Woomera, Australia* (1966) and one which was a compilation of various missile firings.

The film, *This is Woomera*, contained footage of the 1963 interview with Laurine Hall by Peter Fairley of the Evening Standard for an ITN program aired about Woomera.
This was a film I had viewed online early on in the research process where the sound had been removed soon after I had seen it on YouTube. I later saw part of the interview in Steven Thomas’s 2004 documentary, *Welcome to Woomera*, mentioned in section 2.3.1 of this chapter. I had been attempting to find the full footage of the interview between Fairley and Hall for some time. This film is analysed in depth in Chapter Four.

Had I not developed a friendship with Heather Cleland and assisted at the Woomera reunion I would never have gained open access to this complete collection of Woomera-related film.

2.7 Conclusion

On beginning this research project, I aimed to discover details of the experience of women working as camera operators on the Woomera rocket range between 1950 and 1970 and additionally, to explore the role of the men (“photographers”) to whom these women (“assistant photographers”) reported – primarily through an examination of archival film. This media emphasis changed due to the practicalities of accessing film, and although the research emphasis remained the same, the method was varied to some degree. The most significant method employed was a case study approach using oral history in the form of recorded interviews that were analysed to compare the experiences of a variety of women. This method provided the best opportunity to appreciate the personal experience of women as revealed through their own words. I also used mixed methods to verify my findings. The oral history project benefited most of the participants who expressed the view that they enjoyed the opportunity to talk about their work and were flattered that someone cared to ask about it. They reported that it enabled them to reflect on a period of their lives that had been almost forgotten in the passage of time. Original manuscript and archival collections, documentary, publicity and data film were also appraised during the course of the research, to ensure the case study findings had been rigorously tested against other archival sources.

The following Literature Review in Chapter Three explores in more depth the range of sources analysed and their relative usefulness for gaining an understanding of the role of women in the utilitarian filmmaking that went on at Woomera. Subsequent chapters specifically address the findings of the oral histories through the primary case study of Laurine Hall and supporting oral histories with a number of her colleagues and male superiors.
Endnotes


2. Excellent theses have looked at aspects of life at Woomera, although not focused on women’s experiences (Iwanaki, 2011, Williams, 2004). These theses are analysed in the Literature Review.

3. A full exploration of the women who worked in communications roles and as “Computers” on the range is beyond the scope of the dissertation, but their work is discussed during the oral histories examined in chapters 5 and 6 and in Appendix 2.

4. WRESAT, Weapons Research Establishment Satellite, Australia’s first satellite, launched from Woomera, 29 November 1967. Its launch made Australia only the third country globally to build and launch its own satellite behind Russia and the United States of America.

5. Clio’s Current, is a blog “that explores contemporary issues with historical perspectives. This blog asks questions of the present using answers from the past. It is written by three historians located in Canada: http://clioscurrent.com/about The web blog closed down in October 2015 but its posts can be accessed at present.

6. The interviews utilised for my undergraduate honours thesis marked the start of my respect for oral history as a research method. On graduation, I worked as an historian within a major Australian organisation where I established an intensive oral history program involving retired employees. I later began my freelance career as a historian, publishing 12 books, all of which have included numerous oral history interviews.


8. Copies of digitised films (whatever the size of the film) are supplied as MP4 files at $203.30 each, films with separate audio tracks cost $329 per set. In addition, a per item plus delivery media charge of $16.70 applies to view an audiovisual record in a research centre where an access copy does not already exist. Copies of NYE items may take more than the mandated 90 business days from the paid request being received by the National Archives. Thus, even if you are unsure of the specific content of the film, the fee must be paid prior to viewing the film and deciding if its content is pertinent to one’s research.

9. This presented a dilemma, as initially it was expected that the study would be based on the examination of original film.

10. In 1955, Britain had begun developing a long-range liquid-fuelled missile, which was to be known as “the Blue Streak program”. Designed to deliver nuclear weapons, as part of Britain’s independent nuclear capability, work focused on producing an intermediate range missile. In 1960, given rising costs, the Blue Streak program was scrapped. Although Blue Streak’s life as a military weapon ended in 1960, the technology was quickly assigned to the European Launcher Development Organisation (ELDO) project based at Woomera. This utilised the Blue Streak rocket as the first-stage of a composite space vehicle designed to launch satellites into orbit. In 1967 Britain announced that it would withdraw from the ELDO programme in 1971. The last Blue Streak launch was on 12 January 1970.

11. Dan Kendall, curator at the National Space Centre (UK) saw my post, asking for possible interview subjects and/or information on film made at Woomera and alerted me to a large collection of films held by the National Museum of Scotland in Edinburgh.

12. The Conquest Film Unit had been formed by Hawker Siddeley Dynamics Ltd. to document, through filmmaking, various aspects of the group’s activities, including its work on the testing program at Woomera. It was run by trained cameramen. WRE worked in association with Conquest, (Conquest is noted in the film credits). My research indicates an important working relationship between WRE and Conquest, showing how seriously WRE took its filmmaking activities (Barry Guess, personal correspondence, 21 October 2017).
Chapter Three

Literature Review

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3.1 Introduction

This review reports on the literature (which includes film and video media, as well as journal articles, books, newspapers and original archival documents) relating to the Cold War, which sets the study in historical context; the joint project between the United Kingdom and Australia, which in turn led to the creation of the Woomera rocket range; women’s roles at Woomera, specifically pertaining to utilitarian filmmaking, the central consideration of the thesis; utilitarian and associated film sources, as they apply to the images captured at Woomera; cameras and ancillary equipment, in terms of their use on the Woomera range; the impact of the weapons testing at Woomera on the Indigenous community; and consideration of women’s place in Australia (1947-1970), with particular reference to women’s working lives outside of the home.

Other scholars who have examined aspects of Woomera have referenced the “plethora of archival material” relating to Woomera (Garnaut & Freestone, 2007, p. 18). Even if this is the case, access policies to Australian Government archives were prohibitive for researching certain aspects of this dissertation, as detailed in Chapter Two.

Film scholar, Julia Erhart comments that women have a tendency to downplay their role in history, referring to the film, *A League of their Own* (1992), in which one of the characters, Dottie, says: “I’m not really part of it. It was never that important to me. It was just something I did. That’s all” (Erhart, 2018, p. 24). This downplaying of important work and lessening the significance of one’s role has appeared throughout the interviews with women conducted for this research. Most of the women with whom I have spoken, initially expressed surprise that I would want to meet with them, suggested they did nothing very unusual and seemed reluctant to accept any admiration for what they saw as “just a job” (this is further addressed in Chapters Four, Five and Six). Is this then a gendered response to working in unusual or atypical occupations, particularly occupations traditionally considered as the preserve of men? If so, it is likely also to be a gendered response to perceived self-worth or a “performed” expression to meet expectations of female discourse and to avoid patriarchal dismissal or opprobrium.

Erhart asserts that the work of filmmakers like Penny Marshall and others, “draws attention to small but significant components of otherwise forgotten history, which is reflexively narrated by a woman about women” (Erhart, 2018, p. 25). This echoes my intent for this research: women telling the story about women – contrasting other
extant references (such as Southall, 1962; Beadell, 1967; Morton, 1989; Matthews, 2006; Donovan, 2007; Tucker, 2009 and numerous media articles) in which men tell the story of women’s work and lives at Woomera. This is not to discount the work of these male authors, but to offer the possibility that female authors, scholars, filmmakers and, most importantly, the women who worked there, can perhaps offer a more nuanced view of women's work at Woomera.

The key texts studied for this research pay scant attention to the working lives of women at Woomera, other than as wives and potential partners to the disproportionate number of men on the range, and mothers of their children. A pivotal aim of this research was to redress this lack of serious study on the roles of women at Woomera, particularly their roles in the production of utilitarian film. Many of the references relating to the study of gendered space are explored more fully in the case studies. The review of the literature also examined sources concerned with women filmmakers and the depiction of women in film. The Reference List and Appendix 5: Additional References Consulted, contains a full listing of all resources explored during the course of this research.

3.2 The Cold War, its impact on Australian defence science, and the planning of a testing range at Woomera

In excess of 60 million people were killed as a result of the 1939–1945 war, and millions more were left homeless or displaced. Cities were destroyed, people starved, and entire cultures were decimated (Hastings, 2012, p. 646; Doyle, 2013, 208). Despite the establishment of liberal and peacekeeping bodies such as the United Nations and the International Court of Justice, and internationally ratified documents such as the Atlantic Charter and the Universal Declaration of Human Rights, there was an uneasy view of a future of world peace (MacMillan, 2009) and planning began in the United Kingdom with the expectation of a Third World War (Twigge, 1990, p. 162). Historians differ in dating the start of The Cold War (the state of political and military tension after World War II). Immerman and Goedde, editors of *The Oxford Handbook of the Cold War* (2013) dedicate an entire chapter to “Historicizing the Cold War” (pp. 15–31) and offer a starting point for the Cold War at the end of World War II in 1945 (p. 17). Others also consider that it began in 1945, but with the Yalta and Potsdam conferences (Cocroft, Thomas & Barnwell, 2004, p. 4). However, Bridget Kendall suggests it began earlier, in 1944 with the Greek Civil War (2017, pp. xii and 1).
In 1945, German weaponry science was well advanced ahead of the Allies. Captured V-2s (the world’s first long-range guided ballistic missile) and the German scientists who created them (Lasby, 1971), were taken to the United States and the USSR at the end of the war. Britain had to all but begin again with its own research to ensure it at least matched what was being developed in America and Russia, which had evolved into states of great power. The new phrase “super-powers” was coined to describe them (Malchow, 2016).

Australian Defence Department historian Peter Donovan’s *Anticipating tomorrow’s defence needs: A century of Australian defence science* (2007), produced for the Defence Science and Technology Organisation (DSTO), now Defence Science and Technology Group (DSTG), includes an informative narrative on the advances of defence science during the Cold War and beyond. Britain, during and immediately after World War II, heeded the philosophy that “science could help win wars” (p. 60). The Anglo-Australian Joint Project meant that Australia also shared this philosophy, as Donovan attests. The sources on which his book is based are mainly government reports, official summaries and personal papers, as well as a large number of secondary sources, including Peter Morton’s book on Woomera, *Fire Across the Desert* (1989). The index has 12 single page entries on Woomera. There is no dedicated chapter on the activities at Woomera, although there are sections on the various defence science projects that included the essential work on the Black Knight, Blue Steel and Blue Streak rockets and other guided weapons; the development of the pilotless aircraft, Jindivik; and the launch of Australia’s satellite, WRESAT (pp. 206–216). There are no index entries on utilitarian filmmaking, or women, which is not entirely surprising, given that both of these subjects, considered independently and in combination, seem to be neglected areas of study.

Donovan addresses the global fear that arose as individual nations began to develop long range and atomic weapons (2007, p. 35). He also notes that “defence science in Australia took a monumental step forward after World War II with the inauguration of the Anglo-Australian Joint Project for the development of guided weapons” (p. 29).

Donovan quotes figures that reveal the commitment of the Australian Government to defence science during the Cold War. The appropriation for Defence Research and Development grew from £6.4 million in 1950–1951 to £10.9 million in
Projects on which this money was spent included the testing of Black Knight, the largest and most powerful rocket built in Britain and the development of Jindivik, a subsonic unmanned jet-propelled target aircraft designed to measure missile performance.

During the first decade of the Cold War there was an acceptance that a hypothetical Third World War would be waged using rockets with atomic or, as they developed, thermonuclear payloads. These weapons required testing, and for the United Kingdom, Woomera provided the space, conditions and, in time, infrastructure to make this a reality. Australia was also keen to develop its own deterrent weapons and had begun to plan for this as early as 1942 (Reynolds, 1998, p. 854). The history of Australia’s relationships with its “partners”, the United States and United Kingdom, is complex and the changes in these relationships from 1946 to 1957 impacted the development of Australia’s defence policies.

Wayne Reynolds explores these changing relationships in his extensively researched article, “Rethinking the Joint Project: Australia’s Bid for Nuclear Weapons, 1945–1960” (1998). Reynolds contends that Australian planning for deterrent weapons began soon after the fall of Singapore in 1942 (p. 854). Australian defence policy from 1946 rested to a high degree on the work that occurred at Woomera, as Reynolds shows in his article, and this has been largely overlooked in most works on the Cold War. Reynolds argues that both Prime Ministers Chifley and Menzies supported a joint project with the UK to develop and test weapons and rockets and that, furthermore, both governments saw the development of nuclear “deterrents” as an essential policy for Australia up to the 1960s (pp. 870-872).

Sheridan (2006) has observed that the Chifley government’s wholehearted endorsement of the Anglo-Australian Joint Project needs to be understood not only in terms of Australia’s defence requirements but also in terms of national development plans in areas including housing, mining and welfare, which was to be supported by the ambitious post-war immigration program to draw Britons and other “suitable” Europeans to Australia (Sheridan, 2006, p. 17). The research work to be undertaken at Woomera and other sites was considered a strong drawcard for potential migrants (p. 18).
Not only was the work at Woomera significant in terms of the joint project with the United Kingdom, and pivotal to this research into the roles of women at Woomera, it extended across key advances in Australian science, education, and national security from 1945–1960. In terms of education, the Australian National University was created as a corollary to the defence initiatives and the joint project (Reynolds, 1998, pp. 859–860; Foster & Varghese, 1996). Furthermore, the Australian Security Intelligence Organisation (ASIO) was created within weeks of the first rocket firings and is considered one of the most “enduring legacies of the joint project” (Bardwell, 1988, p. 15). Reynolds argues that the joint project at Woomera reached proportions that “transformed Australian industry” (p. 864). By 1956, £50 million had been poured into Woomera. The gains were profound in terms of the development of the WREDAC computer, training of technicians and creation of sophisticated range instruments. Reynolds asserts, “in 1956, the Australians seemed on the verge of a brave new world” (1998, p. 864), and in fact, writers of Woomera’s heyday used those very words (Australia’s throwing stick, 1961). The advances inherent in this brave new world would include the employment of women in new and significant roles.

Immerman and Goedde’s, The Oxford Handbook of the Cold War (2013) is otherwise expansive but omits any real mention of the Cold War in Australia. There is only one index entry to Australia (p. 415) and this relates to the 1970s American pressure on the British to influence an Australian election. The joint project between Britain and Australia is not covered in the section on Britain and the Cold War (pp. 141–157). The development of the Blue Streak missile is briefly mentioned (p. 149) but the important role that Australia played in providing the testing facilities is not mentioned. Likewise, the development of Britain’s hydrogen bomb is touched on (p. 149), but again the role of Australia and the joint project and the testing facilities provided by Australia to Britain is not noted. It has been estimated that the joint project cost Australia and Britain combined $3.25 billion and was a significant part of both country’s Cold War policies (Morton, 1989, p. 533.) One could argue that given these facts, the Anglo-Australian Joint Project should have been included in a credible “handbook” of the Cold War.

This deficiency aside, Immerman and Goedde’s Handbook contains a thought-provoking and extensive chapter, “Gender and Women’s Rights in the Cold War”, which is pertinent to this research (pp. 523–539). While again this chapter makes no reference
to Australia, much of the argument posed in the chapter, written by Helen Laville, is of relevance. For Laville, gender was central to the Cold War. She argues that the USA and USSR used the respective advantages of their systems (democratic or communist) to advance the position of women in society (p. XX). Laville’s chapter “critically examines the early Cold War use of the status of women as a measure of national progress” (p. 524). Laville’s argument is explored further in Chapter Four of this dissertation.

David McLean’s (2001) *Australia in the Cold War: A Historiographical Review* presents a critical review of the literature on Australia during the Cold War published up to the year 2000. McLean’s main contention is that the extant material to that time offers much to address the “misperceptions that characterised the period” (p. 300). These misconceptions include the notion that Labor Party and Liberal-Country Party governments differed substantially in their foreign policies (p. 304). While McLean does discuss the spending by Australia on defence during the Cold War, which rose from £55 million in 1949–1950 to a peak of £207 million in 1952–1953 (p. 318), he makes no mention of the spending on the Woomera joint project and the associated development at Talgarno, Western Australia, which absorbed a large proportion of this spending.

Ivan Southall was writing his book *Woomera* (1962) at a time when the Cold War was well-entrenched, and the threat of an aggressive Soviet regime was very real for Britain, and by extension, Australia, which would inevitably have become a British ally should a future war break out. Lowe discusses the reality of this threat for the then Menzies government (1999, p. 143) and Southall also explains why Woomera evolved to be the ideal location for the UK to test its weapons and describes the land that was set aside for the rocket range with romantic fervour, saying “this land was made for rockets. A rocket blazing into the sky by day or night, seems so right, so natural to the terrain” (1962, p. 74).

A vast area of space was required to replicate the space that would be travelled by the equivalent of a V-2 missile. In Southall’s assessment, the Australian government immediately recognised the benefits in partnering with Britain to develop and test long-range weapons in terms of supporting its own national defence policy (17).

Southall documents the plan to create a version of the V-2 bomber in considerable detail. He summarises the change of plans of the British and the result of these changes, in terms of fear, writing “at the bottom of it was fear. As I see it, they had to
start the super V-2 because they were afraid […]. It remains a *strange comedy of fear* [my emphasis] (p. 43).

It had been Southall’s original intent to call his book *Woomera, A Comedy of Fear.* Two decades later, Noel Sanders called to account Southall’s romanticisation of Woomera (1984, p. 9) and questions the description of the idyllic utopia of Woomera Village that was in fact relatively close to the site of atomic testings (p. 11). He discusses the extent to which Woomera “is the ‘other’ of Maralinga – its ‘civilised side, its adventurous and inspiring side (especially for men and boys)” (p. 23).


One of the strangest things about weapons […] is that they can be used to help men instead of to hurt them; and just as there is more to a newspaper than bad news, there are more things at Woomera than terrible weapons.

One of the two narrators of the 1957 film, *Rocket Range*, says of living in Woomera, “just because you think of deserts, we do the usual things” (6:37) – only that testing weapons of mass destruction is hardly “usual.” Viewers are supposed to take from this film that women do the “usual” things of keeping house, chatting with friends and raising children. This dissertation will show that women were doing “things” very far from “usual” in their work operating cameras on the Woomera rocket range.

Bridget Kendall’s (2017) *The Cold War, A New Oral History of Life Between East and West*, was produced to accompany “a landmark BBC Radio 4 series, The Cold War.” Its jacket proclaims with some hyperbole:

in this meticulously researched account, Bridget Kendall explores the Cold War through the eyes of those who experienced it first-hand […] offering a variety of perspectives that reveal how the Cold War was experienced by ordinary people […] The [book] covers the full geographical and historical reach of the conflict.

Despite this claim for “the full geographical and historical reach” (2017, n.p.), there is not one index entry for Australia and most certainly no consideration of the joint project between the United Kingdom and Australia. While this is unfortunate, it does not detract from the fact that this is a marvellous collection of oral testimonies
from people who lived through the Berlin Blockade, the Korean War, McCarthyism, the H-bomb, The Cuban Missile Crisis, the outbreak of the Chinese Cultural Revolution, the Vietnam War and every other conflict that occurred during the period 1946–1991, prior to the collapse of the Soviet Union.

The testimonies are engaging and often captivating. The following excerpt is from a then graduate student in physics at Princeton University, recruited to work on the H-Bomb, explaining his view at the time on what he considered his moral obligation to help quell the threat of Soviet domination:

The fear of Soviet domination, Soviet expansion, Soviet threat to the rest of the world […] that was the principal motivation. And it was, in fact, the reason why I accepted the invitation and decided to go to Los Alamos. I was pretty naïve about politics, paid no attention to it really, but I had the general idea that the United States was a moral nation, a nation that could be trusted with great power, and the Soviet Union was not – and that all in all it would be better for the world if the United States got the hydrogen bomb before the Soviet Union did. (p. 121)

This is broadly consistent with the view of the women interviewed for this research, most of whom, like Ford, were in their early 20s and claimed no general interest or awareness of politics. They too seemed almost disassociated from the inherent danger of the weapons whose performance they were filming. It would have been of value to add a chapter to Kendall’s volume giving Woomera’s women a voice and adding their stories to this otherwise comprehensive oral history of the Cold War.

3.3 Woomera and the joint project

*The importance Britain attaches to this scientific association [...] reminds us of the old and weathered kinship of the British Commonwealth*

(Scientific kinship of Woomera, 1953, p. 2)

There was significant national pride within both the United Kingdom and Australia in the establishment of Woomera and the achievements made there. Kenneth Gatland, writing for the *RAF Flying Review* in December 1958 titled his article on the Woomera Black Knight tests, “Britain enters the space race”. He described Woomera as “a man-made oasis in a sandstone desert,” claiming of the range’s progress,
“Woomera, at last, is becoming what it was always intended to be – range-head of the finest overland missile test-area in the western world” (Gatland, 1958, p. 20).

Later, in Australia, BHP dedicated most of its Review for February 1961 to Woomera, noting in its lead article titled “Australia’s throwing stick”:

Woomera lies at the apex of the only rocket range in the British Commonwealth, and is part of a vast system of scientific research into the latest practical aspects of man’s scientific curiosity – rocketry. (p. 3.)

The journalist also noted that Woomera was a “model town” and the scene of the testing of the “most effective missiles of our brave new world” (p. 4). He dubbed Woomera “the town of the future” (p. 5) and of Woomera’s involvement in space research, noted:

During the International Geophysical Year, Woomera was a key Centre in many of the observations made about our planet […] on November 7, 1960, one of the most sophisticated and flexible tracking stations in the world for space work came into operation at the Weapons Research Establishment, Woomera (Australia’s throwing stick, 1961, p. 5).

The world was watching, and Woomera was featured in journal and newspaper articles worldwide.

In 1965, Mitchell R. Sharpe Jr. of the University of Alabama Center, Huntsville, Alabama and John M. Lowther of Chrysler Corporation, Cape Kennedy, Florida co-wrote a substantial paper: “Progress in Rocket, Missile, and Space Carrier Vehicle Testing, Launching and Tracking Technology”. The paper appeared in two parts in Volumes 6 and 7 of the journal Advances in Space Science and Technology. Part I is subtitled “Survey of Facilities in the United States” and Part II is subtitled “Survey of Facilities Outside the United States.” This paper was the most comprehensive contemporary summary of technology and space research discovered during this research. Part I runs to 436 pages and reports on ten United States missile ranges. Part II is 150 pages in length and covers the 18 ranges outside the United States: Antarctica, Argentina, Australia, Bermuda (and British West Indies), Canada, France, Great Britain, India, Italy, Japan, The Netherlands, New Zealand, Norway, Pakistan, Soviet Union, Sweden, West Germany and Crete. Given the difficulties with accessing the official records of the Australian range (as outlined in Chapter Two), this detailed report
provided exacting information on the scope and operation of the range and additionally includes an outline of the cameras and other tracking instruments used at Woomera.

According to Sharpe and Lowther, in 1963, White Sands Missile Range (WSMR) in New Mexico was the largest inland missile and rocket test centre in the United States. By that time, 2,000 missiles were fired from the range annually. It was at White Sands that the first captured German V-2 was flight-tested on 16 April 1946 (p. 317), and the “Trinity” atomic test had been conducted nearby the range on 16 July 1945.

WSMR was comparable with Woomera in that it was in “an area where weather and geography permit the maximum use of optical and radar instrumentation” (p. 319). WSMR was also “one of the best equipped ranges in the world for optical instrumentation” which advanced the use of a wide variety of cameras (p. 330). Another similarity with Woomera is noted: “range recovery services at WSMR are similar to those employed at Woomera, Australia; and Colmb-Bechar, Algeria. Indeed, the methods at these three ranges are dictated by the terrain, which is amazingly similar” (p. 342).

The section in Part II on Australia, i.e., the Woomera range, provides an initial summary of the history of the range from 1947, when the range was established, to 1963, the year in which the detail contained in the paper was finalised (p. 29). Of the then current situation (in 1963), the authors state:

Typical missiles and rockets that have been tested at the range include Malkara, Long Tom, Aeolus, Jindivik, Bloodhound, Thunderbird, Firestreak, Fireflash, Sea Slug, Black Knight, Skylark, Jaguar, Bobbin, Blue Steel, Blue Water, Rockoon, CF.299 as well as specially designed research test vehicles such as HAD and HAT, and Blue Streak. (p. 10)

This is a particularly useful summary as reading a contemporary primary source such as this adds immediacy to the account and is always preferable to relying on the official Government-filtered secondary account, written many years after the event (for example Morton, 1989). Within Australia various conference papers were given to publicise the impressive scientific advances at Woomera, such as that presented by R. Cartwright in 1960, “Upper Atmosphere Experiment at Woomera using Rockets”. Stephen Twigge has analysed the early development of guided weapons in the United
Kingdom, although his account, which is from a British point of view, does not suggest that the joint project was an equal one (Twigge, 1990, pp. 251–253).

Sharpe and Lowther detail the geographical features of the Woomera ranges (p. 10). The ABC television documentary, *A Distant Edge* (1964), and other sources make the observation that the location of Woomera proved to be “a giant piece of geographic good fortune” (Southall, 1962). The “Distant Edge” referred to in the film’s title relates to the edge of research and the potential for space exploration. The statement that “the range encompasses some 762,500 square miles, which makes it the largest inland rocket range in the free world,” is quoted often in secondary accounts, it is helpful to have it stated here in a primary source (p. 11). The authors address climate, the most important observation being, “since the area has at least 3,300 hours of sunshine per year, both optical and electronic tracking means operate optimally” (p. 13).

Launching facilities at Woomera are also outlined in considerable detail. The mechanics of position missiles are outlined, and while it appears unsophisticated today, at the time it was advanced technology (p. 14). The authors summarise the support activities offered for the Woomera range by WRE at Salisbury. Both the outdoor laboratory and the physical laboratories and ancillary services provided at Salisbury are inextricably linked and neither can be fully appreciated in isolation. The authors drew on sources supplied by WRE to write the section on the Australian range. These sources were supplemented by records supplied by the Royal Aircraft Establishment at Farnborough in the United Kingdom and various space research journals (pp. 140–141).

Returning now to Southall’s 1962 book, *Woomera*, the author provides considerable insight into the establishment of the Woomera village and long-range weapons testing site at Woomera and was written during Woomera’s heyday. Hence, while it is a narrative non-fiction book, it can be considered a contemporaneous primary source. However, Southall’s *Woomera* was never written as an official history or commentary and contains no footnotes or notes on sources, despite various “officials” being quoted in the text, often with no revelation as to their identity.

*Woomera* can be considered a primary source, given that it was composed in August 1960 and published in 1962 while the Woomera long-range weapons testing program was at its peak.³ Southall provides an excellent background to the weapons
testing program, very much written in the tone of the time, by a man who is writing from the perspective of an “impartial” onlooker, albeit one, still vitally influenced by his time in the RAAF. In the early part of his book, Southall provides a full picture of the importance of the symbiotic relationship between the activities played out at both Woomera and Salisbury where the WRE was centred.

Southall uses Woomera, to explore how a rocket was prepared leading up to launch date. Using this device, he takes the reader through the early history of Woomera, how the site was selected, how the place got its name, its geography, flora, fauna and history. He writes of the people and hence the “characters” who contributed to creating an “outdoor laboratory” in outback South Australia (p. 45). He postulates that the choice of the location of Woomera was in many respects a happy accident, serendipitous that this remote place was chosen before its many virtues in terms of test conditions were essentially realised.

The nature of the work occurring at Woomera reached a world-wide audience. As early as 8 February 1949 the “little township of Woomera” was predicted to become “one of the most important places in the world” due to its rocket firings and research. Said a Canadian journalist from the Toronto Globe and Mail (1949): “It is popularly believed that the missiles that will eventually go tearing through the Australian stratosphere will be such as to make the best efforts of Hitler’s scientists look like museum pieces” (Woomera rocket range Australia, 1949, p. 13).

By 1964 Woomera was being romanticised in major journals like The Bulletin as “the Australian Spaceport” (30 May 1964, p. 39) and given a tenuous link to the indigenous dreamtime:

More so than the American creation, [Woomera] has charm. Aerials prod the sky like a modernist’s concept in steel of things the Aborigine drew on stone at the start of his dream time, and the likeness between these stone drawings and the steel erection next to them is apparent. […] Woomera comes of age this week as one of the world’s great space ports. (p. 39)

The article continues with the exaggerated prediction that the combined efforts of the United Kingdom and Australia will signal “the beginning of the end of the domination of space by the US and the USSR” (p. 39).
This issue of The Bulletin, while embellishing much of the work undertaken and expected to occur at Woomera, contains a wealth of facts and figures about the range and the town, down to the existence of its 73 clubs, fire-station, court, coroner, mortuary, zoo, golf course, cricket ground, telephone service, “several” heliports, two airfields, kerb-lined roads, arboretum, schools and churches and finally the £300,000,000 cost of the Blue Streak launch (p. 42).

3.4 The films

A selection of the films that have been made at and about Woomera are discussed in this section, particularly in terms of their representativeness of a genre. There were some comprehensive documentary compilations that contained archival footage created at the various stages of defence activities at Woomera.

Additionally, a large number of films were accessed concerning World War II rocketry, the end of World War II, German V-2 development at Peenemünde, Britain during the Blitz, Australia post-World War II, the atomic tests at Maralinga and the aftermath of these events, and documentaries about the combined efforts of the allies during World War II. Films held by a number of Australian and British repositories were examined. As has been noted previously, the difficulties with accessing Australian archival footage is addressed in Chapter Two.

In terms of the filming of the Woomera tests, the first reference located in the media of the day appeared on page 1 of the Courier Mail on 19 October 1951, shown in Figure 3.1.

![Figure 3.1](image_url) Excerpt from the Courier Mail reporting on a private film screening in Canberra (“Woomera film”, 1951).
This film is most likely among those held by the NAA and the DSTG, although not all films dating to the early 1950s have survived due to preservation problems.

3.4.1 The Australian Centre for the Moving Image

The Australian Centre for the Moving Image (ACMI) is one of the main repositories and viewing facilities for film under the care of the National Film and Sound Archive (NFSA). NFSA cataloguing notation is used here. A number of films which are part of the NFSA collection accessible at ACMI were viewed. Space limitations prevent a comprehensive exploration, but a number of representative items are discussed, and others are listed in Appendix 5.

A newsreel item created in 1953 (First Pictures: Australia’s Atomic Weapons) is concerned with the development, among others at Woomera, of the radio-controlled rocket, Jindivik, tested at the Woomera rocket range in the presence of then Prime Minister, Robert Menzies. It includes footage of the Woomera township, town children forming a guard of honour and the Prime Minister signing a security book. This film includes some close-up shots of kinetheodolite cameras (1:45). This is a publicity film, focusing on the importance of security, the gravity of the activities at Woomera (signalled by Prime Minister’s presence and his finger pressing the button on the control button launching the craft) and the suggestion of promise of great things to come for Australia, evoked by the children’s guard of honour. With a title including the words “atomic weapons”, the benign production values are at odds with its unsettling subject, but this is the case with practically all films whose subject is the Woomera rocket range. Nicholas Pronay has explored the extent to which newsreels came to suggest “the illusion of actuality” (as cited in Smith, 1976, pp. 95–119). A full exploration of the veracity of newsreel footage is beyond the scope of this thesis, but it is important to stress that newsreel actuality was often as unreliable as television news is today.

Another newsreel item (“British Supply Minister, Duncan Sandys here to see Woomera”) from 1953 shows the arrival at Sydney Airport of Duncan Sandys (Winston Churchill’s son-in-law), the British Minister for Supply, in Australia to finalise details of the forthcoming Woomera rocket range tests. Duncan Sandys’ speech is indicative of the mutual relationship between Britain and Australia that authorities sought to popularise. He said on alighting from his aircraft:
I am looking forward to seeing something for myself of the magnificent contribution Australia is making in the industry and science of defence and of course seeing defence factories and uranium mines and I am especially interested to go out to the great Woomera range.

A 17-minute documentary film survey *Posting – Woomera*, produced in 1960, features the rocket research and testing being carried out at Woomera rocket range (Bennett, 1960). Housing, recreational activities and other amenities are also shown. It was produced by the Army Film Unit. This is a traditional “documentary” as opposed to utilitarian film, as it is propagandist (Barnouw, 1984) with its commentary created to instil pride in Australia’s joint project with Britain (this is also evident in many of government and science journals of the era such as Commonwealth Survey (1953) and *The Australian Journal of Science* (Cartwright, 1960, p. 151)). The viewer is told, “Woomera is an object lesson in cooperation” (16:00). For the purposes of this research, the raw footage is significant, as women, employed as “female trackers” are shown operating kinetheodolites (15:17). Elsewhere the viewer is educated in the operation of “Contraves and other high-speed cameras (12:40).” The film’s key message is to show the cooperation between the Army and civilians working at Woomera.

Many of the films from this era depict both men and women at work on the range, although women tend to be portrayed in traditionally supportive roles to the men who are often depicted in positions of authority. These newsreel films were effectively promotional vehicles and while they were intended to impress the public in terms of the advances in science, space and technological endeavours, they were never designed to challenge prevailing notions of Australian society (this is explored further in Chapter Four discussing women’s place.)

According to Sanders (1984), the earlier Department of Interior documentary film, *Rocket Range Australia* produced by the Australian Commonwealth Film Unit in association with the Department of Supply in 1957 draws attention to its stylised depiction of women’s place (p. 30). The 19-minute colour film opens with a male narrator discussing the importance of the work occurring at Salisbury, “the headquarters of the Weapons Research Establishment [...] where pictures and sounds have to be turned into answers to scientific questions” (0:56). The viewer is shown the huge rooms containing the newly developed computers. The camera pans to a woman retrieving tape as it is ejected from the computer and the narrator comments, “these
are machines that can almost think” (1:42) a veiled implication that the women cannot, or at least, are entirely peripheral to the scene. The narrator adds, “the computer can do in hours what would take skilled men weeks,” (1:43) a somewhat ironic comment given that it was women who were responsible for the computer data analysis. Having shown the wind and rocket testing areas, the film then follows a Bristol Freighter on route to Woomera, where its cargo of missiles will be tested in flight. On arrival at Woomera the narration changes to a female voice, who describes the “attractive” town of Woomera, its churches, schools and shops, while the camera enters into homes where housewives work in modern air-conditioned kitchens. The female narrator says:

People often ask what it’s like living in Woomera […] it seems silly to say that its rather like living in any other town […] it gets hot, but the houses have air-conditioning and most of the other things you need to be comfortable […] we do the usual things that women do in the kitchen. (6:01)

This sequence features a cosy lounge room, with floral sofas and vases of fresh flowers on the table. A young woman reads a magazine. A man, presumably her father, with pipe in mouth, reads a newspaper and an older woman wearing an apron fusses around them. The narrator says of the families’ lives:

We do the usual things […] mother in the kitchen, father digging flowerbeds, the tradesman deliver bread, milk, groceries and friends drop in for a cup of tea in the cool of the garden. (6:49)

We see women with coiffured hair wearing pearls, high heels and pastel-coloured full-skirted dresses, drinking tea and chatting. Later, women are shown chatting in the “department store,” and dressed for church, guided up the steps by a protective male arm. The narration then resumes with a male voice as the work on the range is described. Even though women are filmed operating an Askania Kinetheodolite and a Contraves dual unit, the narrator reveals no details of these women’s work. This omission is addressed in the oral histories presented in Chapters Four, Five and Six.

The development of sophisticated equipment resulting from the applied research at Woomera is mentioned, including a high-speed camera developed at Salisbury. Also covered is the peace-time research arising out of the ELDO project and the “happy
collaboration” between several European nations in which Australia was able to take part given its extensive launching facilities.

A light-hearted two-minute film, *Woomera. Rockets Galore-But No Fish and Chips* (1962), has a buoyant soundtrack and includes aerial images of Woomera. It is a publicity film extolling the virtues of Australia’s outback town with all the modern conveniences, including air-conditioning. It includes images of the town’s housing, post office and of its people in shops (“you can buy anything in the shops except fish and chips” the narrator tells the audience), watering grass, buying clothes, at church, school, in the scout hall and on the golf course. Women are shown in traditional roles, as wives, mothers, teachers and girl guide leaders. Despite the film’s title, there is no footage of rockets.

“*Europa*” *Rocket Fired at Woomera, Australia* (British Pathé, 1966) is a 1:47 minute silent film that begins with (stock footage) views of Indigenous Australians, then depicts the security fence around Woomera, an aerial view of Woomera, the ELDO missile tower, workers, foreman, rocket parts being put into position, control room staff, the rocket launch, and of most interest, a woman and man operating trajectory cameras (1:35). *Figure 3.2* shows an aerial view of the Europa F-6 on the launchpad at Woomera and provides an evocative picture of the range in the desert.

The 20-minute colour film, *Space Research Facilities at Salisbury and Woomera*, made by the Conquest Film Unit and produced by the WRE Documentary Film Section, was not available for viewing in Australia, but was viewed in the UK. The subject of this film is indicative of the joint project between the United Kingdom and Australia to test weapons at Woomera. The film itself is the result of a joint project between the British Conquest Film Unit (the film studio ran by De Havilland Aircraft Co Ltd) and the WRE Documentary Film Section operated at Salisbury, South Australia. The narration provides detailed information about the weapons testing and rocket research at Woomera and Salisbury and helpful commentary on the cameras used to film the tests and the sophistication of the trials process. Information was provided on the layout of the testing facilities, the complexities of the instrumentation systems (doppler, radar, kinetheodolites and ballistic cameras) and the manual and computer data processing that occurred at Salisbury.
Of the data recording, the British narrator noted:

The standard telemetry system in use is a 24-channel timed multiplex system, operating in the 400-megacycle band. The telemetry data is recorded on magnetic tape for subsequent machine analysis. It is also printed out on large sheets of film for visual examination of the centre channels […] High speed cameras record the external behaviour of missiles in flight. These two cameras operate at speeds up to 300 and 2,000 frames per second… These various instrumentation systems and range facilities are used daily in trials.⁴

### 3.4.2 The National Archives of Australia

Given the importance of the Australian Government’s filmmaking initiatives, a broad study of the various agency descriptions, series registrations and finding guides created by the National Archives of Australia (NAA) was undertaken to better appreciate the main developments relevant to the development of the film industry in Australia. It was important to understand how Australia’s documentary film industry developed historically, and to study the development of the various government agencies responsible for film production within Australia. The agencies studied
included Cinema and Photographic Branch (Commonwealth Agency (CA) 5301); The Film Division also known as Commonwealth Film Unit (CA 1670) which consisted of the Department of Information (to 1950) and the Australian News and Information Bureau; and The Australian Film Commission (CA 1929).

Many paper-based and potentially film-based records have not yet been accessioned to series description level and hence there may be files relating to filmmaking pertinent to this research that will not appear on a database search on the NAA web site. John Hughes (2016) has noted that there may be 15% of NAA records pertaining to film collections that are not “controlled,” an NAA term to denote records that have been appraised, registered, given appropriate NAA control symbols and their accession details posted to NAA RecordSearch site.

In analysing the Long Range Weapons Establishments (LRWE) archives it was vital to appreciate the complexities of the changes in administration of the various government departments that were responsible for the operation of the trials at Woomera, and in particular to understand what records were created specifically in relation to filmmaking. The most significant agency for this study is Commonwealth Agency (CA) 3039: Weapons Research Establishment [WRE], Salisbury [South Australia]. The WRE Trials Systems Division managed the trials instrumentation. The range operated a wide range of optical and electronic measuring equipment including high-speed cameras to record the behaviour of missiles in flight and “networks of kinetheodolites and ballistic cameras for trajectory measurement” (CA 3039 agency registration, n.d.). This research was partly concerned with the equipment used in utilitarian filmmaking at Woomera (particularly as it relates to female camera operators) and other sites involved in long range weapons testing, hence the need to examine archives (not only films) that record details of such equipment, its use and operators and the training of operators.

This includes the films created by Defence Science and Technology Organisation (DSTO) and the holdings of the NAA created by DSTO. DSTO created a series identified as D4994: “Series D4994 Documentary films, multiple number series, 1 January 1939 – 31 December 1990.” Series D4994 consists of 1,025 items on RecordSearch [correct at time of writing]. There may also be other films not yet transferred to the NAA or not yet described and annotated and details not yet uploaded to RecordSearch.
The NAA Series Note (National Archives of Australia, n.d) explains:

This series consists of 8-mm, 16-mm and 35-mm cine film in both black and white and colour some with soundtracks. The series documents the progress of the Defence Science and Technology Organisation, Salisbury, South Australia and its predecessor Organisations, its facilities and operational activities. The records cover a wide range of activities including information relating to German rockets, Aboriginal ceremonies, the development of Woomera and scientific trials including the joint project. The series was created in 1953 by the Documentary Film section. Some of the records predate this having been supplied from other sources. The series ceased in 1988 when it was replaced by video production.

3.5 **Specialist camera work and women operating cameras**

*Flight* magazine includes a number of contemporary discussions on the specialised cameras utilised at Woomera. These accounts appear in issues from 1948 through to the 1970s and hence this source was particularly useful for this research as were the proceedings of conferences such as the 1961 Conference on Optical Instruments and Techniques, at which WRE’s Frank Dixon spoke (Dixon, 1961).

Sharpe and Lowther (1965) give a detailed description of the various launching pads for each rocket or missile and the Instrumentation Centre at Woomera (p. 15) and Woomera’s perceived status in the world concerning rocketry and science. Such commentary from a contemporary scientific source rather than through publicity and government reports, provides some objectivity. Of instrumentation, the authors note, “more than 200 data-collecting sites, optical and radar, make Woomera one of the world’s best instrumented ranges” (p. 18).

Their technical summary of the performance cameras used at Woomera includes:

35-mm Vinten HS 300 with lens of focal lengths up to 200in. This camera is attached to a radar tracking mount and can slew at a rate of 12 deg/sec. The movement of the mount is rate-aided and controlled by means of a joystick. Binoculars mounted coaxially with the camera are used for sighting and following. Sometimes other high-speed cameras such as Fastax are coaxially mounted; these mounts can also be slaved to tracking radar like the Contraves instruments. Other cameras used
are of the ribbon-frame type with an effective shutter speed of 100 msec. A number of performance cameras are stationed near the various launchers, on either flank of the centreline for the first 50 mi downrange, and at isolated locations farther downrange. (1965, p. 26)

Chapter Five includes testimonies of women who worked on the Vintens and Chapter Six includes testimonies of men who worked on both the Vintens and the Fastax cameras.

Other contemporary accounts appeared in Australian and British newspapers. As a secondary source, Morton (1989) contains the most detail on the development and use of specialised cameras at Woomera.

Women began operating specialist cameras during World War II, as part of the Ack-Ack (anti-aircraft) forces. The British Movietone film, Girls Work Kine-Theodolite (1942), discussed later in this section, shows these women at work. I have attempted to discover if British women trained on these cameras were brought to Woomera as part of the joint project, either to do this work themselves or to train others. It seems not. Training was very much “on the job,” at least for the women who operated the cameras at Woomera.

The narration in a 1941 British Movietone film, Auxiliary Territorial Services with Royal Artillery includes, “Girls of the ATS join forces with a Royal Artillery Ack-Ack Unit, the girls man the instruments and the gunners do the firing.” While the commentator’s words, “girls man[ning]” instruments is an anachronistic phrase, this film provides evidence of women’s roles in a war-time setting as a precedent of women operating kinetheodolites in a defence setting.

This subject is introduced in Chapter 12 of a book produced by Britain’s Ministry of Information for the War Office, Roof Over Britain, The Official Story of Britain’s Anti-Aircraft Defences (Ministry of Information, 1943). The chapter entitled, “Anti-Aircraft Women”, documents the formation of the mixed forces and initial cynicism about women’s capabilities. Of the women’s work on the kinetheodolites the writer notes:

They have the right delicacy of touch, the keenness and the application which is necessary to the somewhat tiresome arts of knob-twiddling which are the lot of the instrument numbers […] experience has shown that they can be first-class on the job. (p. 58)
Despite the initial problems with messing arrangements and apportioning rations, it was noted, “the men in the mixed batteries show a very real pride in the girls’ work” (p. 59).

Another book written shortly after the Second World War by General Sir Frederick Pile who was General Officer Commanding-in-Chief Anti-Aircraft Command 1939–1945 covers the women’s work in more detail. The book, Ack-Ack, Britain’s Defence Against Air Attack During the Second World War was published in London in 1949. It includes details on the lives and work of women who signed up for the role of camera operators, working in extreme conditions. A contemporary reviewer of the book, commented that the servicemen and women who worked in the Ack-Ack divisions, “never got so much as a mention in despatches,” and that the Army, “thought of it as an ever-expanding reservoir of men doing a ‘cushy job’” (Jacob, 1950, p. 236). It took a substantial effort for General Pile to gain permission to deploy women to the air defence efforts, but the first women to do this work had been signed up by 1940 (Pile, 1949, p. 186). Pile advocated for, and was able to achieve by 1941, mixed teams working in Ack-Ack roles and equal pay for women (p. 187). There was considerable opposition to Pile’s push to employ women, many calling it “breath-taking and revolutionary,” but the assent of Churchill helped his cause:

From the day Mr Churchill first heard of the proposal from me he approved, and at once said that his daughter Mary would be glad to join a mixed battery. [...] In this laudable ambition of getting the girls equal status (and equal pay) I was more of a feminist than the members of the A.T.S. Directorate. (1949, pp. 188–189)

A 1942 British Movietone film, Girls Work Kine-Theodolite depicts uniformed women of the ATS (Auxiliary Territorial Service) working the kinetheodolite camera to capture footage of anti-aircraft guns firing. It also shows film being developed by a female specialist and mathematical readings being recorded by female specialists. This is an important visual record of women’s roles vis-à-vis filmmaking in war time. There seem to be few accounts written by or about kinetheodolite operators, although a recent book, based on the memoirs of three British World War II service women, does provide some insight (Barrett & Calvi, 2015). The Girls Who Went to War: Heroism, Heartache and Happiness in the War Time Forces includes the story of one young woman, Jessie Ward, who enlisted with the ATS and operated kinetheodolites.
Chapter Three. Literature Review

Peter Morton’s lofty tome, *Fire Across the Desert* (1989) is considered the definitive and official history of the Anglo-Australian Joint Project, although not written by an historian but a literature professor (Frost, 1985, p. 97). Morton was given an ASIO top-secret clearance to research and write the book, which took four years, based on a larger Woomera history project that lasted 11 years (Frost, 1985, p. 99). Morton encountered countless difficulties navigating the processes, procedures, bureaucracies and idiosyncrasies of both classified scientific study and Australian Government record keeping (Morton, 1992, n.p.). Both Southall (1962, pp. 123–132) and Morton (1989, pp. 259–283) discuss the specialist camera work performed at Woomera.

Morton provides a detailed exploration of the technical qualities and performance capabilities of the various cameras used at Woomera, including ballistic cameras (pp. 276–278), target aircraft cameras (pp. 278–280) and missile cameras (pp. 280–281). Records exist at the NAA that make reference to the Vintens, but it has not been possible to find any archival documentation of the female operators of these machines. The oral history case studies have been essential in providing this missing information.

Sharpe and Lowther (1965) provide the most concise and clear summary in the literature of the specialist camera work at Woomera:

Woomera makes use of a large number of optical tracking devices and cameras because of their great accuracy and because of the generally clear skies over the range. While some Askania cinetheodolites [sic] are still in use at the range, the primary instrument is the Contraves. The cinetheodolites at Range E are located along Instrumentation Road, which runs downrange and generally parallel to the centreline. The Askanias are sited along the first 5 mi of the route, while the Contraves are sited out to 50 mi. Most of the cinetheodolite stations have two instruments, one for tracking the missile and one for the target. The Contraves are also slaved to tracking radars so they can be pointed at targets too far away to be seen by the human operators. Once the targets become visible, they are tracked manually because of the greater accuracy afforded by this mode. The cinetheodolite system is designed so that all units operate simultaneously; thus, any two stations located on an accurate surveyed baseline can furnish trajectory, altitude, and velocity data. (pp. 24–25)
This passage has provided important contextual information for understanding the film footage examined as part of this research and for making sense of the descriptions provided by the camera operators during oral history interviews.

Sharpe and Lowther (1965) explain the film processing system from that era:

The 35-mm films from the cinetheodolites are scanned by semi-automatic readers that print out data on an electric typewriter, punched cards, or paper tape for use with the computer facility at Salisbury. The reader is said to be capable of an accuracy of 6 sec of arc. (p. 25)

Details are provided on the phototheodolite (ballistic) cameras in use at the time on the range (p. 25). A further section explores Vinten, Fastax and ribbon frame cameras (p. 26), the operation of which has been explored through oral history as part of this research.

Cameras specifically developed by the WRE are described. During the oral history process, cameras that match the description below, were described, but the interviewee Bruce Aitken (personal communication, February 2018) could not recall their specific names and did not suggest that they had been developed by the WRE as Sharpe and Lowther state:

Special cameras are also used for measuring miss distance. These were developed at WRE and are mounted in wing-tip pods of the target missile or in the nose of the attacking missile. The first of these is called WRETAR (Weapons Research Establishment Target Aircraft Recorder) and has an f8 lens with a 180-deg field of view. It uses 35-mm film and is switched on and off by radio command. The second is the WRECISS [Weapons Research Establishment Camera Interception Single Shot]. This small camera has a shutter operated by an explosive charge and is rugged enough to be recovered after impact of the missile (p. 26).

This is significant, as part of this research is concerned with the technological advances pioneered in Australia during the Cold War era. Additionally, this commentary enables a better understanding of the oral testimonies collected.
Both Southall and Morton make reference to women operating the cameras and draw attention to Laurine Hall’s work (Southall, 1962, p. 129; Morton, 1989, p. 264), but they do so with little attention to the women’s proficiency.

While all of these sources above describe technical details of the cameras, none address the training required to operate the cameras or the differences between male and female roles in their use. The oral histories provide fuller details of the training required to operate the cameras, the daily work on the range and the social lives of their operators that evolved out of their work.

3.6 Women working at Woomera

The exclusion of women’s experience in the understanding and writing of Australian history is well known (Mercer, 1975; Summers, 1975; McMurchy, Oliver & Thornley, 1983; O’Donnell & Hall, 1988; Lake, 1999 and others). As Summers observed, up until 1975, “the most authoritative, and most widely acclaimed works of Australian history […] all fail to include in their interpretative frameworks any consideration of what women were doing” (cited in Mercer, 1975, p. 50). Furthermore, what women thought and felt about their lives and work in Australian life has also been given scant attention (Mercer, p. 51). Penny Summerfield has examined women’s wartime experience through extensive oral history research and has observed that accounts of war are “reproduced as (inevitably) masculine” (Summerfield, 1998, p. 28). Likewise, women’s experiences post-World War II are depicted through a gendered lens that is conventionally masculine. Moran and O’Regan (1989) reference the “entrenched misogyny of Australian culture” in their discussion of the “Ocker Film” tradition that they believe “attacked the currency of woman as aestheticised object” (p. 81). Oral history has enabled women to discuss their experiences (as explored in Chapter Two) and it has been important to understand the experience of women in an arena – Woomera – created as a result of World War II through the film medium.

Science has historically been one of the most strongly gendered spheres in modern society and this is true of Australia as it is globally (Carey, 2001, p. 10). Carey (2001) states that while women in science roles and as science graduates were not particularly unusual prior to World War II, during the 1950s and 1960s their participation in these areas rapidly declined (pp. 11–13). The low participation of women in the study of science was an issue of disquiet in the 1960s and 1970s, given the growing awareness
of the importance of science in daily life (p. 11) and the massive expenditure pumped into science at Woomera and elsewhere from the time of the joint project. There is no evidence in the literature of female “boffins”, the colloquial term given to scientists, at Woomera. These facts make the existence of women in scientific roles at Woomera worthy of serious consideration. Carey (2001) does note that “women in unusual occupations were often featured in the women’s pages of the newspapers” (p. 18) and this has indeed been observed from a detailed study of the Australian and British press 1947–1970. What is revealing is that while the women in these “unusual occupations”, such as kinetheodolite operators, the journalists tended to be interested in the personalities and appearance of the operators rather than their technical skills or the intricacies of their work. The disadvantages and discrimination against women in science fields has been a focus of study for Ann Moyal (1993; 2014; 2016).

The media trope can be found, for example, in The Illustrated London News that produced a feature on Woomera in December 1951 (Daily life at an experimental rocket range, p. 944). The surprise existence of a female member of the Woomera township board was noted, and a photograph depicted her, notebook in hand, jotting down points from another woman over a garden fence and the pair looking very much like the gossiping women referred to other articles of the era. In July 1952, Walkabout magazine published an article, “Half-Way Round the World to Test Atomic Weapons”, which not only glorifies the range but dismisses the women living there in the clichéd observation, “You will find a township with an ordinary every-day atmosphere where women do their shopping, where there is the usual gossip and chat” (“Half-Way Round the World”, 1952, p. 13). As Vivienne Brophy has observed, reporting of conversation has evolved in gendered terms in that men “converse” and women “gossip.” Women’s talk is attributed the negative description of dialogue (Mercer, 1975, p. 325).

Another article, entitled “Where Men Work and Women Must Not Watch,” considers the secret work of men at Woomera, of which their wives are ignorant. This “fact” is not consistent with my research that shows women were very much involved in working on the range, which is not, as this article asserts, “out of bounds to them” (Manning, 1953, p. 6).
In 1967, Zara Holt, wife of Prime Minister Harold Holt, visited Woomera. Her visit was described during a Liberal Party fundraiser and reported in the *Canberra Times* (“Mrs Holt Takes the Stage”, 1967, p. 21). Her physical appearance was referred to in the opening sentence. In the de-personalised way married women were named in this era, “Mrs Harold Holt”, was noted to have “appeared in the gold-buttoned navy dress-coat, broad-brimmed hat and large wristwatch on a wide green band which she wore in Perth” (p. 21). The reporter claimed that she was “bewildered by science and technology,” but impressed to find that the Woomera rockets “were tracked every inch of the way with cameras operated by women – all those brilliant scientists yet women are more dexterous and better at the job” (“Mrs Holt Takes The Stage”, 1967, p. 21.) Mrs Holt’s view on the superior dexterity of women camera operators is shared by some of those interviewed for this dissertation, a theme explored in Chapters Five and Six.

There was a plethora of magazine and newspaper articles that considered women in a similar light, and these are explored in Chapter Four and listed in the Reference List and Appendix 5.

3.6.1 Women’s pay

With regards to the women’s remuneration for their work as camera operators at Woomera, the literature doesn’t state explicitly what the women's salaries were with respect to the men, and the (potentially) relevant material held in the NAA was not accessible for reasons outlined elsewhere. However, given that the female camera operators were almost without exception employed as "assistant photographers" whereas the men had roles as "photographer" and "senior photographer", it can be assumed that the women's pay was less than the men's for this reason alone.

This was true of most work in Australia during the 1950s–1960s, prior to the equal pay legislation of 1969, and to a significant degree after it, as the legislation did not apply to all work (Lake, 1999, p. 218). Nonetheless, all of the women interviewed considered their pay rate to be high compared with that of women working in Adelaide and other cities and towns of South Australia, and none complained about being poorly remunerated. As early as 1949, when advertisements first appeared calling for workers at Woomera, the high rates of pay were always featured.
For instance:

The Woomera rocket range appears to be rapidly becoming famed as a workers’ paradise, about the only place in Australia where living is cheap. No worker receives less than £12 a week [...] with overtime, practically all skilled tradesmen are said to be on the £1,000 a year class. Consequently, most of the approximately 3,000 persons employed in the rocket area are getting rich quick. [...] Among the laborers there are many white-collar men from the city who have decided to put in a year or two in the area to get a big bank roll together. (*Rocket range worker’s paradise*, 1949, p. 1)

An article from August 1949 covered the arrival of female nurses from the Australian Army Medical Women’s Service (AAMWS) in Woomera to assist with the establishment of the camp medical service. It was reported that “the girls expect to sign on for a year and hope to get the same ‘area allowance’ as the men – 5/6 per day over the usual pay” (“Rocket Jobs For Women”, 18 August 1949). Whether the girls’ “expectation” was realised is not known.

### 3.6.2 Australian “Computers”

The first article in relation to the employment of women at Woomera as “Computers” appeared in the [Adelaide] News on 15 September 1949, and noted, “Women will be paid between £6/3/ and £7/2/ a week and girls, between £4/9/ and £5/17/1. Their job will be to compute and dissect the result of rocket experiments” (“Applications For Women”, 1949) To “compute and dissect” referred to the work undertaken by the female Computers at Salisbury and Woomera (detailed in Appendix 2). These women received considerable attention in newspapers during 1949, with the photograph shown in Figure 3.3 of Pat Davies, 21, and Elisabeth Patten, 18, (“Girl Computers”, 6 November 1949) is representative of this attention.

However, the women depicted are not shown at work as Computers as suggested in the caption, but as kinetheodolite operators. The human Computers were taken to the range from Salisbury to understand the provenance of the data they were computing. They were chaperoned by Mary Whitehead, the most senior Computer at Salisbury who was instructed to ensure the women were modestly dressed to avoid arousing the men on the range, who were considered to be “starved” of female company – hence their attire in male leather flying vests (Dougherty, 1994).
Figure 3.3 One of the first photographs of female kinetheodolite operators at Woomera, (“Girl Computers”, 1949).

There has been an enduring history of women working in computing roles in the scientific arena. Dava Sobel has studied the work of females employed by the Harvard College Observatory as early as 1887 in America (Sobel, 2016). Her Glass Universe, named one of the best books of 2016 (by NPR, The Economist, Smithsonian, Nature and NPR’s Science Friday), is one example of an increasing field of interest in the study of women’s work in a traditionally male sphere.

Women’s superior aptitude for computing work compared with men was often reported. In 1949, a reporter explained, “The board has been told that women are more reliable computers than men. Women with Leaving Standard mathematics and at least Intermediate physics and English will get between £6/3 and £7/2 a week if they are adults, and £4/9 to £5/7 if juniors” (“Rocket Jobs For Women”, 18 August 1949).
A WRE careers guide sets out the qualifications required, duties expected and rates of pay for young graduates and cadets seeking employment at Woomera (“Career Opportunities”, 1960) Most of the guide is directed solely at men and refers to “his career opportunities”, “his promotional prospects”, etc. However, in terms of rates of pay the document states: “Female officers [at Woomera] will receive £180 per annum less” (p. 3). On a starting salary of £1235 for experimental Officer Grade 1, this is substantially less.

Australian space historian, Kerrie Dougherty (1994), interviewed mathematician Mary Whitehead [d. 2014], mentioned above, who was for a time the most senior Computer during the joint project. Dougherty sought to “redress the oversight” of the lack of information on the roles of the “computer girls” at Woomera and Salisbury. Dougherty believes that Whitehead was the first female professional employed by the LRWE (Dougherty, 1994, p. 226). I was also fortunate to interview three women who had worked as Computers at Woomera and their oral histories are written up in Appendix 2.

### 3.6.3 Senior female roles and men as bosses

There are few sources that consider the women at Woomera who worked in senior roles. A 1956 WRE information brochure as shown in Figure 3.4 was particularly useful for its inclusion of an organisation chart for personnel working at the range and at Salisbury, including the reporting structure for the Optical Instrumentation division.

An officer in charge of Optical Instrumentation reported to the Principal Officer. Beneath the Optical Instrumentation officer were three branch heads of Systems Application, Systems Servicing and Systems Operation. Reporting to the Systems Operation head were branch heads for Contraves & Askanias, Ballistic Cameras, High Speed Cameras and Processing. Subordinate to these were the individual machine operators, which research has revealed were mainly women. One magazine article made reference to a senior female employee on the range, Stephanie Travers, who was pejoratively said to “stagger under the title of Sub-Controller Instrumentation” (McKie, 1958, p. 16). Travers’ work is discussed in Chapter Six. Other than this brief mention of a senior woman, there are limited references to the employment of women in senior roles at Woomera, however the oral histories presented in this research reveal a contrary view, with the work of Travers, Barbara Hewish and Joan Campbell discussed, in some detail by Patrick Bradley and Loma Silsbury.
3.6.4 Women's experience at Woomera

Most of the media articles studied that mentioned the women living in Woomera were concerned with “women’s interests” and printed in various “women’s magazines” of the time, particularly *The Australian Women’s Weekly*, which appeared to have a voracious appetite for stories about the lives of women on the rocket range.
There are few articles that referred to the paid work performed by women. Most of the articles depict women in the gendered vein of housewife or single girl on the lookout for a husband. Reports that Woomera is a “woman's paradise” because of the opportunities for securing a husband and a decent home are not isolated (for instance “Woomera Woman's Paradise”, 1953, p. 8). Limited space here prevents a full analysis of all articles consulted for this research and Appendix 5 contains a comprehensive listing. Particularly noteworthy newspaper and magazine articles written between 1947–1970, and with a focus on women at Woomera, are discussed below.

News stories began to appear in the media relating to women at Woomera and the surrounding region from 1947. Early articles recount the “downfall” of young women either as sexual or romantic prey by caddish range workers or as the worker’s temptresses (“Rocket range blamed”, 1947). Oral history testimonies have confirmed that cases of teenage unwanted pregnancies at Woomera and surrounding towns were not isolated events in the early years of the establishment of the town (Pat Barter, personal correspondence, 2 October, 2018). However, WRE insisted on the chaperoning of the “computer girls” visiting Woomera from 1949 to ensure they did not become the victims of the “lean and hungry single males” of the town (Morton, 1989, p. 235). The prevailing discourse was that the young, single servicemen who worked at Woomera craved female company.

The scarcity of women at Woomera was a fact often covered in the press. The first women to work there were a group of 30 Baltic waitresses and occasional computing machine operators who are described in terms of their appearance, (for instance, Computer “slender, brown-eyed Pat Davies,”) rather than their mathematical skills (“Remarkable Personalities”, 10 November 1949). An attempt was been made to find some detail on the lives of the Baltic waitresses, but with no success.

By 1964 a documentary had been made on the progress in the development and launch of the Blue Streak rocket (The Blue Streak Rocket, 1964). This includes reference to the work of a female camera operator, “Mrs Lawrence”, and her unusual work on the range. Her profile is explored in Chapter Four. The documentary was reported on in two contemporary aerospace journals: Flight Magazine and Flight International. As shall be shown in Chapter Four, while Flight International and Flight Magazine are credible sources in terms of the technical processes around rocket
science and utilitarian filmmaking, they are flawed in terms of the biased and gendered analysis of the more traditional documentary films produced about Woomera and about women’s roles at Woomera.

Morton (1989) provides some analysis of the technical aspects of women’s work on the range at Woomera, but very little on their lived experience. Morton’s index contains only two specific entries for women: one for the Women’s Christian Temperance Union (p. 72) – one of the many active clubs at Woomera – another for the Women’s Hostel (p. 131) and one as a sub-heading under “Woomera: women's life in” (p. 237). While the book’s Chapter 13, “At Home in Woomera” does present a detailed picture of women’s homes and social lives in the village, what is missing is any real detail on women’s working lives. Due to this deficiency it was vital to find and interview women who worked at Woomera.

Southall’s Woomera (1962) has provided more insight than any other primary source on the gendered roles at Woomera. Southall comments on the social structure at the village, based on the British service model and of the experience of women in relation to this military hierarchy. These observations are significant given my research focus on women’s roles at Woomera, particularly their work in the filmmaking process. Southall’s comments on women are consistent with broadly held views of the period and he implied – as much by what he left out, as what he overtly said – that women were generally not capable of analytical thinking (pp. 78-79). While this view no longer has traction, my research proves that this view is erroneous with respect to the women working as camera operators and Computers at Woomera.

In her PhD thesis, Iris Iwanicki (2011) makes reference to the gendered social spaces created within the village:

- It was a period when there were clear demarcations between men and women’s socialising along status and gender lines – for the messes were primarily a male domain and employment was controlled to meet Defence requirements. (p. 178)

Iwanicki conducted 12 interviews for her PhD research, most of which were with people currently associated with Woomera, or at least associated with it during the period of her study (2007–2010). There were no duplications of interviewees in the interviews Dr Iwanicki conducted with those conducted for this thesis.
3.6.5 Relationships, marriage and children

Of the literature reviewed, all sources concentrate significantly more on the experience of women as wives and mothers or “young singles”, than as camera operators or in other professions. Numerous newspaper and magazine articles that appeared in both the Australian and British media comment on the opportunities provided to women to find husbands and raise families. One refers to Woomera being a “town without shops, not even beauty parlours” (“The Women of Woomera”, 1952). The oral histories have shown that women did indeed decry the limited shopping options, but that this pertained more to the lack of fresh fruit and vegetables rather than the lack of beauty parlours. Another considers the important role of women in making the Woomera working experience more bearable for their husbands (Pincher, 1953). Another depicts Woomera as a “paradise for the single girls […] even if you are not a raving beauty” (McKie, 1958).

These limited views of women are explored further in the case studies. The oral histories recorded for this research reveal another side to ‘women’s place’ and personalities, examining their work in paid roles in the Anglo-Australian Joint Project.

Regular issues of the Woomera newspaper, Gibber Gabber, reveal women at Woomera primarily as housewives and young mothers whose leisure time is spent in craft work, card parties and fundraisers of the schools, kindergartens and churches with which they were associated. The only women referenced in paid working roles are the women who ran a local taxi service. However, Gibber Gabber was always intended as a social village newsletter and it is not until its more recent history that articles appear referencing working lives at Woomera.

The archival films reviewed also primarily depict women as wives and mothers. In the 1957 Rocket Range Australia film, when viewers are shown the first glimpse of Woomera with a plane load of new arrivals, we are advised that, “men are arriving for tests.” Then a woman alights the plane, and the male narrator explains, “wives [arrive] making a welcome return from holiday” (5:17). Women are then shown in a domestic setting, as discussed earlier in this chapter, as wives and mothers, shopping, cooking, entertaining and at church. The female narrator says over footage of the Woomera hospital, “our hospital has a proud record – 800 babies in five years” (7:38).
3.7 Security and secrecy on the range

Southall (1962, pp. 96–108) and Morton (1989, pp. 97–108) address the various aspects of security at Woomera, including the pass system, access restrictions to certain areas, peace officers, guard dogs and local justice. The secrecy of filming on the range was a subject for news media from 1947, shortly after the range had first become operational. The first of many articles with dramatic titles appeared on 12 July 1947 in Sydney’s *Smith’s Weekly*: proclaiming: “Iron Curtain Drops on Rocket Range” advising that “Newspapers will be allowed to print only the most guarded statements about the Commonwealth’s greatest post-war venture.” Other articles covered the suspicion of migrant construction workers as being pro-fascist, anti-union and former Nazis (Balts Arrive in Semi-Secrecy, 1948). Harry Bardwell, writing in 1988, declared that Woomera, “forms part of the secret side of our nation, the deals, alliances and silent partnerships which we never hear about until after the event” (Bardwell, 1988, p. 15).

Even Peter Morton was considered a security risk while writing his book, as he noted:

> Even I, as official historian, had no privileged access to these papers at all. I had to go through a TS [top-secret] clearance, and it is an expensive exercise. It required an interview with an ASIO agent, which in my case took place one mournful rainy morning in a small isolated hut, formerly used for storing explosives. It had the atmosphere of a confessional, reinforced when I was quizzed on my sexual preferences and other potential blackmailing opportunities (Morton, 1992).

Of the documentary films examined, the strict security on the range was always highlighted. In the 1957 film, *Rocket Range* the viewer is informed, “here ‘security’ means ‘security’ for the secret information that can be of vital information to the defence of Australia” (2:19). In the same film, the narrator explains the importance of always remembering one’s pass on entry to the range, as shown in *Figure 3.5.*

Some of the films viewed began with a title card announcing that the films were “classified”. When attempting to gain access to records now up to 70 years old I was advised I would need to obtain a security clearance to conduct research at DSTG. I was also cautioned that this process would take many months and it was implied that it was hardly worth the trouble of applying. It was ironic then that some of the NAA films bearing the “classified” status I was able to view freely in Scotland.
The material gathered in the oral histories suggests that there were ways around the strict security protocols and that many of the women who worked on the range did not take them entirely seriously as is explored in Chapters Four and Five. Furthermore, three of the women who were interviewed were daughters of a “Peace Officer” so were able to offer nuanced accounts of this role.

3.8 Third World War fears and communism concerns

Given that Woomera was established to test deterrent weapons, the possession of which was considered essential in the event of a third global conflict, it is unsurprising that contemporary commentaries on the activities at Woomera include references to fears of a Third World War and the desirability of preventing the spread of communism. Likewise, there were contemporary commentators who voiced opposition to the range on the grounds that it perpetuated and strengthened the discourse around Australian involvement in another catastrophic global conflict.

Southall (1962) grapples with the investment of so much money in the development of weapons and space research by a government already impoverished by the enormous costs of World War II and questions the prudence of it. Even so, he concludes that “we cannot escape from Woomera, because Woomera is the future” (p. 248). Furthermore, while he does not directly address the frenzied fear of communism in Australia, he
comments on the formation of ASIO and its handling of “the Petrov defection” (p. 99). Morton (1989) covers the banning of work on the range during 1947–1948 by the Building Trades’ Federation (BTF) Union, an organisation that Prime Minister Menzies claimed, “was known to be riddled with communists” (p. 118). Paul Wilson (1980) has examined this subject in more depth in his thesis on the various protest movements that formed in response to the establishment of the range, with particular reference to the threat posed to the Indigenous peoples on whose tribal land the range was built. The presiding government managed to negate the protest movement’s central argument of Indigenous harm by making the Communist Party of Australia (CPA) the instigators of the movement against the rocket range rather than the movement’s supporters.

The NAA contains files that were maintained to investigate the existence of communist sympathisers on the range. One file concerns taking subversive photographs and the painting of “ban the bomb” slogans on the wall of the Woomera store by suspected communists (Weapons Research Establishment, NAA item: A6456/2, R141/106), the supposition being only communists sympathisers would oppose testing atomic weapons in the region.

Hugh Walters’ young adult science fiction novel *Blast off at Woomera* (1957), involves a 17-year-old British schoolboy science genius, being selected to travel to the moon from Woomera to take satellite pictures – the first human to participate in a space flight. A sub-plot includes the race to find the Soviet traitor among the ground crew at the launch site before he thwarts the mission and kills the young astronaut. At the time of its release the book exploited the prevalent fear of the “red menace” both in the United Kingdom and in Australia. In terms of this study the novel not only conveys the excitement of space travel and the genuine fear of communist infiltration into the British and Australian space research initiatives, but also firmly puts Woomera at the forefront of public imagination regarding space research and travel in this era. Deery (2001) and Rubin (2004) made use of recently released cabinet papers to explore “the Woomera spy case” of 1958 that stirred Menzies into abrupt confrontation with Britain over its lax attitude to an irresponsible British airman who sold documents that had been considered top-secret but were later proved to be not highly sensitive. The oral histories suggest there may have been rumours about spies at Woomera, but none were every taken seriously and the prevailing atmosphere was one of trust and mutual support among the various nationalities represented on the range.
3.9 Indigenous/ethnic composition

The Woomera Protected Area (WPA) is home to the traditional lands of the Maralinga Tjarutja (MT), Anangu Pitjantjatjara Yunkuntjatjara (APY), Antakirinja Matu-Yankunytjatjara (AMY), Kokatha, Arabana and Gawler Ranges people (Department of Defence, 2018, p. 13.) The impact of the Woomera Rocket range on the Indigenous peoples on whose tribal lands the range was to be built was considered by the Australian Government when the Anglo-Australian Joint Project was first mooted although it is clear that they never considered not constructing the range for reasons of Aboriginal traditional ownership. Indeed, the Australian Committee on Guided Projectiles concluded that “De-tribalisation of Aborigines is inevitable, and provided the contacts brought about by the construction and use of the range are controlled and of a wholesome nature, their only effect would be the putting forward of the clock regarding de-tribalisation by possibly a generation” (Wilson, 1980, p. 84). A protest movement evolved from 1946 consisting of a number of distinct religious and humane societies and at least one Aboriginal group, the Australian Aborigines League (AAL), headed at that time by William Onus, an Aboriginal political and cultural activist (Onus, n.d.). The efforts of the protest movement are explored in great detail in Wilson’s thesis and also addressed by Sanders (1984, p. 13). The Australian Government initially targeted the protest movement with a smear campaign that linked it to the Communist Party and eventually crushed it with the passage of The Approved Defence Projects Protection Act, 1947, which in effect made it treasonable to mount any opposition to the rocket range, and threatened protestors with heavy fines and long prison terms (Wilson, 1980, pp. 67–76).

Contemporary media reports often dehumanise the Indigenous people. One representative article that appeared in the British Daily Mirror in June 1964 included this comment:

I was amused to read that one of the many slight complications that have occurred in the fringe of the British Blue Streak rocket from the range at Woomera in Australia is that a group of 14 aboriginals are wandering around on a dangerous part of the range. The authorities have managed to shoo them out of the way of the big whizz bang […] They are fading out and soon they will be done. But the old strain of independence remains and the “abos” can still show a couple of points
to their sophisticated masters. On the great sheep and cattle stations in Australia [...] abos are among the most valued helpers. They belong to the deep primitive past and now and again they suddenly leave their white employers. They just hop it. (Go Walkabout, 1964, p. 6)

Southall (1962) references the protection of the Indigenous community by the Australian Government. His work is written not long after atomic weapons technology had been tested at Montebello Islands (WA), Emu Field and Maralinga (SA) from 1952–1963. He makes no reference to these tests or the potential danger to the Indigenous community as a result of these detonations. He comments in Woomera:

admittedly, detribalisation of all the natives in the commonwealth was inevitable but contact still had to be vigorously policed to minimise the shock (p. 36).

Len Beadell, who is remembered by the Woomera community with almost heroic status, worked in many sacred lands of the local Indigenous peoples and while it is important to consider Beadell a man of his time (white and perhaps unconsciously racist), it is still confronting to read his almost dismissive comments about the European incursion into tribal lands:

I had some misgivings about being involved – a fleeting insight into the feelings the natives must have had when they first saw the white settlers arriving in ships, they were powerless to stop, trespassing on waters that had been theirs for centuries. Projects such as this, however, must keep abreast of progress, and many share in the ultimate benefits. (1967, p. 103)

Bayly (2009) asserts:

In some respect Blast the Bush reads like an interesting description of a large picnic in which white fellas indulged themselves; certainly, there was repeated mention of the ‘fun element’ associated with the preparatory work at Emu. (pp. 118-119)

Bayly is critical of Beadell’s:

peculiar form of white-fella blindness or amnesia with respect to the degree to which indigenous Australians had occupied our continent [...] it was not uncommon for him to declare parts of Australia to be ‘uninhabited’ when he really meant uninhabited by white fellas”. (p. 111)
Other writers have commented on the inadequate efforts made to prevent Indigenous peoples being present in areas where weapons were tested, and Bayly joins them in his condemnation of these half-hearted efforts (pp. 114–115).

*Hidden Figures* (2016) tracks the lives of a large number of African American women who played vital roles as mathematicians and engineers in the years leading up to, and during, the space race. Their early work as “Computers” is mirrored by the work of a smaller number of Australian women whose work this research has considered. The history of computing as women’s work is the subject of Marie Hicks’ (2018) book, *Programmed Inequality, How Britain Discarded Women Technologists and Lost its Edge in Computing*.

During this PhD work I pondered whether Australia had its own “hidden figures” in terms of the female Indigenous population working on the range at Woomera in roles associated with the weapons testing. The research has revealed this was not the case. The work of Indigenous women in purely domestic roles is discussed in Chapter Five.

There were originally large numbers of nomadic Indigenous women living close to the range, as noted in Morton (1989) and Beadell’s (1967) books. The impact of the incursion on the tribal lands of the Martu people, who were at possible risk of rockets fired from Woomera and landing in the Western Desert in Western Australia is addressed by Davenport, Johnson, and Yuwali in *Cleared out: first contact in the Western Desert* (2005). Grayden’s work, *Adam and Atoms* (1957) is discredited by Morton who documents contemporary claims of Grayden misreporting facts, such as the employees on the Giles project taking photographs of a native woman giving birth (Morton, 1989, p. 89). Morton suggests there were, by the beginning of the 1960s, “about a dozen young women […] being employed as servants and nursery maids at Woomera” (p. 80), which is consistent with the oral histories. He disturbingly notes:

> Though the department of supply recognised that this inevitably led to liaisons which might not be in the girls’ interests, it took the view that it had no right to deny them the experience of regular employment and wages (p. 80).
3.10 Conclusion

Due to the global significance of the joint project between Australia and Britain to test rockets and other weapons at Woomera during the Cold War there is ample written and filmic primary and secondary source material that documents this work. Additionally, due to the importance of the scientific endeavours at Woomera there are plentiful examples of contemporary and recent literature that explore the technical details of this work, and of camera and film technology and its role in Australia’s scientific progress.

This review has documented the current literature that considers these innovations and has included a brief exploration of the Australian Government agencies that created film records relating to Woomera. The review has also cited the repositories of film collections both in Australia and overseas that are pertinent to the dissertation. The literature surrounding the fears of a potential Third World War, and of the perceived threat of Communism and the security provisions and legislation that arose to address these fears – particularly in relation to the Woomera Joint Project – has been considered.

It is important that these records – films, contemporary newspapers, government archives, contemporary and recent journal articles, books and monographs and the oral testimonies – are evaluated in synergy. When analysed together, these records enable a full and rich understanding of a significant period in Australian scientific and social history.

Critically, what is missing in the literature is a nuanced presentation of the role of women at Woomera, particularly those who worked on the rocket range. The oral history case studies presented in Chapters Four, Five and Six challenge much of the contemporary literature that variously ignores, marginalises and trivialises women’s existence at Woomera and their roles on the range. Unsurprisingly, the prevailing misogynistic notions of women as wives, mothers and often intellectual lightweights tend to prevail in the media reports of the era. When women are found to be working in unusual roles, such as as camera operators, their contributions are downplayed and reports concentrate on their appearance and marriage prospects. Chapter Four, which includes the primary case study on Laurine Hall, addresses these issues and provides the forum for Hall to present her own account of life and work at Woomera. Subsequent chapters, Five and Six, present further case studies, with Chapter Five revealing more first hand women’s experiences on the range, and Chapter Six providing the men who worked with these women the opportunity to express their (always complimentary) views on the value of the work performed by the women.
These were the perceived “present day costs” as calculated by Morton in 1986. In terms of the actual costs, Australia spent close to $381 million and the UK, $210 million (in 1986 conversions, Australia more than $2.26 billion and the UK $982 million).

Ivan Southall Papers, National Library of Australia, MS 5379. However, the reasons for the choice of the final title is not evident in his correspondence or working papers on the book.

National Library of Australia, Ivan Southall Papers, MS 5379, Box 42, file 28/1.

I recorded and transcribed on my return to Australia. No time code was available at time of viewing.

CA 3038, The Long Range Weapons Establishment, Salisbury [South Australia.] became a part of CA 3039. The NAA Agency registration for CA 3038 provides detailed information on the history and scope of operations of this Australian Government agency, as well as providing links into the records it created, some of which have been consulted as part of this research. Agency CA 3038 was active between 1 January 1947 and 31 January 1955, when it became a part of subsequent agency, CA 3039. Other agencies linked to CA 3038 are two superior agencies, CA442, New Weapons and Equipment Development Committee (January 1947–November 1948) and CA 186, Board of Management for Research and Development (September 1949 – January 1955.) Further associated agencies are CA 3732, Long Range Weapons Experimental Establishment, Woomera [South Australia] and CA 3075, Long Range Weapons Establishment Range, Woomera [South Australia].

The (ATS) Auxiliary Territorial Service was the women’s branch of the British Army during the Second World War.

This was referencing former British Prime Minister (Sir) Winston Churchill who had coined the phrase, “Iron Curtain”. Referring to the rise of communist power in Europe, he had warned: “From Stettin in the Baltic to Trieste in the Adriatic, an iron curtain has descended across the continent.”
Chapter Four

Primary Case Study: Prominent Women Camera Operators

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4.1 Introduction

This dissertation is chiefly concerned with understanding both the perceptions of the various roles and the lived experience of female camera operators working at the Woomera rocket range during the Cold War (additionally the work of the female Computers is referred to and discussed in Appendix 2). This chapter presents the primary case study, focusing on women camera operators, Mrs Lawrence, Miss Laurine Hall and the Trench sisters (Catherine, Margaret, Helen and Sue). The first oral histories for the dissertation were recorded with the Trench sisters at the Woomera reunion in April 2017. Two formal interviews were recorded, and a number of subsequent telephone conversations were carried out with Mrs Laurine East (née Hall) over the period of June 2017 and February 2020 and the oral history gleaned from her time at Woomera forms the bulk of this case study. The work of Mrs Lawrence was first viewed in a documentary film and together with Ivan Southall’s Woomera (1962) initially sparked my interest in the work of women camera operators at Woomera.

4.2 Mrs Lawrence

A documentary film from this era includes the depiction of a day in the life of a female camera operator, “Mrs Lawrence”, who travelled by bus and then airplane to her work on the Woomera range. The film, entitled The Blue Streak Rocket, was created for the UK Central Office of Information for Foreign Office and Commonwealth Relations Office in 1964.

The excerpt of the film featuring Mrs Lawrence, opens in the Lawrence’s kitchen where, prior to her day’s paid work, Mrs Lawrence is shown in her role as a devoted housewife. Gender is a significant theme in the study of the Cold War. Immerman and Goedde’s (2013) Oxford Handbook of the Cold War includes Helen Laville’s important essay, “Gender and Women’s Rights in the Cold War” (pp. 523–539) and
while this book does not specifically address the subject in the Australian context, much of its thesis can be applied to the situation in Australian at that time.

Laville (2013) asserts that the 1959 “kitchen debate” between United States Vice-President Nixon and Soviet Premier, Nikita Khrushchev in which Nixon and Khrushchev debated the respective merits of capitalism and communism within a “model kitchen” “was testament to the centrality of gender in the Cold War.” The kitchen featured modern labour-saving devices and had been built as part of the American National Exhibit in Moscow. She explains:

while the kitchen debate was shaped by disagreements and airings of vast ideological, economic and social differences between the two systems, Nixon and Khrushchev found common ground on their understanding of heterosexual masculinity. (p. 523)

Laville explores the degree to which the status of women in the 1950s and 1960s was used widely as a measure of national progress (p. 524). The US prioritised domesticity and consumerism, while the Soviets measured the progress of women in terms of equality to men against specific economic and political markers (p. 524). Laville postulates that “clear and stable gender roles were crucial in offering […] stability in a dangerous world” (p. 525). The situation at Woomera then becomes doubly interesting: given the women who worked there are viewed in both a traditional gendered setting – within the kitchen – while at the same time venturing into the male domain of rocketry and missile science.

As Mrs Lawrence’s husband reads his newspaper and smokes his pipe, she happily attends to the breakfast dishes at the kitchen sink – shown in Figure 4.1. There is no apparent threat to his masculinity or his “natural” role as “head of the household,” nor to the role of Mrs Lawrence as “queen” of her “domestic domain”. In Homeward Bound, Elaine Tyler May (2008), argues that in America, the goal of the civil defence strategies developed in response to the threat of nuclear war “was to infuse the traditional role of women with new meaning and importance, which would help fortify the home as a place of security amid the Cold War” (Tyler May, 2008, p. 105). This was also true in Australia. Director of Civil Defence in NSW, Major-General Ivan Dougherty conveyed “a special message to women” in Women’s Day that during a nuclear attack when “the man of the house” would most likely be absent, “the
responsibility for protection of the family would fall on the housewife” (Baker, 1957, p. 5). Her role would involve ensuring the household was ready for a nuclear attack by stockpiling foodstuffs, bottled water, first aid items, torches and portable radios, and in so doing she “will have taken the first important step in civil defence preparedness for [her] country” (p. 5). In the same message, housewives were also warned that in the event of a nuclear explosion, to “wipe each [food] container before opening with a damp cloth to remove possible radioactive dust” (p. 5).

Figure 4.1 Still image from the film *The Blue Streak Rocket* showing Mrs Lawrence attending to the breakfast dishes before she goes to work on the range (“The Blue Streak rocket”, 1964).

In the above image from *The Blue Streak Rocket*, the modern kitchen is shown to include various labour-saving devices of the period (here, electric appliances and a gleaming new refrigerator), which were supposed to unfetter women from the chains of domestic drudgery. Part of the “kitchen debate” between Nixon and Khrushchev centered on the degree to which women in post-World War II America and the USSR respectively, were more liberated. Khrushchev insisted that soviet women were far more liberated through political and industrial equality than were American women.
through their new model kitchens (Immerman & Goedde, 2013, p. 529). Australia followed the USA in the clamour for domestic and consumer goods.

In the post-World War II period through to the mid 1960s, prevailing attitudes to women and their paid employment outside of the home were conservative (Curthoys & Merritt, 1984, pp. 21–24). The working mother was regarded with widespread suspicion (Martin, 2003, p. 446) and, though to a lesser degree, working married women were considered less than ideal in terms of the preservation of traditional family values (Curthoys & Merritt, 1984, p. 23). Additionally, the threat of the “communist menace” was linked to an attack on traditional family values and the prevailing understanding of masculinity (Dean, 1998, p. 33). Being too closely associated with domesticity, at least for men in America, entailed the risk of being identified with “soft” masculinity, homosexuality and political weakness (Immerman & Goedde, 2013, p. 527). To help with the dishes was to tread on dangerous ground.

In this respect the Blue Streak Rocket film is not only propagandist in its promotion of the Anglo-Australian rocket testing programs, but also in terms of its endorsement of the prevailing perception of a woman's place in the home that had arisen out of the post-war conservatism that affected most spheres of Australian life (Curthoys & Merritt, 1984, pp. 21–23; McMurchy, Oliver & Thorney, 1983, p. 129; Mercer, 1975, pp. 61–62). Norman MacKenzie’s respected study, Women in Australia, first published in 1962, observed:

> It is taken for granted that women are home centered and that there is something odd and rather undesirable about a woman who is making a career, or is active in public life outside a range of socially approved types of women’s work and women’s interests. The ‘normal’ woman is expected to conform to the stereotype of femininity, seeking her satisfactions in house pride and the care of husband and children. (p. 81)

Laville quotes historian, Susan Reid, who states that “the happy housewife […] did service in the global politics of the Cold War as an advertisement for the benefits of people’s capitalism” (Reid, as cited in Laville, 2013, p. 528).

Mrs Lawrence’s attire is somewhere between traditional femininity and the modern working woman, in smart slacks with a modest jacket and carrying a functional handbag. To some degree she represents the emerging modern working woman who is off to work with her packed lunch, having first attended to her most significant role
as housewife. The life of Mrs Lawrence differs from most women of this era, not only because she works both inside and outside of the home, but also in that specifically, she works at the Woomera rocket range, a largely male bastion. We see her boarding first a bus and then a plane, arriving at her camera post, climbing the steps to her camera and immediately beginning work at her kinetheodolite (shown in Figure 4.2) tracking the trajectory of one of the most important ballistic missiles in the British arsenal, the Blue Streak rocket, designed to carry a nuclear warhead.

*Figure 4.2  Still image from the film *The Blue Streak Rocket* showing Mrs Lawrence at her camera post (“The Blue Streak rocket”, 1964).*

The narrator informs us:

Mrs Lawrence is more than a housewife. She has a part-time job on the range and for her, and several hundred others involved in Blue Streak’s test, the weeks of preparation are almost over. Every working day, she joins the other desert commuters on the trek to work, but for her, it’s more than a bus ride away. (7:15)

The film then moves from the implied banality of the kitchen to the gravity of a bus filled with dour passengers, most of whom are male, with a security officer making his way down the aisle. The narration continues:
Security is tight here. Blue Streak isn’t the only rocket on the stocks and many of the projects are still top secret. You don’t need a bus ticket, but you must carry your pass. (7:40)

Mrs Lawrence then alights the bus and boards an awaiting plane that takes her to her workplace.

And, now for the next leg of the journey. Mrs Lawrence’s post is far up north and there can’t be many women in the world who fly 300 miles to work, and back, every day. She takes sandwiches for lunch and the plane will be back for her around four in the afternoon. But, today is special, the day of Blue Streak’s launch, and Mrs Lawrence’s camera will be one of the many to follow the flight. (7:55)

This film featuring Mrs Lawrence was released soon after the 1963 publication of Betty Friedan’s, *The Feminine Mystique*, which critiqued the idealisation of the housewife and heralded the beginning of the Second Wave of the women’s movement. Encel, MacKenzie and Tebbutt (1974) have dubbed Friedan as “the mother superior of Neo-Feminism” (1974, p. 308). Friedan’s book became a best seller in America and eventually found its way to Australia though only a handful of reviews of the book appeared in contemporary Australian newspapers up to the end of the 1960s. One review published in January 1967 in the Australian communist newspaper, *Tribune*, lauded the work as “a most valuable and stimulating book”, but took Friedan to task on her “lop-sided emphasis on the intellectual and emotional frustration of women”, rather than focusing on the perceived evils of the capitalist society that enslaved women (Harrison, 1967). In March 1967, an article appeared in the *Australian Women’s Weekly*, “The Dilemma of the Modern Woman,” which examined the history of the “women’s question” and reviewed Friedan’s work. The article by Elizabeth Janeway, was subtitled, “A sceptical report on the experts who tell women how to be women.” Given the populist circulation of the *Australian Women’s Weekly* and the Cold War stigma attached to communism, this was an article Mrs Lawrence and other women at Woomera were more likely to have read. Janeway comments:

As the sixties began, majority opinion declared a woman’s role to be that of the nurturing mother and loving and giving wife. Occasionally a reader might wonder why, if this was so natural and normal, it was necessary for quite so many people to say it so often. (Janeway, 1967, p. 12)
Janeway, who was married, educated and working as a journalist declared, perhaps ahead of her time:

It seems to me from my own experience of combining career, marriage, and motherhood in ever-varying proportions and from the best and most thoughtful of the books on women's destiny I have read, that our role today is to have many roles. (p. 12)

This observation strongly aligns with the findings of my research into the work of women such as Mrs Lawrence, at Woomera.

On initially viewing the Blue Streak Rocket film and considering the gendered representation in the film, it seemed important to attempt to locate Mrs Lawrence and speak with her about her work. Another film from the same period included an interview with a Miss Laurine Hall, another camera operator. Did these two women know each other? Were their jobs similar? Both women became key initial subjects of my research investigating the multiple roles of women at Woomera. I hoped to discover more about both these women at the Woomera reunion.

After an initial site visit and reconnaissance trip in January 2017, I returned to Woomera over the Easter 2017 long weekend to attend the 70th anniversary reunion as an observer and volunteer on the registration desk. This enabled me to meet the 300 plus attendees over the course of three days, as well as participate in some tours to the various Woomera launch sites. This proved to be a rewarding experience in many respects, the most significant of which was the opportunity it offered to meet with people who might later agree to participate in my research.

4.3 The Trench sisters

My first oral history interview with women involved in filming weapons tests on the range was conducted spontaneously during my Easter visit. At this time, I met with members of the Trench family, four sisters, three of whom had lived and worked at Woomera during the period of my study. Two of these women, Kate McGoran and Margaret Rumble (née Catherine Trench and Margaret Trench – who is also known as Irene) had been camera operators between 1960–1967 (their family background and work are explored in greater detail in Chapter Five). This interview, conducted on 15 April 2017, provided initial insights into the tendency for people to either profoundly
enjoy living at Woomera and hence remain there for a long period of time or despise it and move away as quickly as possible. When asked why so many women seemed to work as camera operators at Woomera, Margaret Rumble observed:

I think it was just that there [were] more jobs available on the cameras than anywhere else, the admin, or wherever.

Margaret did not last long at the job as she found it technically challenging, whereas her sister, Kate remained working on the Contraves kinetheodolites for seven years. Learning about these women working on filming rockets out in the desert, I imagined it must have been exciting work. However, the sisters soon disavowed me of that assumption and explained the tedious reality of the work. Kate recalled:

We’d load the film. We’d know what time roughly [the test was to happen], and be prepared […] we could be (waiting) hours.

For both Kate and Margaret, the fondest memory of working on the range was “the camaraderie.” Says Kate:

Woomera ruins you for everywhere else. Cause nowhere is as good as Woomera. You can’t find that camaraderie, that sort of […] it’s just in your blood.

I asked both sisters if they had known a Mrs Lawrence on the range. They had not.

Margaret met her husband while working on her camera post and at the time of the interview they had been married for 51 years.

4.4 Miss Laurine Hall

Laurie East, known at the time as Laurine Hall, worked as a camera operator at Woomera from 1955 to 1964. Her role was primarily as a skilled operator of the Askania Kinetheodolite camera, though she also trained and became proficient in using the Contraves. For the majority of her time, she was stationed at the K2 location at Range E, working solo in her camera post, doing work that variously included filming and recording missile testing and developing film in the tiny darkroom attached to her post. Laurie, as she resolutely wishes to be known in this dissertation, has been the principal informant to this research and this section of the thesis presents her oral
history, gathered over the course of two formal interviews and many instances of email and telephone correspondence between June 2017 and February 2020.

Having first read about Laurine Hall in Southall’s 1962 book, I was hopeful to discover if she was still living. The Trench sisters knew of her, although they were not personal friends. She was not registered to attend the reunion, but connections were made there that did help me find her.

4.4.1 Tracking “Miss Hall”

In May 2017, I made contact with Laurine Hall, now Mrs Laurie East, and had many long phone conversations with her about her life and work. So began my enduring association with Laurie East, remembered by many as Floss and lauded by Southall as described in Chapter Three.

Prior to meeting Laurie, I conducted background biographical research at the NAA and also read as many of the primary and secondary sources that referred to her as I could find, aware already that she was well-known in the Woomera community, past and present. Laurie had never returned to Woomera and had never spoken again of her work on the range after marrying and leaving the area. For her, it was simply a part of her life and she has a personal philosophy that once you move on to a different career or interest, the past remains in the past. Her view has since altered in light of our association and the content of the research with which Laurie has become fascinated.

The work of Laurie and her colleagues was significant both for their time and more broadly as a career for women in any era. The oral history case studies have provided details about their work not found elsewhere. At our first meeting, Laurie and I talked for an hour or so and then we prepared dinner and talked for a little longer. At this stage were just getting to know each other and I was careful to not ask direct questions about her work at Woomera as I wanted to save that for a recorded interview. All quotations from Laurie East derive from my interview with her on 2 June 2017, unless otherwise noted.

4.4.2 Background and biography

Laurine Diane Hall was born to butcher, Edward (Ted) Hall and his wife, Mildred Grace (Follett) Hall in Taunton, Somerset, England on 2 July 1938. Laurine was the
second eldest of four girls, Patricia Joy (Pat), Marguerite Eve (Margo) and Dawn Jean Shirley (Jean). A fifth child, Phillip was born in 1952, at Murray Bridge where the family initially settled on migration to Australia in 1948.

Life was difficult for many Britons in post-war England and a massive campaign driven by the anxiety to “populate or perish” led the Australian Government to attract young migrant families to Australia. Many young families like the Halls were captivated (Pullen, 2014). Laurine’s parents had told her:

they had four girls, and things were really tough in England after the war.
And they had been to Australia House, and thought it [Australia] looked like the Land of Milk and Honey. (L. East, interview, June 1, 2017)

Additionally, Mrs Hall had a sister, Marjorie, who had married and migrated to Murray Bridge in South Australia shortly after the war. Marjorie and her husband were the Halls’ sponsors.

The family migrated to Australia, departing aboard the P&O Ship, Ranchi on 30 September 1948, travelling “tourist class.” Ranchi was dubbed “the floating nursery,” due to the number of child migrants aboard (“200 Child Migrants”, 1948, p. 10). Laurine and her sisters still reminisce about the voyage:

I think we came as assisted passengers. We had next to no money – we were poor. Mum made four bathing suits for us to wear on the boat. She dyed white singlets pink and the hem was sewn together in the centre of the front and back and that made a super strong crotch! (L. East, personal communication, August 21, 2018).

Disembarking passengers were greeted by the Deputy Director of Migration, Mr Ashton, who told the assembled press, “the 198 migrants who disembarked here were a particularly fine lot” (“Ship brings penfriends together”, 1948, p. 12).

The Halls then travelled to Murray Bridge, 50 miles south east of Adelaide, where they were reunited with the girls’ Auntie Marjorie with whom they stayed until they were able to secure their own accommodation. Ted Hall eventually bought a house and the family stayed in Murray Bridge for six years where Laurine and her sisters attended high school.
In 1954, Ted saw an advertisement for a job as a butcher at Woomera and most of the family then relocated to Woomera. Laurine finished her schooling in Murray Bridge and then joined the rest of her family in Woomera, the following year. Laurie says:

I don’t think we knew what it [Woomera] was, I think it was just another adventure, and it got us out of Murray Bridge, which we didn’t like […] we stepped out of the plane [on arrival in Woomera] and thought we were in Hell. 40 odd degrees, you were just stepping into an oven!

Ted Hall worked for a short time in Woomera as a butcher, but quickly moved into a role as a bus driver, driving workers out to the range each day. Mildred Hall, a triple certificated nursing sister, worked at the Woomera hospital.

Laurine Hall’s sisters, Pat and Margo, also worked on the Woomera cameras and their other sister, Jean, worked in the village in a secretarial role. It was not unusual for many members of one family to work together on the range, as I first appreciated when interviewing members of the Trench family, also discussed in Chapter Five.

4.4.3 Laurie’s work on the range

Laurie had no particular career aspirations, she just knew that she disliked school and was keen to join the work force. Her first job at Woomera, as a 17-year-old in 1955, was as a secretary in the technical area. It was not a job she particularly enjoyed, although the location of the tech area enabled her to listen to aircraft prior to take off:

I hated typing, and the aircraft hanger was very close to the admin building, and every time I heard a jet start up, I was out the door like a shot to listen to the aircraft and watch them […] And I used to draw cartoons of the characters working in the admin building […] eventually they said to me, ‘Laurine, would you like a transfer to Koolymilka?’ (the rocket range). ‘Yes please!’

Laurie did relocate to the rocket range at Koolymilka in 1956 where her job was to operate a camera that filmed the rocket firings. Figure 4.3 shows her at work around this time.
Figure 4.3 19-year old Laurine Hall (blonde hair wearing a white collar) appears in the background of this still image taken from the film The Firing of Skylark at Woomera (1957).

This is the earliest film record of Laurie at work. The woman and the man handling the film have not been identified. The woman may be a Computer. Laurie had never operated a camera in her life (other than a box brownie) and has little memory of any training:

I think the head of the department of the cameras came, and took you to the camera, and showed you what to do, and took you through it a couple of times. It wasn’t difficult.

She had no special interest in filming or in cameras, saying “It was the rockets that got me, and the planes. And the noise.”

She recalled the gender composition of the staff on the camera post:

our section was mostly girls, a couple of lads in there, young lads. And then there were the Army guys there, and they operated mostly the Vinten cameras […] The girls and the lads who were with us, operated the Kinies [Askania Kinetheodolites] and the Contraves.
Echoing the Trench sisters’ comments, a day on the range meant a considerable amount of waiting around for a trial. Hall and her female colleagues passed the time talking, doing handcrafts, playing cards or reading. She recalls a typical day in the late 1950s: the journey to the range, the procedure of operating the camera, loading and unloading the film, and the work tracking missiles. The camera operators would catch a bus to the range from the village at Woomera at 7am. It was just over an hour to the range. Work finished at 4pm when another bus returned to the village. Employees took their lunch with them to the range as there were no facilities for cooking or storing food at that time. Laurie tended to remain on the same camera. Figure 4.4 shows her at work on her Askania Kinetheodolite at K2.

Camera posts were located at various places down the range. Laurie loved her work and her camera post. Her camera was at K2, which was situated close to the Instrumentation Building. Camera posts were situated at various positions down range and their positions changed over time as the range developed and was altered to suit emerging rocket research (Morton, 1989, pp. 261–272). This dissertation focuses on the instrumentation of range E, which became synonymous with “the Woomera
range.” The “K” stood for kinetheodolite. K2, an Askania site, was 1km from the
launcher and closest to the Instrumentation Building, from which the trials were
coordinated and where the data processing equipment was located (Southall, 1962,
pp.128–129). There were Contraves camera posts located as far as 100km down the
range as shown in Figure 4.5.

![Figure 4.5 Disposition of the Contraves kinetheodolites on Range E. (Morton, 1989, p. 271).](image)

Operators were able to personalise their camera posts which were small stand-
alone buildings housing the cumbersome camera as well as other materials the
operators needed. Hall’s post was renowned for being decorated with chintz curtains:

> It was like a little house. A boxy house. The Kine camera was up near
the front, back here was a little area with benches for doing your film
and everything, and you had, a window here, not sure about a window
there. And we had tea and coffee here, and I had pictures of aircraft all
the way around, and curtains up for the window, to make it like home.
We used to sleep in there when we weren’t busy. You had enough space
to lie down…. The place was special, that was my little Kine, my little
home on the range. And because you were there so many hours of the
day, you needed to make it quite comfortable. And nice.

While the chintz curtains and the preference to make her workplace “like home,”
points to the prevailing homemaking imperative of 1950s women, Laurie’s choice of
decorative posters depicting aircraft is at odds with the otherwise feminised rendering
of her workplace. Southall (1963, p. 129) takes considerable poetic licence in writing
that she had “pictures of puppies hang on the walls”, a statement to which Laurie took
great exception. While she had a particular interest in breeding and training German Shepherd dogs later in life, she insists she did not have pictures of puppies in her camera posts, but only pictures of aircraft.

Laurie often worked on one of the Contraves posts downrange and camera operators could be moved around to camera posts to suit the varying requirements of each trial. On occasion, particularly in the event of a night firing, the daily routine was a little different if operators were assigned to different posts:

When there was a firing on, maybe a couple of hours before, we would be up in the recky [recreation] room, in the Instrumentation Building. And then we would get our details, and we would all go out in a Land Rover, and be dropped off at each post.

On a standard day the process was more relaxed:

You get to work, and you sit in the common room, and we’d all gossip, and talk, and laugh, and probably do hand crafts until it was time to go out to the camera. They would announce there was going to be a firing, and we’d go out and get ready. And then we’d sit around and drink coffee in your little Kine until the firing was on. Then you’d track that, pack your film up, and your trial, go back up to the building, unless there was another trial coming up soon.

Laurie considered the technical aspects of loading film into the camera and tracking a rocket to be straightforward. The following is a verbatim transcript of an animated response from Hall describing her operation of the Askania Kine theodolite, a literal capturing of her stream of consciousness:

You just took the film out, and put it on top the camera, and levelled it [...] levelling it was easy [...] it was easy. You had four knobs, and you would move two, and try to get a bubble in the Centre [gestures with her hand to show a level like a spirit level]. And if that didn’t work, you would do what we call “throw it out,” go back to the beginning, and start again. Depending on the temperature of the day, it could sometimes be a little bit difficult. The temperature of the day affected what the bubble did. So we always had to leave the roof right over the camera in the shade, so that it was cool before we started filming. But still, basically just so simple [...] and you would put your face in the binocular, watching the launching pad, and track it [the missile] up. [Laurie stands
and performs the physical action required to follow the missile while operating the camera through changes in body positioning. [Follow its trajectory until down, and don’t look through the sun. You just brought the handlebars back, handlebars up here, you just bring them back towards [you] you’ve got your eyes in the binoculars. [Again, Laurie shows the physical operation of the camera.] Depending on how high it goes, you go back down, bring the handles towards you. You are standing up to do this, the filming. And then as it comes back down, you bring your legs back up, straighten yourself up, follow down over. But we all did [perform this physical operation using the camera]. [We] didn’t want to lose it […] You held the handles on the camera, and you were standing up. You put your head forward into the binoculars, which you’d focused earlier, and look at the missile, and when it took off you followed it up into the sky, and followed it all the way down. [After the trial was over] we took the film out, it was in a cassette, and we had a little darkroom, where we kept our food and a jug. And unloaded it [the film] in there, and put it in a different container, and labelled it, and then when the trials were all finished, we took it up to admin building […] The Kinie was only four frames per second.

For all Laurie’s claims that the work was not difficult, Southall’s account would suggest she was one of the more skilled operators on the range and Bruce Aitken’s and Ron Matthews’ testimonies (Chapter Six) and that of one of the female Computers (Appendix 2) confirms this. Southall suggested:

On its operator the speed and efficiency of Woomera’s instrumentation in part depend […] the results of a major trial, costing tens of thousands of pounds, could be seriously affected if the K2 operator missed a cue […] the quickness of a single pair of human eyes guides scores of instruments onto the missile with a swiftness and a sureness that cannot be matched electronically at low level. It is the task of this operator to follow the flight of each missile from the moment of firing to a height of 8,000 feet and never to lose it […] K2 is the working home of Miss Laurine Hall. (Southall, 1962, pp. 128-129)

This description relates to operating an Askania Kine theodolite which was utilised by a sole operator. Laurie also worked on the two-person operated Contraves machine, which involved a different procedure:
On the Contraves, you were sitting down, and it [the mounted camera post] rotated. I guess it had a motor in it, you must have turned that on, and turned the cameras on, and two of you tracked the missile […] you were both tracking the missile together from either side of the camera, which would have been […] about a metre, or just over a metre apart. It recorded at a faster speed.

On loading and unloading the film after a trial, Laurie notes:

You pulled the lid back that the camera “pod”, I guess you’d call it, was up there, and you had it in this tin, you loaded it into a cassette in your little darkroom, and brought it out, and put the cassette onto the camera. And then you would have closed the lid. And then when the film wound through - it was easy, it was only a couple of spools, and then into the last take up spool that would take it into the other tin, the take-up cassette. Then you’d push a little bit more film into the cassette, and then you take it off, and then you’d go into the darkroom and you’d put the date on it. We would date it, using a biro pen onto a label.

This part of the interview was particularly helpful as currently there are no “open” extant records on the operation of the Askania Kineheodolites at National Archives of Australia.

4.4.4 Askania Kineheodolite manuals

A number of records held by the NAA in the D879 series, include Askania Kineheodolite operation manuals. Unfortunately, these are all categorised as “NYE” (Not Yet Examined). A sample of these records is listed below (NAA RecordSearch on D879):

<table>
<thead>
<tr>
<th>D879, DC722/D</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE: Booklet electronics as part of the rocket range instrumentation. CATEGORY: photograph</td>
</tr>
<tr>
<td>FORMAT: b&amp;w negative</td>
</tr>
<tr>
<td>QUANTITY: 4 of 13 images</td>
</tr>
<tr>
<td>TYPE: cellulose acetate</td>
</tr>
<tr>
<td>STATUS: preservation material</td>
</tr>
<tr>
<td>1950, Photographs, NYE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D879, DD859/3</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORMAT: b&amp;w negative</td>
</tr>
<tr>
<td>QUANTITY: 2 of 26 images</td>
</tr>
<tr>
<td>TYPE: cellulose acetate</td>
</tr>
<tr>
<td>STATUS: preservation material</td>
</tr>
<tr>
<td>1951, Photographs, NYE</td>
</tr>
</tbody>
</table>
There are more than 30 such “unexamined” items which would certainly be of use in understanding the operation of the Askania Kinetheodolites, and many more that relate to the Contraves and Vintens.

From a study of these item and series listings, it seems the manual for the Askania Kinetheodolite was photographed and each page of the 26-page manual was individually photographed. However, the physical condition of these records is suspect. The series note on Series D879: Duplicates of negatives, annual single number series with D prefix (and progressive alpha infix A - K from 1948-1957) states:

The negatives in this series are stored in opaque envelopes in plastic type 5 boxes in annual single number order. The images have been processed on glass plate and film. Some of the film negatives are suffering from "vinegar syndrome" and have been separated from the glass negatives to be treated at a later date. Portions of the glass negatives are broken and have been boxed with appropriate conservation materials. The negatives depict a wide variety of activities associated with the Defence Science and Technology Organisation.

Eventually I was able to view a copy of an Askania Kinetheodolite manual with the help of the records manager at the Department of Science and Technology Group based in Adelaide (this is reproduced as Appendix 3).

4.4.5 “A real ripping, rip-snorting noise”

Laurie enjoyed everything about her job, the camaraderie between her colleagues, the excitement of new rockets being developed, the noise, the scenery and the enduring friendships made. She has memories of particular rockets:

Red Shoes was just pretty. […] Sea Slug was a big lumbering giant. They had a tiny little wooden aircraft there called, I think it was, Malkara. And it was just beautiful. We went out to see it on the launch pad, and it was just sad to see it go up into the sky, because it was going
to hit the ground, or be destroyed. [The trials were] not as loud as I would have liked. I always wanted to be closer. A real ripping, rip-snorting noise, as all the boosters were roaring. […] I had a soft spot for any jet aircraft, and the bigger the better, and the noisier the better […] the beautiful V-Bombers, they were big, and they’re were just graceful, and they never came really close enough to be as noisy as I would have liked. They were sort of on their way up to bomb-dropping height. I know there were quite a few jets, the Sabre, that was a dear little plane, that was a little sweetheart, so nifty in the air. Prior to them, we had the Canberras and the Meteors. The Canberra was so graceful, and the Meteors were […] a bit of a Klutz! I think Skylark, because of its name, was sort of dainty. Seaslug, of course being a slug, was a big, heavy hustler.

This commentary comprises a hybrid of both a masculinised and feminised narrative. The “prettiness” of the Red Shoe missiles is at odds with its creation as a missile. Red Shoes, one of Britain’s experimental ground-to-air missiles (a short-range anti-aircraft guided weapon – the first guided weapon produced by the British Army) was tested at Woomera from April 1954 (Morton, 1989, p. 340). It would go through several iterations, being renamed Thunderbird, Green Flax, Yellow Temple and VR 725 (Morton, 1989, p. 331). Red Shoes was developed as a part of the trio of missiles developed for the three British armed forces: Navy, Army and Air Force. It was 6.3 metres long and 55 centimetres in diameter, with a booster consisting of four solid fuel motors fitted round its body. It launched using a solid fuel sustainer propellant (Morton, 1989, p. 341). Following the complex series of tests at Woomera (many of which Laurie filmed), Red Shoes was brought into British service by 1960, under the name Thunderbird Mk1. One of its most successful firings at Woomera saw it destroy a Jindivik pilotless aircraft at 55km range (Morton, 1989, p. 341).

Laurie’s description of Skylark as “dainty,” also presents an interesting conception of the usual definition of petite. Skylark was a British-made sounding rocket designed for upper atmospheric research – 200 of which were tested at Woomera from 1957–1978 – and represented the joint project’s longest running trials program (Morton, 1989, p. 397). Skylark stood 7.5 metres high with a diameter of 44 centimetres and was first launched in February 1957. For Laurie, the streamlined form of the rocket suggested daintiness. Recently, Skylark has been heralded as “the unsung hero of the British space program” (Amos, 2017).
Describing V-Bombers as “beautiful” is also surprising, given their intended use as weapons of mass destruction. This is not to challenge Laurie’s viewpoint; it simply serves to illustrate that for Laurie, and many of her co-workers, the sinister reality of the weapons being tested was not a part of their thinking. They enjoyed their work, admired the power and streamlined appearance of the rockets and missiles, and tended to give almost no thought to their intended use.

Of the actual trials, Laurie states that camera operators did not ask questions about the outcomes of the trials, nor were they offered any information:

We didn’t know what the end result was going to be. I think we were in the moment. The rockets just went down the range, fell on the ground, and were picked up by Recovery.

Laurie’s notoriety at Woomera was not confined to her talents as a missile tracker. Equally of interest to reporters and writers at the time was her skill as a motorbike rider. She developed her interest in motorbikes after arriving in Woomera, as her father often rode his James 150cc motorbike from the village to the bus depot where he worked. Laurie liked the machine and her father bought her one on one of his trips to Adelaide. Figure 4.6 shows Laurie sitting on her cherished machine around 1960.

Figure 4.6  Laurine Hall on her James motorbike, c.1960 (East, c.1960).
Initially her father taught her to ride and later her lessons continued with the boyfriend who would eventually become her husband, Victor (Vic) East [formerly Puddle].

She was soon riding a 250cc James Commodore out to work on the range:

I’d ride the 250 James Commodore, little red bike, out to work, and pass all the buses. And the spark plug would ice up, so I had to stop on the side of the road to clean the spark plug, get back on, pass the buses again […] I think they weren’t very happy about that [riding the bike to work]. And I used to tear around the village. My main aim was how far over I could lean without falling off. The confidence of youth!

Hall rode a motorbike the entire rest of the time she was at Woomera and thinks she was the only woman motorcyclist there in that era. She explains the attraction:

Something inside me. The need for speed, and fun. There’s nothing like being on the front of a motorbike. It’s a fantastic thrill. I used to drive out to Woomera West Movies, and sit down and watch the movie, and go home on my bike. I used to go to the balls, they had a lot of balls out there, put my ball gown on, and drive to the ball on the bike. […] [I’d] have been in heels too, ’cause I danced.

It was due to her riding a bike, without a helmet, with her blonde hair streaming behind her, that Hall was given the knick-name, “Flossy” or “Floss.”

4.4.6 Cold War awareness

Despite having memories of going to air raid shelters during the German bombing raids over England during the Second World War, Laurie had no fears of a Third World War: “We were too young. I know you think about that nowadays as a 17-year-old, but we didn’t.”

In terms of the reality of war, awareness of nuclear weapons, the communist “red menace” and the possibility of a future war, Laurie has no memory of being concerned about any of the sinister realities of her work filming weapons tests:

I don’t think we understood the nuclear side of it. Of course, we had heard about Hiroshima and Nagasaki, but it’s a foreign land, and I think we’re selfish in this country and that we really don’t care about what goes on overseas. Particularly when you’re young, it’s not affecting you, so you’re not bothered by it. But I did worry for the Army lads
who I knew went [to Vietnam]. We didn’t understand about Russia and wars. We were all eating well and had a good life. […] Years later, seeing that film, *The Deer Hunter* (Cimino, 1978), that brought it home – that was shocking. Man’s inhumanity to man. […] I remember that affair with the two Russians, the Petrovs. Yes. When they arrested them, and we saw them on the black and white television, being taken onto the plane and escorted out of the country. But we just watched it happen.

Similar sentiments were shared by all the women interviewed for this research. Although the rocket range was established to develop weapons both as deterrents and if necessary, to prosecute a Third World War, none of the people interviewed for this research considered this a real threat, nor were they suspicious of others working at Woomera who may have come from socialist countries.

### 4.4.7 Ivan Southall (on Laurie): Woomera

Laurie has vague memories of being interviewed by Ivan Southall for his 1962 publication, *Woomera*. A popular children’s author, Ivan Southall, AO (1921–2008), was said to have been defined by his war experiences (Steggall, 2008, p. 16). During World War II, he commanded a *Short Sunderland* flying boat at No. 461 Squadron, Pembroke Dock, Wales. Captain Southall was awarded the Distinguished Flying Cross in 1944 and spent the rest of the war in London at RAAF overseas headquarters, working in the history section (Steggall, 2008, p. 16). He saw *Woomera* as a book that he “simply wanted to write” (Southall, 1962, p. ix) to learn what really was going on there, were the rumours true (Southall, 1962, pp. ix–x) and to better understand the choices faced by British and Australian Governments in terms of the arms and space race (Southall, 1962, 248–257.) In writing the book, he was given practically free reign to interview those working there and observe aspects of daily life.

His biographer, Stephany Evans Steggall suggests that his wartime friendship with John Herington, the official historian of the RAAF in Europe, and Chief Security Officer for the Department of Supply by the time Southall came to write *Woomera*, enabled him to live and work freely in Woomera (Steggall, 2006, pp. 102 and 163). Steggall notes:

He spent several weeks at Woomera in November 1960, given VIP treatment and amazing freedom of movement, writing home happily from the Senior Staff Mess. […] he flew a light aircraft down the range, the only time since the war that he had been in the pilot’s seat. […] He
dedicated the book ‘To Joy, my wife’, who had known with him the first hand fear of V-2 rocket bombs and who, in the recent backdrop to the book’s writing, had been forced to face a fearful future. (p. 164)

This latter comment might explain why he originally planned to subtitle the book *A Comedy of Fear*. Given that Southall was resident in Woomera in 1960, this is when he would have met and interviewed Laurie as a 22-year-old.

Southall’s *Woomera* was published by Angus and Robertson late in 1962. Southall had taken two years to research and write the book, and was encouraged by his publisher to believe that it would be a great success. However, the book was not received as well as the author and publisher had hoped, and 700 copies of the book were remaindered in 1966. Additionally, a TV documentary was to be produced by the Australian Broadcasting Corporation (ABC) in collaboration with the author. He had made his work and research freely available to the ABC, yet was not invited to be formally involved and hence received no royalties from the final production, *The Distant Edge*, which went to air on 15 February 1964 (Southall Papers n.d.). Southall’s perception of the book’s failure almost led him to abandon his career as a writer.

Southall was clearly captivated by Laurine Hall. From his working papers it appears he was encouraged to interview her for his book. Laurie is not sure who would have encouraged Southall to interview her but believes it may have been Alan Mole who was in charge of the instrumentation section at Woomera in this era (L. East, personal communication, August 26, 2019.) Southall’s early notes state: “the fate of all instrumentation is in her [Laurine Hall’s] hands. She is a legend in British/Australian rocketry” (Southall papers, n.d.). In his early drafts of the chapter in which Hall appears, Southall suggested that her co-workers may have been jealous of her fame. But he crosses this out in later drafts and tones down his adoration, although perhaps not enough for Morton who makes note of Southall’s “fascinated admiration” of Hall (Morton, 1989, p. 264). In his final manuscript, Southall says of the female operators of the kinetheodolites and Contraves cameras and their fortunate male supervisor:

Some of the operators are girls in their teens; some have grown up in Woomera; some scarcely remember any other home. A post where I spent a few hours had a crew of five, a lucky man and four distinctly attractive young women dressed to suit the weather (127).
The photo shown in Figure 4.7 gives an indication of camera operator Laurine Hall as Southall would have met her in 1960.

Figure 4.7 Laurine Hall working at K2, as Ivan Southall would have seen her, c 1960. (East, n.d).

In 1960, when Southall spent a year at Woomera, women were still outnumbered at least two to one by men and women’s marital status at Woomera appeared to be a topic of interest to journalists at the time. In the few extant interviews there is little focus on the technical expertise of the women on the range, but a continued emphasis on their marital status, physical appearance and adherence to traditional notions of women's place (Sanders 1984, p. 30, “Daily life at an experimental rocket range” 1951, “Half-Way Round the World to Test Atomic Weapons” 1952, Manning 1953, Pincher 1953, McKie 1958, Bedford 1963).

Australian and British journalists visited Woomera numerous times during the rocket testing program. In November 1963, the British Daily Mirror science editor, Ronald Bedford, travelled to Woomera to watch the debut of Blue Streak and produced an article entitled, “Where only the beer lays dust” (Bedford, 1963, p. 21). He writes a clichéd account of Woomera’s inhabitants, drawing attention to the large beer-drinking population, “where weekly beer consumption works out at 6 ½ gallons per head […] the average Australian rates a good glass of beer as vital to existence”. He also commented on the female Indigenous presence at Woomera in racist terms (common in that era), “a few ‘Gins’ – local word for young girls – work as maids in the local
houses, but Aborigines mostly give Woomera a wide berth”, (Bedford, 1963, p. 21) although he does not explain why they would be reluctant to be there, possibly because of the confined nature of the place. He also interviewed Laurine Hall, who was quoted on some of Woomera’s “problems”, and like Southall was captivated by her appearance and abilities on a motorbike:

They [the problems] are summed up by pretty blonde Laurine Hall, 24-year-old Marilyn Monroe of the desert rocket city. She told me: ‘this place is becoming too full of red tape. In the early days – I have been here since I was fifteen – you worked when there was work to do, even if it meant working around the clock. When we didn’t have a trial on, you could go down range and find kangaroos, giant emus and all sorts of fascinating wildlife. Now you have to sit at your post until somebody says you can go home. Laurine works at the station called Downrange Gooney Bird (a mythical bird that flies backwards not knowing whether it is going or coming.) She rides a blood red 500cc motorbike, comes from Bristol, England and is saving every penny to get back. (Bedford, 1963, p. 21)

Despite Bedford being the science editor for the paper, the article contains little, if any, substance on the scientific advances that were occurring at Woomera at the time.

4.4.8 Peter Fairley’s ITN interview with Laurine Hall

*Evening Standard* and ITN journalist, Peter Fairley, visited Woomera in November 1963. In his autobiography he notes that he had read Southall’s recently published book and borrows the phrase “Laurine Hall is a born missile tracker” straight from the text (Fairley, 1999, pp. 123-125.) Fairley had joined the *London Evening Standard* in 1955, initially as a court and news reporter. During his 1963 visit of the range he produced a “roving report” film for the *Evening Standard* on the progress of the Anglo-Australian Joint Project. His report included an interview with Laurine Hall.¹

Laurie and her co-workers were never shown the results of their camera work, and rarely, if ever, saw the finished news reports or televised interviews they gave during their time at Woomera. It was with great surprise that Laurie first saw the film footage of herself being interviewed by Peter Fairley in 1963 when I showed it to her in June 2017. She had memories of being instructed to take part in the interview and appeared not to have had a choice of refusal and most certainly was not shown the resulting news article. Having viewed the footage her memory was jogged about the interview:
I can vaguely remember it. And I think I spoke very honestly about how I felt, and later I thought that wasn’t the right thing to do […] I think I was chosen because I was young, blonde, good looking, slim, rode a motorbike; [they said] “We’ll take her.” I was terribly embarrassed and didn’t want to do it. I think I was probably told, “This is what you need to do.” I was fraught with anxiety of having to do it, I remember that, I really didn’t want to do it. Because it was bringing attention to me. That wasn’t natural for me. Which is in contrast with riding a motorbike in a male-orientated place, what else could you do to bring more attention to yourself? But I didn’t look at it that way.

Figure 4.8  Still image from the ITN interview with Peter Fairley showing Laurine Hall with her camera at Woomera, November 1963.

While she reports being anxious about the interview, the footage shows her looking relaxed and at ease. Figure 4.8 is a still image taken from the film showing Laurie at her camera post.

In retrospect, Laurie says she believes she appeared in so many photos of camera operators on the range, mainly because of her appearance and also because she was on K2, which was closest to the Instrumentation Building and so for practical reasons it made sense to have her in the photographs. While this is plausible, Laurie remains modest about her role at Woomera in any capacity. Recently she has added – and the capitals, exclamation and quotation marks are all hers:
Now, here's the thing. As far as I am concerned, I was never "FAMOUS!" I was a naive teenager just doing a job, that I LOVED because of the NOISE, the aircraft, and the goddam screaming rockets. I absolutely HAD NO IDEA if ever that was the TRUTH, whatever anyone thought ABOUT me, that line of "CREDIT" was just not there for me, never thought about it, also when I read the books that were printed, I remember scribbling out some of the comments that I did not like and/or believed were not true! (L. Hall, personal communication, October, 23, 2019)

The following is a transcript of the interview between Fairley and Hall (Fairley, 1963, 19:50, which appears in the film:

*Fairley*: One highly important link in the tracking chain is a camera called Gooney Bird Five and it’s in the hands of a woman, Miss Laurine Hall, known hereabouts as *Floss*. She’s a born missile tracker.

[Peter Fairley leans in to speak to Hall who is seated at the camera post, he then begins the interview.]

*Fairley*: Laurine, is it exciting work?

*Hall*: Yes it’s very exciting. Especially when we track a missile. The bigger the better! From here I am very close. At about minus three seconds, I can hear the engines running. Just after zero, the missile comes out of the top of the launcher. It fills the whole frame, you can hear it roaring and it looks beautiful. You can track it right up and nearly break your neck, then if you get it all the way down again all the way down to impact, sometimes you lose it in the haze, sometimes in the sun, in a cloud, anything. If you get it all the way, you feel real good!

*Fairley*: Good. How long have you been doing this job?

*Hall*: Nine years.

*Fairley*: And how long do you hope to be doing it?

*Hall*: [giggling] About another 15 months.

*Fairley*: Why so short a time?

*Hall*: I’m going home.

*Fairley*: Home being where?

*Hall*: Bristol.

*Fairley*: Bristol, England?

*Hall*: Yes.

*Fairley*: Oh jolly good! And are you saving money?
Chapter Four. Primary Case Study: Prominent Women Camera Operators

Hall: I sure am [laughs].
Fairley: How much do you make a week?
Hall: About £20 a week.
Fairley: And how much of that do you manage to save?
Hall: 15.
Fairley: Do many girls get married out in Woomera?
Hall: Yes, nearly all of them. I don’t think any girl comes to Woomera and leaves here single!
Fairley: Are you hoping to leave Woomera single?
Hall: Yes [laughs].
Fairley: Why?
Hall: Well the lad I’d like to marry isn’t here, he’s in England.
Fairley: Ah, and that’s why you are going home?
Hall: Yes, main reason.
Fairley: Good luck.
[The interview ends]

Viewed for the first time, decades after the interview, it brought back strong memories for Laurie, although today she seems more embarrassed about her appearance (her unruly, windswept hair) than impressed by her notoriety at the time.

Fairley, a respected television journalist, would almost certainly have not quizzed a male camera operator about marriage plans or personal financial matters. The gendered televisual gaze is emphasised by a patriarchal line of enquiry. Even though Fairley appears to be impressed at meeting this “born missile tracker,” he does not enquire into the demands or technical details of the work that Hall performs on the range.

Southall (1962) was similarly impressed at Hall’s physical athleticism, motorbike riding skills and traditional, feminine skill as a seamstress. He comments:

This unusual young woman, scarcely out of her teens, has remained unspoilt by the fame her exploits have brought her. Barefooted she can kick a football further than most men, yet she makes her own clothes and spends her leisure hours, on and off watch, sewing or knitting or embroidering. (p. 129)

Laurie observed in late 2018 via email correspondence that Southall took great “poetic license” in writing this piece. Responding to various sentences in his books she has recently challenged Southall’s claims with her characteristic humour:
The range will shut down if I leave,? Yeah, riiightt! […] Kick football with bare feet? That would or could result in broke foot! Although I used to ride my motorbike bare footed, keeping them cool, until the kickstart “kicked-back” into the arch of my right foot!! Enough to make you weep! There endeth my stupidity!” […] A born missile tracker? I loved the roarrrr, the speed & the beauty of the rockets and the aircraft, so, when you love something you try really hard, but “born?”??!! (L. East, personal communication, October 11, 2018)

### 4.4.9 Workplace safety at Woomera

Given the era that is the focus of this research, it is perhaps unsurprising that there was scant attention given to occupational health and safety on the range. Yet it is somewhat confronting to hear how relaxed the workplace was, particularly given the fact that missiles and rockets were being fired. There appeared to be no medical checks or screening of camera operators. Laurie has memories of one of her colleagues who suffered from epilepsy:

> We had one older girl there who I remember had epilepsy, because she used to have seizures. And it frightened all of us; we didn’t know what to do. She’d lay on the ground having a seizure, and all we knew was to put a ruler in her mouth so she wouldn’t swallow her tongue. And we didn’t know to call help, or anything. At least I can’t remember if we got help. I don’t think we did. We waited until she recovered, and then we went back to the headquarters, Instrumentation Building […] she would carry on with her work after that […] I’m certain she was older than us girls. But when you’re young, when you’re 17, somebody at 21 looks really old. (L. East, personal communication, June 2, 2017)

### 4.4.10 Married women at Woomera

There was no discrimination against married women operating the cameras at Woomera, despite the public service “marriage bar” of that era in which Australian Government regulations demanded that women resign from their jobs when they got married (Sawer, 1996; Colley, 2018). Several of Laurie’s friends married while employed as camera operators and remained employed. The prevailing public service regulations did not seem to apply at Woomera, or were overlooked, as many women worked on the cameras after marriage and even when they became mothers.
According to Laurie, men and women mixed easily with each other. Her fellow female camera operators also mixed with members of the Army (Australian Imperial Force) who worked close by on a radar post near the Instrumentation Building:

We had fun. The Army was there, we got to know all the boys because they were next door in a radar unit, where I used to keep my tins of fruit cold for lunch, in the icy side of it. And a certain little redhead used to steel it, but it took me a long time to find out who was doing it. Not happy. But generally we had fun with them. And they were at the dances where we went, and we danced with them of course.

4.4.11 Recreation at Woomera

Laurie and others interviewed for this research have talked about the difference made by the coming of the Americans to Woomera (from the late 1950s) on the social life of the village:

We had a great time with the Americans. They brought life to Woomera. They knew how to enjoy themselves. They started up the softball, most of us had only played at school, they taught us how to play, how to steal bases, how to place your feet, everything. And we had such fun. We played in mixed teams, we had competitions, we had a beautiful big black man, who was just so lovely, whose name was Rubin. He was the umpire. And I can still hear him saying, “Strike!” Lovely. The best times of our lives. […] We all got to hit, we all got to run. […] They taught us so much. Their 4th of July celebrations were legendary. We would all be down the arboretum, and they would set up all the stalls and stands, a tyre on a big frame, and you had to throw their football through the tyre. And games to play. (L. East, personal communication, June 2, 2017)²

Sporting facilities were provided very early on in the development of the village. WRE knew that to attract people to the village and keep them there for enduring periods there needed to be plenty of leisure activities. By 1968 there were 82 active clubs and societies, most of which were sporting (this had grown significantly from the 73 noted in The Bulletin in 1964). There were two Olympic pools; football, soccer, rugby, softball and cricket ovals, fields and pitches; basketball and netball courts; bowling greens, golf courses, archery and pistol ranges and even at one point a sailing club active on the temporarily filled Lake Koolymilka (Morton 1989, 248). This suited
people like Laurie, who loved the outdoor life and taking part in as many sporting activities as possible:

[much] of our time was spent up at the pool. We had a beautiful Olympic size pool, and hundreds of us went up there every day. Lying on the lawn, I bet getting early cancers, and early wrinkles. We didn’t know what the sun did in those days. I think the only sunscreen we put on was olive oil, and that wasn’t a sunscreen, that was to fry! […] And the football. There was soccer, and Aussie Rules, and there was basketball and netball. Every sport. (L. East, personal communication, June 2, 2017)

For all the men in various professional roles on the range, it was at the pool that Hall met the man she would go on to marry:

Everybody up there swam. It was our main entertainment, and the pool was always full because the weather was always hot, and we needed to cool down. And I’m sunbaking there with a friend, and I see these long legs walk past, and I see this mop of hair, and a beautiful smile. And I said to my friend, “I’m going to have that.” Took me nine years to catch him over two continents, but I did.

She is referring to Victor Puddle, later Victor East who was an engineer working for the RAF on the Jindivik pilotless aircraft development program. Laurine Hall married Vic Puddle in Bristol on 18 September 1965. He changed his surname to East (his grandfather’s name) to save his wife the indignity of going through life “as a Puddle”. The Easts returned to Woomera the following year.

Laurie does however speak in self-deprecating terms of her place (and that of other female camera operators) in the range hierarchy, the top tier being the preserve of the “boffins”. Boffin was a term used universally at Woomera for the scientists who worked there. Initially these scientists were from the United Kingdom, but as the joint project developed, more Australians joined the rank of the “boffins”. This research has not discovered any female boffins, other than the female Computers who worked at Salisbury.

Laurie is extremely modest about her role as “only” a camera operator and the fact that her ignorance of weaponry was used by the Army to ensure its training was intelligible enough for even the most average of IQs:
[the boffins] weren’t down with us. We were only the camera operators. But one day the Army lads would do drills with their weapons, and the sergeant would come down and say, “Right, we’re going to do drills out the front on the grass.” And he would say to me, “We’d like you to come in because you don’t know anything about guns, and lie down with the boys, and listen to what we are telling you, and if you don’t understand what to do, you need to ask.” I think it was that they wanted someone who knew nothing, so that if I didn’t understand it, the lads may have been too […] men-orientated or self-conscious to say, “I didn’t get that bit.” Or “Would you say that again?” So I could ask again, even though they may all have got it. He needed to know that he was telling people the right way to understand what he was saying.

Laurie and Vic East had a very close and happy marriage, breeding dogs and riding motorbikes together. On their return to Woomera in 1966, Laurine was not able to go back to her work on the range so she spent four years working for Grace Bros Removals shifting house-lots of furniture for couples and families moving in and out of Woomera Village. In 1970, the Easts left Woomera having decided it was time to move from such a cloistered environment.

She reflects on why she and Vic eventually left Woomera:

There are a lot of people who stayed there that long because they couldn’t have survived in the outside world. They probably were quite heavy socialisers, maybe drinkers, and maybe had a good job there they didn’t want to lose, or whatever. It was the old, anybody with any go in them, stayed there for a period of time, and then saved, and then got out. That might be a bit cruel to say that.

German refugee Siegrid Hlava, who went to Woomera in the mid-1950s when her Yugoslavian husband found work there, also bemoaned the strictures of life, which eventually led to her leaving in order to provide her children a more “normal” life:

we also felt that Woomera was not the best town to be bringing up children. It was such a protected area, which in some ways was good for the children – they could run free – but there was no poverty, no sick people and no old people. Everything was laid on for you – it was all too easy. […] The children were always safe but really, it was an artificial society. (Hlava, 2013, p. 63)
Almost everyone I spoke to at the Woomera Easter reunion admitted that life there was unusual, artificial and could be considered ensnaring. Yet others (such as interviewee Sue Trench) remained there for their entire working lives and enjoyed the security and predictability of village and range life.

### 4.4.12 Woomera as a gendered space

Recent scholarship has examined Woomera Village during the Cold War as a gendered space (Williams, 2004, p. 17ff). Williams argues that women were confined to the village, as they were not given security passes to the rocket range, which was a male domain. However, as my oral histories reveal, the experience of Laurie East and the many other women who operated the cameras runs counter to this view. The village may have indeed been a broadly and separately gendered space, but the unique roles offered to women on the cameras (and as Computers) provided them with the opportunity to traverse this space. They had security passes and important, less-gender specific roles. While I would not challenge Williams’ view that Woomera Village was a “controlled space” (Williams, 2004, p. 20) my research reveals that the work operating the cameras and filming the weapons trials enabled women to renegotiate and evade certain aspects of this “control,” at least during working hours.

Williams also documents another non-gendered area in which women found occupation at Woomera. She cites an article from 1957 in the local Woomera newspaper, *Gibber Gabber*, an advertisement for a taxi service run by married women (Petersch, 1957). She notes that employment such as this gave the cohort of married women much greater geographical freedom than most women in the village. *Figure 4.9* and *Figure 4.10* show two *Gibber Gabber* issues from July 1957 that published advertisements for female taxi drivers.

**Figure 4.9** Advertisement from the Woomera newspaper *Gibber Gabber*, 12 July 1957 (Taxi required, 1957).
Williams’ research included two oral histories with a married couple who lived at Woomera (2004, p. 39). However, neither of these interviewees worked on the filming that took part at Woomera. Williams also distributed a number of questionnaires, 20 of which were returned to supplement her oral history interviews. 65% of the responses came from men (2004, p. 40).

The only other identified oral history interviews, which refer to women at Woomera are those conducted by Dr Iris Iwaniki for her PhD thesis which concentrates on the sustainability of remote planned communities (Iwaniki, 2011). Given the topic of Iwaniki’s thesis, these interviews were not concerned with the work of women on the cameras. However, her dissertation does consider the gendered spaces at Woomera, particularly in terms of the mess system (p. 196ff).

The paucity of oral histories on women’s roles at Woomera, prior to conducting this research, suggests that it is essential that women’s stories are recorded whilst the women who operated the cameras at Woomera are still lucid. Sadly, one male participant in this research died some months after he was interviewed. His work in a supervisory role of the women on the cameras is discussed in Chapter Six. It is serendipitous that this research was initiated prior to all prospective interviewees reaching the end of their lives.

4.4.13 Laurie East post-Woomera

Initially Laurie and Vic East moved to Nowra, NSW and later relocated to Adelaide. The couple eventually retired to Tasmania where Laurie lives today. Vic East died in a motorbike accident in November 2014. Laurie did not continue with work in any other camera or film related capacity after leaving Woomera and maintains that she did not reflect upon her time at Woomera until this research began. She repeatedly expressed her surprise that anyone would be interested in her life and work:
I remember we had a great life in Woomera, and then you move on. I wasn’t interested in going back to any of the reunions, I was too busy with my fellow, really. And I thought at the time, “That’s not what I want to do.” […] Looking at [the] documentaries recently made me think more about the past life that was there, and I am now amazed at the desolation of the place when you see it. We didn’t see that.

At the time, Laurie thought Woomera would endure well into the future:

We thought it would last forever… Because of the progress that was being made, and I think probably all the people there felt the same. We thought, “There’s all this money being spent on this village; you can’t just lose it!”

She was correct in that assumption as most people interviewed for this research find it hard to believe that Woomera Village and the range are a shadow of what they once were. Ivor Jones, special correspondent for the BBC reflected in 1953, “people seem to take it for granted that the place, the research into guided missiles, have no foreseeable end”. (Jones, 1953, p. 714.)

Laurie East has been a focal point of this research and furthermore has facilitated aspects of it by providing contacts with other women who worked in technical roles. She has also identified many women working on cameras who appear in Morton’s (1989) and other secondary source references. In many cases, women are not named in official photographs. It is as if their identity was considered superfluous to the information contained in the images in which they appear. Laurie’s experience at Woomera has informed a large part of this research and her revived insights continue to be of value to the study of women’s roles at Woomera.


During July 2017, I began corresponding with Dan Kendall from the National Space Museum in Leicestershire. He had read some of the posts about my research on the Woomera!! Facebook site. Kendall and I began an email correspondence and he notified me of the existence of a large collection of films relating to the Blue Streak rocket and Woomera that were part of a collection in the National Museum of Scotland (NMS) (D. Kendall, personal communication, June – July 2017). In September and October 2017, I travelled to Europe and visited the NMS and met with staff there who went out of their way to assist me in viewing some of the films Kendall had mentioned.
In 1955, Britain had begun developing a long-range liquid-fuelled missile, which was to be known as “the Blue Streak programme” (Morton, 1989, 434ff; Southall, 1962, pp. 54-55; Cocroft & Thomas, 2004, p. 45; Cook & Stevenson, 2000). The Blue Streak was designed to deliver nuclear weapons, as part of Britain’s independent nuclear capability, and work focused on producing an intermediate range ballistic missile (IRBM).

By 1960, given rising costs, the Blue Streak programme was scrapped. The British Cabinet Defence Committee were reluctant to spend an addition £600m on top of the £65m already spent for a delivery system that proved to be militarily inadequate after testing (Morton, 1989, p. 435). Although Blue Streak’s life as a military weapon ended in 1960, it was quickly re-assigned to the European Launcher Development Organisation (ELDO) project based at Woomera. This program utilised the Blue Streak rocket for the first stage of a composite space vehicle designed to launch satellites into orbit. In 1967 Britain made the announcement that it would pull out of the ELDO programme in 1971. The last Blue Streak launch was on 12 January 1970.

Films were known to exist charting the story of Blue Streak from its first static firing of the rocket engines in the United Kingdom to the first flight test in Australia on 5 June 1964. Four other first-stage launches were carried out successfully, but test launches of second and third stages proved unsuccessful (National Archives of Australia, n.d.).

On becoming aware of the existence of the Blue Streak film collection, I made contact with the curator of the technology department of the NMS, Dr Tacye Phillipson, who was responsible for the films. In time, I was made aware that the collection consisted of some 2,000 items, in both 16-mm and 35-mm formats. It was not clear how many of these films had been shot in Woomera, but existing listings indicate that several hundred had been.

While the logistical access and viewing planning was in progress, I checked the NAA RecordSearch and found that some 195 films relating to Blue Streak were held by that organisation. Of these only 34 had been assessed and were categorised as “open.” Most of the others were “Not Yet Examined” (NYE). I phoned the NAA to discuss my research and explained the situation with the Scottish films and asked for clarification on the NAA’s Blue Streak holdings and the costs involved in accessing any or all of the 34 “open” films as well as the likelihood of more being access-
screened and opened in the future. I received no reply from the NAA prior to my departure for the United Kingdom, so went ahead with my planning, and included a trip to Scotland where I was fortunate to be able to examine a collection of films and artefacts that had received little scholarly attention. The collection included a model of the Blue Streak rocket as shown in Figure 4.11.

The Blue Streak films held by the NMS were stored on open shelves, as shown in Figure 4.12 and another area in the museum housed a number of files relating to the films. I decided to make a brief check of the paper records first in case they provided some clues as to the provenance of the collection and contained guides as to their location to determine whether it corresponded to the item lists of some of the films. Dr Philipson was the third curator under whose care the films were entrusted, and she knew very little about their provenance. On reading the correspondence files in one of the boxes it seemed that the entire collection had been put together by the Conquest Film Unit, a division of Hawker Siddeley Dynamics.

![Figure 4.11 Model of parts of the Blue Streak test rocket, National Museum of Scotland, September 2017 (Barber, 2017).]
British company Hawker Siddeley Dynamics was a division of the Hawker Siddeley Group that specialised in space technology operations and guided missiles. By 1961 Hawker Siddeley employed some 90,000 people and had annual sales of £324 million (Hawker Siddeley, n.d.). It is unsurprising, given the extent and success of the company, that it would operate its own film unit to record its many successful aeronautical and space research endeavours. There were some correspondence files that suggested the film unit was transferred to the Museum of Scotland in 1974 (Conquest Film Unit, 1974). Among these records was also a photograph taken c.1974–5, which appears to show the collection being organised for transfer.

The most useful discovery among the paper records at NMS was the script to the 1964 film, *The Blue Streak Rocket*. An unexpected discovery that came from reading the script was the revelation that Mrs Lawrence was a fictional character played by an actress and not an actual camera operator at Woomera at all!

It is likely that the WRE and its associates in the United Kingdom created the character of Mrs Lawrence to ensure viewers were comfortable with the concept of women working in an unusual field outside of the home. It is significant that the...
Chapter Four. Comparative Case Studies 2 to 7: Other Women Camera Operators

character is Mrs Lawrence, the wife of Mr Lawrence, who would be considered the breadwinner in the home. The narrator of the film in which Mrs Lawrence appears stresses that she has “a part-time job on the range” (my emphasis). The film implies that while her part time job is interesting and unusual, it does not interfere with her main role as a housewife. “Mrs Lawrence is more than a housewife,” we are informed, but she is still “a housewife.”

4.5 Conclusion

This chapter presented the stories of two of the subjects of this research, the camera operators Mrs Lawrence and Mrs Laurie East (née Laurine Hall). Also introduced in this chapter are the Trench sisters whose work will be discussed in more detail in the ensuing Chapter Five. During the course of the research it was discovered that Mrs Lawrence was a fictional character, created for a purportedly informational documentary that was in reality more of a propaganda film. My major research question, “what was, and how important was, the work that women did on the Woomera rocket range during the Cold War?,” was addressed through this primary case study. The work of Laurie East who worked on the Woomera range was shown through contemporary and secondary sources and through her own detailed testimony to be of extreme importance to the testing program at Woomera.

In contrast to the fictional Mrs Lawrence, the real camera operator at the centre of this research, Laurine Hall, was a single, confident woman who was atypical among her peers of the era in several respects. The depiction of Mrs Lawrence attending to her duties at the sink prior to work conforms to the traditional early-1960s gender stereotype of a devoted housewife. That she arrives home in the afternoon, prior to the return of her husband and likely in time to cook his dinner, carries a subtle implication that her husband’s role, and needs, trump her important work on the cameras. Likewise, Peter Fairley’s interview with Laurine Hall focuses more on her marriage plans than it does on her mysterious work as a “born missile tracker,” which is given very little air-time. Oral histories with a number of other camera operators and the women who worked as Computers, analysing the data derived from the films created by those camera operators, have posed further questions about the Woomera rocket range as a gendered space. The following chapter provides seven comparative oral histories.
Endnotes

1 Fairley explains in his autobiography that the Roving Report was not aired immediately as just prior to it being arranged to go to air President Kennedy was shot and all news stories were focused on the assassination.

2 Subsequent communication with members of the Woomera!! Facebook group has revealed that there were Americans in Woomera as early as 1959 when they were posted there due to shortages of technicians in certain areas. However, the first significant numbers of US Forces personnel arrived to work on the Sparta project involving the testing of the Redstone rockets (which began in 1967) (Woomera!! Facebook group, personal communications, 31 October – 4 November 2019).

3 Dr Iwaniki interviewed 11 people, four of them women and of these, only two lived at Woomera during the time on which my study focuses.
Comparative Case Studies 2 to 7: Other Women Camera Operators

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Women have the ideal living conditions there [at Woomera] and have no grumbles whatever about what the male mind has produced for them

(Woomera 'man's world' is fine, 1954, p. 6).

5.1 Introduction

Women who operated all three types of cine cameras on the range, Askanias, Contraves and Vintens have been interviewed for this dissertation. Their collective experience covers work at Woomera from the 1950s through to the 1970s.

<table>
<thead>
<tr>
<th>Name</th>
<th>Date of Birth</th>
<th>Place of Birth</th>
<th>Year of Migration</th>
<th>Age on arrival at Woomera</th>
<th>Years spent at Woomera</th>
<th>Date(s) of interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cecily Quinn</td>
<td>17.03.1939</td>
<td>Sydney, NSW</td>
<td>N/A</td>
<td>15</td>
<td>1954–1964</td>
<td>09.02.2018 08.06.2018</td>
</tr>
<tr>
<td>Merrilyn Bell</td>
<td>23.01.1940</td>
<td>South Australia</td>
<td>N/A</td>
<td>20</td>
<td>1965–1968</td>
<td>22.06.2017 24.06.2017(by phone)</td>
</tr>
<tr>
<td>Loma Silsbury (Galloway) (née Cox)</td>
<td>04.05.1943</td>
<td>Fiji</td>
<td>1948</td>
<td>10</td>
<td>1956–1962 1968–1970</td>
<td>09.02.2018</td>
</tr>
</tbody>
</table>

Each of the women have different views about the importance of their work and the difficulties that they faced in doing it. The uniting feature is that each of them enjoyed the social aspects of living and working at Woomera. All of the women were in their teens, one as young as 14, when they began work. They all attest that marriage was not a bar to working on the rocket range and some of them worked while married and continued to do so after having children. All of the women took part in a face to face interview for this dissertation, other than Merrilyn Bell who was interviewed over the phone. A brief biography of each of the participants in the research is given below.
Chapter Five. Comparative Case Studies 2 to 7: Other Women Camera Operators

5.2 Brief biographies of women camera operators

5.2.1 Joan Adams (née Zajicek)

*It was a silence of nothingness out there that was ringing, Like that ringing of silence in the bush, it’s phenomenal [...] I loved it. It was nice, you never forget it.*

(J. Adams, personal communication, 27 July, 2017)

Joan Anna Zajicek was born on 27 June 1946 in Olomouc, Czechoslovakia. Her parents, Lubomir Zajicek and Joan Lillian Mooney had met in England during World War II. Joan Mooney was in the Land Army and Lubomir Zajicek was in the Czech forces stationed in Britain (Czechoslovakia was occupied by Germany from 1838–1945 and the Czechoslovakian government was in exile in the United Kingdom.) After the war, Joan’s parents briefly returned to Czechoslovakia and then back to the United Kingdom before migrating under the Assisted Passage Migration Scheme to Australia (with 16-year-old Joan and two-year-old Peter) by boat in April 1962. The family initially settled in Elizabeth, South Australia. Lubomir, an electronics engineer, found a job with WRE in Woomera and the family followed him there. Soon after, Joan applied for work as an assistant photographer on the range. No experience was required. Single women could not live in Woomera without a job and so young Joan needed to secure employment or leave Woomera.

As a young migrant girl from London, Joan found the heat oppressive and suffered from sunstroke for the first two weeks. Once at Woomera, the family lived in a house, which is no longer standing, in Goonda Street.

Joan met her future husband, Kelvin Adams, who was an Australian, at Woomera. He worked in Trials Recovery. They married and went back to England. In London, Joan worked as a plain-clothes security officer, catching shop lifters. She and her husband then briefly returned to Woomera. They had one son, David. Joan has not kept contact with any of the women she worked with at Woomera and she has not attended any reunions held there. Joan was interviewed on 27 July 2017 at her home in Redwood Park, South Australia; all quoted material from Joan is taken from this interview and will not be cited separately after the first instance.
5.2.2 Cecily Quinn

When you work on these things you don’t realise what a great thing it was. You knew you were doing a job, but you never realise. [...] It was hard at times, because you could be out in all weather, and then waiting for hours on end. And then very much, when there was a trial, it was all rush, rush, rush to get everything organised. So you had to be very efficient

(C. Quinn, personal communication, February 9, 2018.)

Cecilia (Cecily) Quinn was born in Sydney on 17 March 1939, one of Mary and Jack Quinn’s six children. Her father and her uncle had gained employment as contractors building the original Woomera township in 1948. They lived at what was then called “the tent city” and later became Woomera West. The men were attracted to the work because of the high wages offered. Cecily’s father suffered respiratory problems and had often been hospitalised due to damaged lungs. He thought the drier warmer climate in Woomera would ease his health. While Jack was working in Woomera in 1948, he would be away from home for extended periods and only return during “stand down,” when the construction work ceased.

In 1951 the family, moved to Port Adelaide. Cecily was about 14 at the time and had recently finished high school at Mt Carmel in Alberton. The climate in Port Adelaide irritated Mr Quinn’s asthma, so in 1954 the family moved to Woomera where they secured a house in Coolaroo Street. Jack Quinn obtained a job in the WRE Mechanical Engineering section. Around 1963 Jack and Mary Quinn moved to Valley View in Adelaide and Jack transferred to WRE in Salisbury.

Cecily was the only member of the family who worked on the cameras. Her brother John secured an apprenticeship in Mechanical Engineering with WRE on the range and her two sisters worked as telephonists in the village.

The family was religiously observant. Mrs Quinn had an Irish Catholic background and Jack Quinn was Church of England, but baptised Catholic when he married. After this he ensured the family observed most Catholic traditions including reciting the Rosary as a family each night. In Woomera, the family attended the newly built, St Michael’s Catholic church.

Cecily Quinn left Woomera in July 1964 and gave birth to her first child, Nicola in Adelaide. She had intended to return to the range, but the lack of childcare prevented
her doing so. Cecily went on to become a teachers’ assistant in Berry, South Australia and then a debt collector in Adelaide. She was interviewed on 9 February and 8 June 2018 (and is depicted at the time of this interview in Figure 5.1) at her home in Whyalla. All quoted material from Cecily is taken from the interview on 9 February 2018 and will not be cited separately after the first instance.

![Figure 5.1](Image)

**Figure 5.1** Cecily Quinn February 2018 with a framed photograph of the Woomera Village (Barber, 2018).

### 5.2.3 Merrilyn Bell

*It was an exciting occupation, never boring. As the time wore on, it was almost that I was in awe of what we were doing. What we recorded.*

(Merrilyn Bell, personal communication, June 24, 2017.)

Merrilyn Bell, a Registered Nurse, went to Woomera in 1965 with her husband, Robert Bell. At first, she worked at the Woomera Hospital. When work there ran out she decided to apply for a role working on the cameras. Unlike Laurie, Merrilyn considered her work as unique for the era and even more so as she reflects back on it.

At the time she felt inadequate applying for a role on the range but was so intrigued by the nature of the work “she was dared to apply.” She was successful and worked on
the cameras for two and half years, leaving once she became pregnant, with her son Marcus. Once Marcus was at school, she took on another job at Woomera, managing the Woomera Dress Salon.

Merrilyn lives in Peterborough South Australia. Laurie East remembered her as a woman who was particularly talented on the cameras. Her account is based on the extensive notes made during a telephone conversation that took place on 22 and 24 June 2017. All quoted material from Merrilyn is derived from these discussions and will not be cited separately after the first instance.

### 5.2.4 Loma Silsbury

*Woomera was, for such as we, a place of dreams and hopes. Not merely a time when we were young. We felt we stood poised on the very threshold of History in the Making. Surrounded by the hurly burly of daily life which centred on the Gateway to the Stars, we were actually part of it.*

(L. Silsbury, personal communication, June 1, 2018.)

Loma Silsbury was born Loma Janet Cox on 4 May 1943 on an Australian ship *The Centaur*, while at anchor in a harbour in Fiji. Loma’s parents, Perceval (Percy) Harrold Cox and Loma Isabel Cox [née Mortimer] had married in 1930. Loma and her parents went to Woomera in 1953. Loma attended the Area school, until she turned 14. She then went to work on the range and remained there until 1962. When she turned 16, Loma was married to William Edward Galloway, aged 23, a member of the Armed Forces stationed in Woomera, however this marriage did not last. She is depicted at the time of her marriage in *Figure 5.2*. Loma was married twice more.

Loma had been known as Janet Cox while working at Woomera. She dropped the name “Loma” as too many people could not spell it and tended to call her Lorna. Her third husband was Silsbury and when she stood as a candidate for the National Party in the 1990s she was required to use her Christian name, Loma as it appeared on her birth certificate.

She departed Woomera in 1962 when her parents left, as her mother had cared for Loma’s children while Loma worked on the range. Without access to this childcare Loma was unable to continue working there. She returned to Woomera in 1968 when she married a chef who worked in Woomera Village. Her husband lost his job in 1970 so the couple was forced to leave Woomera.
In all, Loma had eight children, and now has 39 grandchildren and 68 great grandchildren. She is extremely articulate and writes often of her work at Woomera; she is one of the most frequent contributors to the *Woomera!!* Facebook group, such that it is impossible to do justice to her broad range of reflections. She has referred to herself as “an observer with eidetic memory” and to some degree an outsider. She has spent many hours thinking and talking about her time in Woomera, particularly since my research began. She has said:

> Although I have stark memory of time, place and event, I remained a nonentity to most of those I associated with. I am a lifelong “White Crow” and, due to the peculiarity of my intellect, I spent most of my time [while working at Woomera] in the company of much older, highly educated and erudite men. This gave me a unique insight into the era (L. Silsbury, personal communication, May 9, 2018.)

Loma was interviewed in her home in Port Pirie on 9 February 2018. All quoted material from Loma is taken from the interview on 9 February 2018 and will not be cited separately after the first instance. However, the many additional personal exchanges with Loma that occurred by phone or Facebook messenger are noted when they occur.
5.2.5 The Trench sisters

*I lived a sporting life in Woomera, and there wasn’t enough days in the week or hours in the day. [I did] everything: netball, basketball, softball, tennis. Swimming was a big thing. I was a swimming instructor as well. So I started up the Women’s Water Polo in Woomera with Jenny Butcher.*

(M. Trench, personal communication, April 15, 2017.)

William Alexander Trench, his wife, Jean Trench and their four children, William, Catherine (Kate), Margaret and Helen, migrated to Australia from Scotland in 1950. Arriving in Adelaide on 27 June of that year, with all children aged ten or under. They spent a year in Port Adelaide, South Australia before William joined the Police Force and successfully applied for a posting to Woomera in 1951, as a Commonwealth Peace Officer. The children went to the Woomera Area School. Kate and Margaret later gained employment on the rocket range as camera operators; Kate started worked in 1960, aged 16, and Margaret started work, aged 17, in 1963. Kate worked on the range from 1960–1967, until she married and had to resign her post. Helen and Susan (known as Sue, who was born in Woomera in 1953) did not work on the cameras and neither did their brothers. Robert, the youngest, who had also been born in Woomera, undertook an apprenticeship with WRE, which prompted his father to seek a transfer to Salisbury. William retired from the Police Force as a senior constable in 1978 when he reached the retiring age of 60 (Trench, W. A., n.d.).

At one time 11 members of the Trench family lived in Woomera. The oldest Trench sibling, William, died in a house fire in Woomera in 1980. Kate lived in Woomera for 24 years, Margaret for 19 years and Sue for 40 years. Helen lived in Woomera for 17 years, then married a member of the defence forces and left Woomera.

The interview with the Trench sisters occurred spontaneously while I was working as a volunteer at the Woomera 70th reunion function during the Easter long weekend of 2017 (13–17 April). On the second day of the reunion, members of the Trench family were interviewed, following a preliminary meeting the night before, and they are shown at the time of this interview in Figure 5.3. All quotations from the sisters in this chapter derive from the interview on 14 April 2017 and will not be cited separately after the first instance.
5.2.6 Patricia (Pat) Hall

They were all big then. And that’s another plus. I mean, if you’re going to blow something up, blow it up with something big. Go big! [Laughs] Bigger bang!

(P. Hall, personal communication, Hall, October 28, 2017)

Patricia (Pat) Joy Hall is the older sister of Laurine Hall, whose case study written up in Chapter Four is a focal point of this dissertation. Born on 28 August 1937 in Somerset, England, Pat migrated to Australia in 1948 when she was 11, with her parents, Mildred and Edward (Ted) Hall and her younger sisters, Laurine, Marguerite and Dawn as “£10 Poms”. Pat’s brother, Phil was born in 1952. The family settled in Murray Bridge, South Australia and relocated to Woomera in 1954, where Ted Hall obtained a job initially as a butcher and later as a bus driver, and Mildred worked as a nurse. Pat had worked as a nurse in Adelaide prior to the family relocating to Woomera.

Pat married Charles Geoffrey (Geoff) Hall (no relation), who was a member of the RAF, in December 1958. Geoff had been stationed in Woomera, and worked briefly at Maralinga, but the pair’s paths did not cross at the time. They met when homesick Pat was returning to England by boat. They became engaged in England and then returned to Woomera, where they were married and Geoff recommenced working. Unable to obtain housing, they left Woomera and settled in Brisbane. They now live in Western Australia. Pat Hall was the first of three Hall sisters to work on
the rocket range at Woomera operating a camera. Pat and Geoff Hall were interviewed in the Fremantle Library on 28 October 2017 and all quoted material is taken from the interview on 28 October 2017 and will not be cited separately after the first instance.

5.3 Woomera job interviews

In the 1950s there appeared to be no formal interviews for female camera operators. There were more vacant positions than there were willing operators and all women (or in many cases, girls) who applied for work were appointed. Kate McGoran (née Trench), has vague memories of an informal interview taking place prior to beginning work in 1951. She reported that no special skills were required and securing a job there seemed straightforward. Her sister, Margaret said, “I think it was more where there was [sic] more jobs available on the cameras than anywhere else, the admin, or wherever”.

Cecily Quinn, who first worked on the range in 1954, also recalls there being an informal interview, and particularly remembers being asked about her hobbies as this was deemed to be relevant in terms of being able to tolerate the down time at work:

I was asked […] what hobbies did you have? Because a lot of times you were sitting around doing nothing, waiting for trials, and trials would be cancelled. So if you had a hobby, that was all right. I used to like making my own clothes, doing this and that, sewing, knitting, whatever. And I loved reading, and I liked travel. […] And I think that was the incentive for people when you had your interviews, if you didn’t have a hobby, you would not have existed out there [on the range]. You’d be bored stiff.

Pat Hall was around 17 when she started work on the range, like Cecily, in 1954. She recalls that it was easy to get a job out there:

we [other women and herself] just applied for it. Everybody applied to go on the range […] I just think everybody around my age, like [Cecily Quinn] I can remember her well, we were a group that got on so well together.

By the 1960s, job interviews had become more formal. Joan Adams was interviewed at WRE in Salisbury and was 16 years old when she got the job on the range in 1962. A medical examination in Adelaide was also required, however, Joan said the only qualification required to pass the medical was “upright and breathing!”
In 1965, Merrilyn Bell was interviewed for her position in Woomera and made a particular effort to prepare. She knew next to nothing about cameras and learnt as much as she could about the workings of her Agfa stills camera that had a time exposure. Merrilyn practised using it as a way of experimenting with different functions on her camera. Her interview was conducted by a panel of three men and she got the job.

5.4 Wages

Unlike the men (whose experiences of working at Woomera are discussed in Chapter Six), the female camera operators did not keep records of their remuneration. Yet all believe they were well paid. The combination of earning a full-time salary and having little on which to spend it in the township meant that women saved money quite quickly. Cecily Quinn saved much of her pay for an overseas trip.

Cecily believes that she and her co-workers were well-paid. She also recalls an incident where she discovered that the Australian “Army lads” received much higher pay than the members of the British Services. At that time, if a woman was courted by a serviceman, the man would often buy her a corsage or some jewellery to match her dress if they were to attend an important ball. It was on one of these occasions that she learnt about the pay discrepancies:

Brian [a British Serviceman whom she was dating] had said to me, “If you’re buying a new outfit, buy yourself something to go with it.” So I’d brought my golden satin dress […] this taffeta gold sort of colour, and so I brought myself […] a diamanté necklace and earrings to go with it. So I got back, and Brian said, “Oh what did you buy?” and I said, “This is it,” and gave him the bill. Then I found out from one of his mates later, that was a month’s wages. I felt so guilty! ’Cause you just didn’t ask people […] I felt so guilty, and I tried to give him back his money, and he wouldn’t accept it. And he said, “No, I did tell you.” And I said, “Look, I’m sorry.” I thought how awful is that. So we were earning good [money], I can’t remember, but I think we were probably earning about a couple of hundred pounds a week.

No overtime was paid. If a trial was delayed the women would miss the bus back to the range and have to wait for a village taxi to collect them. A normal day lasted from 7am to 6pm, from the time of leaving in the morning to when they returned home. On the days that trials were delayed and the 5pm bus had left, the women could be working more than 12-hour days.
Bell’s view is consistent with that of Cecily who regarded the pay rates as high compared with other jobs in Woomera Village available to women.

5.5 First impressions of Woomera

The extremes of temperature experienced at Woomera are a strong memory for all the women as is the long journey to work. Woomera was oppressively hot in summer, yet winters could be bitterly cold, especially at night. Cecily remembers the blistering heat on arrival in Woomera and her response – and that of her parents – is indicative of the resilience of most people in Woomera of that era:

we stepped out of the plane, and it must have been in December, […]
and we stepped out onto the airport, and it was like we’d stepped into Hell. It was just so hot, the north wind. And my mother thought, ‘What have we come to?’ So it was a very, very hot place. But we survived.

Margaret Trench worked 70km down range on K27 (see Figure 4.5 in Chapter Four) and recalls the trip to work:

we had to go by Otter and then Land Rover down range, just to get to work […] I can’t remember how long [it took exactly], but I think it was about another half hour in the Land Rover, further down range, and I don’t know, maybe 40 minutes or something, in the air on the eight seater Otter.

For Loma Silsbury, her first impressions were those of a girl who had recently left school. Loma had been only 14 when she began working on the range on a twin Contraves post with three other young women, or as she notes, “girls,” straight out of school. They were all under the supervision of photographer, Dennis Kader, and their particular camera post was referred to as “Kader’s creche.” (Dennis Kader’s testimony is discussed in Chapter Six.) Loma says, of the nickname: “Four 14-year-old kids and a 26-year-old man, what else are you going to call it?”

Loma was the first woman interviewed to suggest that young women may have been exploited on the range. No archival evidence has been found to support these assertions, although newspaper accounts, as cited in the Literature Review of Chapter Three, do reveal that young women who lived in Port Augusta were preyed upon by male Woomera workers on leave, resulting in a number of teenage pregnancies.
Loma’s personal experience suggests that at the very least the range was a potentially dangerous place for young women, surrounded as they were by older men, in a hot isolated environment where women were scarce. Her father did not want her to be one of the girls who fell pregnant prior to marriage and so “arranged” a marriage for her when she was just 16. By the time she was 18 she had two small children who were cared for by her mother while Loma remained at work on the rocket range as a camera operator. She can recall her appearance on her first day on the range: “Well I got off of the bus. Aged 14. I was wearing an extremely fluffy skirt, bright blouse, […] and the skirt was blue and white with checks, and big pockets on it.” Interestingly, other women who have reminisced about their work at Woomera also have vivid memories about the fashions of the day and what they wore to work. These women were often still adolescents and an interest in one’s appearance and the prevailing fashions was typical of women in that era – much as it is today.

5.6 On the job training

Only one woman, Merrilyn Bell, recalls any sort of formal training for female camera operators. Joan, Cecily, Loma, the Trench sisters and Pat all recall only “on the job training.”

Merrilyn’s account is different in that she had been inspired to try out for a job on the cameras having read an autobiography, *Anybody can do Anything* (1951) written by American writer, Betty MacDonald. MacDonald had married at 18, and a few years later was working on a chicken farm with two children and hating her life. She left the marriage, went to night school and retrained for a variety of jobs, which eventually led to a career as a writer (Macdonald, 1951, p. 18). A review of MacDonald’s book in the *Australian Women’s Weekly* may have led to Merrilyn reading the book, which inspired her to apply for the job at Woomera. In *Anybody Can do Anything*, MacDonald’s writes of her job-hunting experiences with her sister Mary, “a highly executive young woman, whose creed was that anyone could fill any position without any training” (MacDonald, 1951, p.9). That Merrilyn remembers the content of this book all these years later suggests that MacDonald’s message resonated strongly with her.

Merrilyn was successful in her application and interview and then began a three-month on-the-job training program. She vividly recalls the first time she was taken out to the range to see her camera post, working on the Contraves kinetheodolites. Training
was held in the instrumentation room close to the range head. It was conducted under the control of Jack McDonald. Merrilyn said of him, “he was a very knowledgeable person, he knew everything there was about the cameras, the mechanics, the science, the whole shebang”. Other women have also remembered Jack McDonald when asked about him specifically.

During the training, McDonald asked Merrilyn to “think about how she might photograph a fly crawling up a wall.” Her testimony is precise and reveals both the actual physical actions required to operate the cameras and the mental processes that occurred during the course of the missile tracking.

Merrilyn remembers the first day she was driven out to the cameras on the range:

I saw the sloped roof of a stone building, with a corrugated iron roof and then the roof rolled back and there were two training cameras that you sat on. I thought, ‘My God! What have I got myself into?’ When the roof rolled back, I said, ‘That’s a camera!’ Jack laughed. Then we had an enlightened lecture on the range head.

She was taught how to use the camera:

It was a matter of learning how to use the steering wheel, follow the missile and gee they were hard to catch. We had to learn how to load the film, and you felt like you were making a movie. I felt like I was in a parallel universe, I wondered, how do we use these machines to film? But Jack taught us everything, he took us right back to the basics. One of us [there were two seats on the Contraves and two operators] was doing the azimuth and one was doing the elevation. […] You could lose the missile and then take your hands off the wheel and the radar would kick in. The Camera would then go through a couple of rotations and then would be back on track.

Joan Adams said that all training took place “on the job.” No background in science or mathematics was involved. She commented:

Kinetheodolites were positioned to capture the data back to the range head for [others] to work out. It wasn’t for us [camera operators] to work out. We were to track the [missile], all we had to do was keep [it] in the middle [of the viewing screen]. It wasn’t rocket science! [Laughs] But it was fun.
After a short period of on-the-job training, the women knew what was required and looked for minimal supervision even while they idolised their bosses, particularly those who were some years older than them. Loma commented:

We each completed the necessary tasks and then, back to the military adage of “Make haste, and wait.” Come the “Trial” and the post boss was just another camera operator, doing his thing on either azimuth or elevation or possibly as the lone Vinten operator if there were not one of the Wunderkinder already doing so. […] These men never came over as being authoritarian “bosses” but rather they were leaders to whom we looked for direction and assurance. We delighted in pleasing them and a compliment – no matter how backhanded, was something to be revelled in. The older men, in particular, we adored […] They never talked down to us nor were we ever made to feel excluded in anything we did. We were part of their extended family and we planned birthday surprises and the like – just as one would for a loved brother. In turn, they taught us an incredible array of skills and taught us not only that we could think, but to actively do so. (L. Silsbury, personal communication, June 1, 2018)

Margaret Trench, despite admitting that starting the camera involved a simple action of flicking a switch, said that having to do so under pressure to ensure capturing a flight path was intimidating:

It was hands-on. [We were shown:] “This is what you do.” And that’s why I was no good at it, ’cause I didn’t flick a switch. You’ve got to, from “manual” to “counter” […] when you put the film in, and then you’ve got it on “counter” and then you had to manually flick a switch to put it back to “operation”. And that’s where I fell down. When the rocket went off, all I got was “tick, tick, tick,” and I just wanted to die. I was 17, or something, you know? I just died. So they said, “Okay, you can come into the admin building to work. We’ll find you a filing job or something!”

Hence Margaret’s working life on the cameras was short lived. She was offered an administrative role on the range. Her sister Kate vaguely recalls a trip to Salisbury for training, but she has no detailed memory of this other than travelling there and staying for “about two days”
5.7 Working on the cameras

The women varied in their responses to their experiences of working on the camera. It was thus helpful to have interviewed several women to attempt to gather a detailed picture of what the work was like and the degree to which the women enjoyed it and saw it as important to the broader testing work that occurred at Woomera.

5.7.1 Film testing, loading and processing

Female camera operators would generally load the film onto their cameras and unload it after each trial themselves. Some men have said that this task was done by the male in charge (as discussed in Chapter Six) but this has not been confirmed by any of the women interviewed. A darkroom was attached to each camera post so that film could be loaded without exposure to light. The film would then be collected and generally taken to Salisbury by plane for processing, though there were processing facilities on the range that were used when the visual results of a trial were required immediately. (Morton, 1989, p. 282) and Appendix 2.

So adept were the women at changing films in the dark, they would sometimes be required, and capable of doing this while they awaited the descent of a rocket. Cecily Quinn has reflected on this aspect of her role, and in doing has for the first time come to acknowledge her skills and those of her colleagues:

-[during] night trials, especially [...] on V34 [...] I would have had to change my film and reload again in the dark, because you couldn’t have any lights on. And because the camera was on a platform, I often think now, it’s a wonder I didn’t step off [that platform] in the middle of night. If you were setting up [to film] a rocket, and you had to film it going up, so you’ve used up your 400 ft of film, then you’d have to reload [the camera with film] to get the rocket coming down again [...] in the dark. [...] The camera was set on a platform, which was probably about this high [gestures], and you had a couple of steps. [...] And the more I think about it, and I think, “Yeah, we were a bit good, weren’t we?,” to do all that.

Merrilyn was less confident than Cecily, probably because she worked in the role for a shorter period of time. On occasion the film was not loaded correctly and would become jammed in the camera. She says, “we were all such amateurs, we’d be in a trial
and the damn thing wouldn’t roll!” Joan Adams confirms this, saying: “If you bungled it up [laughs], a thousand foot of film was meant to fit into a little camera – whoopsy!”

Loma has vivid memories of the film processing at the range. None of the women, other than Loma have spoken in any detail about the handling of film post-trials, other than mentioning that it was taken back to the Instrumentation Building, after which most camera operators gave it little thought. In comparison Loma describes the process in detail:

> We had a film room in the Block House at the Range Head […] its purpose was to distribute and collect film for appropriate handling. Basic “Test Strips” were processed at this facility as a proforma means of ascertaining the health of the cameras and the competence of their operators. The camera balance, orientation, timing . . . all this could be satisfactorily audited by the staff of the film room. […] “Camera Girls” who were being rotated through the film room, used to carry water by the 4-gallon bucket full all day. Stop bath, Developers, Photo Flo, Washaid, Fixers, wetting agent, hypo clearing agent, and more, had to be constantly topped up with cool water to prevent the emulsion from melting off the film before it was completely developed. This was not a job for wimps. (L. Silsbury, personal communication, April 11, 2018)

**5.7.2 Camera types**

The three principal types of cameras operated by the women to track and record the missile trajectories at Woomera were the Askania Kinetheodolite, the Contraves dual unit Kinetheodolite and the Vinten HS300. They had different specifications and capabilities and were used for different purposes during the testing program.

The first kinetheodolites used on the range were the Askanias, which had been developed by the Germans during World War II as part of their V-1 and V-2 bombing program. They were designed to track at relatively slow film speeds and had originally required a two-person operation, but were adapted at Salisbury and Woomera to be used by a single operator (Morton, 1989, p. 268). These are the cameras that Laurine Hall was particularly skilled at operating (as discussed in Chapter Four.)

The Contraves were made by the Swiss firm Contraves AG, the name being derived from the Latin, *contra aves* – against birds (Morton, 1989, p. 270). WRE’s R.P. (Bob) Bonnell, who was in charge of the optical instrumentation used on the
range, travelled to Switzerland on a research mission prior to buying the modified
cameras. This led to an order for £262,000 of specifically modified Contraves cameras
being placed with Contraves AG in mid 1954 (Morton, 1989, p. 271). Bonnell’s
colleague, David Miller, later spent six months in Switzerland improving his
understanding of the technical aspects of the cameras and remained the resident

By 1955, Contraves cameras were utilised more widely than the Askanias, which,
while they remained in use, were not replaced as they broke down. Contraves were a
more modern camera, designed ten years after the Askanias and known to have a higher
degree of accuracy. These units were also modified to suit the trials requirements at
Woomera and were generally reckoned to be capable of locating any object in
observational range to within a maximum of three metres (Morton, 1989, p. 270).

The Contraves had a servo-controlled power-driven mount operated by two
camera operators using handwheels, one measuring azimuth and the other, elevation.
Some 12 Contraves might be used during a typical trail, positioned at different
locations down the range. They were heralded for their tracking accuracy and for the
fact that they could expose film at either 10 or 20 frames per second (fps) (as compared
with the 4 fps of the Askanias.) Another advantage of the Contraves was they used 35-
mm cine film which could be viewed on a standard cine projector and shown on a large
screen, post-trial, as a behaviour record (Morton, 1989, p. 270).

More accurate again than the Contraves, the most commonly used high-
performance camera was the British precision hand-finished Vinten HS300, which was
able to expose up to 300 frames per second. As many as 37 Vinten cameras were used
1954, when Cecily Quinn was working on the range, a particular mount had been
designed to ease the operation of the Vinten – the EMU (Easily Movable Unit). From
1953, the Missile Instrumentation Group had commenced the development of another
more practical means of operating the Vinten. This enabled a single operator to track
a missile while looking through binoculars attached to the camera that itself was
carried with a mount on a wheeled chair on a circular bearing plate (Morton, 1989, pp.
274–275). Morton explains:
The operator tracked in both azimuth and elevation with a small joystick connected to a rate-aided servo system […] the new design was officially a SAVU (Servo-Assisted Vinten Unit), but colloquially called a Gooney-Bird. (p. 275)

The Vintens were started with a push button and fitted with a microphone for communication regarding the start and end times of each trial, as well as earphones for the operator to hear the countdown to the start of the trial.

Cecily Quinn was the first woman to operate a Vinten at Woomera and is modest about her camera operating skills. Figure 5.4 shows her operating her Vinten with the Gooney-Bird mount. Her colleagues have commented that she was the most highly skilled camera operator of her era. Vinten operators were entirely responsible for the machine on which they worked. Cecily reflects:

if you made a mistake, you couldn’t blame the other girl, “Well maybe she didn’t level the camera properly.” Or “What happened to you? You didn’t pick up the rocket when it hit over the horizon,” sort of thing. And the more you think about it, it was like with the Kinies [Askanias], they were on their own, and they were actually physically standing, and working their cameras. And they were closer to the range head. […] So they were solely responsible for loading their cameras, making sure everything was okay, and with the Vinten operator, you were the same. You loaded your film, you had to set it up, you had to contact “Uncle” [the controller of the communications unit] to report when you were ready, get in your little seat. And it was like a little circle, and you just operated with your thumb and finger, so it was a touchy sort of thing.

Cecily enjoyed working on the Vinten for the beauty of the images it produced. She also enjoyed night trials, although they posed additional challenges. It is only now, years later, that she has recognised and accepted the degree of the talent that she and her co-workers displayed:

when I worked on night trials, it was beautiful with V34, with the lens, you know, to look at the moon, it was just like a grape. […] I used to love being out there looking at the stars and the moon […] And I loved working nights, and this is what you miss when you go to the cities, you don’t see the stars. I often go out here and look at the stars […] you had to be very competent. Get your machine turned on, get your checks from Uncle.
Cecily received a telegram from Queen Elizabeth II for being the only camera operator to record the impact of a rocket. At the time she was operating a Vinten, at V34 post and believes this had been a night trial. Unfortunately, that telegram has been lost. Cecily took a photo of the moon (shown in Figure 5.5) while working one night and has shared that as part of this research.

Cecily was aware that few women of her era operated the Vintens and was humble about her abilities:

most of the men, they worked on the Vintens first […] for us girls to take over, probably looking back, maybe it might have been a sore point [for the men]. Because I know when I worked on V34, that was a bit of a surprise for people. And I don’t know how I got to work on that, but I did anyway.

Figure 5.4  Cecily Quinn on a Vinten with a Gooney-Bird mount, 1963. (Quinn, 1963).
Figure 5.5 Photograph of the Moon, taken by Cecily Quinn at 23:00 hours, September 1960 at Woomera, Range E on V34, using a 360cm lens – at the time, the only one of its kind in Australia (Quinn, 1963).

Loma Silsbury was also skilled at her work and, like Cecily Quinn and later Joan Adams (nee Zajicek), she was hand-picked to operate the Vintens:

Women were invited to operate Vintens if their skill level was considered superior. Vintens […] were usually operated by men, however, for the era we had Ces Quinn, Jan Cox (Galloway) and Sue Blackmore. There were likely more women at a later era but not in the beginning as the responsibility of operating these cameras was very heavy. Ces and I also spent considerable time posted to V8 on the way to K12 as lone operators. This was a very high-trust post, in the impact area.
It was not only the responsibility that was “heavy”. As Morton (1989) suggests, in the early days Vintens were physically too heavy for most women to operate:

The first tracking mounts were of the trunnion type. Operated manually. Behind the camera stood one man (it was usually judged too heavy for women) using handlebars to move the ponderous Vinten with its motor and big 900-millimetre refractor lens. (p. 273)

The Vinten was Joan Adams’ favourite camera. She is shown on a Contraves dual unit in Figure 5.6 and operating a Vinten in Figure 5.7:

I liked the Vinten, probably because I was sitting in the chair, you were on your own, you’ve got a joystick, and you could do your own thing. You weren’t subjected to somebody down the other end. It was all you! [Laughs...] It could take “big” close-up pictures [such as] of rockets going through Canberra bombers and taking out all the radio equipment. Bolts coming out on impact. [...] It went fast. It showed you the actual impact of missiles hitting targets, and where they hit.

And we had big targets, [such as] Canberra bombers. I can remember being on V34 when they lost a Sea Slug. They had tracking flares on either side of the rocket, and it used to go off on an angle. And this thing did a left-hand u-bolt, and we saw two tracking flares, and it came over the top of the camera and it landed down the road. [Laughs] That’s the Sea Slug. But all the rockets were big. And it was only in the later stages that they had the technology to make them smaller.

Joan refers to the operation of the Vinten as shown in Figure 5.7, “See how big that lens is? And that’s a radar mount and you sat in the seat and it swung around, and you had a joystick. It was probably a precursor to all these video games!”
Chapter Five. Comparative Case Studies 2 to 7: Other Women Camera Operators

Figure 5.6 Joan (Zajicek) Adams is on the KT post, second from the right, in jeans (Southall, 1962, p. 129).

Figure 5.7 Joan Zajieck working on the Vinten, c. 1969 (Adams, 1969).
5.7.3 A “typical day” on the range

Each of the women talked about their trip to work, which could involve travel by buses, Land Rovers, helicopters, light planes or any combination of these vehicles – or in the case of Laurine Hall, by motorbike (as discussed in Chapter Four). Those working on the posts relatively close to the Instrumentation Building took a bus to work, which was a one-hour trip from Woomera Village. Workers on posts further down range would take a bus to Evatt’s Field and then be transported to work on a light plane or helicopter. The buses left at 7am and arrived at the range at 8.00am.

Once they had arrived at work the women would be allocated a work group and camera post and their male supervisor (“photographer” or “senior photographer”) would talk through with them the day’s planned trials. Often the trials would be cancelled or re-scheduled. Cecily explains the process in the early 1950s, and how women, who never drove on the range, relied on men to take them to their specific post:

We’d meet up with our chief photographer, and then we’d look and see what trials were on that day, and then we’d have to work out what film we needed for those trials, go to the film room, draw the films out, sign for them, and then we’d get a jeep. And it wasn’t very often, but sometimes there’d only be four girls on there, so we didn’t drive ourselves ’cause none of us had Commonwealth licenses, it was always the men. So if we didn’t have a photographer on our post, then we would get taken out in a taxi by one of the transport drivers, they would drop us off, and we’d be left out there. So if you didn’t remember to take your water […] you’d be stuck without water all day.

A typical day on the range often involved waiting for something to happen, as Loma said, “out of the eight hours that we were there, you might have 20 minutes work to do in a day”. The rest of the time the camera operators either needed to amuse themselves or rely on their supervisors to provide occupation or entertainment. Loma refers to the work as a “well-oiled routine” and each of the women have referred to the teamwork involved in their job. In Cecily’s era, one woman would set up the camera up and load the film. Another would prepare the site by activating the “donkey” mechanism that enabled the camera to roll down a slope into position as shown in Figure 5.8.
The reality was, there was no “typical” day, other than there was a format of either readying a camera post for a trial or deciding what to do if there was to be no trial. Joan Adams explains that in her era, the early 1960s:

You saw the crew listing, you got with your group, got your lunch, off you go in the Land Rover out [to the more distant camera posts]. If nothing was happening, great. [We would ask each other] Got the cards? What’s happening? Barbecue? Who’s doing the cooking? Got a cup of tea? Put the kettle on. Go for a walk in the bush […] we did shift work. We were out there sometimes in the middle of the night. And they’d pick you up early in the morning to do firings, and you had breakfasts at Koolymilka. […] I can remember all these greasy eggs on this slab, swimming in grease. And you’d get beans, toast, everything was there, you’d get your breakfast, and then you went off. They looked after us. You’d could be there for eight hours, and then it was time to go. […] There was comms in at the range head, and you had an intercom down in the signal van that told you the stages that you were at. And there were certain stages that you were called by for readiness for this firing. It wasn’t done off the cuff. At minus such-and-such, they called readiness for the cameras on the range. And they went through the whole lot, “Ready”, “Ready”, “Ready”, and then the countdown happened. So you knew where you were […] And then you’d get so far into the count, and they’d go, “Stop, stop, stop. Technical difficulty, there’s a hold.” That’s when you sat, “There’s a hold.” Not aborted, there’s a hold.
5.8 Job satisfaction and skills

All the women remember their work at Woomera with great fondness. Loma Silsbury eloquently related:

We inhaled [Woomera] with each breath and absorbed it through our skin – it was exciting and larger than life. For us, living in the day was so enthralling we could have been witnessing the building of the Pyramids. It had the same ethereal combination of the humdrum and the electric. Dust and heat and flies and, above us, the light of the eternal stars crisscrossed with glorious vapour trails all reaching for eternity.

All the female operators interviewed for this dissertation found their work interesting and exciting. They also all enjoyed the friendships made through the work and the hobbies and games they engaged in during the down time when trials were called off or aborted. Only Margaret Trench found this problematic:

All day. All day, and then it was cancelled. […] And even when we were set up to do it, they’d get to a countdown of “10, 9, 8, 7, 6, trial aborted. Abort. Stop, stop, stop.” So that could happen as well. We just had to be prepared for whatever was dished out. I have to tell you, it was the most boring job in the world.

This is at odds with the accounts of some interviewees who downplayed the frustrations of some aspects of their work. As Margaret explained, operating cameras was challenging for some and not an easy job. Her sister, Kate had a little more patience and given she endured those conditions of preparing and waiting around, found ways to stay busy, “we played cards while we were waiting. We cooked. We slept on the floor, we’d just put a blanket down there.”

Kate’s fondest memories, like those of others are not of the work itself, although she found it “exciting and amazing,” but of the friendships formed:

Just the camaraderie, and we set each other’s hair […] if there was nothing happening, we’d have our hair dyed, and coloured, while we were on the job. […] we’d have little cardboard boxes with our lunches, catered for us. And a lot of fruit would pile up on route. So our boss would cut up all the apples, and fry them in butter and sugar [and] make an apple pie. It was beautiful.
Despite the boredom, Margaret Trench does have fond memories of the launch of Blue Streak:

Blue Streak was brilliant. Just the fact that the whole world knew about it. Like it was very, very in the news, and you can say now that “I photographed the Blue Streak!”

After Margaret was relieved of her job on the cameras, she went to work in the Instrumentation Building as an administration assistant. One of the jobs she was given was to prepare the punched cards for the computer installed at Woomera at the time. She said that this job suited her much better than had her work operating a camera, “I was very good at clerical work [I had], found my little niche.”

Kate and Margaret’s sister, Sue, worked in an administrative position in the Woomera township. She left Woomera at one point, but missed it and returned. All the sisters agree there was something unique about Woomera that remained with you forever. Kate’s daughter, Cathie says:

My dad [John McGoran] explains it, that Woomera ruins you for everywhere else. ‘Cause nowhere is as good as Woomera. You can’t find that camaraderie […] it’s just in your blood.

Joan Adams describes the excitement of filming rockets and missiles with enthusiasm:

Look, it was Guy Fawkes day every day of the week when there was a firing! We had five firings a day. We had target aircrafts that were Canberra bombers and Meteors, and Jindiviks. And it was big “kaboom!” and what’s not to love? What’s not to love! It was colourful, it was entertaining. We were in a beautiful spot.

While she acknowledges that, “a lot of important people were up there, and a lot of good work was done by a lot of clever people,” she does not think this made Woomera “special.” Rather she says:

It was in a lovely place, with reasonable people, different people […] you could plonk yourself down in the middle of London and you’re going to get different people from different walks of life. You can’t just say Woomera was special, because it wasn’t special. I think it was a pleasant place, it was what you made it. And there was heaps of sport. It was great.
After she left Woomera, Adams did not give her former life much thought, and she does not see anything morally troubling in the work she did. Again, this has been a common response to people interviewed for this research. She explains:

people move on, you do different things. I mean, my life isn’t Woomera. It happened, it was good fun, I enjoyed it. There was nothing malicious about what they did, I thought they did, firing rockets at people? Fine, it happens. And this is what people do; they kill each other. That’s life. And it didn’t enter my head when I was in Woomera, and I didn’t give it a second thought. I enjoyed my time there, and I enjoyed the people I worked with. […] I loved it. I thought it was a real blast. Met some lovely people up there.

For Cecily Quinn the work enhanced the women’s self-esteem. Initially Cecily had been aware of a stigma associated with working on the range, with a veiled reference that women working there may have been considered promiscuous. But once she started work and quickly formed strong friendships, she came to accept the work she and her colleagues were doing was important. Despite the various negatives in terms of extremes of climate, Cecily feels she speaks for many:

Even with putting up with the dust and the heat, we all loved it […] we all got along; we never had any arguments or disagreements. […] we had hobbies. We would do our hair up out there, we’d change hair colours, we would take sewing machines out there.

Today Cecily is cognisant of the unique nature of her work and that period in history, which lends further importance to this research. Cecily has recently reflected that more could have been made of the infrastructure at Woomera:

It was very exciting, and I think because we were younger, and we didn’t really, not until I’ve got older [realise how significant the work was] I’ve gone over [to Woomera] every time they have a reunion, how important Woomera was, and how we should have been putting a man on the moon from there. When you think of what’s wasted when you go back there now. You think all the expertise we had there, and that just got wasted.

An agile memory and observation skills were required to record the details of the trial after it was completed. Cecily explains that this was a matter of remembering when
rockets were sighted as they came down after firing and reaching their apex, when impact might occur in a missile trial and for how long missiles might be visible. All this the operators did without a notebook, much less a computer or recording device:

You had to memorise what was going on to give that information on as well. It wasn’t just sitting there and thinking, “Oh yes, we’ve done that; it’s on the film.” […] as soon as the trial was finished, or we’d got the impact area, [we would] just sit down and write […] say it’s a rocket going up, so because we didn’t sight it until it came up to the horizon, so you would be counting five seconds, whatever, and “sighted at such-and-such a time; this happened at such-and-such a minute,” because you’d be estimating. And then if it was one that was deploying rockets, and the rockets came off, “That came off at 30 seconds” […] And if the rocket blew up when that happened, and how long it was in your sight for. So often, if it was a bigger rocket, then you wouldn’t get it all the way because you would have run out of film. But if you were thinking, if it was an important one and you had to change your film in the middle. [You had to] get it going up, and then if you were waiting for it to come down again, you’d have to quickly change [the film] as well to pick it up on the way down. And I always said I wasn’t a competitive person, but you were then; because it was always a competition who sighted it first, and you were radioing Controller with, “It’s on the way down now, and this is the bearing of it.” So, some of the others that may not have sighted at the same time, they could lock on as well, and they’d track it down to earth again.

The women had immense pride in their work and Cecily explains:

it was always a bit of competition to be ready first between the various places. And it was also a competition to pick up the planes when they were coming over, and to see who could actually get the trajectory right and get the right [co-ordinate] for recovery to pick up the rocket.

In 1961, when Cecily went overseas and took a break from her work on the cameras, her boss wrote her a reference which reveals the degree of her skills. Some of this letter is reproduced here:

Cecily has been working under my direction on a high-speed camera in a position at Woomera for the past two years and has been employed with the Department of Supply for approximately six years. I have
found Miss Quinn at all times to be conscientious on arrival and have come to expect an intelligent approach to her fairly complex job operating a servo-assisted camera mount as normal. But I assess this as above average. No difficulty was noticeable in adapting herself to a variety of other equipment as she can absorb instruction easily. Summing up, I would say that Miss Quinn would suit any job that she assesses herself capable of, and have no hesitation in saying that her present position would be open to her when she reapplies, and her loss will be difficult to find a replacement for. (Edmondson, personal communication, 1961)

Edmondson’s letter noting that it would be difficult to find a replacement for Cecily, is interesting, and challenges the comment by several of the women that there had been plenty of women available to operate the cameras.

Merrilyn Bell says she can remember thinking, “this is a fascinating job […] an exciting occupation, never boring. As the time wore on, it was almost that I was in awe of what we were doing. What we recorded”. This is both consistent and at odds with what Laurine Hall said about the work. Both women found it exciting, but Merrilyn was more conscious of the enormity of what she was doing, Laurie holds this view now, with hindsight, but Merrilyn felt she had it at the time.

Additionally, Loma Silsbury recognises how unique the experience was, and to some degree, how fortunate she was to have been a part of this time in Australian history. She writes eloquently of this, as the epigraph that opens this section demonstrates. Pat Hall is a little more unusual, in that while she considered her work “exciting,” she did not think that at the time she was aware that she was doing something important and reflects today, “I still don’t.” She enjoyed all the launches and like her sister, Laurie did not equate the size of the spectacle with the sinister intent of rocketry. She enjoyed the noise of the rockets and the louder the better!

**5.9 Working conditions**

In the early years on the range up to the late 1950s the camera posts were not air-conditioned, although the Instrumentation Building was. When Cecily Quinn first began working on the range in 1954 there was no air conditioning; it was installed around 1960. Cecily said, “that made life a lot more pleasant for those of us that were out there originally in the dust and the heat”.
Prior to 1960, in the summer days when there was no cooling on the range, women would return to Woomera Village only to have to cope with extreme heat in the houses as well. Around 1954, the UK government did supply 200 Breezaire evaporative cooling units to WRE but the Department of Supply was in no rush to install them, considering them an “unnecessary luxury”. The units, known by Woomerites as “swamp-coolers,” were a novelty in Woomera and their technology was primitive, so they offered little relief and their operation used large quantities of water that often leaked onto carpets leaving an unpleasant smell (Morton, 1989, p. 232; personal communication, Woomera!! [Facebook page], June 12, 2019). The original family homes at Woomera faced east or west and their occupants thus dealt with morning and afternoon sun in summer through the front and rear windows. The blocks of flats were better situated with front windows facing north (Morton, 1989, p. 232). Hence it was the heat that women most commented on in terms of working conditions, although their reflections were not really complaints, but rather observations, in keeping with their general optimism and resilience.

Conditions in the Great Victoria Desert could also get very cold and camera operators were issued with duffle coats for the colder nights and early morning firings. Joan Adams recalls, “it was freezing. You are in the desert just before dawn, it was freezing”. Working in the desert also presented additional challenges. The red dust was ever-present. Most women on the range took great pride in their appearance and liked to dress up for work. This was impractical given the rugged desert conditions and women would often return home with delicate fabrics spoiled by the red dust. Cecily Quinn explains it was the “rock ‘n roll era” when the fashion was for women to wear full-circle skirts. She says there was competition between the women for who might have the most petticoats and relates that they would, “dip [their] petticoats in sugar and soap, to make them stiffer”. Eventually sense prevailed and Cecily and many of her co-workers resorted to slacks. She says “when I first went out there, I never used to wear slacks, I always wore a skirt. And I always said, ‘I’m never wearing jeans’”. But after an occasion when she and her co-workers had to travel home in the back of a Utility and she arrived home wearing a blue dress, turned red, Cecily recounts, “I said to Mum, ‘I’m going to wear slacks from now on and I’m not wearing good clothes out there anymore!’”. Practicality and common sense prevailed over fashion, “I think over the
years […] we all ended up thinking we’d have to be sensible and wear slacks or jeans, then we went into sneakers, or something like that, once we’d sort of settled down!”.

Despite this, the women were often well-dressed. Figure 5.9 shows the women at work in 1959 and Cecily says the artist’s impression is accurate and that the women’s personalities are appropriately captured.

![Figure 5.9](image)

*Figure 5.9* Christmas card from 1959 created for the women who worked on camera posts K11–K12 and at V34. Cecily is depicted far left wearing a very full skirt (Quinn, 1959).

Being a remote, unsettled environment there were the added challenges of indigenous fauna. Joan Adams recounts an incident at her Vinten that has haunted her for decades:

the V34 had a roof and it was split level. You had all the stuff that you turned on, and up there was the camera. And up here were the roof hooks. So, you walked in, you turned everything on, and you unhooked the thing, and you opened the roof. Well I put my hand up there, and there’s this lovely soft feeling to the touch. I thought to myself, “what is that?” And no joke, there was a spider as big as my fist. It felt like velvet. Oh my god!” I nearly shook my hand off. “That’s it, I’m getting out of
here, I don’t give a damn what they’re putting up! I’m out of here. I’m not going back in there until it’s gone.” […] It was a firing day, but they had to get rid of him. It wasn’t like, “Oh hang on, we’re not going to fire because Joan’s got a spider in her camera post.”

In the early days there were also only make-shift toilets. As Cecily explains,

[They were] down the bottom of the hill, and it was like, I suppose a holiday place; it was just a drop-down thing […] No flushing. And I think we did get tanks out there in the end. At first it was very rough and ready.

By the 1960s the toilets had concrete floors that were cooler than the surrounding areas and often insects, spiders and small reptiles would take refuge there from the heat. This meant that from time to time women would be confronted with lizards, goannas and spiders. There were also scorpions at Woomera, but no women reported seeing one during their working lives.

In addition to heat, cold, dust and local wildlife, women had to contend with a workplace that could be dangerous. The Contraves post had a sloping roof that was slid open with a catch mechanism. On a couple of occasions, the catch was released in error and a woman was injured. Kate Trench recalls, “I wasn’t paying attention, and I had my arm on the edge of it when it was coming down, and I was squashed”. She was taken to hospital by helicopter and her arm was treated for heavy bruising. On another occasion a faulty electrical connection blew up and badly burned her hand. A legacy of seven years on the range for Kate was the permanent damage to her hearing from the noise of the rockets. As was typical for people in 1950s and 1960s Australia, camera operators wore no sunscreen or head protection. It is impossible to know what number of later skin cancers were suffered as a result of working on the range. There are no reports of any injuries due to the actual rockets. Joan Adams believes it was a very safe work environment in this regard because of the isolation:

I didn’t hear of anybody getting hurt. But there’s a lot of space between things that fell down […] it’s so safe out there. The odds on you getting hit are very remote.
5.10 Senior roles for women, and men as bosses

In stark contrast to the hierarchical structure of the village and the mess divisions that were arranged according to seniority, the women interviewed did not consider their workplace to be particularly hierarchical. While there were no female “photographers” (only “assistant photographers”), none considered their male bosses as superior. The women had universal respect for these men and considered them as people who enhanced their working lives rather than made them difficult in any respect. The senior men were also considered teachers and people to whom the younger women, especially, looked up to as mentors.

Regarding the different personalities of the men who supervised the young women on the cameras, Loma Silsbury’s comments are indicative in many ways, not least of which in that they remind us not to stereotype male supervisors as “other”. She reflects on some of her bosses’ approach to training and life:

Jim Hogan [a World War II amputee] was inclined to dish out books for us to read and then discuss the subject matter. Twofold result - we were quiet while reading and then engaged in the discussions after. His range was quite large and, due to the necessity to manage pain from his amputation, delved heavily into meditation and the metaphysical. Shall we say, more esoteric than the average. Brian McNamara was a brilliant teacher, however, for those who were more interested in primping and preening, he also instructed on how to make our own shampoo, cosmetics and facial masks. Interesting bloke, Brian. He also ‘invented’ his own version of Trivial Pursuit to keep us amused. […] Jim Degatardi was into bush walking, orienteering and outdoorsy things. His instruction was on survival both in the harsh post-war reality and in the bush if needed. Much the same could be said of Jack Warrell. Les Dayman appealed to all things theatrical and so on it went. Dennis [Kader] was a wheeler-dealer and gave tremendous insight into the world of commerce and the art of the entrepreneur. Len Gallagher was a historian and thus, even with his slightly old-womanish tendency to being both a pedantic list maker and general fusspot, we learned much from his recounting of historical events. All in all, we had the chance of a very broad education. (L. Silsbury, personal communication, February 18, 2018)
Loma was one of the younger women on the range and her testimony refers to women in their early teens. She explains why, in her view, a male in control of these young women was required:

keeping the “wunderkinder” occupied required a firm hand at the wheel but, with one competent man as Post Boss at each site was all it required. These men were a special breed: natural teachers, highly skilled and with the patience of a saint, the Range would never have run without their expertise. These men should have been canonised for all the crap we tossed their way. (L. Silsbury, personal communication, May 6, 2018)

This is not to say a woman could not have filled a similar role.

Loma admits to “hero-worshipping” Dennis Kader and believes other young women felt the same. Not purely because of his physical appearance, but because he helped the women grow in confidence at work and in other aspects of their lives. Loma has talked about the quiet leadership qualities of one of her bosses, Patrick Bradley (whose work is discussed further in Chapter Six):

Although, technically, Patrick was at times ‘our Boss’, I never thought of him as being so. Neither above nor less than, he was a supreme Team Player. We all had our work to do and, while some instructed and others followed to a lesser degree, I never felt anything other than camaraderie with Patrick. He issued clear, concise instructions, encouraged and praised when necessary and heaved an appropriately exasperated sigh when we were less than perfect in our endeavours. If pushed for a description, I think that of a ‘big brother’ would have best suited him. Protective and nurturing and never ‘too busy’ not to take time for this small person when asked (L. Silsbury, personal communication, May 8, 2018.)

This was also true for Dennis Kader, who was universally respected on the range. Loma who worked for him in the 1950s recalled:

Darkly handsome, black hair and gimlet eyes, with incredible long lashes, he was our hero and another of the eternal Peter Pan personalities who made us aim for the stars and never count the cost of failure. With Dennis nothing was impossible. Nothing you could dream was not so. He taught us how important it was to never take no for an answer: to think for ourselves (L. Silsbury, personal communication, May 8, 2018.)
Joan Adams believes that in her era there was close to an equal ratio of men to women working on the cameras. Her male boss, John McDonald, was also the projectionist at the village theatre. Adams likened herself and her co-workers as, “his little hens running around after him.”

Cecily believes women did not consider applying for a senior role as photographer and men were not considered “superiors” as such:

I don’t think any of us ever thought that; we were happy doing what we did. […] And you didn’t feel like you were the under person. None of the men ever pulled a stunt, “Well I’m the boss, you do what is say,” because everybody got along. We didn’t really have any conflict with people.

She also explains that women were always self-motivated to get the work done regardless of the presence of a male:

there were times when there were only us girls working on it [the camera post]. So then we would just do whatever we had to do. [There were not] such strict guidelines. When we had a male there, we would defer to him because he was our boss. But if there was only us four girls there, or five girls if you’re on a camera post that had a Vinten there as well, you would just work. You knew what you had to do, and you did it.

She also does not think the work the women and men did operating cameras was vastly different, and she is adamant that the presence of women was essential for the utilitarian filmmaking at Woomera:

if it wasn’t for the women, they wouldn’t have had the cameras operating […] none of us wanted to be [chief photographer], I suppose. We were camera operators. They were in charge, and not that they did any different to what we did, to be honest; they were just the boss because they were a Photographer.

The camera women were all aware of the three senior women on the range in communications roles, Stephanie Travers, Barbara Hewish and Barbara Fail. The female camera operators all had immense respect for these women, as did the male interviewees. Loma has high praise for these women, but again her reflections could equally apply to a male in these roles:
The ability to regurgitate times, dates, locations, Trial Numbers and heaven only knows what else (even a mountain of spurious complex algorithms) were needed, verbatim, at any given moment and no room for error […] One needed to be a human computer and this took time, maturity and constant practice to remain fully competent in these positions. (L. Silsbury, personal communication, May 6, 2018)

Cecily Quinn has spoken of the work done by the controller of the communications unit who was referred to as “Uncle” and denoted by the call sign “U”. For many years, Uncle was a woman, Barbara Hewish, who was responsible for coordinating all communications from each section on the range, the Askanias, Contraves, Vintens, radar and telemetry staff.

5.11 Why women?

One of the research sub-questions, “why were women employed as camera operators on the range at Woomera?” was raised with all those interviewed for this dissertation. While there have been a variety of responses, it seems that none of the women gave the matter any thought at the time they worked there. They did not consider the work demeaning in that they were only ever “assistant” photographers, yet nor did they consider their work particularly significant. The latter point has most certainly changed as the women have matured and now have had the opportunity to reflect on the work they did.

Merrilyn Bell felt that women working on the cameras had nothing to do with women being cheaper labour, but more to do with the fact that men would have found the job “demeaning” – filming the weapons tests, rather than actually conducting the tests. The “real men” – the “boffins” and Service Men – preparing the craft to launch the rockets, were firing the rockets, and performed all the technical work associated with the rocket-testing program. In Merrilyn’s opinion, men considered it beneath them to work with the women in the more passive role of simply filming the tests. This view is not shared by the male photographers who had only slightly more senior roles than the women and were doing virtually the same work of filming (see Chapter Six).

Both Merrilyn and Loma felt that women were more patient, tolerant and flexible. Merrilyn especially, regarded women more able to cope with the physical conditions on the range. Camera operators might be out on the range during winter night frosts
or 42°C degree (107.6°F) heat, and yet tolerated this, while men in roles that kept them within the Instrumentation Building, or other roles with the rockets, tended to be in air-conditioned areas, or at least in areas less exposed to the raw elements. Merrilyn felt that women were less likely to complain about these conditions. Despite this, there were of course male photographers and senior photographers who endured exactly the same conditions.

Loma has given much thought to the work of women at Woomera and why women were particularly suited to the work or chosen for the work operating cameras on the range. She cites women’s faster reflexes, stronger eyesight and physical flexibility. This is an opinion not entirely supported by biological fact (Jain, Bansal, Kumar & Singh, 2015, pp. 124–227). Her comments relating to the greater flexibility of the recent school leavers does have some credence, though:

those with the best eyesight and the fastest reflexes were thus highly sought after for the camera operator’s positions. There were, however, other factors to be taken into account […] getting an accurate record of the trials was number 1 priority and to hell with secondary considerations. Thus, we must consider these basic needs and place them into the framework of the era. 1. Fast reflexes 2. Superior dexterity 3. Perfect vision 4. Teachable with a steep learning curve. 5. Obedient – capable of accepting a direct order without question or hesitation. 6. Fearless 7. Patient and with an 8. high boredom threshold. Looked at realistically with the standards of the era held firmly in mind, it comes down to a pubescent “child” – preferably female. They have fast reflexes, astonishing vision, incredible dexterity and balance, are at the peak of learning capacity, inquisitive mind, already programmed to accept the authority of an adult and obey to the letter also too young and inexperienced to fully appreciate exactly how dangerous their work actually is […] the choice of female is also the more important when it comes to communications equipment. In the low registers, the female voice carries better with greater clarity. Add the parcel together and Fingering the toggles like greased lightning, sure footed as a mountain pony with self-assured, stick-to-it-ness at all costs and, when the chaos is over, report in a clear, concise manner with unwavering accuracy and, go back to knitting socks or reading a book and never miss a beat. Men in those positions go near stir crazy. They champ at the bit and ask too many fool questions instead of getting on with the job. In the early days,
the young school leavers were exactly what the doctor ordered for Optics […] Later, when there was not such a high boredom factor, it was believed the older married women were more up to the position. (L. Silsbury, personal communication, May 6, 2018)

Loma also has strong views on women generally at Woomera, not just those working on the cameras, and believes that women held positions of power in the town in which they were in the clear minority. As late as 1972 men still outnumbered women 4:1 and in the 1950s this was close to 5:1 (Morton, 1989, p. 234). Loma comments:

Woomera was a frontier town and eligible women few and far between […] it was quite feasible for a woman to date a different bloke every night for a couple of years without going out with the same one twice. This placed women in a very strong position and thus, for the most, Woomera was a matriarchal society […] Young women on the Range were a vastly different kettle of fish. A strange combination of blasé and the naive, they wielded power beyond their station and were totally unaware of any glass ceiling. Petticoat government was alive and well back then and any man foolish enough to neglect his particular woman was in for a nasty shock. (L. Silsbury, personal communication, May 6, 2018)

Despite Loma’s observations about being oblivious to a glass ceiling it still appears that the women did not believe they could hold roles of equal superiority or pursue independent careers. It is likely that prevailing notions of women’s place still remained entrenched in their thinking despite the relative freedoms they enjoyed at Woomera. Carolyn Harding, a (married) data analyst on the ELDO program, could have pursued a senior role overseas when the ELDO program relocated from Woomera, but explained that this was not an era when men would ever consider relocating to follow their wife’s career (see Appendix 2).

Loma recalls she had a short stint in the Instrumentation Building and believes the men on the range considered her female colleagues as:

as a combination of eye candy and a telephonist crossed with directory assistants in a big store. That is to say, they did not seem to think of these women as being in a position of control – more like an information terminal there for their convenience. A Genie who miraculously made things happen when they rubbed the lamp? This is, if they thought about it at all. (L. Silsbury, personal communication, May 6, 2018)
Loma’s reflection has been tested against the testimony of the males interviewed for this research (see Chapter Five). None of them considered women in this way; on the contrary, most respected the aptitude of the women and lament the fact that they did not get appropriate recognition, as the testimonies presented in Chapter Six demonstrate, particularly that of Patrick Bradley.

However, Loma’s reflection that the eventual acceptance of women in these roles can be compared to the original secretarial roles that were performed by men until that work came to be considered as women's work, is somewhat plausible:

in days gone by, nursing and secretarial work were originally the domain of the male, it was eventually realised that women had the ‘touch’ required to maximise performance. So too, was the instance of such positions “on the Range” […] A simple analogy would be that no right thinking man, for the era, would question the ability of a woman to attend to the complexities of running a home and family – this is what they did. Ditto for the jobs we held on the Range. (L. Silsbury, personal communication, May 6, 2018)

Perhaps so, but it must be borne in mind that the era in which males filled secretarial roles, was one in which males filled almost all positions of paid work (Curthoys & Merritt, 1984, pp. 23–26).

5.12 Social hierarchy and cultural differences at Woomera

There has been considerable commentary about the mess system at Woomera and the social distinctions it created. Woomera was organised according to the British Services mess system and even the location of one’s house depended on one’s rank, with senior people and their families living on the higher more attractive ground that came to be known as “Snob Hill”. Many took exception to this at the time, including some of the men interviewed (see Chapter Six) and those that found it impossible to live with would ultimately leave Woomera. Elizabeth Auld, writing for Women’s Day and Home in 1953 said, “everyone visits everyone and social distinctions are as taboo as the technical zone on the range” (p. 5). Her article focused on the “community spirit” at Woomera and added, “housewives told me Woomera Village was the happiest place they have ever been in” (Auld, 1953, p. 5). My research would endorse this, for those women interviewed universally found Woomera a happy place, yet some found the social distinctions were anything but taboo.
Loma did not find the mess system problematic and on the contrary believed it was advantageous for women as it gave them more freedom to move within the different messes compared with men. For Loma, “this was not class distinction but rather one confined to professions, trades, work areas” (L. Silsbury, personal communication, May 6, 2018).

Loma considers that objections to the mess system was a matter of inverted snobbery:

On occasion members of the Other Ranks/Junior Mess would take an antagonistic attitude towards the upper ranks – just on principle. You know the type of thing, “Think they’re better than us. Think their pee don’t stink” and take all opportunity to cast aspersions upon those whom they fear may be better educated, more highly paid, or have greater authority than they. Such persons then seem to take pride in claiming they are the victims. (L. Silsbury, personal communication, April 11, 2018)

Loma’s view that Woomera was a place of true equality in terms of material possessions and democratic freedoms is not entirely correct. Senior people lived in superior housing with more domestic comforts and even had their gardens tended to by WRE staff (Morton, 1989, p. 232). Her comments on some of the unique features of Woomera, compared with many Australian towns though, are accurate:

We were living in paradise. Stop and think about it. No old age. […] No physical traumas. No unemployment. No poverty. Total equality. You went to somebody’s else house, and they had the same furniture as what you had […] The only thing different from one house to the next were your personal touches, the curtains that you had, the tablecloth, your picture on the wall. So everybody was the same.

This is true to some extent for those people who rented furniture from WRE, but there were also those who chose to have their personal furniture transported to Woomera.

There were a number of accommodation facilities at Woomera to cater for the women working there. Single women who worked on the range, nurses from the Woomera hospital, cleaning staff and “Computers” visiting from Salisbury lived at the Women's Hostel, which had the nickname, “The Crumpet Farm”. Married women
lived with their husbands, and children, if they had them, in the married quarters, which consisted of flats for married couples and houses for families.

Anglo-Australians of the mid-20th Century tended to consider themselves as British and hence most were not troubled by existing under a British mess system. Loma’s comments are in keeping with all of those interviewed given most them were migrants from the United Kingdom. Her testimony is also consistent with prevailing views of loyal association with Britain. She explains:

Did we consider ourselves British? My bloody oath we did! We held British Passports, Saluted the flag, sang “God Save the Queen” and proudly acknowledged ourselves to be “the Fairest of Britain’s daughters, fair”. […] Most of the visiting dignitaries were Poms while we were Aussies. However, we never doubted we were all British for a moment. (L. Silsbury, personal communication, May 9, 2018)

While some residents like Loma considered themselves British, the town was home to people from a wide range of cultures, particularly after the advent of the European Launcher Development Organisation (ELDO) in 1964 (Morton, 1989, p. 452). Joan Adams, who herself had been born in Czechoslovakia, believed that “Woomera was one of the first really multicultural cities [in Australia]. You could be damn sure you wouldn’t have run into a French person down in Adelaide, or in Myers then”. However, while she could identify people from many European nations, she saw Australia’s Indigenous people as fringe-dwellers:

there was the Poms there, the French there, the Italians there, the Americans there, the Aborigines were hanging around there as well, ’cause that was their land. […] Well they were out on the stations, I think. You saw them going backwards and forwards.

Her view that there were no Indigenous people working on the cameras on the range is consistent with the findings of this dissertation.

All the women interviewed enjoyed the coming of the Americans to Woomera (also discussed in Chapter Four). They brought with them a greater range of sporting and leisure facilities and a more relaxed attitude than that of the British. Cecily’s family took exception to the inherent racism of some Americans in terms of their
segregated society, yet Cecily admits to having little awareness of Australia’s Indigenous heritage, “I never saw any Aborigines really until I came to Whyalla.”

Cecily valued the opportunities that Woomera provided to get to know people from a wide range of cultures:

> It taught myself and my younger brothers and sisters I believe, to be more open to other cultures, to recognise we all need to work together. And through my father’s influence, and my mother being accepting of everybody [...] we would have social events on Sunday at night at our home, we’d have the records playing, and we had one Maltese chap, “Cheating Heart George”, we used to call him, ‘cause the only song he could play on the guitar, [was] Cheating Heart, which was one of Elvis’ songs. And we also had a lot of Europeans that came there. Unfortunately, after the war years, a lot of them were very traumatised, they had lost a lot. So, we were open.

When the Americans came to Woomera, Cecily’s mother invited them to her house, as she did with other nationalities, unaware of the degree of segregation in the United States. Cecily recalls an incident:

> When the Americans came, that was another bit of a culture shock, because one person in particular that came, he was an officer, he came to our place one Sunday night [...] he was boasting about how his grandfather had a shotgun over his mantelpiece that had shot a nigger. Mum just froze and said, “Excuse me, if you’re going to talk like that, you can leave.” She said, “That person is a human being.” And he was quite proud of that fact. He came from [the deep South] that’s something we could not understand. Then I said to him, “You wouldn’t be anywhere without the negros in your military. Who are your good professional athletes? They’re nearly all dark people.” And my mother said, “Look, sorry, you’re welcome to come anytime, but not with those politics.” And she asked him to leave, so that cooled things down. So that was the first time I’d ever really come across bigotry at all.

Joan Adams also enjoyed the arrival of the Americans to the range, “I never met a Yank that you couldn’t get on with, they were great”. The Trench sisters also talked about the American celebrations that were held at Woomera and how these evolved (by the 1980s when some of the family were still in Woomera) into a cross cultural celebration:
On the 4th of July, Woomera would have a public notice, and there’d be a big parade down Main Street. And down at the Arboretum, they would put on kegs of beer, and they’d actually bring Hungry Jacks from Port Augusta. So you’d line up with your beer voucher and your burger voucher, and everyone would celebrate. And we’d have the Littlest America’s Cup, where people would make a boat and run around in the red dirt. It was a cross of international cultures.

As noted earlier, while Woomera operated with a defined social hierarchy through the British services mess system that divided people on quasi-class lines according to their defined job status, there was still a degree of multi-cultural acceptance, particularly if this involved finding additional ways to have fun and engage in sporting activities. Times eventually changed and the mess system was gradually disbanded after the creation of ELDO, with the “Jazza” (the Junior Ranks Mess) being the last segregated mess to be closed in 1977 (Morton, 1989, p. 243).

5.13 Relationships, marriage and children

The Woomera rocket range and township provided numerous opportunities for meeting members of the opposite sex. Anecdotal evidence suggests that there was also a small but hesitant queer culture, as was the case in the rest of early post-World War II Australia. However, given the fact that homosexuality was illegal in South Australia until 1975, it is unsurprising that people were careful in the expressions of their sexual preferences. Loma comments:

In the early days (late 40/50's) I guess you could say "Don't ask - don't tell" would likely cover it however, house mates, bachelor brothers, spinster sisters. Put bluntly, it was none of our bloody business as long as it did not impact on us. If said 'couple' were grooming kids, it became a very different matter. Couples were high contributing members of the community and just as welcome in polite society as anyone else. I remember one such male 'couple' bringing back scads of holiday snaps which featured the two on their travels. No one thought twice about it. My experience has been that, with some fairly nasty exceptions, the rule of thumb for those days was simply this: were they decent people? Yes, then, to reiterate, it was none of anyone else’s bloody business. (L. Silsbury, personal communication, December 3, 2019)
A member of the Woomera!! Facebook group added, “it was always "Flat Mates" or "House Mates" never out in the open. Don't ask- Don't Tell. Even when we were there early 80s” (R. Coates, personal communication, December 4, 2019).

Linked to this was the security system, which was designed to ensure communists and people with anything other than mainstream ideologies were excluded from the town and the range. In the United States there was an accepted view that homosexuality and communism were linked (Tyler May, 2008, p. 95). Tyler May discusses the “lavender scare,” that saw hundreds of government employees lose their jobs because of homosexual stigma, more people in fact, than those who lost their jobs due to the “red scare” (2008, p. 92). Similarly, there was a campaign waged against particularly communist “subversives” by the South Australian Police Commissioner (Hodge, 2011).

By contrast, traditional female-male relationships were openly celebrated. Kate Trench met her future husband, John McGoran, a radar operator with the RAF, on the range. Like her family, he had also migrated from Scotland. Kate remained working on the range until she became pregnant with her son, Darren. She then remained in Woomera as a stay-at-home mother. However, women did work on the range while pregnant, and when young mothers – provided they could find childcare. Both Loma and Cecily left Woomera when their mothers could no longer take care of their children.

Margaret Trench also met her husband, Barry Rumble, on the range. Her recollections also reveal both the opportunities to rest during down time on the range and the prevalent active social lives of many of the young female camera operators:

We met on K2. I was on the cameras, and there was nothing happening, so I was asleep on the floor. So, I must have had a big night the night before, and I was lying on the floor, and I get this phone call and this voice says, “Hello Menace.” And I found out later on that Barry had been in love with this girl in Woomera, and [he] had left Woomera to go to Canberra to work for a while to get over her. And she used to be at K2. So, to prove that he was over her, he rang her at K2, but he got me. And she was the “menace” not me. For a change, I wasn’t the menace! In the end I said, “Look, I think you’ve got the wrong menace.” So, he started asking questions at the Instrumentation Building, and you know, I was asking questions, and the rest is history. We’ve been married for 51 years! So, it started at K2.
Loma’s parents arranged her marriage with William (Bill) Edward Galloway. Loma’s father was concerned about the possibility of his daughter falling pregnant as a teenager given the ratio of men to women in Woomera and the many opportunities for social interaction between men and women both at work and after hours. Loma says, “he figured that the way to keep me out of the pregnancy state was to marry me off”. Loma had only known her husband for three weeks when she celebrated her 16th birthday on the Thursday, was married on the Friday and was back at work the following Monday. Initially the young couple stayed with friends and then moved into Flat 53, Block E in Woomera Village. The marriage did not last long as Bill deserted her. They ultimately divorced, leaving Loma as a single mother of two at the age of 19.

5.14 Security and secrecy on the range

It was universally believed that Woomera was a secure place to live. All extant literature as well as the testimonies of the interviewees confirms this. Morton (1989) notes that people left their front doors unlocked and car keys in the ignition, that serious crime “like assault or abduction was inconceivable”, and that children could be safely left in their homes alone if their parents were out socialising (p. 235). Joan Adams confirmed this, relating that “the village was a closed area. Nothing was locked. You didn’t lock your car, you didn’t lock your homes, you could walk around at 3 o’clock in the morning; it was the safest place on earth”.

Contrary to the many documentary films and Movietone newsreels about Woomera that often featured the strict security measures, for instance, First Pictures: Australia’s Atomic Weapons (1953); Posting – Woomera (Bennett, 1960); Woomera. Rockets Galore-But No Fish and Chips, (1962); The Blue Streak Rocket: Britain’s Part in Europe’s Space Plan, (1964); The Distant Edge (Australian Broadcasting Corporation, 1964); and Woomera, The Silent Partners (Bardwell, 1988), Loma’s testimony suggests that this was, to a large degree, a sham and said that many residents and workers on the range found their way around the rules concerning passes. Her pass is reproduced as Figure 5.10. She explains:

Have you ever seen a Woomera pass? It looked like a one-pound note. You hand up a pound note ’cause you’d forgot your pass, they’d look at it, and you’d be fine. […] they never checked the damn things.
Despite the seeming laxity of the pass system and the freedom of movement for workers around the township, there was nevertheless an acute awareness of the importance of secrecy on the range. Talking about the nature of one’s work was not encouraged, although the Trench sisters, like most, would occasionally slip up, as Margaret attests:

We weren’t allowed to talk about [our work…]. One of the supervisors, heard me talk about, “Oh, there’s no trials today, so maybe we’ll get home early,” or something like that. He said, “You can’t say that! You can’t’ tell anybody over the phone there’s no trials today.” That was top secret!

5.15 Cold War fears

Other than Loma Silsbury, none of the women gave the thought of a potential Third World War any serious consideration. Nor did they link the work they were doing with the Anglo–Australian Joint Program to create deterrent weapons of mass destruction with any sense of personal morality or responsibility.

The first British atomic bombs were tested on the Montebello islands, off the Western Australian coast, in 1952 and then at Emu Field, South Australia in 1953, the year before Cecily Quinn arrived in Woomera. A further test series occurred at Maralinga.
during 1956–1957. While Cecily was aware of the tests, she did not understand the seriousness of them at the time. She and some of her friends went to visit the tests site at Maralinga as tourists while still living in Woomera (c 1960). She comments:

It shows you how ignorant we were. We were aware [of the tests], but we didn’t really think about the consequences. [...] You just think you’re infallible, sort of thing. And it wasn’t until later on when you realise, and you thought, “Well, yeah, that ground was probably contaminated.” And there we were; we went out there with my younger sister, and a couple of the telephonists, and we just went out there and stayed out in the [Maralinga] village for an overnight trip.

It is difficult to separate Loma’s strong political views, reflecting back today as an older, wiser person, with the views she held as a young (self-confessed “naïve”) woman working on the range. Nonetheless her views are of interest and again plausible. She broadly believed that most of her colleagues on the range cared little for politics and did not believe a communist takeover of their country was likely. This view is consistent with that of other women on the range. However, while Loma’s views are a little more analytical, they are likely to be retrospective, rather than exactly representing those she held at the time:

The average man in the street was pretty confident that “our” government was the equal of anything Nikita Khrushchev could come up with. [...] The Cuban Missile Crisis of October 1962 had given us cause for optimism. With all this in mind, it is easy to see why on November 22, 1963, when President John F. Kennedy was assassinated, we found ourselves going into a bit of a tailspin. Who would face down the Russian Bear now? (L. Silsbury, personal correspondence, 6 May 2018)

Pat Hall was not aware of the threat of communism while working on the range and says, “we were more worried about Japan”.

5.16 Sport and entertainment

Those who went to Woomera and stayed tended to enjoy sport. By 1968 there were 82 different clubs and sporting organisations (Morton, 1989, p. 248). From the early beginnings of the Woomera Village, different sporting opportunities were offered in abundance, for both men and women. Team sports were paramount,
including a range of mixed sports, which were offered and enjoyed by most. Women interviewees each spoke about the fun they had on the sporting field and people who may not have been interested in sport outside of Woomera enjoyed it while they were there. As well as sport, there were a range of churches, social clubs and societies that very much offered something for everyone. Women have shared stories about the dinners and parties enjoyed in friends’ homes. A journalist writing in 1953 observed, “housewives find it an everlasting battle with the waistline at Woomera because entertainment is seldom divorced from food” (Auld, 1953, p.5). Yet none of the women interviewed made any comments about these concerns.

After what could often have been a boring day on the range, there was plenty to do after work, although for those who chose not to participate, life outside of work may have been tedious. Cecily comments:

We got involved in sports, you became members of the Photographic Society, Modelling, and whatever. We always played tennis, didn’t matter how hot it was, we’d be playing tennis. We’d go to the Red Shield Hut, which was run by the Salvation Army, and because of all the single men there, they used to have a movie night on there, and we’d go to Benediction at St Michael’s, and then […] and go to the Red Shield Hut […] it was about two and sixpence, I think, and that would be your entrance in to watch the movies, and you’d get a cup of tea and biscuits.

The “duo-decathlon” was a quasi-sporting-social competition between staff on the range, initiated to relieve boredom, have fun and to provide a gentle challenge to the expected codes of behaviour on the range. Three women interviewed have recalled the duo-decathlon with great fondness. Unsurprisingly, none have described it in quite the detail provided by Loma Silsbury. During the course of this research a short piece of silent film of the duo-decathlon was discovered “in a box behind an old couch” in Woomera. Loma describes the format of the duo-decathlon and some of its events:

Firstly, the divisions. N.O.B.’s ergo, North OF Border that is to say G and E Ranges and all installations North of Tech Area. S.O.B.’s as in South of Border referring to Tech Area and all points South of the Tech Area Turn off to the Range Head proper. The “Events” were a morale booster much like a company picnic however, with a good deal more latitude involved, and this was regarded as a cathartic safety valve designed to bleed off the potential stresses experienced as a direct result
of potentially lethal working conditions. Ergo, they worked hard, and they played even harder. The programme consisted of events suitably altered to increase the mirth and capacity to let off steam. They also involved as many of the existing clubs and amenities as possible. The variety of insanity remained fluid and appeared subject to availability of venues and participants. For example, much depended upon hilarious gender bending. Basketball – played by the men wearing the ladies’ gym slips. Football, Australian Rules, played by the women wearing the Men’s guernseys and boots. Bowls using Paddy Melons instead of balls. (Cricket and golf were similarly ill-treated). Blokes competing in water sports wearing women’s costumes. I recall Go-carting and Land Sailing at one time and generally as much warping as possible. Darts, Pistol Club and all kinds of events all culminating in a Grand Ball for the presentation of the Trophy accompanied by food, drink and dancing till you dropped. The event continued with great success for many years. (L. Silsbury, personal communication, February 9, 2018)

Cecily recalls the same event which, on reflection, would be deemed inappropriate today:

We got dressed up with blackened faces – this is before a trial, mind you, one morning. Dressed up with black on, we had black everywhere, and we were in a plane, and we were dropping flour bombs into the people at Evetts Field area. And then all of a sudden they brought a trial on earlier than we were anticipating it, so we got into a lot of trouble because we couldn’t go to work as we were, in our black outfits, we had to go into Koolymilka, to the men’s quarters there, have a quick shower and change, and then get driven out to our camera posts, and the trial was held up while we were doing that.

Another fancy-dress operation involved women wearing hessian sacks to become “cave women”, as shown in Figure 5.11, and on another, wearing rugby uniforms (Figure 5.12). Most of these occasions were recalled as young people having fun to cope with the tedium of long days on the range when no trials were occurring:
Figure 5.11 Women dressed as cavemen as part of the 1957 duo-decathlon. Cecily Quinn is seated far left in the front row (Quinn, 1957).

Figure 5.12 The women’s duo-decathlon rugby team, October 1957. Laurine Hall, back row far left; Cecilia Quinn, back row, third from right; Barbara Fail, back row second from right; Barbara Hewish, back row, far right (Quinn, 1957).
With the large ratio of men to women on the range, dances were always popular with the women who had plenty of choices for dancing partners. The Junior Ranks Mess (the Jazza) regularly held dances and all the women interviewees enjoyed these immensely, both for the social interactions they offered and for the opportunities they gave women to dress up.

The coffee lounge in the village was popular with Cecily and others of her age, much to the dismay of some parents who saw it as a bad influence. Cecily loved going there despite her father’s disapproval and even secured a part time job there. After spending all day on the range, she would then work at the coffee lounge as a waitress. Cecily and her sisters were also members of the Woomera Photographic Society. They often dressed up and posed for the photographers who Cecily believed were testing out their cameras and film, “it was just for them to trial out their cameras, and we used to just pose, you’d [do] modelling […] it was just a fun thing. We weren’t learning anything; it was just for them”.

Even during the course of a working day, camera operators made their own fun, and this also spilled into celebrations after work. Joan Adams remembers a great deal of card playing, and a fun time “cooking, reading, [playing] Canasta, [playing] double-handed Canasta. And I can remember playing that all day”. She says there were also parties when a successful missile firing had occurred:

ELDO [the hotel] is where they put on the big parties. If Black Knight had a good firing, they had a firing party. Crayfish, prawns, British Government paying the bill. They probably flew them in. Money wasn’t an object.

Adams enjoyed the movie theatre:

I can remember being out Woomera West at the outside theatre, and you had garden benches, and you used to take your pillow to sit out there, and [on one occasion] it was one of those nights when it was 35 degrees and we saw Lawrence of Arabia. I remember Jack saying that was the biggest turnover of soft drinks he’d ever had.

In the down times, Adams recalls that the women would sunbake and be casually dressed and there might be a BBQ which would involve other range workers from different areas or services:
we would sunbake on these flaps [of the camera post housing], with olive oil, mind you, and then you’d look out, and because K11 and 12, and that was the closest to the range head, so that was probably about 20 minutes or so drive, and the VIPs would often come down […] if any VIPs were coming up, they’d come to your camera site. Well when we got to work, we’d be dressed up, but then we would sit in shorts, or something, we’d sunbake. And then we’d see the dust forming on the roads and we’d think, “Oh, somebody’s coming.” So then it would be a mad dash to the darkroom to get changed into something more suitable for showing visitors around! […] if it wasn’t going to be a busy day, if it was say cloudy, we would have a barbecue, and we’d invite the army recovery boys [to join us…] I suppose in one sense you think it’s very Australian, because you’re out bush, and doing these things.

5.17 Conclusion

All of the women interviewed and described in this chapter have strong memories of their work and lives at Woomera. All of them other than Margaret Trench considered their work to be exciting and unusual. Yet it is only now after the passage of more than 50 years and with the questions put to them during interviews, that they have spoken in depth about their work and that some of them have come to acknowledge what important and skilled work they did. Their memories have provided valuable insight into the technical difficulties of their work and revealed their immense resilience and pragmatism as they performed work for which there was no real precedent – most certainly not in Australia. The following chapter provides a similar discussion from the male photographers’ perspectives and also presents first-hand accounts of the technical aspects of the filming program.

Endnotes

1 Patrick Bradley disputes Morton's view, as discussed in Chapter Six.
2 Seaslug was a first-generation surface-to-air missile designed in the UK by Armstrong Whitworth (which later became part of Hawker Siddeley) for the Royal Navy and tested at Woomera. It came into operational service in the 1960s and was still in use during the Falklands War.
3 In 1975, South Australia became the first Australian state to decriminalise male homosexuality (Parker 2018).
Chapter Six

Comparative Case Studies 8 to 12: Male Camera Operators and Supervisors

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Woomera will make him or break him. In six months he’s a solid citizen or a fool. In six months he’s made something better of himself or he’s drifting in a coma at the bar.

(Southall, 1962, p. 80)

6.1 Introduction

Four men were interviewed about their experience of utilitarian filming on the Woomera rocket range: Bruce Aitken, Patrick Bradley, Dennis Kader and Ron Matthews. The story of a fifth, Roy Whitburn, was revealed through the testimony of his son, Nigel and through access to a personal archive of records that have provided a wealth of additional information about the experience of male photographers on the range.

<table>
<thead>
<tr>
<th>Name</th>
<th>Date of Birth</th>
<th>Place of Birth</th>
<th>Year of Migration</th>
<th>Age on arrival at Woomera</th>
<th>Years spent at Woomera</th>
<th>Date(s) of interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bruce Roland Aitken</td>
<td>23.03.1935</td>
<td>Australia</td>
<td>N/A</td>
<td>20</td>
<td>1955–1957, 1960–1971</td>
<td>05.02.2018</td>
</tr>
<tr>
<td>Patrick Bradley</td>
<td>20.07.1937</td>
<td>Adelaide, SA</td>
<td>N/A</td>
<td>20</td>
<td>1957–1959</td>
<td>07.06.2018</td>
</tr>
<tr>
<td>Dennis Kader</td>
<td>24.06.1932</td>
<td>Adelaide, SA</td>
<td>N/A</td>
<td>20</td>
<td>1952–1953, 1955–1965</td>
<td>17.06.2018</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(via email)</td>
</tr>
</tbody>
</table>

Each of these men, with the exception of Ron Matthews, was responsible for the supervision of women on the range. Although Ron was in a more technical role, servicing the cameras, he had many opportunities to observe the women at work operating the cameras in his eight years at Woomera. Each of the men was aged between 19 and 24 when they began working on the range and they were as young as 20 when they took on supervisory roles.
Bruce Aitken had a background as a photographer with the RAAF and worked in a photographic studio prior to enlistment. Ron Matthews was with the Australian Imperial Force as an instrument fitter. Roy Whitburn, originally a Peace Officer at Woomera, retrained as a photographer. Dennis Kader had previously worked in a construction role on the range and retrained as a photographer. Patrick Bradley had formal training as a photographer and experience as an amateur filmmaker before being offered a job on the range.

6.2 Brief biographies of male camera operators

6.2.1 Bruce Aitken

Bruce Aitken was born on 23 March 1935. He attended Crowsnest High School in Sydney and, having left school in 1947 at the age of 15, obtained an apprenticeship with Fork Studios where he studied photography. He joined the RAAF in 1950 where he received further training as an Air Force Photographer, which included operating cine cameras and covering all aspects of RAAF operations. RAAF photographers took on many roles, which included both film and photographic activities, such as photographing paratroopers in wartime. In Bruce’s words: “It’s interesting when you go to hang out of a DC3, you’ve got to hang out the escape hatch, and take photos as they jump out the door.” Asked if he had a harness, he replied, “No, no, you just wrap your legs around the chair.” Bruce was interviewed on 5 February 2018 at his home in Paralowie, South Australia; all quoted material from Bruce is taken from the interview on 5 February 2018 and will not be cited separately after the first instance.

Bruce received a posting to Woomera in 1955 where he worked on the Jindivik program. He married his wife, Dorothy in 1956 and they had three children, two of whom were born in Woomera. Bruce remained in Woomera for two years and then was posted to Salisbury where he worked as a film editor with WRE. He returned to Woomera in 1960 to work as a systems coordinator on the computerisation of data collection on the range. During this second stint at Woomera, he also worked as a training officer for the Contraves and other cameras. He is shown at work on the Contraves in Figure 6.1. He left Woomera in 1968/69 to start a business with his wife. Bruce Aitken died on 12 September 2018.
6.2.2 Patrick Bradley

Patrick William Bradley was born on 20 July 1937 in Adelaide, South Australia. His father had been a music teacher and then retrained to become a professional photographer and taught his son rudimentary photographic and darkroom skills. During his teens, Patrick’s skills developed to the extent that he considered himself an amateur photographer. He also had a cine camera and dabbled in filmmaking. On leaving school, he worked as a warehouse assistant with F.H. Faulding in their Scientific Apparatus Department.

Patrick undertook six months National Service with the RAAF in 1956. Responding to an advertisement in the newspaper, he applied and was accepted into the Commonwealth Public Service with WRE as an Assistant (Photography) at Woomera, commencing in 1957 with a starting salary of £401 pa. He is depicted on his first day at work in Figure 6.2. Patrick remained in Woomera until June 1959, then spent a year with Southern Television Corporation (NWS9) before returning to WRE Salisbury where he worked as a Photographer until 1973. In 1973 he transferred to the South Australian State Public Service in a variety of research management positions where he remained until his retirement in 1995. Patrick was interviewed on 7 June 2018 at his home on Kangaroo Island, South Australia; all quoted material from Patrick is taken from the interview on 7 June 2018 and will not be cited separately after the first instance.
6.2.3 Dennis Kader

Thar Ramon (Dennis) el Kader was born on 24 June 1932 in Adelaide. He was of Afghani decent, the son of lapsed Catholic parents. He was a “wild child” of his generation, fearless, looking for adventure and prepared to try anything. He was a skilled motorcyclist and secretary of South Australia’s largest motorcycle club by the age of 18. While he was still a teenager, he and his girlfriend Chris became engaged and she fell pregnant soon afterwards. They married and were lured to Woomera in 1952 by Dennis’s brother and sister-in-law who were living in Woomera and advised him that it was the cheapest place in South Australia to have a baby.

Dennis’s first job in Woomera involved driving graders for the Department of Works. He then returned to Adelaide before moving back to Woomera in 1955 as a bus driver conveying cameras and camera operators out to distant sites. He was soon offered a job as a photographer on the range. He completed a six-month training course in Woomera and began managing a down-range Contraves site that became known as “Kader’s Creche,” in reference to the young women (of around 14 years of age) who
reported to him. He is depicted during his time at Woomera in Figure 6.3. Kader left Woomera in 1965.

![Dennis Kader, Woomera, 1958 (Kader, 1958).](image)

Prior to leaving Woomera and while still working on the camera sites, he built a number of boats, one of which he would sail around the world and another in which he nearly perished when it was wrecked off the Isle of Wight in 1972. He spent a brief period at Salisbury processing colour film, then went prospecting for opals and later made a living selling bulldozers before taking to the seas. He divorced Chris and later lived with his partner, Jo for 20 years. They married in the UK in 1993, later retiring to Victoria where they live today. Dennis was interviewed on 17 June 2018 at his home in Warrnambool, Victoria; all quoted material from Dennis is taken from the interview on 17 June 2018 and will not be cited separately after the first instance.

### 6.2.4 Ron Matthews

Ronald (Ron) Matthews was born in Perth on 1 July 1936, the eldest of four children. Born at the end of the Great Depression, Ron’s childhood was spent mostly in poverty as his father was often out of work or employed in low-paying labouring jobs. At times the family was homeless and forced to live in a tent. After he left school, Ron completed a fitting and turning apprenticeship and then joined the Australian Army. Figure 6.4. depicts Ron just prior to his enlistment. Ron spent two years in Melbourne retraining as an instrument fitter.
Ron Matthews, just prior to enlisting with the Army in 1958 (Matthews, 1958).

Ron was posted to Army Guided Weapons Trials Unit (AGWTU) Woomera in October 1960. He spent eight years in the Army and from June 1964 continued to work in Woomera as a civilian attached to WRE. He married in 1962 and he and his wife, Nancy, had three children, two of whom were born at Woomera Hospital. His role with WRE, as a civilian, was with the Servo Optical Section and was largely concerned with the servicing of the cameras on the range. He left Woomera in 1968, embarking on a new career as a technician at the University of New England, Armidale, NSW. Ron has written a number of comedic short stories about life and his time at Woomera. Ron was interviewed on 30 April 2018 at his home in Toowoomba, Queensland; all quoted material from Ron is taken from the interview on 30 April 2018 and will not be cited separately after the first instance.

6.2.5 Roy Whitburn

Roy Whitburn was a “£10 Pom”. He sailed from Tilbury to Adelaide in Feb/March 1957 with his wife, Marjorie and son, Nigel (who turned four shortly after their arrival). After a few months in Adelaide, Roy obtained work with the Commonwealth Police as he had previously been a Metropolitan Police “bobby” in London. This led to him moving to Woomera with his family. The job mainly involved manning the security posts such as the main entrance to the village at Phillip Ponds, which he found boring and so sought an alternative role.
In 1959 Roy Whitburn left the Commonwealth Police and secured a job as a Photographic Assistant on the range. He was soon promoted to Photographer and shortly afterwards, Senior Photographer. Figure 6.5 shows Roy at work on the range. Quotes regarding the experience of Roy Whitburn at Woomera (who had died prior to the commencement of my research) are taken from a series of email exchanges I conducted with his son Nigel (who lives in the United Kingdom) between August and November 2018.

![Figure 6.5](image)

**Figure 6.5**  Roy Whitburn with an EMU 3 (Easily Movable Unit 3) (Vinten high-speed camera with 36" lens) c 1960 (Whitburn, c.1960).

### 6.3 Job interviews

For men working at Woomera who applied for a specific and defined role as a photographer, interviews were held at WRE in Salisbury, as was the experience of Patrick Bradley. Two of the men interviewed for this research were posted to Woomera as part of their military service role, Bruce Aitken (RAAF) and Ron Matthews (AIF.) As noted, Roy Whitburn and Dennis Kader were employed in other roles at Woomera and retrained to work on the filming program on the range. Their interviews were casual as they were advised there would be a role for them as long as they undertook re-training.
Patrick Bradley, who knew something of the existence and raison d’être for Woomera, saw an advertisement for a job as photographer on the range and was keen to apply. He was aware that the role would involve photographing, “bombs, and rockets, and aircraft and stuff.” He recalled thinking, “Wow, this is for me! I’ve got to be in this.”

He was interviewed for a role as an assistant photographer on the range on 17 May 1956, close to his 19th birthday.

![Figure 6.6 Department of Supply Minute Paper re employment of Patrick Bradley to WRE, 17 May 1956.]

Patrick is the only person interviewed who has kept records documenting the stages of his Woomera career, providing an insight into the interviewing process for jobs in filming on the range and the pay scales of the time. With a view to writing an autobiography, Patrick had applied to the Defence Science and Technology Group and managed to obtain a record of his interview, reproduced in Figure 6.6.
6.4 Wages

Woomera was an attractive job location due to the combination of higher wages than those paid in other South Australian cities and the dearth of shops and services, which may have caused some inconvenience but meant that workers could save much of their salary. Morton (1989, p. 233) states that tradesmen could earn £1,000 pa (which included the remote area allowance and overtime.) This gave people the opportunity to save a lot of money. Ron recalls his wages being around £3–£4 a week more than people in Adelaide doing a similar instrument maintenance job. The average annual wage in 1956 was £733 (Australian Bureau of Statistics, 1956, p. 168).

Patrick Bradley has copies of his employment records (shown in Figure 6.7) that show he was initially employed as an assistant photographer on the salary scale £339/£858 per annum.

![Figure 6.7](image_url)  
WRE Staff record for the appointment of Patrick Bradley showing his pay scale for position of Assistant Photographer: £339/£858 (Bradley, n.d.)
Patrick was almost immediately promoted to the more senior role of Photographer. Public Service pay scales were typically broad, with pay raises awarded according to age and increased responsibilities. The lower level represents a youth rate.

In 1959, Roy Whitburn was paid £15-10 per week as an assistant photographer. In January 1961 he was promoted to Photographer on a starting salary of £1053 pa. This was the minimum salary of the lowest of the three pay ranges that applied to the role at that time (£1053–£1168, £1091–£1206 and £1130–£1244). These three annual increments were subject to satisfactory reports. Roy was promoted to photographer in charge in 1966 on a starting salary of £2974. By 1969 he was earning $3991 pa and by 1971, $4428.¹

6.5 First impressions of Woomera

Various accounts have been written about the shock of experiencing Woomera for the first time that describe the heat, desolation and stark desert landscape. Also noted is the ratio of men to women, skewed very much to males. As late as 1972 there were four men to every woman, whereas in the 1960s this ratio had been closer to 10:1 (Southall, 1962, p.79) For AIF servicemen Ron Matthews, the shock of being posted to Woomera was confronting. He received his posting from Melbourne where he had been retraining as an instrument fitter. When Ron was posted to Woomera in October 1960, few people outside of the town knew very much about the location and a curiosity to learn something of the secret rocket range increased their motivation to go there. This was certainly true for Matthews. He takes great poetic license in recounting his arrival in Woomera, but his account is based on fact:

I knew they fired rockets there; that was about it. I didn’t even know where [Woomera] was. […] Every now and again there’d be something in the paper to say, they’d launched the Skylark Missile, or something, to investigate the upper atmosphere. But they didn’t ever mention weapons, because they were the most secret thing. [I was given scant directions as to how to get there, and] no one could tell me exactly. The Australian officer didn’t know. He said, ‘All I know is it’s somewhere between Port Augusta and Alice Springs.’ And I said, ‘Excuse me Sir, there’s a hell of a lot of dirt between.’ And he said, ‘Well it’s up there somewhere […]’ I asked the same questions at Shell and was told that I should cross the old wooden bridge, go two blocks then turn right and
it was about two hundred kilometres, but not to waste my time because it was closed to the public. I did some quick calculations and figured that with a full tank and a twenty litre can of fuel I could drive about three hundred and fifty kilometres and if I hadn't found Woomera, still have enough fuel to get back to Port Augusta. (Matthews, 2006, p. 1.)

Patrick also has very clear memories of his arrival in Woomera:

I flew from the Edinburgh Air Base […] I got off the airplane And I couldn’t believe how hot it was. It was January. It was hot as blazes. And I remember breathing in and thinking, ‘This is not possible! How am I going to survive this?’ And there was no one there to greet me. You get off the air craft, and there was the bus and a notice saying, ‘People going into the village should get on the bus.’ So I got on the bus.

On arrival at the range it was necessary to obtain a pass, which had been pre-ordered and sign an oath of secrecy. Patrick, being of Irish Catholic heritage, was not keen on swearing an oath as a British subject. This is at odds with most of the other people interviewed who very much saw themselves as British. But for Patrick there was no alternative:

That was about the worse thing in the world to be told, that you were a British Subject! And I carried on a bit about it. I said, ‘I’m not going to sign that.’ And they said, ‘Then you’re going to go back to Adelaide.’

He reluctantly agreed, was given his pass and then taken out to the range. He continued to doubt his decision on taking the job:

I got my pass, I settled down a little bit, and was driven out with a couple of other guys, work blokes, to the range. And this drive went on, and on, and on through the plains, and salt bush, and the only thing you can see is the power lines, and the pipeline going up there. And again, I thought to myself, what have I got myself into here.

Yet this all changed when his eyes were opened to a wonderland of equipment and possibility and the realisation that he was in fact in a privileged position:

We got to the range. […] We got out of that vehicle, and into another vehicle, and then we were driven onto the Instrumentation Building. And then I got out, and I looked around I thought, this is magic! This is unbelievable! Here are these great radars, and antennas here and there,
and there’s launchers up there, and I thought, this is magic! This is where I want to be! And so that transition, it happened just like that. There I was, on the range, where most people couldn’t be, and I felt extremely privileged. And that was my introduction to Woomera. […] And there were about five blokes there, all a few years older than me. I imagine they were late 20s, maybe early 30s, and all of whom were extremely welcoming. And here they were, welcoming the new boy. They were all Photographers; they were all males. There wasn’t a woman to be seen.

6.6 On-the-job training

Like the women camera operators, men received most of their training on the job. The main difference in the preparation for their work was that men were given the opportunity to study for further qualifications to receive promotions on the range. There is no evidence to suggest women were ever offered the chance to extend their education and hence receive promotions.

Roy Whitburn and Dennis Kader went back to school (in Woomera) with a number of other male adults to study physics, maths and other subjects required to understand the science around rocket trajectory and associated camera technology as a requirement to take on senior roles on the range.

Roy Whitburn’s son, Nigel explained that for his father to be approved in the role of Senior Photographer on the range he was required to go back to school to do “Leaving” Physics and Chemistry adding that it was not uncommon for adult men to attend the Woomera school in order to obtain the necessary qualifications to work as senior photographers on the range.

This does raise the question: “Why were women not given this option?” None of the secondary sources consulted for this research referred to the adult education process at Woomera, nor provided any justification for women being excluded from this possibility. The 1966 Register from the Woomera School, shown in Figure 6.8, confirms that many men over 21 years were students at the school studying subjects to enable them to secure better jobs on the range.”

2
Nigel Whitburn explained the education process in more detail:

That meant actually going to the appropriate lessons during the day with the normal pupils. He wasn’t unique in this as the attached registration document shows that in 1966 there were about 8 people ‘Over 21’ who registered at the school. At least one of them, Tom Cook, was also in the Photographic section.

Dennis Kader also attended classes during the day in the school, but others went to night classes to obtain leaving certificate to enable them to be admitted into the Public Service (B. Rumble, personal communication, May 22-24, 2019).

6.7 Camera technicalities

The testimonies of the men working as camera operators and in associated roles reveal the technical complexities of the equipment used during the filming program at Woomera. The men reveal that while plenty of things could go wrong they were resilient pragmatic people who took great pride in all aspects of their work.

6.7.1 Film testing, loading and processing

Film was required to be tested prior to loading into the cameras. This was usually a job for which the male photographers and senior photographers were responsible. Each camera post had its own darkroom in which film was tested, and this facility was
also used when the results of tests were required immediately, and the film therefore had to be developed on site. Otherwise, all interviewees confirm that film was sent to Salisbury for processing. Part of Ron’s job was to collect the film from each camera site, although others transported film back to the Instrumentation Building from the distant down-range sites from where it would then be flown to Salisbury.

Ron Matthews was able to explain the various steps of the process of creating utilitarian film in layman’s terms:

Before every trial or test, […] you had to do a test strip of a short piece of film, and then they would count the number of sprocket holes from the picture to whatever the electronic code was […] and that could vary, depending on who loaded the camera, […] occasionally something would happen, and the pins that came out and went through the holes, would get out of synch with the movement of the film, and it would punch a new set of holes every time. And eventually there’d be so many bits and pieces, the whole camera would stop. The Vintens had a little door on the side […] you’d undo that and then take that whole side out, and then this whole lot of film would come flying out at you, [in] little tiny bits and pieces. […] You’d take it back into the laboratory where it’s nice and clean, and clean all the little bits of film and stuff out.

The women operating the cameras would usually be responsible for loading the film themselves. Ron explains this in more detail than any of the women interviewed. Perhaps for them, the experience had become “second nature” and they could not recall the procedure in detail. However, it is useful to have this detailed as it has not appeared in any of the official sources on filming at Woomera. Ron noted the women would usually load the film into the magazine in a darkroom that was a part of each camera post:

[They would] take it out, and put it into the magazine, thread it through, so there was only a small amount sticking out […] and go through the camera, and back up again, and there was a loop. On the Vintens, it was a little bit different. There’d be quite [a] long loop, and you had to thread it over all the little sprockets […] and then take it up into the take-up side, and then wind up any slack. And then you’d just switch it on and off for a few seconds to make sure that it was loaded properly, and it would work. Then you had to close the door, and then the camera is then light proof. But you had all this film that was in here that had been exposed, so you had to turn the camera on for a few seconds to make sure all that film was back up through, and you had nice fresh stuff.
Ron also comments on the wastage of film during his time on the range:

We threw away miles of film over the years. And they processed so much film in Adelaide that it was a profitable business to salvage the silver bromide that comes off the film. The emulsion is silver bromide, and it sinks to the bottom of the tank, and it was worthwhile salvaging the silver from that [they] probably sold it to some silver merchant.

Dennis has also referred to the wastage of film:

There was a great waste of film in the early days. And in the early days, we’d run the whole 400 ft of film through nearly every trial, and there was a great wastage of film.

However, Ron did not believe there was ever a shortage of film, although it was used up very quickly, particularly during the operation of the Vintens:

The performance cameras were British made High Speed Vintens, capable of up to 300 frames per second, (fps), though we normally ran them at 100. They were fitted with a variety of lenses, the largest was 40cm diameter and five metres focal length. At 100 fps, a 400ft roll of film would be exhausted in just over six seconds. (Matthews 2006, p. 77)

Dennis Kader describes the darkroom and loading process. Unlike Ron, he was a photographer responsible for four women on a dual Contraves site and always loaded the film for the women who worked under his supervision:

There was a little darkroom about four-feet square, about a metre square, and that’s where you loaded your magazines with film. You put in 400ft of 35-mm film in each magazine before a trial, and you left the end of the film hanging out, and the other end was in the dark side of the top of the magazine. Then before the trial, you’d spit on the lead hanging out, and write on the date, and the trial number, and the site, so you had recognition [in the event] that got tangled up with other things, it was scratched on the film. So then you put it onto the camera and fed that loose end through the gate, through the camera, and then back into the other end of the magazine, and you hooked it up, and turned it and made sure it was rolling properly, but the other top had to be light-tight; you couldn’t let light into the top part. And once that bottom-less lid went on, then that became light-tight, and that’s how you’d [load] your film.
The Anglo-Australian Joint Project at Woomera was one of the most generously funded post-war activities in Australia (as documented in the Literature Review). Dennis commented on expenditure on areas other than film:

I always used to make a comparison between Woomera and Andamooka [where there was an “opal rush”], at one stage in the sixties, there was about the same number of people at each place. Andamooka got absolutely nothing, and Woomera got everything. They had teams of people employed watering the trees at Woomera.

6.7.2 Camera operation and the filming of rockets and weapons tests

By using different cameras to track the same missile at different parts of its trajectory, an accurate picture could be obtained of its behaviour in flight, a sophisticated use of technology for this time. Dennis explains this function, from the point of view of his area of responsibility, which involved eight Contraves and one Vinten situated down range:

The purpose of these cameras was to obtain photographic images of the object being tracked e.g., rocket, aeroplane or bomb [to] give an image of the object and each photograph had a survey angle from which trajectory information was obtained. All nine of these cameras scattered around the range were synchronised to take a photograph at the same time.

Ron noted that the placement and operation of the cameras was carefully managed in order to maximize the efficiency of film usage so that it would last for the duration of a particular trial. He explained that the cameras would be switched on and off to ensure that there was enough film in the camera to track the relevant part of the trial:

You’d be told that the aeroplane will come in on a certain course, at a certain height, at a particular speed, and the impact is expected to be at plus 27 seconds, or whatever it was […] For those days, [it was] amazing technology […] If you’ve got two Contraves, and they’re a distance apart, and you know the exact distance between them […] they were all synchronised, so every camera was registering the same time, (frame number 7,421 or something) happening at a particular time.

There was a variety of different cameras working in unison on the range. The Fastax ballistic cameras were almost entirely operated by the male photographers (and have therefore not featured in the testimonies of the female camera operators in
Chapters Four and Five). These used a different filming mechanism, a plate rather than standard film. Patrick explains the features of these 16-mm Fastax cameras:

Early in the piece when I was there, they were just starting to arrive [and were] extremely accurately surveyed, very solid Theodolites, with a large plate, and which could be oriented with extreme accuracy. [They were mounted] on concrete plinths, very solidly mounted so that there was no movement. They were surveyed very accurately. They had a plate rather than film, and a shutter which opened and closed under control of the central timing unit […] their job was to very, very accurately orient a missile or bomb, or whatever it happened to be, or an aircraft, in space, and at a particular point in time. [They took] the photograph or the shutter might go “clunk, clunk, clunk,” like that, and you might get a dot across the picture. Each one of which they knew the precise elevation, as with bearings, and they knew the precise time it was taken.

Fastax cameras could be used at speeds of 1,000-2,000 frames per second “for special work”, said WRE’s Robert Boswell in 1958, but none of the men commented on this and Boswell did not outline details of the nature that work (Boswell, 1958, p. 414). Boswell was writing at the time in his role as Deputy Controller (Trials and Instrumentation) at WRE.

The wide variety of cameras required different skills in their operation, and it is Patrick’s belief that during the late 1950s and early 1960s, a male photographer in charge of each site required a broad understanding of each of the machines. He explains what this role involved:

There was a big variety of cameras to be used in a big variety of locations, with different sorts of tracking arrangements. And the degree of control over these [Vinten and other high performance] cameras was totally in the hands of the photographer […] that means the exposure adjusting, and something called the shutter angle, and ensuring that the loading of these cameras had to be done with a high degree of precision. Much more so than loading a normal Cine camera, where you just thread it through the gate, film and so on. In these cases, it needed to be done extremely accurately, because of the high speed that the film was moving, it was moving like 300 frames per second, typically. […] It needed to be very precisely loaded, otherwise the film would be destroyed as it moved through the gate. And also, the timing units which
were in these cameras, little flashing bulb things […] the loop size had to be fairly accurately done. In other words, there was a lot of things to do. So you’ve got a bunch of males, with highly varied jobs, they weren’t being driven about the place, they had to take themselves, and I had to take a camera out 30 kilometres down range […] We would need to read the trials instructions to work out which cameras were going to be used, and then make sure that they were in position, they were set up properly, and that they were going to work.

Patrick noted, “it’s not rocket science, but it’s qualitatively very different work from simply tracking a missile”. His testimony suggests that the work the men did, really did require more technical skill than the roles given to the women, which is consistent with the impression of structural inequalities on the range. The women were not given the chance to upskill and increase their level of education (as the men did at the Woomera school) and hence take on the senior roles that Patrick refers to. Additionally, only very rarely did women seem to be put in positions of leadership. While the work the women did was sophisticated and required skill and expertise it is important to note that they were never given the opportunity to move beyond it.

6.7.3 Scientific developments in filming and camera technology at Woomera: The Jindivik program

The development of the Jindivik pilotless aircraft was one of the most significant projects at Woomera and its progress and success enhanced the reputation of Australian scientists and aeronautical engineers (Donovan, 2007, p. 43). The Jindivik is anecdotally claimed to have been named from an Indigenous word purportedly meaning “hunted one”. Morton, in one of his endnotes states, “an ethnologist at the South Australian Museum said it meant not “the hunted one” but “to consume” or “destroy” in the language of the Wurundjeri of Victoria. (Morton, 1989, p. 373) A Jindivik was a subsonic unmanned jet-propelled target aircraft designed to measure missile performance. It was initially built at the Australian Government Aircraft factory at Fishermen’s Bend in Melbourne. Jindiviks were powered by an Armstrong-Siddeley Viper jet engine, giving them a maximum speed of Mach .85 (1,013.7 km per hour) and a ceiling of 40,000 feet. Jindivik prototypes were developed from 1948. The first successful Jindivik test occurred on 28 August 1952, from Evetts Field, Woomera. Jindivik continued in service at Woomera until 27 June 1975 (Enderby, 1974).
This news release, anticipating the final production of the Jindivik, declared:

When the Jindivik was first developed [...] it was expected to have a “life” of 10 missions. It has far exceeded those expectations [...]; the current longest-flying Jindivik, operated by the British Ministry of Defence [is heading for seventy flights [...]. Orders for Jindivik now total 466, including exports – worth more than $26 million – of 278 aircraft to Britain, the US and Sweden. (n.p.)

As noted above, Jindiviks were bought by defence departments in a number of countries outside of Australia. Laurine Hall’s husband, Vic East was an engineer on the Jindiviks (see Chapter Four), and can be seen working on a Jindivik in Figure 6.9.

After every flight a small boomerang was stencilled on the rudder of each Jindivik pilotless aircraft used by the RAAF at Woomera Range as shown in Figure 6.10.
In 1955 Bruce Aitken, still in the RAAF, was posted to Woomera, mainly to participate in the camera carrying and film work associated with the Jindivik pilotless aircraft. Bruce explains:

the Jindiviks had nine cameras in them. They had quads, so they had two in the front, two in the back, and they had one underneath. So that it didn’t matter which angle the missile came, you had it covered. Because they wanted to photograph the distance from where it blew up.

Donovan (2007) discusses the filming capacity of the Jindiviks with their purpose built compact cameras and specially designed lens with a field of view exceeding 180 degrees, “The aircraft carried Weapons Research Establishment Target Recorder (WRETAR) cameras with fish-eye lenses to gather information about missile behaviour […] The WRETAR camera system as shown in Figure 6.11 became the standard miss-distance measuring system for Jindivik and other target aircraft” (Donovan, 2007, p. 43).
Figure 6.11 Bonnell’s design for the camera that would become WRETAR (Dixon, 1961, p. 273).

The WRETAR was not a traditional cine camera, although it was technically a high-speed cine camera shooting 100 frames per second. It produced negatives that were not projected as motion pictures, but each frame was examined individually so as to assess the miss distance of a missile in relation to its target (Dixon 1961, p. 274). The films then, derived from WRETAR, were very much utilitarian films, much as those produced by the kinetheodolites on which the women worked.

In late 1956 or 1957, the entire Jindivik photographic section was transferred to Edinburgh (in South Australia) to work on the Canberra bomber.

6.7.4 Camera maintenance

Each camera required regular maintenance. Ron Matthews and Bruce Aitken were involved in the camera maintenance process. The Vintens were most prone to malfunction. Ron explains the pin-registered system of film movement through the Vinten:
they were so fast […] You’ve got a strip of film, and it’s in the gate where you take a photograph, so the shutter opens and then it closes. And so then you’ve got to transport that piece of film down so that the fresh piece of film comes up, and the shutter opens and closes. And you’ve got to do that 300 times a second on a Vinten. So the film would have to move, and movie film has got little sprocket holes down the side. The film would move, then these little pins used to come out and go through those sprocket holes to hold it still, and there would be a pressure plate holding it as well. You’d take the picture, the shutter would open and close very quickly, and then the pins would withdraw, and then the film would have to be transported again. And when it’s done like that, they call it “pin registered,” because that’s the most reliable. Because you can’t have any movement of the film when it’s taking the photograph, otherwise you’re not going to get a good image, it will be all blurred. So for that to happen 300 times per second, that’s pretty smart, and the mechanism needed quite a bit of work.

Each camera was shipped with a maintenance toolkit, which Ron said were “coveted” on the range. He explains their contents and use:

That tool kit was so good. A kit came with every camera, but when I got there, there were only two of these kits left; people had stolen them. The guy that I worked with, he had one, and I had one. They had loads of screwdrivers, and pliers, and they were superb quality too. […] they’d roll up into a little canvas pack. And it had lots of compartments where you could put ether for cleaning [the] lens, and all that sort of stuff. And we had some really smart radioactive lens cleaning brushes. And to get them, because they had to be approved by the South Australian Department of Health, the Commonwealth Department of Health, and the Prime Minister’s Department, because they were radioactive. I mean, in the desert with the dust and that flying around, to try and keep lenses clean was really hard work. You’d clean the lens, and every speck of dust within a hundred metres would be on it. […] you use [the brushes] in a certain way, and they had a little radioactive element, and then a very fine brush behind them. And you had to carefully wipe in a certain pattern.

While Ron and his colleagues in Instrumentation had a very flexible workplace in terms of the scope of their repair and maintenance brief, there were certain repairs they
were prevented from undertaking, usually to protect the cameras. However, the men were also expected to use their initiative. Ron described a particular instance involving an unauthorised repair to a Contraves cameras:

At the range, we were only allowed to do certain things. For instance, the Contraves had a gearbox. They had quite a large electric motor to gear it down so that it would rotate nice and smoothly, they had a cast-iron gearbox. And we were absolutely forbidden to ever take one of those apart. They didn’t want to get dirt in them or dust, or anything. And we didn’t have a clean room that was of satisfactory standard. […] One of the guys [Ted] took the electric motor off to repair it, and when he put it back on, he was tightening up the bolt, […] he tightened it too tight, and it stripped the thread. And he said, “What do you reckon we can do about this? Someone’s going to have to take that gearbox out, drill it out, and then put a new thread in there.” And we were not allowed to do that. But if we sent it down to Adelaide, to Salisbury, then Ted would have got into trouble for stripping the thread. So Terry and I had our hearts in our mouths, and we went into one little room that was a darkroom, and we very carefully took it apart, took the gears out, and took this top off. We were really sweating. We had to drill out the remainder of the thread, and then put in a thing called a helicoid. And you’ve got to get a tap, and tap a thread into it, and put this special thing in. Anyway, it took us all afternoon, and we got it back together again, and we were certainly glad!

Cameras used on the range were not designed for a desert environment, and Ron and his colleagues had to ensure the cameras and ancillary equipment remained operational despite the relentless red dust. They would use rudimentary “tools” including toothbrushes to clean these items. The efficient operation of the Woomera rocket range could be at least partly attributed to the improvisation, pragmatism and initiative of the range photographers and service personnel.

For Ron, there was a plentiful supply of all the equipment he and his colleagues required to do their jobs. This is in keeping with the prevailing view that “no expense had been spared” in establishing and operating the Woomera range. Men were encouraged to submit ideas for improving the equipment, the technology was so new and all tweaks to the existing machinery could assist in the testing program. There is no evidence to suggest that feedback from the women was requested, nor that their
efforts were similarly rewarded; on one occasion, Ron was awarded £10 and received “a nice letter from Adelaide” for his submission of a system that would steady the film in a Contraves camera.

Ron Matthew’s testimony has enabled a better understanding of the sensitivity and relative complexity of the machines used to film the tests. For all the women’s assertion about their work on the cameras being straightforward, Ron’s accounts prove that these women were in fact working on sophisticated cameras with only basic training which led to their developing skills they still hardly acknowledge today.

As well as editing the films from the various trials, Bruce was in demand as a mechanic on the cameras when they malfunctioned and undertook specialised training in electronics in order to perform this role. Because he was a qualified photographer, he was in demand on the range:

the Contraves needed fairly constant maintenance. I did a four-year apprenticeship while I was up there through the Royal Melbourne Institute of Technology, in electronics, so when I was 50 miles down range, and something went wrong, I could fix it. Because if you’ve got a trial coming up in half an hour, and something goes wrong, and it only involves changing a valve, you don’t ring up the range and say, ‘Hey, can you get here in half an hour?’ because it’s an hour and a half drive.

6.8 Women’s roles through men’s eyes

The men interviewed for this research have spoken openly about the roles of women on the range. Patrick Bradley particularly, gave the subject a great deal of thought prior to my meeting with him.

6.8.1 Supervising women

Most of the men involved in the data film collection on the range were involved to a greater or lesser degree in the supervision of the female employees. This included training women, loading film into the more complex cameras, managing their work during a trial and even taking on a paternalistic role in their care and education as described by Loma Silsbury (and explored in more depth in Chapter Five).

By the time that Bruce Aitken was in charge of camera site 8 it was 1965. More sophisticated cameras were being used at this point, and Bruce’s job also involved
training women to operate the cameras and retraining women to operate the newly introduced cameras that not only handled differently but used different film. He relates:

So I did a conversion course for them. They had about six weeks initially on training. Not most of them, all of them, without exception, were house-wives.

Bruce preferred to work with women on the filming activities of the range because he considered them to be more meticulous and more reliable. In his view, women would be prepared to repeat the tedious daily process of calibrating the camera through a specific observation and recording of the triangulation point, while men were more reluctant to do so:

The reason why I like women employees is because they’re so bloody good. They do what they’re told. They learn the job […]. The girls are much better than the blokes […] and you could rely on women. If they said, “I’ve done this,” they’d done it.

He explained that males tended not to go through the tedious calibration and checking process that was required to be repeated daily to take into account changed environmental conditions.

In 1961, Bruce Aitken was seconded to the newly created Systems Application department on the range. His job involved introducing the punch-card computer system for data collection and analysis to the range. The majority of this work was performed by women, under male supervision. Woomera had its own human “Computers” working in Systems Application, based in the Instrumentation Building (their work is discussed in Appendix 2). Bruce explains why he considers women were more suitable for this work than men:

Let’s face it, women are ten times better at mathematics than men. So, we used all the girls--they sent them up from Salisbury […] Cause the whole building was full of girls, because they were good at mathematics. We had one there, and they had a Computer in charge of them, and then I had two of those girls to help me […] Women have got a different sort of brain than men. […] they understand maths better than we do. Especially when it gets to pure mathematics.
6.8.2 Marital status of women on the range

It was Laurine Hall’s belief that no woman left Woomera single and that given the ratio of men to women (skewed heavily such that women were in the minority), it was an ideal place to find a husband. While Laurie’s belief is probably not fully accurate, many young women certainly did find their husbands-to-be at Woomera. Marital status however did not prevent women from securing employment on the range, and becoming pregnant did not necessarily mean they had to give up their jobs. Anecdotal evidence suggests that prevailing public service regulations that prevented married women from remaining in government roles did not apply at Woomera for women who were employed by WRE, even though it was a government agency. This “marriage bar” was finally lifted elsewhere in Australia in 1966, which meant that married women were no longer forced to relinquish their paid work or conceal their relationship status on marrying (Sawer, 1996; Colley, 2018).

Bruce Aitken believes that standard government regulations did not apply at Woomera because there were not enough candidates to fill all the roles involved in the camera operation on the range:

They got away with murder at Woomera, the things they could do [such as] employing women. When you employed women in the government, once they got married; [they would be ordered to leave, whereas] we had married women, pregnant women, we had everything.

6.8.3 Women’s capabilities and opportunities for advancement

It is evident that in terms of the operation of the cameras on the range and the filming operations there were no women in senior roles. The only senior women were involved in communications and these roles were held by women who had originally held roles as Computers. Furthermore, there is no evidence to suggest that women were approached with the offer of advancement, promotion or further education.

Patrick Bradley believes that women would not have been prevented from taking on the role of Photographer or Senior Photographer. He considered the assertion (by other interviewees) that women were more likely to take the tedious roles on the cameras because men preferred to be employed in more exciting work as “bullshit: completely and totally untrue.” Patrick explained why there were no women employed
in the more senior role of Photographer – rather only as Assistant Photographer – by the service background of the men on the range in these senior roles:

With the exception of myself, and later on a couple of other outsiders, they were all ex-servicemen. They were people who’d been employed in the Army or Air Force as photographers. So they came into their job as skilled, experienced photographers […] with a broad range of experience.

Bruce Aitken’s view is at variance with this. He believes, women had a higher tolerance of boredom and they did not mind that operating a kinetheodolite did not offer an enormous challenge whereas the male photographers considered tracking cameras as playthings:

what photographers see as a ‘toy machine’ [the camera and the process]
it’s not photography. You’re pointing it [the kinetheodolite] at an aeroplane, it’s going ‘click, click, click,’ it’s putting numbers on a [piece of film], it’s not photography, its data collection.

Data collection is precisely what the utilitarian filmmaking work on the range involved. Bruce notes:

We had a hell of a job trying to get [male] photographers to Woomera. [The job] was too boring. The ones that did come to Woomera, most of them didn’t want to operate these cameras. So the photographers that came there eventually were trained to be in charge of [the women on] one of the sites.

He also believes that men did not want to work as “photographic assistants,” as the role was considered lowly. Furthermore, in his view it was not a well-paid job and that most women would have had no prior wage against which to assess the value of their remuneration. This was the era in which one’s pay was not discussed or compared. Total pay would increase when extra shifts were required due to a large number of trials:

A “Photographic Assistant”. There’s nothing lower. That was the lowest job. Probably they’d get less pay than the cleaner. It was just a low job. […] “Photographer” was a dirty word, when you first went to WRE. “Photographer? Anybody can take photos. Nothing to it […] we did a lot of overtime.
This was not the view held by Cecily Quinn who was embarrassed when she discovered her pay was far more than that of some of the servicemen on the range (as discussed in Chapter Five).

Dennis maintains women were treated as equals, but the status quo was that men were in the senior roles and women were their subordinates, and in his view neither gender could see a reason to question that:

None of the girls ever said to me, ‘Why don’t we become bosses?’ It’s just the way life is; that’s how it was. And there was no hatred of women involved in it, or a desire to subjugate them, or anything like that; it just was the way it always had been done.

Perhaps so, but given Dennis was speaking of a time when the range had been operational less than a decade, “the way it had always been done,” was a relatively short time. By the time more women were obtaining senior roles in other areas of the Australian workplace, the range was winding down. No women from any era have been discovered who had a senior role on the camera posts. It has been suggested that women were more suited to the easier-to-handle Contraves and Askanias than the more wieldy Vintens due to the more diminutive size of females. (Morton, 273).

Ron concurs:

The cameras had to move quite quickly. And especially if an aeroplane or a missile was just about to go overhead, you had to be tracking it, and the person who was doing the elevation would be tracking it, and then when it got to here, the cameras couldn’t go over the top, they had to suddenly spin around, and track the thing going away from them […] the ladies were usually quite a bit lighter.

The implication here is that the women lacked sufficient heft and strength to make such a manoeuvre at the speed required. Patrick challenges this:

I think that’s a load of old cobblers. Because in actual fact, these things were beautifully balanced, and I’d be very surprised if Laurine Hall couldn’t have lugged a case full of film up a 30-foot tower as well as I could. Of course she could. In fact, probably a bit more easily. On the other hand, everyone needs training and experience to carry out their job, whatever the job is.
A point has been made by some women that their work was straightforward. But many errors were found in the recording of the tests by some camera operators, such that at one time, Bruce Aitken’s fulltime job was to assess the work of the camera operators:

Our secondary job, which turned out in the end to be the most important job, was to assess what was going on with the records. Because there’s no point in sitting there, taking photos, if the [rocket or missile] is here and they’re following it down here. […] We used to get roughly 20,000 feet of film a day at that stage from Woomera. […] we had to sit in the theatre, watch it and make notes, so that we could ring up the boss in charge of the operators at Woomera to say, ‘Hey, 32 has got a shudder, or the operator there, get rid of her.’ Floss [Laurine Hall] was one of our better operators.

That last comment refers to the capabilities of the camera operators recording the trials on their kinetheodolites. Thus, the comments from many female camera operators that their work was not difficult have to be considered carefully. It is likely that many of the women were so highly skilled and adept at their work they took these skills for granted. Bruce’s comment that Laurine Hall was one of the better operators is interesting in this regard. Laurie has said that she was one of the least talented camera operators, but Bruce would argue the point, as did Southall in his book, writing in his rough notes for his 1962 Woomera, “the fate of all instrumentation is in her hands. She’s a legend in British/Australian rocketry”. (Southall Papers, MS5379) While Southall is using poetic license, Hall’s experience, aptitude and personal application to the work led to her reputation as a particularly competent camera operator.

6.8.4 The role and status of Uncle and Sub Controller: Sub 1

“Uncle” was the shortened call sign for Central Control Unit. The role was filled by a woman for the period on which this study is based, specifically, Barbara Hewish. Ron talks about the senior status of Uncle:

She had senior mess status, and her husband only had junior mess status. But she was sort of the mouth, or the voice [on the range]. She would announce 30 minutes before the trial […] “Camera post such-and-such, are you ready?” And she’d get all the reports from all the different posts. And so she sort of directed it [the trial] She was by far the most senior female at the range.
The second most senior person in communications on the range during much of the 1950s was a woman – Stephanie Travers. Stephanie Travers was a colleague of Patrick’s, with whom he formed a strong friendship. Travers was in her mid to late 20s. Patrick spoke in depth about her and her work and how trials were run:

Stephanie Travers was a very important person on the range, she was a Sub-controller, the most senior woman at Woomera. She worked for the range crew […] she was a little bit senior to Barb Hewish [Uncle] she was deputy to the Range Controller, and the Range Controller was responsible for running the trial. We all, all sections, all units, had trials instructions. The Range Controller’s job was the run the trial according to the trial’s instruction. It’s a massive responsibility, because there was a bunch of instrumentation, optical and electronic, spread over hundreds of square miles, and there were the launch teams, all the support people, and so on. And so what this person is responsible for is managing the setup of the trial, and being responsible for the fact that the launch team, and the contractors are preparing the weapon properly, that the Air Force are prepared, the target aircraft for example is oriented and ready to go, that all the optical instruments are in place and operating correctly, and all the electronic instrumentation, and so on. That the recovery people are ready to go, that the whole system is ready. And that’s too much work for one person. And so there was a Sub-Controller, and that was Stephanie Travers. Stephanie’s job, Sub1, she was called. Sub1. And she was the contact for all of the optical [operations]. For instance, I would go out to a camera post somewhere, and start to set it up, and I would communicate with Barb Hewish, Uncle, to say that the communications system is working, and get a timing check to make sure that the timing unit’s working properly, and all those sorts of things. Actually the first thing I’d do when I’d get to the camera post and power it up, was report in. And that was calling up on the intercom system, calling up the Sub-Controller, Stephanie, and saying, “V22 is here.” […] so we reported into her, and then the camera is set up and everything’s ready to go, you’d advise her, and she’d be collating all this information that’s coming in, and reporting to her boss, who was the Range Controller, saying, ‘Okay, the optics are right, the electronics are right, the radar are right’.

He goes on to explain the individual responsibility to call for a trial to be aborted would rest with people like him and his colleagues in charge of each camera post.
However, that decision was then relayed to Travers who had the ultimate power to call a trial to a halt, a decision that could cost thousands of pounds:

let’s say it’s a trial where there’s a target aircraft is up there, and another aircraft is going to fire an air-to-air missile, and my job is to photograph the target aircraft. Now if, when I’m doing this, I notice that there’s going to be cloud cover over the impact zone, the camera’s not going to be able to see it. Then I would have to call the Sub-controller, ‘Stop, stop, stop’ and the trial would stop. Now that’s a horrible responsibility when you are 19, say, and you’ve got two aircraft up there, and you’ve got hundreds of people working. But say there was a radar, and it was a key radar; it was important, that operator could call ‘stop’ if the radar failed, and something went wrong. So not every operator of electronic or optical instrumentation always had the right to do so, but somebody who had key information, or had a key piece of equipment, did. And that information went to Stephanie Travers, who immediately would call ‘Stop the trial.’

Stephanie Travers was never a camera operator; she was a mathematician, a “Computer,” who was selected for the role. She had grown up in Woomera and her father was principal of the Woomera Catholic School for some time. Given her senior role on the range, she was eligible for membership of the Senior Mess in her own right, that is without having to accompany a man of that status.

6.8.5 Why women? Men reflect

Why were so many women employed on the rocket range at Woomera to film the weapons and rocket tests during the Cold War? There are a range of reasons offered for this, including their high tolerance of boredom, tendency to follow instructions without question, and mathematical prowess. But it is also clear that women were a ready source of labour. Women could not live at Woomera without employment, unless still at school or wife to a male Woomera wage-earner. There were limited opportunities for employment, especially in what were considered unskilled roles. Qualified nurses could work at the hospital, and given the high birth rate, midwives were in high demand. Also, there were teaching roles at the schools, which varied in number over the years. Other skilled work was available on the range in the Instrumentation area, where women with maths and science backgrounds found work as Computers. Other than that, there were roles as waitresses, shop assistants or
domestics. The latter seemed to have been taken by the few Indigenous women who worked at Woomera Village and this cohort also filled roles as childcare workers, as discussed in Chapter Five.

Woomera was created to test weapons and rockets. To understand the performance of these machines a photographic (film) record was required. In its heyday, hundreds of trials were held at Woomera and various camera posts were established the entire length of the range. As this chapter has shown, servicemen who had worked at photographers during World War II were either posted to Woomera within their existing roles, or they responded to advertisements for work there in similar roles to those they had undertaken in either the RAAF or the AIF. These men tended to be already skilled and those without the necessary qualifications attended “school” at Woomera to obtain them. These men took on the supervisory or senior photographic roles on the range. Primarily the lesser, but nonetheless, vital roles of operating the cameras fell to women. Some of them were girls as young as 14, most were in their late teens and a few were married women with no children who found life as a housewife boring or who worked for the extra income. The joyful social lives of the women on the cameras are memories that remain strong for great numbers of women who lived at Woomera. The work itself could be tedious, particular on days where there were no trials, but for the most part women enjoyed their work and enjoyed more the friendships they made and the fun they had. Figure 6.12 shows the proportion of men to women on the range in 1969.

Male photographers who worked on the range have varying views about why the women under their supervision worked in these roles. Patrick Bradley is adamant that women were there because they came to the job with no skills in photography or filming, had no management experience and constituted a ready-made work force arising from family connections to Woomera:
Another group of people came into the Optical Instrumentation area and they were women. And they came in almost universally as family members, partners, or children of people, like Floss [Laurine Hall], who had another job. And the reason that they were at Woomera was because they were members of the family. They did not necessarily, and they probably didn’t have, photographic experience; nor did they need it. Patrick explains the skills required to be a “photographer” on the range, as opposed to a camera operator, or in terms of the definitions in this research, “camera operators recording utilitarian – data – film”:

I use the term deliberately, ‘camera operators’, as opposed to say ‘photographers’, meaning that there was a whole bunch of photographic, and other skills, which because of the rank that these guys might have held, they might have been corporals, or they might have been sergeants, and so on, had experience in managing people. [Women] came in because they could be trained to operate cameras. There was a big difference there. And I think that is the reason why, at least in the period that I was there, […] the women were Photographic Assistants and the men were Photographers. [Men] had the photographic skills, they had experience of managing people in almost all cases. The other group of people did not. Now they certainly developed a high degree of skill in their job, but […] the women’s job in those days involved being taken to a camera site […] operating the tracking camera.
According to Patrick, women operating the Askania Kinetheodolites (and this included Laurine Hall), had more responsibilities than those operating the Contraves. This is because the Contraves were located at sites occupied by four women, in teams of two on two dual-operated machines, with one male “photographer” in charge of the site. His role was to load and unload film, arrange timing and communication protocols and manage the workloads of the women. Askanias were a one-person operation and this person, usually a woman, also had to load and unload the film and liaise with the timing controller.

Patrick described the broader responsibilities of the male Photographers who supervised the women on the Contraves sites:

[The women] were lovely people, they were fun, they knew their stuff, but what they needed to know to do their job was very limited. Essentially, they knew how to drive their Contrave; and that was what they had to do. They didn’t have to maintain it [and loading the film] was the photographer’s job. It was certainly the photographer’s responsibility. Now, I will be amazed if they didn’t want to do everything they could possibly do […] I think one of the greatest skills was how to manage their time when there wasn’t really a great deal to do. Now, the blokes on the other hand – and I’m talking now about the people in the Vintens section, but it applies up to a point to the men who were managing the various Contraves – we had a million things to do. Very, very much so. Because there were hundreds of surveyed sites along the range where communications, and timing, and power outlets were set up for camera use, there were a heap of cameras in different set ups and different circumstances – some on different sorts of tracking mounts, some on these servo-controlled things, some of them being launcher cameras; there were different sorts of cameras.

Roy Whitburn had a supervisory role on the K15-K16 Contraves site in 1959. He appears bottom right in a cartoon Xmas card for that year shown in Figure 6.13. This card was drawn by the same person who produced the card showing Cecily Quinn and her workmates as reproduced in Chapter Five as Figure 5.9.
Patrick is adamant that women could have been trained to take on these more responsible roles, but, in his era, at least, they either did not apply for such roles or they were not offered them. Additionally, there were many returned servicemen available to take the senior roles. The culture of that time was that women would not be offered a role that could be taken by a returned serviceman (Grimshaw, Lake, McGrath & Quartly, 1994, p. 265). He concedes though:

I’m absolutely sure that if you took a bunch of intelligent women – which these people were – they could have been trained to do the work that we had been doing. [...] Given that someone was sort of culturally prepared for this sort of work, and that they got the training that was necessary, then I’m sure they could have handled every aspect of the job.

Evidence from this research suggests that women were not “culturally ready” to take on the supervisory roles during the 1950s and early 1960s, but had they been given the opportunity to do so, as these oral histories attest, there would have been nothing to prevent them being as competent as any man. Yet women on the range were, for the
most part, either still teenagers or at most in their early 20s, not specifically looking for a career but fulfilling the obligation to be gainfully employed in order to remain at Woomera, a place that most found to be a social paradise. There were also those who sought work on the range to save for overseas holidays or build up personal savings.

Patrick also maintains there was no specific impediment to women being promoted or trained in senior roles had they sought it:

I can think of no reason why a woman, working on the range, had she wanted to turn herself into a specialist of sorts, say a photographer [that] they couldn’t have done it, or that they would have been prevented from doing it.

Dennis Kader was sometimes responsible for the new arrivals to the range and these people were usually female. At times he could not resist teasing them. One memory that stands out was an occasion when his sense of humour was clearly misplaced. A young newly arrived Scottish migrant woman who had only been in Australia for a week obtained employment on the range, through her brother-in-law who was a Peace Officer and lived with his wife, her sister, in Woomera. Dennis took her to the camera post and showed her how to track a missile:

[She and I] were tracking the aircraft, it had been a bit of a rushed job. We’d got to the site not that long ago before the trial, we had to set the cameras up […] I said, “Well you sit up there, and you turn this wheel, you’ll be able to follow the aeroplane.” I explained very quickly what it was about. [We were] tracking the aeroplane and it got hit; it was a live firing, and it went into a great big orange ball of flame. And like an idiot, I said, “Oh, the poor pilot.” Well guess what happened to her? She packed up and she threw a fit, ’cause she thought the pilot had just been blown to pieces. So that wasn’t a very wise thing to do, but it happened.

Thankfully the woman, Myra Wilson, was not scarred for life and remained working on the range for some time. The incident does reveal the extent to which the young women on the range were naïve about the nature of their work. They took the events of the day at face value and were given little background briefing on what to expect. It is not unreasonable to imagine incidents like this occurring, particularly when the new operators on the range were also newly arrived migrants, whereas girls
who had grown up in Woomera would at least have had a broad idea of the trials occurring on the range.

At one point, Myra revealed to Dennis why she had left the United Kingdom:

> When I got to know her after a week or two, I’d told her then about what to do, and she was telling me she’d just come from England, she’d split with her boyfriend […]. She told me, ‘He’s a young actor, and he’s going to go into a film shortly.’ But she’d just split with him and come to Woomera; and his name was Sean Connery!

Kader was soon appointed to manage a number of young women, mostly recent school-leavers, such that his camera post was known colloquially on the range as “Kader’s Creche”. He explains this:

> It was a rarity to have a young fellow with me; they were nearly all girls. […] We had two types of girls. The kids leaving school had to have work somewhere, and they became Photographic Assistants out on the range, and worked on the cameras […] as young as 14 […] Not much older, some of them. Because you could leave school at 14 then, and if they had no idea of going on to higher education […] most of them there were kids from school. And at one stage they used to call one of the posts I was on Kader’s Creche. I didn’t call it that, but others did. […] They were so young. And I’d take them out there and train them how to set up the cameras.

It is unlikely that this would be acceptable today, given current employment laws. The case of Myra Wilson being the victim of a practical joke played by her boss is evidence enough of the levity with which some male bosses treated their younger female charges. However, there is anecdotal evidence that the “older” male photographers behaved with great respect in relation to their younger charges, teaching them bush skills and introducing them to literature and philosophy. Loma Silsbury has said, “they mentored and protected us.” Yet she also observed that it was the “Army boys” who were more inclined to take liberties with the younger women. She has also reflected that young women, in the minority as they were at Woomera, also used their scarcity to their advantage in their dealings with the young men who were so eager for their company. (L. Silsbury, personal communication, November 28, 2019)
6.8.6 Excitement/Tedium of the work

In the early days of Woomera’s operation there were often five trials a day and a constant stream of activity. Yet there were still days when trials were cancelled or not scheduled, and camera operators had to fill in long days with their own activities. It has been suggested that women were ideal candidates for work on the range because of their tolerance of tedium and their ability to find their own amusements – which they often did by engaging in typically female pursuits of the era, such as needlework, knitting and hairdressing – as described in Chapter Five. The men working with the women sometimes joined them in board games or even mock seances! Bruce Aitken explains how time was spent waiting for trials:

When I first joined [in the 1950s], we shot about 20,000 feet a day, which in most cases meant we were having about five major trials a day, five major firings. But [from 1961 until the time] I left, you might sit there for a whole week with nothing [to do], and then a firing, and then another week of nothing. So we used to do Ouija boards, played chess.

Dennis shares this view and adds that for some men in senior roles the boredom led to their speedy resignation:

We’d play cards or scrabble or read books […] we had people get jobs in charge of these sites and last two weeks. They couldn’t stand doing nothing. […] So, it took a certain mindset, or physical condition in my case to put in all that time. Because sometimes you’d get a week with absolutely nothing happening. [The women] were free to do anything. There was nothing to do; you could create your own ‘busy-ness’ […] that’s why, living like that, I didn’t dominate anyone, it wasn’t in me. It was just, ‘Let’s have a game of Scrabble. Let’s have a game of cards. Oh, we’ve got at trial on; we’d better go and set the camera up.’ That would take an hour.

Patrick explains that during those times when it was required to fill in time the ability to get along with one’s fellows was paramount:

Some days there were two or three trials. Many, many days there were none […] you had a team of people, always working together as a team, going to a remote camera site, 20 kilometres, or wherever it was down range, and there was bugger all to do. So housekeeping, and I mean it
in the broad sense of the word, I don’t mean it in the gender-specific sense [...] became very important. Social relationships, and the maintenance of the social relationship became very important. And keeping the place neat and clean and tidy and working, and making sure that everything was A-Okay.

6.9 Social hierarchy at Woomera

As noted in earlier chapters, Woomera operated under the British services mess system with a Junior Ranks Mess: (the famed Jazza), a staff mess and a senior mess. Wives could attend the mess to which their husband belonged. Women in the rare senior roles on the range were entitled to attend to senior mess, but if they were married, their husband could only attend the mess that accorded with his service seniority. Most in Woomera accepted the system, others enjoyed it and others still found it irksome and anathema to the Australian way of life. Most people interviewed simply accepted that was “how it was”, while a small number including Patrick, balked at it.

Australian servicemen at Woomera were generally used to a relaxed form of service hierarchy compared with their British counterparts. While without doubt there was a prevailing social hierarchy in the Woomera township, as dictated by the British Services mess system, on the range a sense of egalitarianism prevailed. This has been confirmed by most of the participants in this research. Dennis reflected:

Bosses didn’t come into it really; we were all friends [...] There wasn’t really bosses; you just all worked together, and you were friends.

While Ron considered that Army discipline was more relaxed at Woomera than in other locations in which he had served, he found the Woomera mess system exasperating. While in the AIF he had been a member of the Junior Mess, on leaving the Army and joining WRE as a civilian, he moved up into the Staff Mess. Ron also felt that there was division between the three separate Armed Forces:

The Air Force seemed to think that they were better than anybody else, but everyone was pretty friendly really. The British Army were very aloof, especially the officers, and some of the senior NCOs [non-commissioned officers]. And it was a very class-conscious town, which was sad. [People would ask in a judgmental way] ‘And to what mess do you belong?’ The interesting thing was if you got out of the Army and got a job as a civilian, you almost always went up one mess.
Occasionally you might have gone up to the officer’s mess, depending on what you did. […] So it was a bit of a joke really, but you belonged to the lowest mess, and then you got out of the Army, and suddenly you moved up to the next mess.

As an assistant photographer Patrick was one of the junior staff and so qualified only to attend the Junior Ranks Mess – the Jazza. He found the mess system almost intolerable when he first arrived at Woomera and was instructed to get a meal at the Junior Mess:

The dreadful Jazza, an appalling establishment […] I say appalling, because I’ve never met people like it in my life! Never! […] I just felt like a fish out of water. Anyhow, I came back to my room and contemplated what madness I’d got myself involved in […] I’m a 5th-generation Australian, but nevertheless, I had a very different background. And a father who sings in Grand Opera, what do you expect! [Laughs].

Figure 6.14 Patrick Bradley at work on a Vinten camera at camera post V28, Woomera, 1957 (Bradley, 1957).
Patrick, shown working on his favourite camera in Figure 6.14, is the only person interviewed for this research who avoided going to the Junior Ranks Mess. The prevalent hierarchal system was anathema to him:

[The mess system] was an absolute abomination; I resented it. I saw it as the British Armed Services, and it was just appalling. And in fact, I think even though I had secured myself a promotion, and sort of moved up in the messing arrangements […] I found it sort of soured a lot. And it did for a lot of people. It did for an awful lot of people. I think if there was a negative of being at Woomera, for me, it was that […] the messing arrangements really, really pissed me off for a long time.

He then reflected on the insularity created by the mess system and by the fact that the town was “closed”:

Being a closed town, meaning the outsiders couldn’t come in, meant that the social structures of the town became, I think, very sort of inward-looking. And I think the range of interests that people had, the range of means of expression that people had, it was very different to living here [at Kangaroo Island, South Australia], for example.

### 6.10 Drinking

It is widely accepted that collectively, many of the inhabitants of Woomera had a “drinking problem.” For many this was a matter of pride, along with reputedly having the longest bar in the world. The authorities accepted there was a problem with the massive consumption of alcohol. Michael Breen, secretary of the Woomera Board, was quoted to have said, “we drink beer to conserve water” (“Woomera, Women’s Paradise”, 1953). Figure 6.15 shows a typically crowded night at the “Jazza”. Morton’s research confirms this, and he acknowledges that the:

incipient or chronic alcoholism was the greatest social scourge. Heavy drinking was practically a way of life for everyone except confirmed teetotallers, and the chief aim in life of some women was to get their husbands transferred before they were sacked or succeeded in their apparent determination to drink themselves to death. (p. 237)
Dennis Kader was one of these “confirmed teetotallers” and comments on the limited options available during his free time:

Living on the range you had the option of going to the messes, invariably becoming an alcoholic, or going to church [I didn’t attend church] I don’t drink either. So you were the odd man out. […] Living in the town wasn’t my cup of tea. You had this narrow-minded view of “belong to the mess and get pissed or belong to the church and wail and cry”.

In the late 1950s Patrick believes the drinking problem was addressed in a peculiar way:

At one stage, at the junior staff club, when I arrived there actually, you couldn’t take a closed bottle away. You could take as many opened beer bottles as you wanted; you could take a crate out if you wanted to, but they all had to be opened. Because they were afraid that people would go back to their rooms and sort of drink themselves to death. And it had actually happened.

Yet Roy Whitburn and many like him enjoyed the lifestyle offered at Woomera as his son Nigel attests:
As a Senior Photographer he was allocated to the Staff Mess, but he wasn't interested in the mess life or the drinking cultures that existed there. Nor in the status games. I think that apart from his months in single quarters when he needed to go into the Jazza for meals, he hardly ever went into any of the three original messes or the later ELDO Mess […]. Much has been written about all the clubs, activities and mess life. However, that wasn't my parent's life or the life of all residents although it certainly existed for many. He was a keen gardener and spent a lot of time trying to grow tomatoes and other plants and enjoyed a social life with a small group of friends who preferred to meet at each other’s houses, have barbecues in the bush etc. He wasn't sporty or a big drinker. He built his own darkroom and enjoyed processing and printing his photos (N. Whitburn, personal communication, August 17, 2017).

6.11 Sport and entertainment

Morton (1989) suggested that the heavy weighting given to sport over other cultural pursuits at Woomera,

could look like the worst kind of ocker philistinism, underlined by the dearth of cultural life, a lack of bookshops and plays, concerts, galleries and specialist shops. [For some] Woomera could look like a cross between one of those relentlessly cheerful British holiday camps and a boarding school in the country. (p 237)

This assessment certainly applies to Patrick Bradley. One of the reasons Patrick did not enjoy living at Woomera was that he had no interest in sport. Patrick said he led a “sheltered” life prior to going to Woomera. His father sang in Grand Opera and had also managed a radio station. The Arts were important to the Bradley family, as was their cultural background as Irish Catholics with a tendency to dislike the British. Many others, men and women, have celebrated the fact that so many different sports were offered at Woomera, however for Patrick this was not of interest. He explains:

Sport was God [laughs]. Sport was very important, and one of my problems was that I wasn’t the slightest bit interested in sport. Sport was frightfully important, and all manner of sports. It was terrible, but there was a golf course, there were motorcycle clubs, you name it, they were all there. Very much. Because it was a young, male population.
Partly because of this emphasis on sport, Patrick did not feel a strong affinity for those around him. He felt cut off from “people of a similar cultural background”.

In contrast, Ron signed up for the Centrals AFL football team almost immediately after his arrival – in fact before he had been allocated sleeping quarters he was asked to sign up for a team. While at Woomera, Ron swam, played Australian Rules Football, soccer, Rugby league, tennis, golf, cricket, softball, badminton, squash and, when the Americans came, later baseball. Ron’s wife, Nancy had never played sport until she came to Woomera. She commented on the inclusiveness of this experience:

You did everything. [...] so, all of a sudden I was playing basketball. And the men would play football, so they would have men against the women. So, the women would go to training with the men, and we’d have a football game against the men. And it was very inclusive. (N. Matthews, personal communication, April 30, 2018)

However, evidence shows that a Woomera Creative Art Society was active in the 1950s. Perhaps it had folded by the time Patrick arrived at Woomera. Elizabeth Young, writing for the Adelaide Advertiser, visited Woomera Village to view the Society’s fourth exhibition and observed:

To my mind the really important and reassuring thing about the Woomera Creative Art Society is the assertion of the creative and the aesthetic in a township which owes its existence to the service of development and experiment with man’s power to destroy. (Young, 1954, p. 2.)

None of the participants in this research were members of that Society.

6.12 Security on the range

There are varying accounts of the degree of security on the range. While acknowledging there was strict security pertaining to what could be discussed in relation to one’s work, most believed there were ways around the pass system and that creative ways could be found around the security procedures. Bruce Aitken’s account confirms Loma Silsbury’s comments (in section 5.14) about the lax security at Woomera and that there were two levels of security. The Commonwealth Police ran one security service and, in both Bruce’s and Loma’s opinions, its employees did not want to be at Woomera and did not “police” people seriously. However, the Canberra-appointed “security
police,” took their jobs extremely seriously and tolerated no rule-breaking. Bruce provided an example of their rigid policing, being that any discussion around the WRE magazine, *Missile,* was forbidden. Readers were banned from discussing details of what they might read in the magazine, and were unable to even confirm the name of an aircraft that may appear in an illustration that had been tested at Woomera:

[We were told] ‘You cannot read a magazine and verify that that’s a Sea Hawk, because you are verifying the information.’ […] So we weren’t allowed to talk about anything like that. And if we went to the mess […] we talked about other things, like sex and grog, and football […] not about our work.

Bruce explains that the double-layered security wasn’t about safety and crime, it was simply about not letting secrets out. Woomera was by all accounts a safe place in which to live. Like the women interviewed, men confirmed few people locked their doors at Woomera. Nigel Whitburn conveyed his mother’s reflection on this:

She liked the relaxed lifestyle compared to the more formal British ways of the times and of course the village was a secure and safe place for children to grow up in. She liked the fact that people would just call in to visit unannounced and take you as they found you. If you were in the middle of some domestic task, like it or not they would muck in to get it finished. Making friends was easy and she retains many of them to this day. (N. Whitburn, personal communication, September 2, 2017)

There was also next to no crime (Morton, 1989, p. 239). Anecdotally, it seems that the courthouse was rarely used and on the few occasions that crimes were committed, the perpetrator would be on the next plane out of Woomera. Morton (1989) quotes an ex-resident who reported a “crime” against prevailing heterosexual modes of behaviour:

We had a chap here as storeman and I think on about the second night after he arrived he got a bit drunk in his mess and he was dancing with another bloke and hugging and kissing in the middle of the floor, he was on the next plane out. (p. 239)

This is consistent with the 1950s Cold War puritanical insistence on men behaving according to strict moral (heterosexual) conventions as discussed in Chapter Five.
It didn’t help that in the early days of Woomera’s existence the role of the security officers was ill-defined, as Morton (1989) explains, quoting a man briefed to simply “just sort of watch the place”:

I didn’t know whether I was listening for stampeding elephants or looking for communists under every rock. In particular I had to keep an eye on the road from Woomera to Koolymilka. [...] I spent months at Woomera with no clear briefing as to what I was supposed to do. (p. 101)

Ron was bemused by the security and pass system. The system was clearly well known within Woomera, but it was not uncommon to be ignorant about the pass requirements prior to arrival. Ron explains, “[it] was heart breaking. I’d driven through the worst road in the world, and I thought they wouldn’t let me in!” He recounts his conversation with the officer at the Ponds Gate Guard House:

Sorry lad you can't come in without a pass.’ I told him that I was in the Army, had just been posted to AGWTU [the Army Guided Weapons Trials Unit] and showed him my Army pay book. He said he would see what he could do. I was hot, dirty, tired and had just driven nearly two hundred kilometres over the worst road I had ever seen. It was a potholed, rock-strewn, goat track called "The Port Road" and now that I had reached my destination I was being refused entry because I didn't have the small piece of paper called a "temporary pass"- a piece of paper I'd never heard of. (Matthews, R. 2006, p. 2)

On this occasion, the guard house officer was lenient and allowed Ron to follow him to Woomera Village where a temporary pass was organised.

Ron respected the fact that his work was classified and did not talk about it outside of the workplace. He says, “Everyone who worked on Range E was cleared to ‘Secret’, and on a few occasions, if you had to do something special, you could get a temporary clearance to ‘Top Secret’.”

6.13 Cold War fears

As discussed in Chapter Three, the “Cold” war that developed after the end of World War II between the Western Allies and the communist Soviet bloc countries was the primary reason for the ratification of the joint project between the United Kingdom and Australia, hence Woomera’s creation. Britain sought to arm herself with
similar weapons to those expected to be used against her in the event of the Cold War evolving into a Third World War. (Morton, 1989, pp. 8-10). These weapons had to be tested, hence the Woomera range and those responsible for the day to day testing program required a place to live, hence the Woomera township. The Cold War was a reality for the Government officials and scientists concerned with the development and testing of the appropriate weaponry to be utilised should a “hot” war eventuate. Yet those working on the range, women particularly, had little concern of a future war (see Chapters Four and Five). Some, who did think a third world war was remotely likely, believed this possible conflict was far away from Australia. However, there was a realisation or vague speculation that the rise of communism might threaten their “way of life” and democratic rights. In the years pre-television, this was far from the realities of their daily existence.

As with all people interviewed for this research, Bruce Aitken was asked if he and his work mates had an awareness of the Cold War and a fear that they may be bombed or infiltrated by communists or people from enemy states. Bruce, as with many others, laughed at this suggestion and commented that, in terms of the Cold War, “No. There was never even a mention or talk of that.”

It may be that any fears were related to being accused of having far left or socialist sympathies. Despite the notion of an egalitarian workplace where the camera operation was concerned, the prevailing political view at Woomera was conservative. Dennis Kader believed there were more people further to the right who could be described as fascist. At one point Dennis was reported to ASIO for his left-wing views. He explained:

We had impromptu debates. And I was a bit of a Commo. I wasn’t a communist, but I was pro-socialism. And virtually all the others weren’t. Having come out of the Army, they were fascists, without a doubt. And I also got dobbed in as being a possible communist sympathiser at that stage, I found out many years later. So the attitudes of the people working on the range were quite conservative [...] all those guys [at Woomera] were very fascist. Not socialist minded, the opposite. You talked socialism to them, and you were talking sedition.

Ron Matthews was in the minority in that he did fear a possible Third World War and was also concerned about the spread of communism and its expected negative impact on the “Australian way of life.” He recalls the thinking at the time:
There was the Domino Theory, that [the Soviets] would take control of one country, and then use that to invade the next country, and eventually they would come down through Indonesia. [...] And there were rumours of a [spy] trawler, or something, off the Great Australian Bight. Sort of rumoured to be listening in on the Woomera conversations [after the Petrov Affair] I think it was some sort of wakeup call to everybody, really. You know, that we’re not insulated, even though we are isolated.

Although not fearing a Third World War, Patrick was concerned about the advances made by the Soviet space program:

I remember feeling rather concerned. I was out at one of these Contraves posts actually, and the newspaper came out with the meals that were delivered, and it said that the Russians had launched their first ICBM [intercontinental ballistic missile], and we knew that the Americans’ Atlas hadn’t got off the ground yet. I certainly didn’t have a morbid fear of the Russians, nor did I anticipate that we were going to be wiped out. The Cold War was, from my perspective, and I think from the perspective of the people around me, really something which was going on in the northern hemisphere […] I know the British were spending all this money unwisely on a counter to the Cold War. But it mainly seemed to me to be something that involved the Americans and the Russians. I suppose that’s because Berlin was still divided. But no, I certainly don’t recall a period when people that I knew, or the people surrounding me, anticipated that there would be another war.

Like most interviewed for this research, Patrick took no issue with Britain testing its weapons on Australian soil, although he does stop short at endorsing the atomic tests:

Nuclear weapons were a different question. But no, [I was] tickled pink about it. [Woomera] was great. It was all very exciting and gung-ho. [...] I think we saw it as a good thing. And again, I’m talking about my immediate friends, and certainly myself, saw it as this cutting-edge stuff, and that we’re going to the moon, sort of thing [...] Working at Woomera, and working on the range was fun; it was interesting; it was challenging; and it seemed like it was important. Whether it was or not is another matter. But it seemed like it was important work. So, the British testing their weapons there, this was a good thing.
6.14 Conclusion

Each of the men who provided oral histories related their time contributing to the creation of utilitarian film at Woomera with great humour and also in considerable detail. Their memories and reflections of the time they spent on the range in this new and unique filming activity have added depth and colour to this history. Each of the men were conscious that their work was significant, not only to the Anglo-Australian Joint Project at Woomera, but more broadly in terms of Australia’s contribution to upper atmospheric testing and space research.

Other than Ron, these men found the British mess system an anachronism at Woomera, where in many other respects they describe the workplace on the range as one of social unity and equality. For them all, the experience offered the opportunity to be innovative and evidence shows that men were rewarded for using initiative. Each of these men had sincere respect for women on the range but they differed in their views on why women were employed on the range. All but Ron were involved in training women but tended to view the women as colleagues rather than subordinates. Although they respected the two senior women on the range, none questioned the status quo that saw female camera operators always taking on the junior roles.

There is no evidence that women were encouraged to be innovative or to pursue additional education. In fact, Mary Whitehead, for many years in charge of women in the Mathematical Services division, was invited to participate in an exchange opportunity with famed British mathematician, Win Lloyd. Six weeks before Whitehead was due to leave Australia to travel to the United Kingdom, the Australian Government reneged on its side of the exchange citing that it would be “waste of money” sending a woman (Dougherty 1994).

So for all its innovation, freedom and purported egalitarianism, Woomera was little different to mainstream Australian society, which dictated that women play roles of subservience to men and where women were overlooked in terms of roles of seniority (Mercer, 1975, pp. 69, 75, 287, 435; Stephenson, 1970, p. 56; McMurchy, Oliver & Thornley, 1983, pp. 142, 151). Despite this, two instances of senior women have been discovered, yet neither Stephanie Travers or Barbara Hewish appear in Morton’s official history of Woomera. However, the unique situation at Woomera meant that prevailing public service laws relating to married and pregnant women were
pragmatically overlooked to ensure nothing stood in the way of the progress of the joint project. For the men, Woomera was a place that allowed them to experiment and explore new paths. Little experience was needed in any of the new roles that became available because of the joint project, and additional schooling and training were provided when it was.

Ron’s accounts of the technical aspects of utilitarian filmmaking at Woomera have been insightful. Particularly, his reflections on his comparative experience as a camera technician while working for first the Australian Army and then as a civilian attached to WRE.

As a qualified photographer with both an interest and keen understanding of film and camera technology, Patrick was an ideal participant in this study. Additionally, he held views at odds with other interviewees and provided an alternative understanding of the Woomera experience vis-à-vis utilitarian film production. Yet like the other men, Patrick offered a personal view of the experience of living at Woomera and working on a project, in a place and at a time, unique in Australian history.

Bruce’s account also offered a slightly different perspective. Like Patrick he worked both on the range and at Salisbury. His experience in the computerisation of the range provided insights into the role of women in data processing, a vital part of the eventual utilisation of the data film collection that occurred on the Woomera range. Bruce was involved in the pioneering development of Australian IT and was able to explain the operation of sophisticated equipment in laymen’s terms.

Unfortunately, Roy Whitburn was deceased by the time these interviews were conducted. However, he left a substantial archive and had talked about his life at Woomera in depth with his son, Nigel, who has generously shared this information. Despite returning to the United Kingdom in 1970 because his wife missed her family, Roy felt that Woomera had been a central part of his existence and he asked that his remains be buried in the Woomera cemetery.

Dennis Kader’s time at Woomera was an interesting period of a long and adventurous life. He spoke frankly about supervising women on a camera site that would be remembered many decades later as “Kader’s Creche.” All the women with whom he worked held him in high regard and he remains one of the legendary
characters of Woomera. Despite being the oldest person interviewed for this research, at 86, he was sharp and lucid. Asked if he was conscious of the contribution he was making to this unique endeavour he replied:

   I don’t think about contributing, because I’m too selfish! I think about what it gave me. And it gave me a very interesting life on the range. And also, the attitude to each other was very civilised. You weren’t brow beaten, you weren’t sort of whipped in any way to achieve anything, to do anything, and you did it just the same. You did it because it had to be done, and you wanted to do it right.

   Each of these men, Bruce, Patrick, Dennis, Ron and (through his son, Nigel) Roy, strove to do the best they could at Woomera and treated their colleagues, male and female alike, with deep respect. The Woomera community that emerged during the Cold War endures today and its members continue to generously share their memories and photographs of this time. Whether these particular oral histories reflect the broader experience of men on the Woomera range is debatable, but their individual and collective memories suggest that the women camera operators were diligent, intelligent and highly competent technicians.

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Endnotes

1 Roy Whitburn’s pay records, made available by Nigel Whitburn, 2 September 2017.
2 Having contacted the Woomera school, it appears that at present, no school records are accessible to the public.
3 Hewish was dead by the time this research began. After a long search, contact was made with Hewish’s godson and an indication was made that he would attempt to locate her personal papers (if in fact they existed.) But this did not come to fruition.
4 Considerable effort was made to locate her to see if she is able to take part in this research, but this was not successful. Given Patrick believes her to have been at least five years older than he was when they were working together it is likely she is no longer alive.
5 Win Lloyd developed Lloyd’s law, a formula which allowed the reconstruction of the complete trajectory of a bomb with immense accuracy.
Conclusion: A Time and a Place

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Chapter Seven. Conclusion: A Time and a Place

Those who lived through the era did not realise they were indeed leaving footprints in the sands of a history as yet unwritten. It is only now, when we have outlived most of our peers, we realise the unique microcosm of our youth. When living it, we took it totally for granted as the norm [...] We rubbed shoulders with giants at the forefront of the New World and counted it no different than any other day. We witnessed new wonders by the hour and never gave it a second thought. Thanks for giving us the chance to know how very different we were and to take pride in our achievements. Without your ability to elicit information which has once more brought this era to life, we would have sunk beneath the waters of history unnoticed, unshriven and unsung. Our eternal thanks, Loma Silsby.

(L. Silsbury, personal communication, August 26, 2019)

7.1 Research objectives

My research has explored the role of women as camera operators at Woomera during the Cold War, focusing on the period 1947-1970. My main research question was, “what was, and how important was, the work that women did on the Woomera rocket range during the Cold War?” To answer this main question and the associated research sub-questions that looked in more detail at the experience of women camera operators and their experience of life at Woomera beyond the range, I used a case study approach by undertaking a series of oral history interviews over two years between April 2017 and December 2018. Interviews were recorded with eight women who worked as camera operators and three women who worked as a human “Computers.” Four men were also interviewed whose work brought them into contact with women camera operators and another one’s working life was examined through the testimony of his son. In addition to the oral histories, primary research was undertaken by analysing films, archival documents and newspapers, and through regular contact with a closed Facebook group Woomera!! where former staff and residents of the facility shared memories and kept in contact. These sources provided rich details and further information from those who lived through Woomera’s heyday.

7.2 The importance of the synergy of sources

The validity of these research findings rests upon the integrity and comprehensiveness of the sources from which inferences were made. It was therefore important that information was collated from a broad range of sources: filmic, archival
records, contemporary newspapers and oral history testimonies, to form a clear picture of the work on the Woomera rocket range. As an historian it is vital to build up a complete picture of events and impressions of events from a multiplicity of sources and consider the secondary sources in the light of the primary sources. All sources are to some degree biased and are inherently flawed. Taken together, synergistically, we can form a more accurate picture of what might be reality. For instance, here, it’s not that Laurie East’s interpretation of events is incorrect, it’s that it reflects attitudes, her own included, concerning the nature of women’s work at that time, which tend to downplay the expertise (or at least technical skills) required, and hence, in turn, the significance of the project as a whole. Had I relied on solely Laurie’s testimony, I may have been convinced the work was “easy” and required few skills. Patrick Bradley’s thorough and considered testimony provides a very different view of the skills Laurie possessed. Patrick explained that the Contraves were always organised in pairs and operated by four women because one pair might be tracking a target aircraft, for example, and the other would be tracking the weapon. That is, one camera was concerned with the behaviour of the aircraft and the other with the weapon, and each camera operator recorded either the elevation or azimuth. The testimony of the female Computers also adds another layer to the understanding of the operation of the cameras and kinetheodolite manuals provide further clarification on their intricate technicality. Primary sources such as Sharpe and Lowther’s comprehensive examination of the Woomera rocket range on global terms reveals the immense significance of the range to Australian defence science. That women as young as 14 took on vital roles in this defence work is almost staggering and it is deserving of greater recognition and acknowledgement in the official record.

7.3  Dissertation structure

The dissertation has comprised seven chapters. The Introduction, which provides background information, outlines the research aims and the key question. Chapter Two, Methodology argued for the selection of the case study approach, examined the specific positive outcomes of conducting oral history interviews and acknowledged the shortcomings of this methodological approach. Chapter Two also outlined the research design choices and the guiding research questions. Chapter Three, Literature Review, consisted of an analysis of the existing literature (which included “literature” in a variety of media, especially film) surrounding the history and purpose of Woomera
and the Anglo-Australian Joint Project, the Cold War, utilitarian film production and a consideration of women’s place in 1947-1970 Australia with specific reference to women’s working lives outside of the home. The review of the literature demonstrated that the extant literature overlooks any serious consideration of the roles of women working at Woomera and, equally significantly, that when their experiences were documented, they were viewed and presented through a male gaze.

Chapter Four examined the media creation of “Mrs Lawrence”, a fictionalised 1960s housewife who had “a part time job on the range” as a camera operator. The chapter showed that her character was created to ensure that prevailing notions of woman’s place – for instance, that women’s participation in the workforce would not supersede their “primary” roles as mother and home-maker – were not challenged. Chapter Four also focused on the role of an actual camera operator, Laurine Hall, and compares her own memories of her work with the depiction of her role and “fame” in contemporary media. This chapter introduced the first oral histories recorded for this dissertation during a familiarisation field trip to Woomera, when the unexpected opportunity to interview the Trench sisters, two of whom had worked on the range, arose.

Chapter Five analysed the memories of more women camera operators and showed that their work was, for almost all of them, exciting and challenging. Their memories, as explored in Chapter Five, present priceless insights into the technical challenges of performing a time-sensitive job under extreme conditions in the Australian desert. This chapter also supported the findings of Chapter Four that revealed the incredible resilience of the camera operators whose work was without precedent in Australia.

Chapter Six revealed that, unlike most of the women, the men interviewed for this dissertation were fully aware that their work was both vital and ground-breaking. All of the men had high regard for the women and largely considered that the work of the women was under-appreciated. The men were not united in their views on why women were employed on the range, and it was clear that (other than Patrick Bradley) they had given the matter little thought until this research was undertaken. Unlike the women, the men were not apologetic about their roles and were pleased to talk about their work at length. Chapter Six also provided a forum for gathering additional information about the technical aspects of the utilitarian filmmaking processes that took place at Woomera.
7.4 Key findings of the research

Woomera was unique in many respects. Aside from being a purpose-built centre for weapons and rocket testing, it provided an arena for women to enjoy new careers outside of the home, and to continue to do so after marriage in an era when most newly-married Australian women were forced to give them up. There were also women who continued to work on the range after they had children, which, again was rare for this era elsewhere in Australia. Despite (though also perhaps made possible by) the strict security and behavioural code that applied at Woomera, many of the prevailing social norms were overlooked. Woomera was a place of pragmatism. It existed to test missiles and weapons, and these tests required numerous camera operators and other personnel to record and analyse the huge amount of data generated by each test. So, from women as young as 14, straight from school, and to more mature women in their thirties with young children, female employment on the range was both accepted, encouraged and “normal.”

The most important findings from my research are:

1. Women played vital roles in the Anglo-Australian Joint Project at Woomera during the Cold War.
2. Their work operating Askania and Contraves kinetheodolites and Vinten cameras was highly skilled.
3. Almost universally the women who were interviewed for my research did not consider their work to have been significant or important.
4. Most of the women had not spoken in any depth about their work prior to my gathering of their oral histories.

7.5 Contribution to the literature

My work contributes to the existing literature in five main areas:

1. It provides nuanced reflections of women’s work on a major rocket range during the Cold War to add to existing oral histories of the Cold War, such as those referenced by Bridget Kendall (whose work does not include any Australian testimonies in her otherwise comprehensive collection).
2. It addresses such deficiencies by providing women with the opportunity to tell their own stories and have them formally recorded for the record and hence addresses the gaps in the official Woomera history written by Peter Morton (1989).  
3. It challenges the views of women as secondary players in Woomera’s history, as portrayed in media at the time and in key sources such Southall’s 1962 book, Woomera, in which they are presented primarily as wives, mothers or women waiting to find a husband, and where most of the focus of these works referenced women largely in terms of their physical appearance and marital status.  
4. It provides detail on the operation of sophisticated (for its time) filmmaking equipment.  
5. It provides detail on the social lives of women at Woomera, presented through a female voice and perspective.  

I hope that these findings will be valued by those interested in Australian Cold War history, gender studies, the science of utilitarian filmmaking (1947-1970) and the Anglo-Australian Joint Project to test weapons at Woomera. It should also be of interest to current and future practitioners of oral history and to scholars interested in South Australian history.  

7.6 Recommendations  

As a result of my study, further interviews could be conducted with the women who were discovered during the latter stages of the research in order to create a larger sample size than was possible within the confines of this dissertation. Follow-up interviews could also be undertaken with the women interviewed early in the research process given that later interviews were informed by a more a comprehensive picture of life at Woomera that was gleaned as the process unfolded. Additionally, the work of the female Computers who worked at the Salisbury and Penfield facilities and also on the range, as documented in Appendix 2 are deserving of more detailed attention.  

It is my intention to make a video about these women, gathering them together on the range where they worked so hard all those years ago, enabling them to tell their stories, no longer as Australia’s “hidden figures”, but celebrated for all they were and all they still are today. This will take the form of a reunion and I intend to bring them all to Adelaide, South Australia, hire a large coach to convey them across the desert and record their casual conversations en route to Woomera as they renew their
friendships in person rather than on the phone as has been the case up until now. Once we arrive at Woomera, (all the defence department permissions being granted), I intend to film them sharing their more formal recollections at the relics of what were once their camera posts. Surely the true stories of these women’s work at Woomera and their contribution to Cold War rocket science is worthy of a wider audience?

7.7 Reflections on undertaking the case studies

Laurie East, Joan Adams, Cecily Quinn, Merrilyn Bell, Loma Silsbury, Pat Hall, Kate McGoran, Margaret Trench, Diane Hele, Pat Barter and Carolyn Harding tell their collective stories with vivid memories going back in excess of 50 years. To say that life at Woomera for these young women was “anything but usual” would be an understatement, and the absence of their testimonies in the official record is stark and startling. However, if it were not for my interviews with them and with their male workmates – who included Patrick Bradley, Dennis Kader, Ron Matthews, Bruce Aitken and Roy Harding (through his son, Nigel) – their contributions and experiences to the vital work at Woomera would have been lost forever.

Oral history can at times produce suspect evidence given the tendency to mythologise one’s own history. Yet this research suggests that it is almost as if the women have demythologised their lives, by completely understating and undervaluing their contribution. Without the use of oral history in this study of Woomera’s women, the work and lives of a unique cohort of women would not be available. My work with my interview subjects has filled in gaps in the extant literature on the role of women at Woomera.

Life at Woomera, to the uninitiated, would seem to have all the appearances of a dry, hot, isolated place and one could not be blamed for assuming that there would be nothing else to do there but work, play sport, and for those inclined, to consume large quantities of alcohol. For some, Woomera was portrayed as a place of strict secrecy and little humour. Yet the women who took part in my research evoke a very different perception in the telling of their stories. Their narratives are conveyed through the eyes of much younger women, girls really, who like most at that age were looking for excitement, companionship with others, fashionable clothes and a sense of fun. What hardships they experienced due to Woomera's isolation was all a part of the incredible journey, which also included the happy times they relive in the telling of their memories.
Woomera's female camera operators were unequivocally highly competent and skilled operators yet when interviewed these same women uniformly presented an unpretentious “modesty” when it came to their contribution and achievements. Perhaps these young women saw themselves as “accidental” employees, reasoning that what was often for them an unintentional career, that set them apart from the men who already had specific skill sets and were either employed in assigned roles or the successful applicants for new positions. Ron Matthews’s testimony relating to the complexity of the cameras reveals the equipment to be anything but straightforward, and yet these women with only the basics of training had become highly skilled in their operation. These “pioneer women” all enjoyed the lifestyle at Woomera and the opportunity of work which they performed with diligence and proficiency.

I am proud that this research has given these women a voice. As poignantly noted by Loma Silsbury in the opening quotation, it has given them an opportunity to reflect on what has largely been a forgotten contribution to Australian Cold War scientific endeavour, and in some cases, to realise for the first time the significance of that contribution.

7.8 Final Reflections

When I began the research for this dissertation, I liked to joke my thesis was “rocket science”, inverting that cliché used when referring to something quite simple. Now, at the end of my journey, not only do I understand a great deal more about rocket science, more importantly, I have a firm understanding of the role women played in Australia’s rocket science program. I have come to know these women and have developed a huge respect for them – for their resilience, their sense of humour, their knowledge and their willingness to share that knowledge with me. Having spent time at Woomera on two occasions, I am in awe of their pragmatism and ability to endure the harsh conditions for many years, and furthermore, not only to endure the conditions but to enjoy and celebrate the experience. That their lives and professional roles have not been the subject of detailed work in the past is surprising, but it has been serendipitous that I came to the topic through the inaccessibility of the archival films that were to be the dissertation’s initial focus, and instead decided to attempt to find the women I read about in Southall’s Woomera. Once I had begun my work, I needed to quickly gain a basic understanding of what went on at Woomera. Morton's 2.5kg
576-page book was hardly suitable for light bedtime reading, and so it was Southall’s much-smaller earlier book that formed my first education on Woomera. It was fortuitous that Southall wrote with what Morton called “fascinated admiration” (264) about Laurine Hall, such that I was determined to track her down and talk to her myself. I naively assumed that she was alive, and that I would find her. I spent the best part of nine months trying to find Hall, who I eventually discovered as Mrs East, living in Tasmania. Then ensued her interview process to see if she wanted to talk to me. Once more, serendipity meant that our shared experiences and values – my English background, love of animals, ability to sew and our similar sense of humour – was enough to convince her that I could make a trip to meet her. She had no interest in my academic background and prior experience. Perhaps we both shared a mutual curiosity about each other. That first meeting led to many more conversations and her family have since told me that my research in some way lifted Laurie from a depressive state, following the death of her beloved husband, Vic and helped give her life renewed purpose. Laurie has been and remains a vital part of my PhD journey.

To me, more than anything, this is the value of my work: that it has made a difference to the lives of some of the women I have met. We all want our lives to be of use and of value to others and it is unlikely that these women, Laurie, Cecily, Joan, Merrilyn, Loma, Margaret, Irene, Pat and their workmates have ever been told how important their labour was and how unique their contribution to rocket science actually is. It has been my great privilege to be the person to convince them of the value of their work and the enduring interest it stimulates in others. Finally, that these women have resumed contact with each other after losing contact for up to 60 years has been the happiest of outcomes of the dissertation.
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APPENDICES
### Appendix 1  Participants in the Oral History Case Studies

<table>
<thead>
<tr>
<th>Name</th>
<th>Date of Birth</th>
<th>Place of Birth</th>
<th>Year of Migration</th>
<th>Age on arrival at Woomera</th>
<th>Years spent at Woomera</th>
<th>Date(s) of interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cecily Quinn</td>
<td>17. 03.1939</td>
<td>Sydney, NSW</td>
<td>N/A</td>
<td>15</td>
<td>1954–1964</td>
<td>09.02.2018, 08.06.2018</td>
</tr>
<tr>
<td>Merrilyn Bell</td>
<td>23.01.1940</td>
<td>South Australia</td>
<td>N/A</td>
<td>20</td>
<td>1965–1968</td>
<td>22.06.2017, 24.06.2017</td>
</tr>
<tr>
<td>Loma Silsbury (Galloway) (née Cox)</td>
<td>04.05.1943</td>
<td>Fiji</td>
<td>1948</td>
<td>10</td>
<td>1956–1962, 1968–1970</td>
<td>09.02.2018</td>
</tr>
<tr>
<td>Bruce Roland Aitken</td>
<td>23.03.1935</td>
<td>Australia</td>
<td>N/A</td>
<td>20</td>
<td>1955–1957, 1960–1971</td>
<td>05.02.2018</td>
</tr>
<tr>
<td>Patrick Bradley</td>
<td>20.07.1937</td>
<td>Adelaide, SA</td>
<td>N/A</td>
<td>20</td>
<td>1957–1959</td>
<td>07.06.2018</td>
</tr>
<tr>
<td>Dennis Kader</td>
<td>24.06.1932</td>
<td>Adelaide, SA</td>
<td>N/A</td>
<td>20</td>
<td>1952–1953, 1955–1965</td>
<td>17.06.2018</td>
</tr>
<tr>
<td>Diane Hele (née Evans)</td>
<td>15.03.1942</td>
<td>Plymouth, England</td>
<td>1952</td>
<td>16</td>
<td>1955–1973</td>
<td>27.08.2018 (by phone)</td>
</tr>
<tr>
<td>Pat Barter (née Palmer)</td>
<td>1938</td>
<td>Adelaide, SA</td>
<td>N/A</td>
<td>18</td>
<td>1956–1963 (17 Salisbury)</td>
<td>02.10.2018</td>
</tr>
</tbody>
</table>
Appendix 2  Female “Computers”: Diane Hele, Pat Barter and Carolyn Harding

The term “computer” in the 21st century unambiguously refers to an information-processing device, however in the 1950s, it was still used to designate “one who computes”. In the context of the Woomera testing range, it fell to a team of (mostly) women to manually interpret the large quantities of data produced by the tracking of weapons and missile tests, and these women were known as “Computers”. Three women who worked in this role at various stages of the Anglo-Australian Joint Project were interviewed in the course of this research, one in person, one by phone and one through a serious of email exchanges. What is most significant about these collective interviews is that the existing literature only documents the existence and work of female Computers at Salisbury, but as the testimonies of Carolyn Harding and Diane Hele affirm, there were female computing staff working full-time at Woomera, contemporaneously with their counterparts at Salisbury. The testimony of Carolyn Harding is particularly significant as she is likely to be the only Australian woman to have worked at the launch site of the Blue Streak, European Launcher Development Organisation (ELDO) project as a data analyst. She is clearly an Australian counterpart of the African American women featured in Shetterly’s book *Hidden Figures* (2016) and the Hollywood film of the same name (Melfi, 2016), noted in the Literature Review. Appendix 1 gives biographical details of the three women Computers interviewed.

**Diane Hele**

Diane Hele (née Evans) was interviewed by phone on 27 August 2018 and all quoted material is taken from that recorded interview. Diane Evans went to Woomera in 1955 where she finished her secondary education, after her parents and siblings had migrated as “ten-pound poms” in 1952. Her father got a job as fire chief in Woomera. Previously he had worked as a fire chief in Port Moresby, Papua New Guinea.

Diane Evans was in the first group of senior students to complete Year 11 at Woomera in 1957; there was no Year 12 offered in that era. She was the only girl in a class of boys who undertook Maths and Physics. She failed English but was clearly
highly accomplished in what are now referred to as STEM subjects. She relates, “All the other girls wanted to do typing, bookkeeping but I liked pure maths and physics”.

After leaving school she briefly took a job at the Australian Services Canteen Organisation (ASCO) store in an accounting role. Very soon afterwards she was approached to see if she was interested in taking a job in the Instrumentation Building at Woomera as a “computor.” Her husband-to-be was a house painter at Woomera West and the couple met on a blind date. She left her work on the range in 1961 just prior to the arrival of her first child, but stayed at Woomera until 1973, when she and her husband decided to move the family elsewhere in South Australia.

**Pat Barter**

Pat Barter (née Palmer) was interviewed in Canberra on 2 October 2018. (All quoted material is taken from this interview and is not be individually referenced.) Pat Palmer was the only girl in a family of seven children and grew up with a strong sense of self. She enjoyed Maths and Physics at school and her first job on completion was as a “computor” at Penfield, close to Salisbury where the WRE data analysing section was based. She took a dedicated staff train to work from Adelaide every day and worked at Penfield in the Maths Services division from April 1955 to January 1956. During this period, she was paid by the WRE to attend Adelaide University to study Physics, which meant she would be paid a higher wage. She was able to use the commonwealth car to take her from Penfield to Adelaide, attend a lecture and then be taken back in another commonwealth car (these vehicles travelled regularly between Penfield and Adelaide with WRE staff). At the end of 1955, Pat volunteered to move to Woomera to work as a “computor” in the Instrumentation Building and began working there in January 1956.

Pat met the man who would become her husband, Dave Barter, on the bus out to the range on her first day on the job. Dave was an engineer with the Army and once he left the Army, he remained in Woomera doing civilian work at the satellite tracking station. The pair married in September 1956. Pat had four children by the time she was 23, which prevented her from returning to work for many years. She eventually went back to work in a job that involved calculation but left when the non-reimbursed travel expenses accrued in the course of her work approached the amount that she took home. She remembers her time with the WRE and at Woomera with great fondness.
Diane and Pat were known to each other but did not maintain a friendship. Their work was similar, and neither was conscious at the time that their work was significant. Pat’s greatest ambition was to travel but marrying young and then having four children in quick succession prevented her realising this dream. Pat and her family moved to Canberra in 1964 when Dave got a job on the new Tidbinbilla Space Tracking Station.¹ Dave Barter had spent a short time at Maralinga in a radar-related role for the British atomic tests and Pat believes his death from cancer resulted from this work.

**Computer/Computer**

Both Diane and Pat Barter insist that human “computors” preferred the spelling ending in “or”, but women like Carolyn Harding say they were referred to as “Computers” with “er.” This change is likely to have evolved over time, as Diane and Pat, both considered themselves “computors” and were working at Woomera in the mid to late 1950s, while Carolyn was there a decade later. This distinction is not recorded in the existing literature, though it was important to the interviewees. It is also probably explained by the fact that computers (i.e. machines) were not used in Woomera in the 1950s, but by the 1960s the IBM was in use. Pat also has another view on this:

> It became quite a joke actually. They’re Computors, and Computers. I was a Computor. And some of the boys [on the range], when it was pointed out to them, sort of looked at the “ors” and put a “wh” in front of them. So then it got to the point where basically the two words [Computer/Computer] were interchangeable.

**Work as a Computer**

Diane’s work involved supplying the co-ordinate-plotting information to women operating the cameras to ensure they received an accurate idea of where and when they should be tracking a missile. Diane explains how her competency in Maths and Physics was important in the work:

> We understood what we were trying to do with the angles, […] we knew all the coordinates of all the cameras. Then we had to send to the camera operators where they specifically had to put [position] their camera to grab the rocket at the certain second. […] We gave them the coordinates of where the rocket would be at a certain time.
After the trial, Diane and her co-workers would examine the film to ensure the camera operators had captured the trial accurately. She was one of four women who did this work in 1958, the other women were: Ann Munson, Robyn Weekly and Janet Holmes. The four young women, who ranged in age from 16-21, reported to a male supervisor, John Walton. Unsuccessful efforts were made to locate Walton and the other three women.

Pat also described her work which involved checking the proficiency of the camera operators by reading the film that was sent down in cannisters from Woomera. Pat and her co-workers looked at the film and assessed the accuracy of the data from a particular trial by:

- taking angles from the two different cameras, and then converting them to logs using sine and cosines, and then multiplying them out so it would give a point in space left or right of the centre line, how high it was in the air, and how far it was. […] The cameras, and all of the equipment basically, were calibrated to measure from that point. […] The camera would take two or three shots, and we could then go to whatever the set, proper figures were for that, and calibrate whether or not the camera was out of alignment, and apply that to all the angles on the film.

Pat knew of Laurine Hall, remembering her as “Floss” and noted that she was the best operator because her work was always accurate. Pat also commented on how time-consuming the work was. The film she was examining was created by the Askania Kinetheodolites at four frames per second. To analyse three seconds of film could take half a day.

**Physical workplace**

Diane described the workplace:

It was just a long thin room, just enough room for us to all sit next to each other with a room behind us where we could walk. […] We were not far at all from the people who were doing the firing.

At the same time that Diane was working at Woomera, Pat was doing a similar job at Penfield:
It was possibly purpose-built, but it was a long building with a big corridor down the middle and rooms on either side. And we worked in groups of four, with a boss in an office in the corner, and the supervisor of the four girls that were working, which was another girl who was a little bit higher up the ladder, worked in the other office, and then there were four of us in an open-plan room.

Pat went to work at the Instrumentation Building at the range in January 1956. She found the work atmosphere much more relaxed than it had been at Penfield, although she found the mess system a little odd. She comments:

> It is how it was, and I just ignored it. I’d go wherever I happened to be invited. But it was funny actually, because there were two sisters married to two Army men. One was married to a Sergeant, and one was married to an Officer. We all used to have to line up to get our money from the post office; they wouldn’t talk to each other. There was an Officer’s line and there was an “Other Ranks’” line, and they wouldn’t talk to each other. But they had family get togethers. You know, that was inside the home. But out in public it was divided!

**Travel to work**

Diane had to catch the bus out to the range at 7:00am and would usually be back in the village by 5:00pm. Similarly, Pat had a long trip to work, leaving home at 7:00am to catch the only train that would arrive at Penfield at 8:20am in time for a working start to the day of 8:30am. Lunch was taken in the staff canteen and morning tea was served to the women from a trolley at their desks in the typical style of the Australian public service of that era.

**Pay**

Diane has no recollection of what she was paid and says the hours were long. Pat remembers being paid £12 a week, which she explains was: “a lot of money. […] A typist, you know a fully qualified, short-hand typist, was lucky to get 7 pounds. A shop assistant would get £5 pounds.”

Even so, she also believes women got paid only 85% of the male rate for doing the same job. When she went back to work in 1973, she was paid 95% of the male wage and this increased to equal pay two years later.
Pat did not approve of this inequality:

I was a bit snarky. I mean, I had six brothers, and I considered I was superior. So none of this business of a man being superior to me! Because I figured I had more common sense than they did.

She concedes that this view was probably unusual in the 1950s. Later on in her working life, Pat became a firm union supporter as the discrimination against women – and not just in terms of pay – irked her.

**Working hours**

While the women on the cameras often had down time to entertain themselves, Diane, Pat and their fellow Computers were constantly busy with their calculations, which Diane remembers at the time being done mentally, using pencil and paper, or with slide rules:

There were not the hand calculators like they have these days. [...] Us knowing our physics and how things worked and having that mathematical brain, it just came to us. We were on the go the whole time. [...] There were four of us working out the calculations for all the different rockets. [...] I think it was all straightforward to us [...] making sure that the rocket was pretty well in the range of what the camera was looking at, we [also] knew we’d done our job right, that way. You know, we’d given them the right coordinate to cotton on once it got to that point.

Pat strongly recalls using Marchant calculating machines but also using sine and cosine tables:

In effect [you had to know] how to follow a formula on a page of stuff, how to look up log cosine and sine tables in a big book. No slide rules, although Dick [the male boss] had a slide rule. And then we used Marchant calculators. There were two different sorts that we use principally, Marchant was a little bit better than the other ones. Marchant was more electric, where the other one you pulled the handle and everything went around and came out with the answer.

All three Computer women enjoyed the work. Diane related, “that’s the sort of brain I had, I like to work things out”. Likewise, Pat enjoyed complex maths problems and would always volunteer for extra work if it became available.
Having recently seen the film, *Hidden Figures*, Diane realised the significance of her work and reflected:

> It was really interesting, because we were all the same age. And it’s funny how all their Computers were also all women! They always say Maths and Physics is a boy thing, and yet looking at that film, and what we did, it’s all girls who are doing it.

Until she saw the movie, Diane had not considered herself a mathematician, but now, having seen “them talking about being mathematician; that makes us feel really important.” In his official Woomera history, Morton (1989) cryptically states, “a male computer was inconceivable” (p. 376) leaving the reader to wonder why it was “inconceivable” as he gives the matter no further attention.

In 1960, when machine computing was well established at Salisbury, Diane and her co-workers were taken to the facility to see, “all these rooms with these huge computers [that] eventually wiped our jobs out”.

**Leisure activities**

Like most people in Woomera, Diane and Pat both enjoyed the leisure activities, Diane played netball, softball and tennis. Pat was also a skilled member of the Woomera Pistol Club.

**Significance of their work**

Asked if her husband was intimidated by Diane having such a technical job, Diane commented, much like other women interviewed, “He probably didn’t think it was incredible, it was just what I did.” Pat said, “I was just part of a cog, there were others doing [the Computer work] with me.”

**Why women?**

Pat believes women were cheaper to employ than men and this was the main reason all the Computers were women. She also thinks women tended to be employed in these roles because they offered little career progression and men would be unlikely to take on jobs in a dead-end role. This lack of career progression was accepted by women because the prevailing “marriage bar” meant that on marriage women working
at Salisbury in a government role, such as with WRE, would be obligated to resign on marriage. At Woomera the situation was different and public services regulations were overlooked; my research has shown that married women did work on the cameras.

Safety at work

As noted in Chapter Five, there has been very little written of the accidents that did occur on the range. There seems to have been more “near misses” than actual disasters. Pat has a clear memory of one incident that could have caused loss of life during the testing of Sea Slug, a rocket known for its unpredictability:

This camera operator lived with her parents, it may have been Maxine Grundy. Her father was part of the Recovery Team. It might have been Sea Slug […] anyway, it did something that it wasn’t supposed to do, and they knew where it was headed for, and it was headed straight for Camera 5. And of course, her dad was pretty uptight about the whole thing. Anyway, she locked onto it from the instant it came off the launch pad, and she followed it all the way, without knowing where it was in the outside world. And it hit the ground just in front of her camera. Of course, dad in the truck, headed straight out, ’cause they were dead scared, ’cause they couldn’t raise her on the radio – and they were dead scared that it had actually hit the camera post. And when they get there, she was sitting there with a great bit grin on her face, and said, “Wasn’t it wonderful!”

Fears of atomic weapons and a Third World War

Pat’s husband worked for a short period at Maralinga in a role associated with radar and was there when bombs were dropped. He later died from cancer. Like most of the women interviewed, Pat was a very young woman when the atomic weapons were tested and did not feel a real sense of fear, partly due to the prevalent government propaganda:

It was all sort of supposedly all this wonderful stuff, and were we going to get our own atomic bomb, and all the rest of it. But you know, the newspapers and the politicians all made it so positive, it was a good thing for progress, and it was perfectly safe. They didn’t clear out all the Aboriginals that were there, and they certainly didn’t stop them from going back afterwards. They didn’t. And I’m damned sure that they knew. And they saw what happened to Marie Curie and her husband [from radiation]. And the Australian Government, Menzies thought that Britain was the place. They’d kowtow, “Yes Sir, no Sir, three bags full Sir.”
Diane also commented: “I don’t think [the concept of a Third World War] would have entered our heads. Yes, we were born in the Second World War, but it never entered my head, anyway.”

At the time Diane had no awareness that her work related to the testing of weapons of mass destruction, “We knew that they wanted to make sure that the cameras got the correct trajectory, or got the rocket being fired; we had no idea what the rockets were for, mind you”.

**Communism**

Pat tells an amusing story about the Communist Party of Australia (CPA) winning an election in Woomera c.1956, that suggests the fear of the “red menace” was not a serious threat to Woomerites:

They were having a Commonwealth election at some stage, and Woomera was a big area, politicians didn’t come and talk to people because it was behind closed doors, and whatever the electorate was, there was only two people standing. One was actually a Communist. Nobody knew either of them. Woomera voted 75% Communist, because they knew the other one was Liberal, and they didn’t want to vote for a Liberal!

**Enjoyment of Woomera:**

Pat and Diane both enjoyed living in Woomera. Pat comments on this and also her enjoyment of the pistol club to which both she and her husband belonged:

I liked the weather, the people were friendly, there were things to do, and look you either hated it or you loved it. My three sons were born there. We had a number of friends that we would go to each other’s homes for dinner, and we’d play cards together, and both Dave and I were members of the pistol shooting club. Towards the end, some of the girls got a bit upset. They wouldn’t see me for months, because I would be pregnant, and I would roll up and “bang, bang, bang,” take out the prize, and disappear again!

Pat still misses the lifestyle today.
The following section relates the oral history of Carolyn Harding, working some ten years after Diane and Pat.

**Carolyn Harding: sole Australian woman on the data analysis team on the ELDO Blue Streak Program**

Carolyn Harding shared her story with me through a series of email exchanges between August 2018 and February 2020. Carolyn Harding (née Bulling) was encouraged by her parents to pursue any career she wished. While her father urged her to follow her goals, he was still a man of his time, preferring that his daughter wear dresses and not trousers. Carolyn was employed as a Computing Assistant (Computer) at Salisbury for three years from 1964, and enjoyed her work immensely. There were no Australian women working on the Blue Streak program, but Carolyn broke the previous trend when she was offered a role with the Australian Division of the British Hawker de Havilland Company on 3 October 1967. She was to replace a British woman who had worked in the role and no longer wanted to continue in it.

Carolyn is one of the few women interviewed who realised that her work, “was pretty unique”. However, of all the women interviewed she is the only one to have been working in an otherwise totally male work environment. For her own family history, she has written an interesting and eloquent account of her work history and with her permission I quote extensively from it, as her words tell her story far better than mine. She kept records that reveal her starting pay ($49 a week in 1967) and references that attest to her ability to work unsupervised. She had met her husband, Trevor Harding, in 1966. He had moved to Woomera in 1952 as a four year old with his family and completed his schooling there. His father worked as a motor mechanic and his work included servicing the vehicles used by famous Woomera surveyor, Len Beadell. Trevor was working in a clerical role at the Technical area at Woomera when the couple met and later moved into a similar role with Spacetrack, the first contractor to operate Island Lagoon Space tracking station located not far from the weapons-testing range at Woomera.

Carolyn was awarded her leaving certificate in 1966 and had hoped to attend Adelaide University and study Pharmacy. In this era, students needed to become apprenticed to a pharmacist and it was very difficult for women to secure places.
Carolyn was unable to secure an apprenticeship and then returned to Concordia College to study for Leaving Honours in order to become a teacher. She recollects:

In the May school holidays that year, I saw an advertisement in the Adelaide News newspaper for an “Assistant (F) Computing Grade 1” at the Weapons Research Establishment at Salisbury. The job description included “mathematical computations pertaining to aerodynamic research and missile trials”, and applicants needed Leaving level Maths and Physics. Yes, that sounded like something I would be interested in! I applied and was called in for an interview.

She landed the job and spent a little over three years with the WRE at Salisbury, making friends who have endured to this day and “lov[ing] the work as soon as I started”. She worked with five other young women and describes the work environment and the technology of the era:

The Computers at Aerodynamics Division were housed in a small stand-alone brick building, with a darkroom – one of many old buildings from the days of World War II when the area was the Penfield Munitions Factory. When I started, there were five other girls, with a supervising older girl, who worked in a glassed-in office. We each had a Marchant calculating machine on our desk, and at that time, two of the more senior girls had just upgraded to machines that performed automatic square root calculations by the press of a button – something we other girls were very envious of. It was a couple of years before the first electronic calculator arrived, and it took up about half of the desk, and had a tiny four-row, twelve-character display. We were given mathematical equations that we had to compute with a list of variables for things like rocket and bomb trajectories. Because of the way the Marchants worked, we had to break the equations down into columns of individual calculations – the most columns I ever had on one joined sheet of paper was 57! Calculations had to be reduced to columns of data, as the Marchant machines didn’t retain information in memory like modern day calculators. Working in columns also made it easier for the other Computers who needed to check calculations. When one of the Computers finished an equation, her calculations were given to a second Computer to check.
The women also checked the calculations of the IBM computer recently installed at the WRE, as it was not trusted to be error-free. This same situation is depicted in the *Hidden Figures* movie (2016) where the heroine’s manual computations are considered more reliable than those of a machine. Carolyn says, “no one really trusted the IBM in these early days, the results needed to be proven”. She later clarified this to explain it was more the programmers, so new to the work who were not trusted: “I’m not sure if they didn’t trust the computer or didn’t trust the programming. Most of the engineers were learning Fortran programming and writing programs to calculate trajectories etc.”

Carolyn’s memories are particularly helpful as she describes other roles the women performed at this time which have not been described elsewhere in the literature:

As well as drawing graphs, we read films, measured the density of gases released from upper atmospheric sounding rockets, and analysed punched tape records. We calculated all sorts of things from Skylark, Jabiru, HAD and HAT rocket trajectories to different shaped nose cones from models trialed in the Wind Tunnel, to trajectories for various bomb types, including retarded and cluster bombs […] it was never boring.

During this time at Salisbury, Carolyn was able to visit Woomera on “a range familiarisation visit”. Prior to the visit, the young women were cautioned to be careful of “predatory males” and stayed in the women’s hostel, dubbed, “the crumpet farm”. Carolyn explains:

A group of young male clerks from Tech Area seemed to have access to the aircraft arrival passenger lists, and were often waiting at the check-in desk at ELDO (also check-in for the single women’s accommodation), to try and chat up any new young women. Older males, some I met later from the Stage 1 team, hung around the bars in ELDO trying to chat up women too.

In 1966 she attended a WRE induction course, a photo of which is reproduced in *Figure A2i*. Attending the same course was the man she would later marry, Trevor Harding.
20-year-old Carolyn Bulling was asked to apply for a role working on the ELDO project on the launch site at Woomera. Initially her father was opposed to her accepting the role, which he considered to offer little job security. On his advice she sought the opinion of a family friend, Dr Bob Roper, who was an astro-physicist. She consulted with Dr Roper, and recounts: “He told me he thought it was an amazing opportunity for me to be there right at the launch site, and that I should not hesitate in applying [and] that convinced Dad.”

She applied and was offered a role as a Data Analyst with Hawker de Havilland on 3 October 1967, working on the Blue Streak first stage of the ELDO rocket. She reported to two male engineers. She “needed to learn fast” and “just loved it”. Between trials she worked at Salisbury and flew backwards and forwards to Woomera as required.

She was well paid, and this enabled her to buy quality clothes. She describes what she wore to work. This information is not available in the extant literature and is the sort of detail that oral history testimonies provide so well:
I dressed well, as I was earning good money. Fletcher Jones skirts, twin sets, designer jeans, jackets etc. I wasn’t issued any safety clothing apart from a helmet that I wore if I went up on the gantry, and a white lab coat that I wore rarely.

She comments on being a part of the British Hawker de Havilland team: “I enjoyed being the only woman on the technical side in the British team. I think I was treated better than the couple of secretaries (also Australian) who did typing and photocopying.” She describes a dramatic launch day when her skills were urgently needed:

We went out to the launcher late the night before to read records and do calculations as part of the thousands of events happening as the Blue Streak was fuelled up and launch preparations carried out. It was a very busy time, and during the countdown, when it came time for non-essential staff to withdraw from the blockhouse to the Preparation Area some kilometres away, my predecessor and I jumped into a car with some French men from the Coralie team, and headed off to the Prep Area, where we climbed onto the roof of the building to watch the launch. The countdown continued over the loudspeakers, final fuelling was completed, the launcher evacuated, and Blue Streak fired up with a mighty roar that we could hear and see kilometres away. Then nothing happened, stop was called, and the engines shut down. People were calling out for us, and we needed to race back to the control room. The jaws of the launcher hadn’t opened, and they needed to know why. We were the ones who could give the information that would help them find what the problem was. Because the engines had started, it was considered to be a static firing, so we had to do all the calculating the same as for a real launch. Apparently, we should never had left the control room building, but, being new, I had no idea. Late into the day, the Engineers and us Computers remained on site to assess and collate data ready to for it to be sent on the afternoon aircraft from Woomera in time to catch the Monarch Airlines courier plane from Adelaide to the UK. F6/2 launched the next morning, with the Blue Streak reliable as usual, and our data assessment and collation happened all over again.

This evocative first-hand account of a female working on a launch site does not exist anywhere in the literature and is an important addition to the historical record. Figure A2ii shows the team of some ninety people who worked on the Blue Streak program, among whom Carolyn was the only woman in a professional role.
Carolyn remained in this role until the ELDO Blue Streak program came to a close and relocated to French Guinea. She reflected on her work, “I was only in my twenties, but had full confidence in my ability to calculate what was required.” She also describes how her calculations were derived prior to the era of digital computing:

The Marchant calculator, Logarithmic tables and Gerber Variable Scale were my constant companions as I performed all my mathematical calculations. All records were still analogue, and nothing was digital until during F9, the final ELDO launch from Woomera, in June 1970, when a digital event recorder was used for the first time. This recorder clicked a switch, and printed on a paper roll when events happened, like a valve opening, a fuel level being reached, or a temperature achieved etc. This launch I had the extra tasks of interpreting the analogue records to cross check with this new digital recorder. It proved to work well.

But the arrival of this technology was too late to make the work easier for Carolyn Harding, who was indeed Australia’s sole equivalent of the women – Mary Jackson, Katherine Johnson and Dorothy Vaughan – immortalised in Shetterly’s book (2016) and the Hollywood film (Melfi, 2016). The telling of her story is long overdue.
After the end of the ELDO program at Woomera, from 16 November 1970 to 26 January 1971, Carolyn worked as a Missile Range Assistant since camera operators were by then classified. As this era is beyond the date range of the dissertation focus this work will not be described in detail. Carolyn married Trevor Harding, had her first child in 1972 and the family moved to Adelaide in 1973, following the closure of the Island Lagoon Tracking Station at which Trevor worked.

Carolyn now reflects, “my interest in computations and computing have always remained with me”.

This appendix to the main case studies highlights that there was another group of women who played significant roles in the weapons and rocket-testing program at Woomera, Salisbury and Penfield. These women’s complex mathematical work was an intrinsic part of Australian scientific progress during the Cold War and, in terms of the work done by Carolyn Harding, made a significant contribution to the British component of the ELDO program.

Endnotes

1 After deciding that the remote Woomera site was not ideal for a deep space tracking station, an alternative site was found not far from the National Capital. The Tidbinbilla valley, 35km south-west of Canberra, was chosen due to its close proximity to a growing city, with the surrounding ridges helping to shield it from unwanted radio interference (Canberra deep space communication complex history. (n.d.). Deep space network [Website]. Retrieved from https://www.cdscc.nasa.gov/Pages/cdscc_history.html)
Appendix 3  Kinetheodolite Manual

This Appendix is an extract from the Department of Supply, Australian Defence Scientific Service, Weapons Research Establishment, Manual WRE 166 (Issue 2): Askania Kinetheodolite K.T. 52.

It is included as an appendix so that readers are able to appreciate the complexity of just one of the cameras operated by women on the Woomera rocket range. This manual was issued on 25 May 1967. I was provided with a copy of the manual by the DSTG records department in early 2017.

The entire manual consists of 150 pages and so it was not practical to include it in full here. Included here are sections 2 and 3. Section 2 relates to Handling and Installation and Section 3 to Operating Instructions.

The other sections (not reproduced here) are Section 1: General Description, Section 4: Technical Description, Section 5: Maintenance and Section 6: Parts List.
### Section 2

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2.1 Handling Procedure

The Kine theodolite is a delicate, precise measuring, optical instrument and should be handled with care at all times. During transportation or periods of storage the instrument should be stowed in the special transit case provided.

2.1.1 Transportation

When transported by road, the transit case, figure 2-1, should be carried on an effective shock absorbing base and the instrument should be kept as dust-free as possible.

2.1.2 Packaging

Store the Kine theodolite in its transit case in the following manner:

1. Fit protective covers to the main telescope, sighting telescope and eyepieces.
2. Elevate the main telescope to 90 degrees and lock in position.
3. Rotate the instrument in azimuth until the rough scale reference pointer is directly over the levelling screw located between an end pair of lifting handles. Lock in this position.
4. Raise the carrying handles into the lifting position and place the instrument in the transit case.

NOTE: Four people are required to lift this instrument, both for the safety of the instrument, and for the safety of the persons so employed.
5. Secure the levelling base to the bottom of the transit case with the two clamps provided.
6. Fit and secure the safety bars to the transit case.
7. Cover the Kine theodolite with the fabric cover.
8. Fit the transit case lid and secure with the toggle clamps.
9. After packing, the transit case must bear the following label, "DELICATE INSTRUMENT - HANDLE WITH CARE".

2.1.3 Storage

For storage purposes the Kine theodolite should be packed in its transit case and stored in a cool, dry, dust-free atmosphere.
2.2 Installation

The installation procedure is divided into three main parts:

(1) Installing the Instrument.
(2) Installation Checks.
(3) Setting-up and taking a test film.

2.2.1 Installing the Instrument

This consists of unpacking the kinetheodolite, placing it in position and connecting services. Two views of an installed instrument are shown in Figure 2-2.

(1) Remove the askania from its transit case by reversing the packaging instructions in paragraph 2.1.1.

(2) Lift the instrument and carefully place it on the stand ensuring that the levelling foot screws are correctly in the Vee blocks. Slide the clamping bars over the feet of the levelling screws and tighten the wing nuts.

(3) Connect the control box to the camera. Connect the D.C. supply cable and the electronic services cable to the control box and connect the high tension leads to the flashing lamp holders.

(4) Check that the required external services are available.

2.2.2 Installation Checks

The installation checks set out below have been extracted from the acceptance schedule. Where an instrument has undergone normal acceptance testing just prior to installation the full schedule is not required. The amount of testing will depend on the recent history of the particular kinetheodolite and should be determined by the officer in charge of the installation.

(3) Mounting, Main Body and Levelling Checks

(1) Check that the instrument is correctly mounted and secure upon its stand.

(2) Check that both spirit levels are fitted to the base of the main body and that they are not damaged.

(3) Release the elevation drive lock control and move the main objective through the full 90° elevation checking smoothness of motion. Check also that elevation locking levers...
For 0° and 90° positions operate correctly.

(4) Engage the elevation drive locking control and move the main objective through the full 90° of elevation using the cranking hand-wheel. Check smoothness of tracking.

(5) With the main objective at 90° elevation use the handwheel to rotate the instrument through a full 360° in azimuth checking smoothness of tracking throughout.

(b) Main Telescope Checks

(1) Check that the lens is clean and not damaged.

(2) Check that the lens aperture control is operative through the full range of stops.

(3) Check that the screws securing the lens flange to the adaptor ring are tight and sealed.

(4) Check that the focus adjusting nuts and locking rings are tight and sealed.

(5) Check that the lens filter ring is fitted with the following:

(i) One 2X Yellow Filter.
(ii) One 4X Orange Filter.
(iii) One Clear Glass.
(iv) One Tilting Lens.

Check also that the indicator reads correctly for each of the above selected.

(e) Ensure that the lens shield is fitted and correctly secured.

(c) Camera Body and Mechanism Checks

(1) Connect the control cable between the rack and the control box ensuring that the cable, plugs and sockets are in good condition.

(2) Check the operation of film break buzzer by depressing the buzzer arm; the buzzer should operate when the arm is released.

(3) Check operation of the film pile-up buzzer by deflecting the buzzer arm situated to the left of the film take-up sprocket; the buzzer should operate when the arm is deflected.

(4) Select the main graticule fogging switch to ON and check that the fogging lamp is operating correctly.

(d) Scale Checks

(1) Observe the angle scales through the reading microscopes and check the following throughout the ranges 0-360° azimuth and 0-180° elevation.

(i) Focus of scale readings.
(ii) Focus of micrometer.
(iii) Cleanliness of scales.
(iv) Parallelism of circle sub-divisions with micrometer divisions.
(v) Magnification of circle sub-divisions relative to micrometer. The error should not exceed 1/4 of one micrometer division at any point.

e) Functional Check

(1) Load camera with 100 ft. of film (can be exposed stock) switch on the camera and run off the 100 ft. Check film take-up tension. The tension should be such that the film core can be removed without difficulty.

£) Accuracy Checks

(1) Foot-Screw Back-Lash

With the aid of a spring balance apply a tangential force in a horizontal direction to one of the lifting handles. The moment should be 10 lbs. ft. about the centre of the theodolite. While this force prevails bisect a suitable beacon and record the bearing. Repeat this with the moment applied in the opposite direction.

The difference in the two bearing angles should not exceed 0.005°.

(2) Levelling Error

Release the azimuth drive lock control and slowly rotate the instrument checking level bubbles at equal increments of 90° through the full 360° rotation. The cone swept out by the vertical axis as indicated by the levelling bubbles should have a total included angle not greater than 10 secs. of arc.

(3) Horizontal Collimation

Bisect a beacon with the main graticule and record the bearing (θ1) and elevation (φ1) values. Repeat in the reverse face position to record the respective values θ2 and φ2.
Calculate the error in horizontal collimation according to:

\[ E_h = \frac{1}{2}(180 - (\beta_2 - \beta_1)) \]

Now with the theodolite bisecting the original beacon on normal face, re-orientate the horizontal circle so that it is reading diametrically opposite to the previous normal face position. Record the precise bearing angle \( \beta_4 \). Repeat in the reverse face position and record the value \( \beta_3 \).

Calculate the error of horizontal collimation:

\[ E_c = \frac{1}{2}(180 - (\beta_4 - \beta_3)) \]

The true error of horizontal collimation will be the average between the two readings obtained by the above procedure.

NOTE: The purpose of re-orientating the circle is to reduce the effect of possible circle eccentricity.

The whole of the above procedure may be repeated three times or each observation should be made three times to obtain a more reliable result. Record the results and calculate the average.

(4) Vertical Circle Index Error

NOTE: It is important that there should be no disturbance to the levelling of the instrument between the readings used in the following calculation and that the readings \( \beta_2 \) and \( \beta_3 \) should be taken with the least possible time lapse between them in order to reduce the effect of atmospheric refraction. For similar reasons the observations should be at a time of day when the atmosphere is most stable.

Calculate the vertical circle index error according to:

\[ E_i = \frac{1}{2}(\beta_2 - \beta_3 - 180) \]

Repeat the observations three times and record the three values obtained for \( E_i \). Calculate the average.

(5) Bisect a beacon with the left hand stadia line on the graticule plate as seen from behind the instrument on normal face. Record the precise bearing angle \( \beta_1 \). Bisect the same beacon with the vertical centre line and the right hand stadia line and record the respective bearing angles \( \beta_c \) and \( \beta_r \).

(g) Tracking Telescope Checks.

(1) Dioptre Adjustment.

(2) Cleanliness of Optics.
(3) Night Illumination.

(4) Alignment should be checked with both graticule positions and each filter in position. The tolerance of $0.01^\circ$ may be in either or both planes. True alignment of tracking telescopes requires the axes to be parallel.

2.2.3 Setting Up and Taking a Test Film

The complete setting up procedure is given in Section 3, paragraph 3.3. Those parts of the procedure which have been covered when checking through the acceptance schedule extracts of paragraph 2.2.2 need not be repeated.

A proving test film is required for assessment after the instrument has been set up. The method of taking a photographic record is set out in Section 3, paragraph 3.4.
1. Protective brackets
2. Contents list
3. Canvas cover
4. Toggle clamps
5. Safety bars
6. Carrying handles

FIGURE 2-1. TRANSIT CASE
1. Camera cover locking lever
2. Elevation locking lever
3. Elevation flashlamp
4. Camera identification plate
5. Elevating handwheel
6. Voltmeter
7. Relay indicator
8. Theodolite plug
9. Battery Plug
10. Tracking binoculars
11. Tracking handle
12. Camera lid
13. Elevation release lever
14. Azimuth release knob
15. Scale setting knob cover
16. Single shot button
17. Control box master switch
18. Control plug

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19. Mechanism cover
20. Azimuth lamp viewing window
21. Azimuth handwheel
22. Azimuth flashlamp
23. Levelling focussing screw
24. Lifting handles
25. Pedestal
26. Control box
27. Main telescope (60 cm)
28. Aperture setting ring
29. Sightline telescope
30. Telescope filter knob
31. Telescope headrest
32. Microscope eyepiece
33. Elevation lamp viewing window
34. Main selector switch
35. Levelling base ring
36. Pedestal locking lever

## Section 3

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Operating Instructions

The operating procedure for the use of an Askania Kinetheodolite Post on trials at Weemera is detailed in the Range Standard Practice RSP/G1. The methods to be used in the various phases of the operation of an Askania NT2 are set out below.

2.1 Cleaning the Theodolite

The cleaning materials listed below should be kept in dust-proof containers when not in use.

1. A dental chip blower (plastic nozzle)
2. A No. 12 Sable Brush.
3. A 1 in. paint brush.
4. Kleenex tissues.
5. A soft clean cloth (solvyn).

3.1.1 Cleaning the Optical Surface

Using the hand blower remove as much loose dirt as possible. Lightly brush the optical surfaces with the sable brush taking care that the metal ferrule does not come in contact with the glass.

NOTE: It is advisable to cover the ferrule with plastic sleeving.

Take a fresh tissue and gently clean the glass surface. Do not use a scubbing motion. Wipe gently and discard tissue frequently. Do not continue to use a tissue contaminated with grit or grease. Blow off any fluff remaining after use of the tissues with the dental chip blower.

When an optical surface does not respond to this treatment the officer in charge should be informed.

3.1.2 Cleaning the Camera Housing

Brush dust and other foreign matter from the camera housing with the 1 in. soft bristle brush. Check that loose bristles are also removed.

Leave the pressure plate in position when cleaning out the camera housing to avoid damage to the graticule glass.

3.1.3 Cleaning the Camera Body

A soft rag slightly dampened with water may be used to clean the external paint work.
3.2 Testing Equipment Servicability

3.2.1 The D.C. Supply

1. Ensure that the 12V d.c. supply is connected to the control box and is switched on.

2. Switch on the master switch on the control box and check that the meter indicates 12.0V to 13.5V.

3. Set the main selector switch to OPERATION and check that the reading does not drop below 12V on load.

3.2.2 The Camera Motor

With the camera switched on as in paragraph 3.2.1 check that the motor runs freely. It should not draw more than 4 amps.

3.2.3 The Counter Illumination

View the counter discs through the inspection window and check that they are illuminated.

3.2.4 The Scale Circle Illumination

Press the cylindrical pushbuttons adjacent to the scale reading microscopes and check the horizontal and vertical circle illumination.

3.2.5 The Night Illumination Systems

1. Place the contact bar, situated on the L.H. inside wall of the film chamber, across the position C.R., see Figure 3-1.

2. Check that the graticule fogging lamps are on by looking down the main telescope towards the shutter.

3. Place the protective covers over the front of the tracking telescopes. Exclude as much of the extraneous light around the eyepiece as possible and check that the graticules are illuminated. Disconnect the contact bar and replace in the neutral position C.A.

3.2.6 The Warning Buzzer

1. Check that the film break buzzer noise stops when the metal arm on the left of the focal plane is depressed.

2. With the buzzer arm held down, push the buckle plate - situated alongside the take-up sprocket - sideways. The film pile up warning should operate.

ORIGINAL
(3) Select the titling lens on the rotating filter disc. Depress the film break buzzer cam and check that the buzzer sounds. De-select the titling lens after this check.

3.2.7 The Flash Lamps

(1) Connect the H.T. leads to the flash lamp holders and switch on the flash pulses.

(2) Remove the film pressure plate and observe that the lights flash regularly in both scale frames.

3.2.8 The Mechanism

(1) Ensure that the film pressure plate is in position.

(2) Switch on the shutter pulse unit and check that pulses are being supplied.

(3) Switch on the master switch on the control box.

(4) Set the main selector switch of the Amsahia to COUNTER.

(5) Switch on the operator’s pulse control switch and check that the counter, and only the counter, operates.

(6) Reset the main selector switch to OPERATION and check that the mechanism cycles regularly.

3.3 Setting Up

After checking serviceability, the Kinetheodolite can be set up. This must be done in such a manner that initial adjustments are not upset by those carried out subsequently.

3.3.1 Levelling

Before commencing levelling check that the camera lids and balance weights are in position on the instrument. Elevate the camera to 90 degrees and note the following points:-

(1) One bubble must be used throughout the procedure.

(2) The levelling screws should be turned in opposite directions: both thumbs travelling either inwards or outwards. The bubble will follow the direction of motion of the left thumb.

(3) Time should be allowed for the bubble to settle.

(4) Direct sunlight should not be allowed to fall on the bubble.

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3-4

The levelling procedure set out below refers to figure 3-2.

Position 1 (a) Bring one bubble parallel to the line through the two footscrews A and B.

(b) Note the bubble position.

Position 2 (c) Swing the instrument through 180 degrees and note the bubble displacement.

(d) If the bubble reading is the same as that of Position 1, go to Position 3. If not, take up half the difference by adjusting the footscrews A and B. Swing the instrument back to Position 1 and note whether the bubble position agrees with the adjusted reading of Position 2. If it does, go to Position 3. If not, repeat the procedure until the bubble gives a constant reading in Positions 1 and 2.

Position 3 (e) Swing the instrument through 90 degrees. The bubble should now be perpendicular to A and B. Footscrew C only, must be used for adjustment in Positions 3 and 4.

(f) Adjust the bubble using C until the reading agrees with that found for Positions 1 and 2.

Position 4 (g) Swing the camera 180 degrees to Position 4. The bubble should agree with Position 3. If the bubble is only slightly out from the Position 3 reading, the difference is halved using screw C and the instrument swung back to Position 3. The bubble position should remain the same as for Position 4. If not, or if the bubble is more than slightly out at Position 4 to begin with, the correct "false zero" has not been achieved and the instrument must be re-levelled from Position 1.

(h) Finally check that the bubble reading remains constant or does not deviate by more than half of one division in Positions 1, 3, 2 and 4.

3.3.2 Collimation

This check would not normally be required each time the Askania is set up. For static posts a monthly check on collimation should be sufficient.

The instrument must be accurately levelled before checking collimation and the checks should be completed as quickly as possible to minimise atmospheric effects.

ORIGINAL
Switch the Kinetheodolite on, remove the film pressure plate and pulse once to open the shutter. Set the main selector switch on ILLUMINATION and insert the ground glass screen.

(1) Horizontal Circle Collimation

(a) Set the camera on normal face, (i.e.,) with the film chamber upwards, and direct the main telescope at a suitable reference beacon.

(b) Bisect the beacon with the focal plane graticule and note the azimuth scale reading $\theta_1$.
   
   NOTE: The small zero sub-script on the azimuth scale indicates the 180 degrees must be added to the reading. E.g. $32_0 = 32 + 180 = 212^\circ$.

(c) Set the instrument on reverse face, re-align on the beacon and note the reading $\theta_2$.

(d) The error is given by: $E_C = \frac{1}{2}(180 - (\theta_2 - \theta_1))$

(e) Repeat the above procedure twice and average the three readings to obtain the average error.

(f) With the camera on normal face again bisect the beacon, re-orient the circle so that it reads $\theta_1 + 180$ degrees.
   
   NOTE: Scale re-orientation reduces the effects of circle eccentricity.

(g) Note the reading $\theta_3$, reverse face, and record $\theta_3$.

(h) Again the error is given by $E_C = \frac{1}{2}(180 - (\theta_3 - \theta_2))$.

(i) Repeat this procedure twice and average the three readings to get the average error.

(j) The true error of horizontal collimation will be the mean of the average errors for the two scale positions. If the numerical value of this error exceeds .0025 degree the scale must be adjusted.

(k) The correction to be applied to the normal face reading is equal in magnitude by opposite in sign to the error. E.g. If the mean error is -0.01 degree, the correction to the normal face reading is +0.01 degree.

(l) With the camera on normal face roughly align the telescope on the beacon. View the azimuth scale image and using the traversing handwheel accurately set the theodolite on the corrected reading.

ORIGINAL
(5) Move the reference graticule back to centre by removing the protective covers and manipulating the adjusting screws shown in figure 3-3. Alternately tighten one screw and tighten the opposing one until the beacon is again bisected.

(6) Repeat the series of checks until satisfied that the error is within the specified tolerance.

(7) Vertical Circle Index Error

(a) Set the camera on normal face, bisect the beacon and note the elevation reading $\theta_1$.

(b) Reverse face, re-align and note $\theta_2$.

(c) Calculate the vertical circle index error by $E_1 = \frac{1}{2}(\theta_1 - \theta_2) - 180$

(8) Repeat the procedure twice and average the three readings to get the average error.

(9) The correction is again equal to the error but has the opposite sign and in this case is applied to the vertical circle optical micrometer.

(f) Remove the circular cover plate fitted to the main body adjacent to the vertical circle scale reading microscope.

(g) Insert a thin bladed screwdriver into the head of the micrometer adjusting screw. View the image in the scale reading microscope and turn the screw until the corrected reading is set.

(h) Repeat the checks until satisfied that the error is less than $\pm 0.0025$ degree.

3.3.3 Orienting the Azimuth Scale

The reference direction at Nooners is the Range Centre Line.

(1) Point the main telescope at the "known" marker and bisect the beacon with the focal plane graticule.

(2) Open the hinged cover of the azimuth scale orientation knob. Push the control knob inwards to engage the turning gear and rotate the scale until the required reading is set.

3.3.4 Checking Telescope Alignment

True alignment of the tracking telescopes requires the axes to be
parallel with the line of collimation. The alignment of both
graticules of each telescope should be checked. A tolerance of
1.01 degree is allowed in either or both planes.

(1) Where sight alignment targets have been provided the method
is as follows:-

(a) Align the main telescope on the centre cross of the target.

(b) Check that the graticules of each telescope are centred
on their respective crosses.

(2) If sight alignment targets are not available use the following
procedure:-

(a) Choose a reference object at further than 2500 yards from
the instrument and centre the main graticule.

(b) Check the graticule alignment with the centre of the
reference object.

(3) If misalignment exceeds the specified tolerance the method of
adjustment is as follows:-

(a) Loosen the locking ring and insert the lens keys into
the notches of the eccentric rings of the objective mount.

(b) Rotate the keys in opposite directions until the reference
point is centred at the telescope graticule.

(c) Check that the main telescope alignment has not been
disturbed by the adjustment and tighten the locking ring.

3.3.5 Checking Synchronisation

Shutter operation and flash pulses are synchronised in the
following manner:-

(1) Switch on flash pulses.

(2) Switch on shutter pulses.

(3) Switch on the master switch on the control box.

(4) Set the main selector switch to OPERATION.

(5) Switch on the operator's pulse control switch.

(6) Rotate the fine control knob on the Synch Control Panel until
the neon indicator ceases to flash.

(7) Ask the R.T.C. operator for a synch check.
NOTE: Synchronization can also be checked using the flash lamp as a strobe light. To do this move the pressure plate, depress the spring pin, position a flash lamp in front of the main telescope and switch 'on' the camera. View the lamp through the focal plane and rotate the fine control knob of the Synch Control Panel until the complete illuminated horse-shoe of the lamp is seen with each throw of the shutter.

3.4 Taking a Photographic Record

Once the instrument is set up so that its adjustments are within the specified limits, it can be loaded with film and used to make a photographic record of some event.

3.4.1 Loading the Camera

Loading the camera consists of two separate operations. The first is the loading of the magazine and the second is inserting the feed and take-up magazines into the camera.

1. Loading the Magazine

The film stock required is 35mm double perforation film with the emulsion wound in. Lengths up to a maximum of 150 ft. can be used. The actual loading of the film into the magazine is done in a darkroom observing the film manufacturer’s recommendations.

(a) To open the magazine for loading, slide the peripheral catch anti-clockwise and lift the lid off.

(b) Place the unreelled film over the film core and pass about 6 in. of film through the mouth of the cassette as shown in figure 3-4.

(c) Ensure that the film core is correctly seated in the magazine and replace the lid.

(d) Secure the lid and clip the film leader under the leaf spring adjacent to the light trap.

(e) Identify the magazine with a label showing:

- Amount of Film loaded
- Type of Film loaded
- Date loaded

2. Inserting the Magazines into the Camera

The film path and magazine arrangement is shown in figure 3-5. The method of insertion and threading is as follows.
(e) Remove the camera cover.

(f) Take a feed magazine and pull out sufficient film to form a leader about 2 ft. long.

(g) Hold the magazine above the feed spindle so that the light trap is near the feed sprocket.

(h) Rotate the spindle so that the key lines up with the key way of the film core. Slide the magazine onto the spindle ensuring that the positioning lug on the side of the magazine locates correctly.

(i) Release the pressure rollers and feed the film around the feed sprocket, through the gate, around the take-up sprocket and into the take-up magazine. When tilting the pressure plate to pass the film across the focal plane, take care not to bend the plate rim.

(j) Form a loop as indicated on the base plate between the feed sprocket and the pressure plate.

(k) Check that the perforations are correctly located over the sprocket teeth and clip the pressure rollers back into place.

(l) Fit the end of the film into the take-up magazine and fasten it to the film core.

(m) Slide the core over the spindle and wind it anticlockwise to secure the end of the film and take up the slack.

(n) Replace the magazine lid and fasten the catches.

(o) Set the magazine retaining clips in position and replace the camera cover.

(p) Pulse the camera 6 to 12 times to clear the focal plane of exposed film.

3.4.2 Photographic Titling

Where photographic titling facilities are provided, the information is recorded as follows:

(1) Align the camera on the titling board using the pre-determined reference bearings.

(2) Set out on the title board the information indicated below.

(a) The post or camera identification.
(c) The serial number of the trial or test.

(c) The date.

(3) Select the tilting lens on the rotating filter disc, use an appropriate exposure setting and expose 8 to 12 frames. A warning buzzer should sound when the supplementary lens is in position.

(4) De-select the tilting lens and check that the buzzer noise ceases.

3.4.3 Exposure Control and Setting

In an Aekenl Kinetheodolite the exposure time is fixed at a nominal 1/150 sec., and the amount of light reaching the film is controlled by a suitable aperture-filter combination.

With a 50 cms lens attached, the effective exposure can be varied from a maximum of 1/150 sec. at f/4.5 to 1/150 sec. at f/45 in increments of 1 stop.

The 100 cms lens provides an exposure range from 1/150 sec. at f/6.3 to 1/150 sec. at f/25 in increments of 1 stop.

The exposure is set by:-

(1) Selecting the appropriate contrast filter on the rotary filter disc.

(4) Setting the aperture on the 60 cms lens or selecting the appropriate Neutral Density (N.D.) filter on the 100 cms lens.

3.4.4 Focus Control (Temp.)

The 100 cms lens is equipped with a thermometer on the barrel and a temperature compensation control at the centre of the object glass. The temperature indicated by the thermometer is set on the control knob to minimise focus shift resulting from expansion variation with temperature.

3.4.5 Photo Orientation

Orientation beacons are usually photographed at the beginning and end of each recording run to establish level end scale orientation for the record. Photo orientation should be carried out not more than half an hour before the actual recording run.

Check that shutter and flash pulses are being supplied and proceed as follows:-

(1) Set the camera on normal face, aim the instrument at each orientation beacon and expose 8 frames.

(2) Plunge the telescope and with the camera on reverse face again expose 8 frames on each beacon.
NOTE: Where centrally mounted binoculars are used for sighting only normal face orientation can be recorded.

3.4.6 Setting Frame Numbers

The counter box has no quick re-setting facility. To simplify checking between appropriate frames on different records of the same event, the frame numbers are set to the nearest hundred.

The method of doing this is as follows:-

1. Set the main selector switch to COUNTER.
2. Switch on the master switch on the control box.
3. Using 4Hz pulses, or the manual pulse control, set the frame numbers to the nearest hundred.
4. Switch off control box and reset main selector switch to OPERATION.

3.4.7 The Recording Run

The Kinetheodolite operation is controlled by pulses sent out from a central timing source. At each instrument the equipment switches are set to the 'armed' position and all the Askalas involved are triggered simultaneously by gated pulses from the central timing source.

Immediately prior to the recording run go through the following procedure:-

1. Check that the trailing leads are clear of obstructions and are unlikely to snag during tracking.
2. Check that the appropriate terminal control rack equipment switches are on.
3. Check that the d.c. supply is switched on.
4. Check that the main selector switch is set on OPERATION.
5. Check that both shutter and flashlight pulses have been cut.
6. Switch on the master switch on the control box.
7. Check the lens and filter settings.
8. Switch on the operator's pulse control switch and get into position to track the object.

After the tracking operation has been completed record the end orientation by following the procedure in paragraph 3.4.5.
3.4.3 Unloading the Record

Having produced a record, care must be taken to ensure that it arrives at its destination undamaged. Unload the record in the following manner:-

(1) Pulse on 12 frames to clear the focal plane of exposed film.

(2) Cut the film at the take-up sprocket, remove the magazine retaining clip, check that the lid is secure and lift the take-up magazine out of the film chamber.

(3) Can and label the film in the darkroom.

(4) Remove the feed magazine and adjust the film footage to correctly indicate the amount of unexposed film remaining.

3.5 Closing Down

The closing down procedure for an Askania Kineetheodolite is set out below:-

(1) Switch off the main selector switch.

(2) Switch off the control box master switch.

(3) Replace the main telescope and sighting telescope covers. Secure camera and mechanism covers.

(4) Elevate the camera to 90 degrees and lock into position.

(5) Engage the azimuth worm.

(6) Place the fabric cover over the instrument and tie it around the stand.

(7) Switch off the d.c. supply.

(8) Switch off all switches on the terminal equipment rack.

(9) Switch off the mains supply unless required for other purposes.
NOTE
CA. NORMAL
CB....NIGHT

FIGURE 3-1. NIGHT ILLUMINATION CONTACT BAR

FIGURE 3-1
ORIGINAL
For positions 1 and 2 use screws A and B

For positions 3 and 4 use screw C only

FIGURE 3-2. LEVELLING POSITION
1. Graticule adjusting screws
2. Protective covers

FIGURE 3-3. SHUTTER BOX
FIGURE 3-4. LOADING A MAGAZINE
1. Film, emulsion side
2. Feed magazine
3. Take-up magazine

FIGURE 3-5. FILM PATH AND MAGAZINE ARRANGEMENT
Appendix 4   Archival, Documentary and Family Films Viewed as Research for this Dissertation

Note: Films and other audio-visual material cited in the thesis are also listed under References.


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Series Registration. D1423. Original plans (negatives), single number series with
alpha prefix denoting discipline.
Series Registration. D172. Alphabetical index register for administrative files.
Series Registration. D174. Correspondence files.
Series Registration. D1768. Photographs, films, drawings and glass negatives
relating to Maralinga area.
Series Registration. D183. Subject index cards for correspondence files.
Series Registration. D2077. Correspondence files.
Series Registration. D2333. Subject/nominal index cards for correspondence files.
Series Registration. D246. Correspondence files.
Series Registration. D2490. Correspondence files (personnel and organisation).
Series Registration. D250. Correspondence files.
Series Registration. D3123. Staff personal files (Ammunition Factory).
Series Registration. D3124. Woomera industrial personal files.
Series Registration. D3126. Staff personnel files (including medical files).
Series Registration. D3715. Audio cassettes containing joint project
trials information.
Series Registration. D3716. Audio cassettes of interviews with defence
personnel, joint project history collection.
Series Registration. D3732. Volumes and folders of newspaper cuttings,
Woomera and Salisbury - UK/Australia Joint Project History Collection.
Series Registration. D3925. Index of contents of circulars, notices and memoranda.
Series Registration. D4960. Aerial film of Woomera and surrounding areas.
Series Registration. D4986. Apprentice training records.
Series Registration. D4994. Documentary Films.
Series Registration. D841. Industrial personnel history and leave cards.
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