ATOMIC SPIES IN SOUTHERN SKIES: Operation Crowflight–United States high altitude radiological sampling in Australia 1960-1966

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NAPSNET Special Report

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I. INTRODUCTION

Operation Crowflight has long been forgotten, but in the first half of the nineteen sixties it was the largest United States defence and intelligence project in Australia. Between 1960 and 1966 the United States Air Force employed advanced U-2, JB-57 and RB-57 aircraft in a high altitude radiological sampling missions over the ocean far south of Australia in what was part of a top secret effort to determine the size of the Soviet Union's nuclear arsenal. Drawing on a wide range of declassified documents, historian Philip Dorling sheds new light on this little known episode in Australian-American relations in the Cold War which has enduring significance as Australia and the United States again step up defence cooperation half a century later.

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II. Special Report by Philip Dorling

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A UFO over Tasmania

In May 1961 a Tasmanian Department of Agriculture inspector, John Young, reported an unidentified flying object to the Royal Australian Air Force (RAAF).

The RAAF's "report on aerial object observed" records that at 8.35 am on 25 May 1961 Young's children were playing in the garden of his house in Devonport, on Tasmania's northern coast, when they saw something in the sky over the sea. Alerted by the children Young turned a pair of binoculars towards what appeared to be a "definite object" flying high over Bass Strait. It was that was "silvery but not reflective" and "shaped like a thermometer or pencil without a point". Visibility was good, but no detail or structure was observable and there was no sound associated with the sighting. The object was moving in a straight line in a north-north-east direction and although its speed was described as "slow" it disappeared from view within a few minutes. Question 26 of the detailed reporting form completed by a RAAF investigator recorded "Location of any air traffic in the vicinity at the time of sighting". Typed there are the words: "U-2 aircraft over Great Lake at approximately 8.15 am traveling in a northerly direction, leaving a distinct vapour trail."[i]

Young's sighting was of no UFO. Just over a year earlier, in May 1960, the U-2 had acquired international fame and notoriety as a "spy plane" with the shooting down over the Soviet Union of a United States Central Intelligence Agency (CIA) U-2 piloted by Gary Powers. U-2s were associated with covert, high altitude reconnaissance. Why then was a U-2 flying over Tasmania, a location far removed from the flashpoints of the Cold War? The answer to this question only became available with the declassification of archival records relating to "Operation Crowflight", the largest United States Defence project in Australia in the first half of the 1960s. The story sheds new light on a forgotten episode in Australian-American relations in the Cold War and has enduring significance as Australia and the United States again step up defence cooperation half a century later.[2]

Krypton-85

On 4 July 1960, the United States Embassy in Canberra passed a diplomatic note to the Australian Department of Defence proposing the establishment of a new United States defence research project in Australia. Specifically, as part of a worldwide high altitude air-sampling program, there was "an urgent requirement … to acquire representative air samples between 40 and 45 degrees south latitude, using aircraft operating from a site preferably in the Melbourne area". The proposed flights would extend some 800 kilometres south of Melbourne, some 160 kilometres south of the southernmost point of Tasmania. The United States note explained that the proposed operations would contribute to the study of radioactive fall-out from atmospheric nuclear weapons tests: "the determination of radioactive material in the atmosphere, from which the rate of fall-out can be calculated, as well as the movement and mixture of air currents in the upper troposphere and the lower stratosphere". The northern hemisphere and equatorial portions of the program were being conducted from the continental United States or other US controlled sites.[3]

The Embassy advised that the United States Air Force (USAF) planned to take high altitude air samples simultaneously at various sites throughout the world during November 1960 and May 1961. Subsequently, if funds were available, it was hoped to conduct the sampling on a regular, semi-monthly basis. Seven unarmed USAF aircraft would be required for the proposed Australian-based sampling operation together with two search and rescue aircraft providing support. It was estimated that between 175 and 200 USAF officers and other ranks would be deployed to Australia during two 30-day operational periods. In order to be prepared for the November operational period, it was necessary to commence moving equipment from the United States to Australia by early August 1961 and an initial survey of potential sites and facilities was required as quickly as possible. The Embassy consequently sought Australian agreement for the proposed November and May operations and for the immediate entry of a USAF survey party of between 20 and 30 USAF personnel.[4]

The reasons for the urgency of the proposed operation were not spelt out in the United States Embassy's note. In 1958, the United States, the Soviet Union, and the United Kingdom had agreed to a temporary nuclear testing moratorium for both political and health reasons. Negotiations in Geneva on a permanent ban on nuclear tests were deadlocked but it was not yet clear that they had broken down irretrievably and that atmospheric nuclear testing would resume. Accompanying the Embassy's note, however, was a separate, secret memorandum which explained that while the proposed air sampling operation had fall-out and air movement calculations as a legitimate and serious unclassified purpose, this was in fact cover for another highly secret program.[5] Much of this memorandum remains classified five decades later. According to the Australian Department of Defence full declassification of the memorandum would reveal details of liaison and cooperation between Australia and the United States that are "of continuing sensitivity and remain properly classified". Furthermore, according to the Defence Department, the memorandum contains information communicated to Australia in strict confidence by the United States: "This information is still afforded security protection in the originating country. The US Government has asked that the information not be released to the public. The release of this information would therefore constitute a breach of confidence owed to the US Government".[6]

The limited sections of the memorandum that have been declassified do confirm, however, that the secret program related to the detection of nuclear activity. Specifically the memorandum expressed US appreciation for "Australian cooperation already being received on this subject with regard to the classified nuclear detonation detection project at Alice Springs" – a reference to the small USAF seismic monitoring facility that had been established in 1955 under the cover story of a "weather research station". The memorandum went on to observe that within appropriate security limitations, the United States would be guided by the Australian Government's views concerning any public

statements about the proposed air sampling operation. It was thought, however, that the basic element of a satisfactory public statement would be along the following lines: “The United States Air Force … is flying atmospheric sampling missions in support of United States Government studies on radioactivity in the atmosphere and fall-out, such studies to be published for world-wide use." However no reference would be made to the underlying classified purpose of the operation. [7]

Fortunately the classified purpose of the air sampling operation has been revealed by documents declassified by the US Department of State. These documents reveal:

The primary purpose for the air samples obtained from these flights is to compute the total amount of a rare gas given off in the process of producing plutonium, which is a prime element in the construction of nuclear weapons. By determining from samples of air taken at various latitudes the total amount of this gas in the atmosphere and subtracting the amount of the gas released by the production of the US and its allies, a reasonably accurate estimate of [the] amount produced by the Soviets can be made.[8]

The rare gas was krypton-85, an isotope only present in significant quantities in the atmosphere after the beginning of plutonium production in the United States in 1944.[9]

Sampling of rare gases to detect nuclear activities was not new. The idea had indeed first been raised by Manhattan Project physicist Luis Alvarez who in late 1943 concluded that one telltale sign of plutonium production would be the emission of xenon-133, a radioactive gas produced by fission in a nuclear reactor. With a half-life of five and a half days, xenon-133 would linger long enough in the atmosphere to be picked up by aircraft with specially designed air filters. Subsequently, in mid-1944, the USAF carried out a series of low-level reconnaissance flights in an effort to detect any German nuclear activity. The results were always negative. Nazi Germany had developed no plutonium production reactors. This was, however, the first attempt by the United States to use radiological methods to monitor the activities of a foreign power.[10]

The early detection of Soviet nuclear activity and especially any nuclear weapon test was a major priority for United States intelligence in the immediate post-war period. The Long Range Detection Division, Special Weapons Group of the US Air Force Material Command was established in December 1947. Within a year it became AFOAT-1 – Section 1 of the Air Force Office of the Assistant Deputy Chief of Staff for Atomic Energy – later renamed the Air Force Technical Applications Centre (AFTAC). AFOAT-1’s obscure designation was selected in an effort to conceal the unit’s mission of detecting foreign nuclear tests and other nuclear weapon related activities. AFOAT-1 had an early success – the discovery through air borne collection of radioactive debris of the first Soviet nuclear test in 1949.[11]

AFOAT-1 developed and deployed a variety of detection systems – including seismic, acoustic, radiological, optical and ionospheric – to discover nuclear weapons tests. Attention also quickly turned to techniques to detect and monitor foreign nuclear programs more generally. In this regard, the longer-lived krypton-85 (with a half-live of ten years) appeared a more useful element than xenon-133. Since noble gases such as krypton-85 do not participate in chemical reactions, it was difficult and expensive to remove them from discharges produced by large-scale nuclear operations. Moreover their chemical inertness also eliminated the need to suppress the emission of such gases for safety reasons since, unlike most other forms of radioactivity, they are not metabolised by living organisms. Consequently it appeared unlikely that the Soviet Union would attempt to suppress the emission of krypton-85 – an inert noble gas – from their nuclear production facilities.[12]

Kryptron-85 was useful not merely to allow the detection of Soviet nuclear facilities. By March 1951, AFOAT-1 scientists had concluded that measurement of the global distribution of Krypton-85, could

give a reasonably accurate estimate of total Soviet plutonium production, and hence the potential size of the USSR's nuclear weapons inventory:

> *The number of grams of plutonium produced in a natural uranium pile is directly proportional to the number of grams of krypton-85 produced by fission of uranium-235 in the pile.*
>
> *In the process of dissolving the uranium to recover the plutonium, the chemically inert krypton is released into the atmosphere with the dissolver gases in an amount proportional to the number of grams of plutonium recovered.*
>
> *A measurement of the total number of grams of krypton-85 in the earth's atmosphere is therefore a measure of the total number of grams of plutonium processed.*
>
> *It has been determined that the atmosphere contained no krypton-85 previous to 1944.*
>
> *The number of grams of krypton-85 released into the atmosphere by Hanford operations can be calculated for any time between 1945 and the present date.*
>
> *The amount of krypton-85 released into the atmosphere at Chalk River, Canada, is reasonably well known.*
>
> *No krypton-85 has been released into the atmosphere by the British to date as far as we know. However, it is understood that the British will be processing plutonium in considerable quantities by the fall of 1951.*
>
> *A method of measuring the number of grams of krypton-85 in the earth's atmosphere has been developed jointly by the Atomic Energy Commission and USAF (AFOAT-1). Accuracy limits of approximately 5% in this measurement should be attainable within six to eight months.*
>
> *In order to determine the number of grams of krypton-85 resulting from Russian production of plutonium, it is necessary to subtract the amounts produced by the United States, the United Kingdom and Canada from the total amount measured.*[13]

The subsequent development of a monitoring program took considerably longer than was initially envisaged. There were considerable scientific and technical difficulties, not least a lack of knowledge of global atmospheric circulation and the consequent distribution of krypton-85 in both the northern and southern hemispheres. US cooperation with the United Kingdom proved vital, both to establish the contribution of British plutonium production to krypton-85 levels and to develop a monitoring program that was initially codenamed "Green Run".[14] Knowledge of the krypton-85 measurement program was highly sensitive because disclosure could prompt the Soviet Union to take measures to suppress the emission of the gas from its plutonium production reactors. The fact that krypton-85 was the key to the United States' ability to estimate nuclear weapons production in the Soviet Union was indeed "the deepest secret of AFOAT-1".[15]

Operation Crowflight

High altitude monitoring of krypton-85 levels commenced 1957-58 under the cover of the US Defence Department's Project HASP (High Altitude Sampling Program). Developed to determine the worldwide distribution and concentration of radioactive debris from nuclear tests, HASP was an

unclassified program carried out through high altitude USAF sampling missions. [16] Krypton-85 sampling was carried out as a highly classified adjunct to HASP operations.

On 3 September 1957, the United States Department of Defence announced that a program of high altitude sampling of radioactive material would commence from Laughlin Air Force Base at Del Rio, Texas. No details were released, other than an acknowledgment that the program was "designed to determine the distribution, movement, and total amount of radioactive particles placed in the upper atmosphere".[17] Sampling missions were also conducted from Fairbanks Alaska, Albuquerque, New Mexico and the Panama Canal Zone. Operations were conducted by the USAF Strategic Air Command's 4025th and 4028th Strategic Reconnaissance Wings, equipped with U-2, JB-57 and RB-57 and high altitude reconnaissance aircraft.[18]

The U-2 had been developed as a classified project by the Central Intelligence Agency to carry out photoreconnaissance missions over the Soviet Union.[19] U-2s were essentially powered gliders capable of reaching an altitude of 85,000 to 90,000 feet.[20] U-2s were also employed by the USAF for high altitude reconnaissance and air sampling missions. U-2s employed in air sampling missions were modified with air intake ducts in the nose through which air flowed into an equipment bay where a series of filters would catch and contain radioactive particles. After each mission the filters were sent to AFTAC's laboratories for analysis.[21]

The JB-57 and RB-57 were American versions, produced under licence by the Glenn L Martin aerospace company, of the English Electric Canberra bomber, the United Kingdom's first operational jet propelled bomber. The JB-57 variant was developed as a test aircraft for missile trials and other high altitude research. The RB-57 equipped with very long, high lift wings and powerful engines and it proved to be a highly capable strategic reconnaissance aircraft capable of reaching 65,000 feet. JB-57s were operated by two or three crew while RB-57s were manned by a single pilot.[22]

The USAF's high altitude air sampling missions were flown in a straight line, north to south or south to north, then reversed course; hence the program's classified codename of Operation "Crowflight" (i.e. "as the crow flies").[23] Krypton-85 sampling missions extended into the Southern Hemisphere with the conclusion of an agreement with Argentina in April 1958 for an unarmed "High Altitude Sampling Unit" of the USAF to operate from Argentinean Air Force facilities. The published exchange of notes covering the operation merely referred to "the desirability of conducting certain meteorological tests in the upper troposphere and lower stratosphere which would be of mutual benefit to our two countries".[24] Krypton-85 sampling missions were carried out from Buenos Aires and extended into 1960. Although the Argentinean Government was informed that the missions involved collecting radioactive fallout, they were kept in the dark about the highly classified krypton-85 sampling. A subsequent State Department account records that: "So far as we can determine, no one in the [Government of Argentina] was told the true purpose of the 1960 air sampling project; [State Department cables] contained a strict injunction against revealing this aspect of the project to the Argentines, and the … information continues to be SECRET NOFORN" (i.e. no foreign dissemination). For reasons of security and political sensitivity, sampling operations from Argentinean bases were considered to be less than ideal and the USAF's attention turned to Australia as an alternative location for operations in the Southern Hemisphere. [25]

The US Ambassador in Canberra, William J Sebald, called on Prime Minister Menzies on 5 July 1960 to discuss the air-sampling project.[26] The Secretary of the Department of Defence, Sir Edwin Hicks, had already recommended approval of the proposal as it was "in keeping with the offers made at various times to the United States for military cooperation between Australia and the United States". [27] There was never any doubt about Australian support for the project. It was axiomatic that every effort would be made to strengthen cooperation under the ANZUS defence alliance which

was seen as vital to Australian security. There were, however, a few concerns at the margins, especially in relation to the public relations aspects of the proposed operation. Some doubt was expressed within the Defence Department about whether the cover story proposed – radioactive fall-out sampling – would be convincing in scientific circles "because the results would not appear to justify the obviously high cost of the operation".[28] There was also sensitivity arising from the prospective employment of U-2 aircraft to carry out the air-sampling missions. Only two months earlier, on 1 May 1960, a CIA U-2 aircraft piloted by Gary Powers had been shot down over the Soviet Union. The Paris Summit between President Dwight Eisenhower and Soviet Premier Nikita Khrushchev collapsed in large part because Khrushchev demanded an apology that Eisenhower was unwilling to give. CIA U-2 operations in East Asia including overflights of Communist China and these had also attracted unwelcome publicity with the crash landing of a U-2 in Japan.[29] The Department of External Affairs strongly supported the US proposal, but suggested that any public announcement of the project should define, however broadly, the area of operations "in order to anticipate public speculation here and possibly in Asia that their true role is photographic reconnaissance".[30]

In his meeting with the US Ambassador on 5 July, Menzies quickly agreed to the proposed air sampling missions and the visit of a USAF survey party. He also sought and obtained agreement that the proposed announcement would broadly define the area over which sampling would be conducted "to remove any public misconception that the flights might have something to do with reconnaissance over China". Sebald remarked that he did not expect that any financial costs would be borne by Australia and the question of whether the operations would be covered by a formal government-to-government agreement was left open. During the discussion, the point was also made that the New Zealand Government was likely to ask about the nature of the flights. The Ambassador agreed to recommend to Washington that New Zealand be briefed on the purpose of the flights, apparently including the krypton-85 sampling. [31] The US Embassy subsequently suggested that in the light of recent controversy, the U-2s to be employed on the air sampling missions might need to be "rechristened". However the State Department pointed out that the characteristics of the U-2 were well known and that "an unsuccessful attempt at camouflage of this kind would make the United States a laughing stock".[32]

Implementation followed quickly. On 11 July the Minister for Defence Athol Townley made a brief announcement that a US Air Force survey party had arrived to make arrangements for a USAF high altitude air sampling program to be conducted "south of the Australian continent between 40 and 45 degrees south latitude". The declared purpose of the operation was to "support … coordinated studies by United States Defence and civilian agencies on fall-out and radioactivity in the atmosphere" and "results of the studies will be published and will contribute to the work of the Scientific Committee of the United Nations in this field". The types of aircraft that could be employed in such operations were not disclosed.[33] In briefing sent to Australian diplomatic posts, the Department of External Affairs explained that that announcement was intended "to forestall undesirable speculation either at this stage or when the aircraft arrive for operations". Australian diplomats were instructed to draw attention to the prospective area of operations south of the Australian continent "in the event of any suggestion that Australia is providing bases for 'espionage' in Asia" by U-2s or other US aircraft.[34] Townley subsequently suggested that future statements relating to the operation should refer to air sampling between 40 and 50 degrees south, and not 40 to 45 degrees south, as "the former would embrace south of Tasmania as well; the latter may indicate that there were fears of radioactivity only over the island of Tasmania which may be undesirable for obvious reasons". The US Ambassador agreed.[35] Management of public relations issues remained in the forefront of Australian policy makers. In any event, however, the announcement attracted little media interest, either in Australia or overseas.[36]

Knowledge of the primary and highly classified purpose of the proposed flights – krypton-85 sampling -- was kept to a minimum of officers within the Australian Government with a clear "need to know".[37] In August the New Zealand High Commission made an informal approach to Australia seeking information about the nature of the air sampling project and raising the possibility of radioactive fall-out samples being sent to New Zealand laboratories for analysis. No such analysis was subsequently undertaken and it is not clear whether the New Zealand Government was ever told of the underlying purpose of Operation Crowflight.[38]

On 14 September 1960, following the USAF survey and consultations with the RAAF, the US Embassy presented another diplomatic note proposing that an initial series of high altitude air sampling flights be conducted during November from the RAAF base at East Sale in Victoria. An airlift of equipment would be followed by the arrival of three U-2 and four JB-57 aircraft which would carry out the sampling missions, supported by two Douglas C-54 Skymaster aircraft modified for search and rescue operations. Operations would be conducted between 1 and 30 November with all activity scheduled to cease by 15 December.[39] As the program was of a short term and all costs would be borne by the United States, the Department of External Affairs did not consider a formal bilateral agreement was required.[40] External Affairs and the Prime Minister's Department anticipated that the most newsworthy aspect of the program would be the arrival of U-2 aircraft in Australia.[41] On 6 October the Defence Minister announced that the USAF air-sampling program would be carried out from East Sale RAAF base and would involve U-2, JB-57 and C-54 aircraft. The three U-2s were based at the USAF's 4080th Strategic Wing at Laughlin Air Force Base at Del Rio, Texas. The JB-57s were based at the 4950th Test Group, part of the USAF Air Research and Development Command, based at Kirtland Air Force Base, Albuquerque, New Mexico.[42]

The notoriety of the U-2 notwithstanding, press interest remained minimal. The Melbourne *Age* noted that the deployment of the US aircraft to East Sale in southern Australia rather than to Darwin or elsewhere in northern Australia precluded any reconnaissance role against Communist China or other countries in South East or East Asia.[43] In what appears to have been the first public campaign against a United States defence project in Australia, however, the Victorian Peace Council called for protests against the USAF deployment at East Sale. Unsure about the purpose of the air sampling flights, the Peace Council speculated that they could be related to a US intention to carry out nuclear tests at the Maralinga range in South Australia.[44] One activist, recently returned from an anti-nuclear conference in Japan, also highlighted negative consequences of the presence of US bases in Japan including "prostitution … and the screaming of low flying American jets disrupting schooling and setting young children trembling".[45]

High altitude air sampling missions were conducted as planed from East Sale in November 1960. At the request of the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Radiophysics Division, the USAF aircraft were also fitted with specially designed filters to sample dust particles in the upper atmosphere. The Radiophysics Division was then engaged in a long-running investigation of cloud seeding and the U-2 flights offered a valuable opportunity to explore the possible role of atmospheric dust in rain formation. CSIRO explained: "Recent balloon flights in USA have shown the existence of something like 100 particles per liter at heights between 40,000 and 70,000 feet. These particles could have an important effect on the weather in at least two ways, by nucleating cloud systems following an exchange of air with the troposphere, and by warming the stratosphere as a result of scattering radiation. The Division wishes to check whether these particles are as numerous in southern latitudes, have the same distribution at height, whether they are active as ice nuclei, and how their concentration varies from day to day."[46]

Carried out with the assistance of Edward George Bowen–a CSIRO officer attached to the USAF detachment at East Sale—the particle sampling program was intended to test a controversial theory

of the CSIRO Radiophysics Division Chief, that a “major part of the world’s rainfall is triggered by meteorite dust particles that catch in the top of the atmosphere and seed clouds as they fall slowly earthward”.[47]

The November Crowflight program was conducted without incident and the USAF aircraft and personnel subsequently returned to the United States. In the course of operations, however, the USAF commander learned that adverse weather conditions often prevailing at East Sale in autumn could cause hazardous operating conditions for U-2 aircraft. As a consequence the US Embassy sought Australian permission for a further USAF survey mission to discuss with the RAAF the possibility of utilizing an airfield in the Melbourne or Adelaide area where the planned May operation could be conducted with a greater margin of flight safety and operational reliability.[48] The Australian authorities quickly agreed.[49] In the end, however, operations continued from East Sale with three U-2s and four JB-57s arriving in April 1961 to conduct operations through the following month.[50] Still an unfamiliar sight in Australian skies, the high flying U-2s prompted a number of UFO reports over Tasmania and elsewhere. A few months later it appears the United States began to provide the Australian Government with some classified results from the radiological sampling program, but the details of this remain secret.[51] More general information about radioactive fall-out measurements, the public purpose of the missions and something of considerable interest to Australia’s Atomic Weapons Test Safety Committee, was less readily available, however, and only became available through the eventual publication of unclassified scientific studies in the United States.[52] A senior officer of the Department of Supply later expressed dissatisfaction with the “summarised presentation of data” which did “not provide the detailed information that the Atomic Weapons Tests Safety Committee requires to assist it in considering fallout mechanisms at these latitudes”. The Department also noted the publication of air sampling results in open literature in the United States: “While there was nothing especially embarrassing in this instance about the publication of the data without our having first seen them, I would stress again the importance of the principle that such information should be made available in Australia for comment before it is released in the United States for general circulation.”[53]

In public statements Defence Minister Townley emphasized the civilian scientific aspect of Operation Crowflight arising from CSIRO’s scientific association with the USAF operations.[54] However attempts to present the project as a peaceful joint scientific exercise did not prevent Australia’s first large demonstration against a US defence project or facility. Organised by the Victorian Peace Council and a newly formed “Committee against Foreign Military Bases in Australia”, some 500 protesters traveled from Melbourne to East Sale on 27 May to demonstrate outside what was called “the Sale U-2 base”. Entry to the base was blocked by a line of police and RAAF personnel. The demonstrators were addressed by speakers led by the Joint Secretary of the Australian Peace Council, Reverend Frank Hartley, who denounced the U-2s as “spy planes” which were a danger to Australia and her neighbours, and called on the Australian people to demand their expulsion and to prevent the establishment of other projected US bases in Australia.[55]

The initial American request to conduct sampling operations in November 1960 and May 1961 had foreshadowed the likelihood, subject to funding, that it would be desirable to carry out further operations, perhaps on a regular basis. This was confirmed by the US Embassy in May 1961 and three months later approval was sought for two further air sampling missions to be conducted during November 1961 and May 1962. While the air sampling missions would continue to be conducted between 40 and 45 degrees south, extra missions would fly to 60 degrees south to provide supplementary information to assist in interpreting the results obtained from the routine flights.[56] The line of 60 degrees south was some 2,400 kilometres south of East Sale (4,800 kilometres for the return trip) and represented the extreme range of the JB-57 without in-flight refueling.[57]

The Australian Government's consideration of the matter coincided with the final break down of the nuclear test ban negotiations in Geneva. The Soviet Union abrogated the nuclear test moratorium on 1 September 1961. Less than two weeks later Menzies agreed to the proposal for further air sampling missions. External Affairs further informed the US Embassy that Australia was happy for operations to be conducted "on the same informal basis as previously".[58] As was the case with the previous missions, the aircraft to be employed were to comprise U-2s from the 4080th Strategic Wing and JB-57s from the 4950th Test Group. The forthcoming missions were announced by the Minister for Defence in a press release on 25 September.[59]

Continuation of the air sampling missions attracted further interest from Australian scientists. USAF operations from East Sale were reliant on meteorological information provided by the Commonwealth Bureau of Metrology. For its part the Bureau was very interested in any observations the U-2s could make of wind and temperatures between Australia and the Antarctic, a region where the lack of observation stations prevented an accurate knowledge of weather conditions. The Bureau was also interested in the possibility that U-2s might take cloud photographs synchronised with the overhead passage of a new TIROS weather observation satellite which was expected to be in orbit towards the end of 1961. Following exchanges with the Bureau, the USAF agreed to make a minimum of three special missions using a sophisticated package of meteorological instrumentation and to secure meteorological data from at least two other missions over the Southern Ocean.[60]

In anticipation of possible press interest arising from the return of the U-2s and JB-57 aircraft to East Sale in mid-October, the US Defence Department prepared a draft press briefing document that explained that air samples taken at high altitude were analysed for such radioactive isotopes as "plutonium, strontium-90 and cesium-137, considered potentially hazardous, strontium-89, yttrium-91, cerium-144, and tungsten-185, useful in estimating the age of atmospheric debris, and rhodium-102, beryllium-7, phosphorous-32, barium-140, zirconium-95, sodium-22, and tungsten-95".[61] No mention was made of krypton-85. Subsequently, however, although the technical information proposed for release was "not markedly classifiable", it was decided it was "not desirable or necessary gratuitously to hand out information". Australian Embassy in Washington commented to External Affairs that was "a most laudable turn of events, bearing in mind the vast amount of intelligence type material (at least to layman eyes) which is unnecessarily made public by one or other of the US defence agencies."[62]

Year-round operations

Even before the November operations commenced, the US Embassy contacted External Affairs to present a formal proposal that Operation Crowflight be conducted on a continuous year-round basis. The United States proposed to conduct a survey at the East Sale and Avalon RAAF bases and other possible locations to determine the most suitable site for continuous U-2 and JB-57 operations. The Embassy noted that responsibility for air sampling missions had recently been transferred from the Strategic Air Command to the US Air Weather Service, part of the Military Air Transport Service (MATS), and it was suggested that this could favour the choice of a site in New Zealand for permanent operations because MATS already had a considerable establishment in Christchurch for servicing US Antarctic operations. Once a base was selected and agreed upon, it was hoped to establish permanent operations by July 1962. Flights would normally be conducted in the same general area, between 40 and 45 degrees south latitude, with occasional flights as far south as 60 degrees. The permanent operation would involve approximately 155 military personnel who, with dependents, would mean between 200 and 300 US nationals.[63]

Prime Minister Menzies and Defence Minister Townley again readily agreed to this US request.[64] The US Embassy was notified on 9 November and the USAF survey proceeded without publicity.[65]

Soon after the US also proposed that the operation already scheduled for May 1962 be brought forward to March. In a note to External Affairs, the US Embassy offered no explanation for the change but gave the following advice on public handling of the matter: "If … a statement is made or a need arises to reply to press inquiries, it would be preferred if the change could be attributed simply to 'technical considerations'. Should more detail be necessary the rescheduling might be further attributed to the need for earlier determination of changes taking place in radioactivity levels and fall-out rates as a result of USSR tests."[66] In fact new schedule had more to do with United States plans to resume atmospheric nuclear testing in the Pacific including high altitude and high yield thermonuclear trials, with the first tests in Operation Dominic planned to take place near the British controlled Christmas Island in the last week of April 1962. Earlier sampling would have provided a new baseline of data prior to an intensive atmospheric nuclear test program. In any case Australian agreement quickly followed with Defence Minister Townley issuing a brief press statement that simply observed that the planned March flights would be "in support of a world-wide air-sampling programme concerned with fall-out and radioactivity in the upper atmosphere".[67]

In February 1962 the US Embassy advised the Australian Government that as a result of the surveys conducted in Australia and New Zealand, the USAF favoured the use of both the RAAF base at Laverton and the Department of Supply's airfield at Avalon for the extension of Operation Crowflight on a continuous basis. A new unit would conduct air-sampling missions, the 57th Weather Reconnaissance Squadron with seven USAF aircraft permanently based in Australia (two U-2s, four JB-57s and one Boeing C-97 Stratofreighter cargo plan (or a Lockheed C-130 Hercules). It was anticipated the U-2 aircraft would undertake about 19 flights, the JB-57s about 25 flights and the C-97 or C-130 seven flights. Approximately 175 personnel would be deployed with operations commencing from 1 July 1962. The Embassy confirmed that scientific results from the program would continue to be made available through unclassified reports forwarded to the Department of Supply and through classified studies transmitted through intelligence channels. The USAF was also happy to cooperate with Australian civilian scientific personnel "provided such projects do not interfere with the primary mission of the squadron and provided the Australian Government pays any costs attributable to such projects".[68]

The Defence Department predictably supported the US proposal. In a minute to Defence Minister on 8 March 1962, the Secretary of the Department declared that permanent USAF operations had obvious advantages "both from the broad aspect of our relationships with the USA and because of the benefits that would accrue to Australia in the way of flow of information that would otherwise not be available to us, and the expenditure of American resources in this country." Hicks noted that the US proposal involved more than an extension of existing arrangements since it would mean the permanent stationing of a small American "colony" of USAF servicemen and their dependents at Laverton and Avalon. As a consequence it was necessary to consider arrangements to cover the status of US personnel stationed in Australia.[69] Despite this, however, the Prime Minister's Department saw no reason for the matter to be considered by Cabinet.[70] Instead with the concurrence of the Prime Minister and the Ministers for External Affairs and Defence, the Department of External Affairs formally notified the US Embassy on 16 April of Australia's agreement in principle to the proposal to conduct air sampling missions on a permanent basis from Laverton and Avalon.[71] Townley announced the decision on 8 May 1962.[72]

CSIRO was quick to approach the USAF to take advantage of the prospect of all year round air sampling operations. On 16 May, Bowen of the Radiophysics Division sought agreement for the U-2s to collect atmospheric dust samples and for their pilots to photograph dust layers, cloud cover and pack ice.[73] While the USAF quickly agreed, the Department of Defence worried about the coordination of such activities and asked the RAAF, as the cooperating agency, to carefully monitor such requests: "For instance, if the Meteorological Bureau started putting similar major requests,

the Americans could become embarrassed by being overloaded with ancillary tasks and this could put the cooperating agency in a difficult negotiating position."[74]

In mid May the US Embassy passed to External Affairs a draft exchange of notes constituting a formal agreement for Operation Crowflight. The draft provided for the United States and Australian Governments to share "reduced scientific data" produced by the air sampling missions and any studies utilising such data. The United States undertook to bear all the costs of the operation including any necessary capital infrastructure. The United States also undertook to assist in carrying out scientific research projects for the Australian Government provided such projects did not interfere with air-sampling operations and the Australian Government met any additional costs.[75]

The Australian Treasury was insistent that the United States should deposit in advance all or part of the funds needed to meet the cost of upgrading of the Laverton and Avalon airfields to handle continuous air sampling operations. Treasury considered advance funding for infrastructure and other operational costs to be essential because no appropriations had been made by the Australian Parliament to cover the project.[76] Although the US Defence Department was prepared to advance funds for capital works carried out by the Australian Government they were not prepared to make advance payments to private contractors.[77] By August the bureaucratic impasse threatened the suspension and possible cancellation of the airlift of supplies and equipment to Australia.[78] In the end, however, Australian guidelines were waived. On 2 August a hastily convened interdepartmental committee advised Australian Ministers that "[c]ooperation with the United States in defence projects is a major aspect of Government policy. Australia should facilitate United States operations and avoid insistence on administrative procedures which, rightly or wrongly, the United States finds irksome and which might complicate United States' dealings with other allies."[79]

Although the Department of External Affairs proposed that the interdepartmental report be submitted to Cabinet, this did not take place. In a subsequent letter to the Treasurer, Harold Holt, the Minister for External Affairs, Sir Garfield Barwick, suggested that the question of pre-payment was "a technical obstacle only" and went on to observe:

I am personally inclined to the view that on broad grounds, related to our relations with the United States, we ought to try to meet their position if this is a reasonable possibility. You know the magnitude of the range of United States' offshore defence activities and the many difficulties that they encounter in their discussions with their allies of arrangements in support of mutual defence arrangements. You know too, that quite recently our Ambassador in the United states has had it from Cabinet Ministers and some other highly placed members of the United States Administration that the United States believes it has to carry an inequitably heavy share of the burden of mutual defence, and specifically that it considers Australia is not completely carrying its proportionate share.[80]

Holt was not easily persuaded, replying that it did "not seem to me to be appropriate if concessions of no inconsiderable financial consequence are to be made to the Americans, that they should be assumed to be of little consequence and be taken for granted by officers of the American Embassy". The Treasurer expressed considerable dissatisfaction with a lack of reprocity given that Australia was obliged to make advance payments for American military equipment and services purchased from the US. In the end, however, Holt grudgingly agreed to seek a Parliamentary appropriation for payment for work to be done in Australia on behalf of the United States on a reimbursable arrangement.[81]

Four JB-57, two U-2 and four Douglas C-124 aircraft arrived at Avalon and Laverton airfields on 12 September 1962. In announcing the deployment the Minister for Air David Fairbairn explained that it would be cheaper and more efficient for the USAF aircraft to be permanently stationed in

Australia rather than having a detachment visit several times each year.[82] On 17 September, only five days after arrival, one JB-57, call-sign “Equip One”, crashed shortly after take-off at Laverton, killing two crew members.[83] One month later another JB-57 crashed into the sea near Lorne killing another two crewmen.[84] Notwithstanding these tragedies, however, air sampling missions continued and at the end of the month were extended with one U-2 flight each month from Laverton to the vicinity of Cooktown, Queensland.[85] In addition the US Embassy obtained clearance for overflights of Manus Island, part of the Australian Trust Territory of Papua New Guinea, by other USAF U-2 aircraft operating from Guam. These flights were another part of the global Crowflight operation, but were not acknowledged in any public statement by the Australian Government.[86] Questioned by Labor Members of Parliament about the U-2 operations from Avalon and Laverton, Fairbairn merely observed that the flights were part of a worldwide effort to determine the extent of radioactivity in the atmosphere.[87]

Crowflight operations continued on a routine basis for more than two years. At the request of CSIRO, the U-2 aircraft also collected dust samples and photographed cloud formations over Tasmania in support of the Radiophysics Division’s cloud seeding program.[88] Approximately ninety USAF personnel were withdrawn in late 1964, but the US Embassy was quick to emphasise that there was “no lessening of interest in this program but is instead part of a reorganisation in the Squadron made possible by increased technological efficiency”.[89]

Further reorganisation of operations followed in 1965. At a meeting with Australian officials on 11 February, the US Air Attaché advised that it was intended to replace the two U-2s with two new RB-57F aircraft. It was essential that the U-2s leave Australia from 1 March to be redeployed to another project of higher priority.[90] The project in question was not identified but appears to have involved the deployment of USAF U-2s for operations in East Asia as the conflict in Vietnam escalated.[91] The RB-57Fs were completely new aircraft with more powerful engines and extra wide wings with an extended span of over 123 feet (37.5 metres). The USAF planned to carry out an average of 16 RB-57F sorties a month, but there were infrastructure problems to be resolved first. The RAAF airfield at Laverton was found to be “extremely hazardous” for RB-57F operations which required a long, shallow glide path for landings. Avalon airfield was also unsuitable for RB-57F operations due to frequent cross winds. Other RAAF airfields in southern Australia lacked suitable hanger space. The one airfield found to have the facilities desired was the civil airport at Essendon, Melbourne.[92] However when the Department of Civil Aviation examined the proposal it was concluded that Essendon was unsuitable for safety reasons. The USAF reconsidered the matter and sought permission to operate the RB-57Fs from East Sale despite the lack of suitable hangers for maintenance.[93] Australian Departments and Ministers quickly agreed and the deployment of the RB-57Fs at East Sale was announced on 24 February 1965[94]

[caption id="attachment_47105" align="aligncenter" width="389"]

RB-57 pilot at East Sale at East Sale RAAF base Lieutenant Edward P. Hendley Jnr stands in his space-suit prepared for flight. Pic filed 8---1965[/caption]

[caption id="attachment_47106" align="aligncenter" width="391"]

US Airforce RB 57 squadron stationed at East Sale RAAF base. Maintenance on the cockpit. Pic filed 8-4-1965.[/caption]

The RB-57Fs arrived at East Sale in March 1965. Every Tuesday the RB-57Fs flew south over the Antarctic Ocean to latitude 60 degrees south, and north to latitude 17 degrees near Cairns. Asked by

the Melbourne *Age* newspaper how he liked sorties so far south towards Antarctic waters, one of the USAF pilots, Captain LL Lackey, candidly acknowledged risk in such operations: “It’s awfully lonely and you feel a long way from help. If you had to eject down there, your rubber dinghy would keep you afloat, but you would have no company but the penguins. There would be no air-sea rescue boys there to collect you. It would be a lonely death.”

Captain Lackey also revealed a number of details about Operation Crowflight which were regarded as sensitive, including the global context of the Australian missions:

This is part of a weekly survey of the world, from latitude 80 north to 60 south, done in flights from four bases, each of which meets the other. Northernmost is the group at Fairbanks Alaska, which flies north to latitude 80 and south to the point where they meet the northward flight from Albuquerque, New Mexico. This flight in turn goes south to meet a flight from Panama, whose southern limit is 17 degrees south, the latitude of Cairns, and the northern limit of East Sale's weekly journey. It would be useful if all these flights could be on the same longitude, to form a continuous north-south barrier through which no fallout could pass without detection.[95]

The average annual cost of Crowflight operations in Australia was approximately US$2.4 million (US$18 million in 2016 values).m In addition the USAF spent some US$125,000 on infrastructure at Laverton, Avalon and East Sale (US$940,000 in 2016 values).[96]

Termination of Australian operations

In anticipation that Crowflight operations would continue on a permanent basis, Australian officials engaged in protracted consideration of the draft intergovernmental agreement to cover the project.[97] Among the various issues considered was the question of access to data from the sampling missions. At an interdepartmental meeting on 17 June, the Department of Defence emphasised that the availability of information “should not be limited to reduced scientific data, and data should be made available under conditions to be agreed between cooperating agencies”. Anxious to increase Australian access to US intelligence information, Defence considered a stronger position on the question was required, with Australian access to data being unqualified.[98]

However Australian expectations that Crowflight operations would continue indefinitely proved mistaken. On 13 August 1965, the US Embassy abruptly advised that as a result of “changing operational requirements”, the JB-57 aircraft would be withdrawn from Avalon airfield by the end of the month and that it was probable that the two RB-57Fs would be withdrawn from East Sale by the end of the year, thereby terminating operations in Australia. The Embassy added that for technical reasons it was planned to base the aircraft, together with similar aircraft, in Latin America.[99]

In fact, the USAF had decided to resume operations from Argentina. In February 1965, Argentina had approved a contingency air-sampling project to be conducted by the USAF from El Plumerillo Airport at Mendoza. Codenamed “Skin Diver” this project was related to the prospective conduct by France of atmospheric nuclear tests in the South Pacific. Radioactive debris from the tests would be carried by the prevailing winds towards South America. Presumably with a view to logistic and operational efficiencies, the USAF had by August decided to move Crowflight operations from Australia to Mendoza under the new codename, “Project Quick Dip”. As was the case with the original 1960 Crowflight operations in Argentina, and unlike the Australian Government, the Government of Argentina was not told of the more highly classified purpose of the flights, namely Kryptron-85 sampling.[100]

USAF operations from East Sale continued until early February 1966 and a USAF logistic element remained at Avalon until the end of the month. The termination of Operation Crowflight appears to

have caused no concern for the Australian Government – no doubt because the departure of the USAF was more than balanced by the expansion of other United States defence related activities in Australia, notably the construction of the US Navy's North West Cape Naval Communication Station near Exmouth in Western Australia, and agreement on the establishment of a highly classified CIA signals intelligence facility, the Joint Defence Space Research Facility, at Pine Gap near Alice Springs in the Northern Territory. Although the details remain classified, it also appears that the United States subsequently gave Australia some assurance of continuing access to the results of the global air sampling program.[101] In a brief press release the Minister for Air, Peter Howson, made no reference to radiological sampling, and instead referred simply to "the closure of the USAF weather reconnaissance project in Australia". According to Howson: "The work in Australia of the USAF weather reconnaissance units using RAAF facilities was a splendid example of the capacity of the two air forces to work harmoniously in cooperation with each other".[102]

Concluding observations

Operation Crowflight was conducted in Australia for more than five years. During that time the high altitude air sampling project was the largest United States defence or intelligence related activity in Australia. Despite this it was never referred for consideration by the Australian Cabinet and was not covered by any treaty or memorandum of understanding. The reasons for this are not clear but suggest a preference on the part of Australian policy makers to deal with the more sensitive aspects of the Australian-American relationship outside some of the more routine processes of government scrutiny. This would prove to be a pattern with later United States defence and intelligence projects in Australia.

The direct benefits of Crowflight to Australia appear to have been quite limited. Arguably the project's unclassified contributions to the study of fall-out from nuclear tests and to the meteorology of the Southern Ocean may have been more significant for Australia than its primary, highly classified purpose. For Australian policy makers, however, this was secondary to the political and strategic objective of deepening American strategic interest and engagement with Australia. For the United States, however, Crowflight was just a small part of a global effort to gather data that would shape estimates of the size of the Soviet Union's nuclear arsenal. When intelligence priorities shifted, the Crowflight was abruptly terminated and operations were shifted elsewhere.

Although now largely forgotten, Crowflight formed a significant part of the burgeoning defence research and intelligence collaboration between Australia and the United States and was a forerunner for other projects that would be central to the bilateral relations in subsequent decades. The Australian Government's political sensitivity and obfuscation about the purpose of the USAF's "weather reconnaissance" activities also foreshadowed later deceptive handling of the public aspects of US military and intelligence facilities in Australia.

Crowflight's underlying purpose – the collection of krypton-85 to help estimate the size of the Soviet Union's nuclear arsenal – was long a dark secret and curiously remains security classified, at least in Australia if not the United States, to this day.[103]

Photo Captions and Source

Banner photo: A US Air Force RB-57F on the runway at the Royal Australian Air Force's East Sale base in 1965.

All photos from National Archives of Australia and published with permission.

III. ENDNOTES

[i] Report on Aerial Object Observed", Attachment to Vernon to Department of Air, 8 June 1961, A703/115, 580/1/1 Part 3, National Archives of Australia (*NAA)*. Great Lake is approximately 85 kilometres southeast of Devonport.

[2] This paper draws on declassified Australian Government records held by the National Archives of Australia including files from the Department of Defence, Department of External Affairs, the Prime Minister's Department, the Treasury and Department of Air. A media report of the author's early research on Operation Crowflight was published in 2005: Brendan Nicholson, "Revealed: secrets of the spies in our skies", *The Age*, 10 September 2005, http://www.theage.com.au/news/national/revealed-secrets-of-the-spies-in-our-skies/2005/09/09/1125772695364.html.

[3] United States Embassy Canberra, Note 1, 4 July 1960, and Hicks to Townley, Minute, 4 July 1960, A1945, 227/1/32, *NAA*.

[4] United States Embassy Canberra, Note 1, 4 July 1960, A1945, 227/1/32, *NAA*.

[5] United States Embassy Memorandum, 4 July 1960, A1945, 227/1/32, *NAA*.

[6] Department of Defence, Statement of Reasons pursuant to sub-section 40(5) of the *Archives Act 1983*, 17 May 2002, A1945, 227/1/32, *NAA*. The National Archives of Australia has reaffirmed the decision to redact this information in 2016.

[7] United States Embassy Memorandum, 4 July 1960, A1945, 227/1/32, *NAA*.

[8] Department of State to US Embassy, Buenos Aires, Telegram CA-3143, 17 September 1965, in William Burr (ed), *Documents on the US Atomic Energy Detection System*, National Security Archive Electronic Briefing Book No. 7, http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB7/nsaebb7.htm.

[9] See Michael S Goodman, *Spying on the Nuclear Bear: Anglo-American intelligence and the Soviet bomb*, Stanford University Press, Stanford, 2007, p. 142.

[10] Luis Alvarez, *Adventures of a Physicist*, Basic Books, 1987, pp. 120-121; and Charles Ziegler and David Jacobson, *Spying Without Spies: Origins of America's Secret Nuclear Surveillance System*, Praeger, 1995, pp. 4-8.

[11] Jeffrey Richelson, "Verification: The ways and means", *Bulletin of Atomic Scientists*, Vol. 54, No. 6, November/December 1998, pp. 52-57. .

[12] Ziegler and Jacobson, *Spying without Spies*, p. 183.

[13] Maude and Northrup to LeBaron, 21 March 1951, Burr *Documents on the US Atomic Energy Detection System*, http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB7/nsaebb7.htm. Please note that the original text was not italicized.

[14] Goodman, *Spying on the Nuclear Bear*, pp. 141-144.

[15] Jeffrey Richelson, *American Espionage and the Soviet Target*, Quill, 1987, p.120.

[16] Office of Scientific and Technical Information, Environmental Measurements Laboratory, Program Review – December 1983, United States Department of Energy, New York, March 1984, p. 8, http://www.osti.gov/scitech/servlets/purl/6918388

[17] Text of US Department of Defence Press Release quoted in Australian Embassy, Washington, to External Affairs, Memorandum, 5 September 1957, A1838/369, 694/7/23 Part 1, *NAA*.

[18] History of 4080th Strategic Reconnaissance Wing, http://www.johnson7170.freeserve.co.uk/4080th.htm.

[19] Gregory Pedlow and Donald Welzenbach, *The CIA and the U-2 Program 1954-1974*, History Staff, Center for the Study of Intelligence, Central Intelligence Agency, 1998.

[20] Norman Polmar and Timothy Laur (eds), *Strategic Air Command: People, Aircraft and Missiles*, Nautical and Aviation Publishing, 1990, pp. 265-268.

[21] Norman Polmar, *Spyplane: The U-2 History Declassified*, MBI Publishing Company, 2001, p. 171.

[22] Robert Jackson, *High Cold War: Strategic air Reconnaissance and the Electronic Intelligence War*, Patrick Stephens, 1998, pp. 97-104; and Polmar and Laur, *Strategic Air Command*, pp. 269-271.

[23] History of 4080th Strategic Reconnaissance Wing, http://www.johnson7170.freeserve.co.uk/4080th.htm.

[24] Exchange of Notes between the United States and Argentina constituting an agreement relating to an un-armed High-Altitude Sampling Unit of the United States Air Force, 23 and 28 April 1958, *United Nations Treaties Series*, no. 4570.

[25] Department of State to US Embassy, Buenos Aires, Telegram CA-3143, 17 September 1965, in Burr (ed), *Documents on the US Atomic Energy Detection System,* http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB7/nsaebb7.htm.

[26] Menzies was also serving as Minister for External Affairs.

[27] Hicks to Townley, Minute, 4 July 1960, A1945/28, 227/1/32, *NAA*.

[28] Kingsland to Hicks, Minute, 5 July 1960, A1945/28, 227/1/32, *NAA*.

[29] CIA U-2 operations in Northeast Asia were conducted from a United States naval air station at Atsugi Japan and included overflights of the Soviet Far East and China. On 8 July 1960, the Japanese Government formally requested the removal of U-2 aircraft based in Japan. See Polmar, *Spyplane: The U-2 History Declassified*, pp. 149-152.

[30] Tange to Menzies, Minute, 5 July 1960, A1838/369, 694/7/22 Part 1, *NAA*.

[31] Record of Conversation between Menzies and Sebald, 5 July 1960, A1838/369, 694/7/22 Part 1, *NAA*. References to the classified purpose of the operations have been deleted from the publicly available copies of this document.

[32] Australian Embassy, Washington, to External Affairs, Cablegram 1833, 6 July 1960, A1209/106, 1961/777 Part 1, *NAA*, and Moodie to Tange, Minute, 8 July 1960, A1838/369, 694/7/22 Part 1, *NAA*.

[33] Press Release by Townley, 11 July 1960, A1209/106, 1961/777 Part 1, *NAA*.

[34] External Affairs to All Posts, Savingram AP36, 12 July 1960, A1838/369, 694/7/22 Part 1. *NAA*.

[35] Note of Action by Kingsland, 18 July 1960, A1945/28, 227/1/32, *NAA*.

[36] The only Australian press report noted by the Prime Minister's department was a brief story in the *Canberra Times*, 12 July 1960, A1209/106, 1961/777 Part 1, *NAA*.

[37] Anderson to Bunting, Memorandum, 18 July 1960, A1209/106, 1961/777 Part 1, *NAA*.

[38] Norris to Weir, Letter, 23 August 1960, A1838/369, 694/7/22 Part 1, *NAA*.

[39] United States Embassy to External Affairs, Note No. 62, 14 September 1960, A1945/28, 227/1/32, *NAA*.

[40] Nutter to Bunting, Memorandum, 16 September 1960, A1209/106, 1961/777 Part 1, *NAA*.

[41] Moodie to Tange, Minute, 19 September 1960, A1838/369, 694/7/22 Part 1, NAA, and Minute to the Acting Prime Minister, 29 September 1960, A1209/106, 1961/777 Part 1, NAA.

[42] Press Release by Townley, 6 October 1960, A1209/106, 1961/777 Part 1, *NAA*.

[43]Melbourne *Age*, 7 October 1960, A1838/369, 694/7/22 Part 1, *NAA*.

[44] The last "major trials" of British nuclear devices had been carried out at Maralinga in September-October 1957 – Operation Antler. So called "minor trials" – safety and weapons development experiments – continued until 1963. The United States had no need to conduct nuclear tests in Australia given its own extensive nuclear test facilities.

[45] *Tribune*, 2 November 1960, A6122/39, 1407, *NAA*. The suggestion that the U-2 deployment was related to an intention to test US nuclear weapons in Australia may have been prompted by Moscow Radio commentary which speculated along such lines. See Marshall to External Affairs, Memorandum, 18 November 1960, A1838/369, 694/7/22 Part 1, *NAA*.

[46] Gresford to Department of Air, Memorandum, 15 September 1960, A1945/28, 227/1/32, *NAA*.

[47] Press Release by Townley, undated – February 1961, A1945/28, 227/1/32, *NAA*. The Radiophysics Divisions cloud seeding and rain formation research is discussed in Brad Collins, *Fields of Discovery: Australia's CSIRO*, Allen and Unwin, 2002, pp.367-375; and Peter Robertson, *Beyond Southern Skys: Radio Astronomy and the Parkes Telescope*, Cambridge University Press, 1992, pp. 33-35. Bowen's theory was heavily criticised by other atmospheric scientists and was eventually discarded.

[48] United States Embassy to External Affairs, Note 140, 20 January 1961, A1838/369, 694/7/22 Part 1, *NAA*.

[49] Kingsland to Townley, Minute, 31 January 1961, A1945/28, 227/1/32, *NAA*.

[50] Undated note entitled "Upper Air Sampling Operation – May 1961", A1945/28, 227/1/32, *NAA*.

[51] Handwritten note to Anderson, 29 March 1962, A1838/369, 694/7/22 Part 1, *NAA*. In August 1961, the Department of External Affairs advised the Prime Minister's Department that "the results of the first two 'Crowflight' operations will shortly be made available by the United States to the

Australian Government". See annotation by Hill on Hill to Bunting, Memorandum, 9 August 1961, A1209/106, 1961/777 Part 1, *NAA*.

[52] Knott to Tange, Memorandum, 1 June 1961, and Hill to Knott, Memorandum, 8 August 1961, A1209/106, 1961/777 Part 1, *NAA*, and Knott to Hicks, Memorandum, 31 August 1961, A1945/28, 227/1/32, *NAA*.

[53] Sumner to Tange, Memorandum, November 1961, A1838/369, 694/7/22 Part 1, *NAA*.

[54] Press Release by Townley, undated copy – February 1961, A1945/28, 227/1/32, *NAA*.

[55] *Tribune*, 31 May 1961, A1838/369, 694/7/22 Part 1, *NAA*; and Victorian Peace Council Pamphlet, "Foreign Bases in Australia?" A6122/39, 1407, *NAA*.

[56] Record of Conversation with Belton, 18 May 1961, and Hill to Bunting, Memorandum, 9 August 1961, A1209/106, 1961/777 Part 1, *NAA*.

[57] The U-2's range was approximately 3,400 kilometres. The JB-57's range was approximately 4,800 kilometres while that of the more advanced RB-57 was considerably greater.

[58] Heydon to Menzies, Minute, 8 September 1961, and External Affairs to United States Embassy, Note, 15 September 1961, A1838/369, 694/7/22 Part 1, *NAA*.

[59] Press Release by Townley, 25 September 1961, 1209/106, 1961/777 Part 1, *NAA*.

[60] Dwyer to Tange, Memoranda, 20 September and 12 October 1961, A1838/369, 694/7/22 Part 1, *NAA*.

[61] Australian Embassy, Washington, to External Affairs, Cablegram 2578, 18 October 1961, A1209/106, 1961/777 Part 1, *NAA*.

[62] Loveday to Tange, Memorandum, 24 October 1961, A1945/28, 227/1/32, *NAA*.

[63] Record of Conversation with Belton, 26 October 1961, and United States Embassy to External Affairs, Note No. 77, 26 October 1961, A1838/369, 694/7/22 Part 1, *NAA*. References to New Zealand have been deleted from other publicly available copies of these documents – see for example A1209/106, 1961/777 Part 1, *NAA*.

[64] Kingsland to Townley, Minute, 1 November 1961, A1945/28, 227/1/32, *NAA*, Eastman to Menzies, Minute, 3 November 1961, A1838/369, 694/7/22 Part 1, *NAA*.

[65] External Affairs to United States Embassy, Note, 9 November 1961, A1209/106, 1961/777 Part 1, *NAA*. Sumner to Hicks, Memorandum, 4 December 1961, A1945/28, 227/1/32, *NAA*; and Laycock to Herde, Minute, 11 December 1961, A1209/106, 1961/777 Part 1, *NAA*.

[66] United States Embassy to External Affairs, Note 150, 16 February 1962, A1209/106, 1961/777 Part 1, NAA.

[67] Tange to Barwick, Minute, 27 February 1962, A1838/369, 694/7/22 Part 1, NAA; and Press Release by Townley, 27 February 1962, A1209/106, 1961/777 Part 1, *NAA*.

[68] United States Embassy to External Affairs, Note 162, 26 February 1962, A1945/28, 227/1/32, *NAA*, and Eastman to Barwick, Minute, 29 March 1962, A1838/369, 694/7/22 Part 2, *NAA*.

[69] Hicks to Townley, Minute, 8 March 1962, A1945, 227/1/32, *NAA*.

[70] Herde to Menzies, Minute, 12 March 1962, and Bunting to Tange, Memorandum, 13 March 1962, A1209/106, 1961/777 Part 1, *NAA*.

[71] Bunting to Tange, Memorandum, 13 March 1962, and Hicks to Tange, Memorandum, 30 March 1962, A1209/106, 1961/777 Part 1, NAA; Greet to Homewood, Teleprinter Message, 12 April 1962, and External Affairs to United States Embassy, Note, 16 April 1962, A1838/369, 694/7/22 Part 2, *NAA*.

[72] Press Release by Townley, 8 May 1962, A1838/369, 694/7/22 Part 2, *NAA*.

[73] Bowen to Ottaway, Letter, 16 May 1962, A1838/369, 694/7/22 Part 2, *NAA*.

[74] Kingsland to Douglas, Letter, 5 June 1962, A1838/369, 694/7/22 Part 2, *NAA*.

[75] Draft Exchange of Notes enclosed with External Affairs Memorandum, 1 June 1962, A1209/106, 1961/777 Part 1, *NAA*.

[76] Record of Conversation with Lamm and Ottaway, 13 June 1962, A1945/28, 227/1/32, *NAA*.

[77] Record of Conversation with Lamm, 31 July 1962, A1209/106, 1961/777 Part 1, *NAA*.

[78] Record of Conversation with Ottaway, 1 August 1962, A1945/28, 227/1/32, NAA; and Summary of Actions relating to Operation Crowflight, 6 August 1962, A1838/369, 694/7/22 Part 2, *NAA*.

[79] Report of Interdepartmental Committee, 2 August 962, A1838/369, 694/7/22 Part 2, *NAA*.

[80] Barwick to Holt, Letter, 26 November 1962, A1838/369, 694/7/22 Part 2, *NAA*.

[81] Holt to Barwick, Letter, 28 December 1962, A1209/106, 1961/777 Part 2, *NAA*.

[82] Press Release by Fairbain, 7 September 1962, Melbourne *Age*, 13 September 1962, and Jones to Brennan, Minute, 14 September 1962, A1838/369, 694/7/22 Part 2, *NAA*.

[83] RAAF reports on the Laverton JB-57 crash can be found in file B94, 33/AIR/7/PART 1, *NAA*.

[84] *Sydney Morning Herald*, 18 October 1962, A1838/369, 694/7/22 Part 2, *NAA*.

[85] Press Release by Townley, 30 October 1962, A1945/28, 227/1/32, *NAA*.

[86] Brennan to Departments of Defence and Territories, Memorandum, 11 October 1962, and Kingsland to Townley, Minute, 24 October 1962, A1945/28, 227/1/32, *NAA*.

[87] *Hansard*, House of Representatives, 16 October and 13 November 1962, pp. 1586 and 2366.

[88] Blakers to Townley, Minute, 19 October 1964, A1945/28, 227/1/32, *NAA*. In cooperation with the Tasmanian Hydroelectric Commission, the Radiophysics Division was engaged in a six-year experimental cloud seeding program over central Tasmania.

[89] Holdich to Departments of Defence and Air, Memorandum, 21 October 1964, A1945/28, 227/1/32, *NAA*.

[90] Minutes of Meeting at Department of Air, 11 February 1965, A1838/369, 694/7/22 Part 2, *NAA*.

[91] The USAF had commenced U-2 operations over North Vietnam in February 1964. See Polmar, *Spyplane*, pp. 175-179.

[92] United States Embassy to External Affairs, Note 123 and attached Memorandum on RB-57F requirements, 12 February 1965, A1209/106, 1961/777 Part 2, *NAA*.

[93] Morris to Hasluck, Minute, 18 February 1965, A1838/369, 694/7/22 Part 4, *NAA*.

[94] Press Release by Howson, 24 February 1965, A1838/369, 694/7/22 Part 4, *NAA*.

[95] Melbourne *Age*, 7 April 1965. Details of discussions between the Departments of External Affairs and defence and the US Embassy about the Melbourne Age article remain classified. See Plimsoll to Hasluck, Minute, 7 April 1965, A1838/369, 694/7/22 Part 4, *NAA*.

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[96] Aldrich to Ottaway, Letter, 5 August 1965, A1838/346, 694/7 Part 1, *NAA*.

[97] External Affairs to Department of Defence and other Departments, Memorandum, 12 January 1965, A1209/106, 1961/777 Part 2, *NAA*.

[98] Minutes of Meeting at Department of External Affairs, 17 June 1965, A1209/106, 1961/777 Part 2, *NAA*.

[99] Jockel to Hasluck, Minute, 16 August 1965, A1838/369, 694/7/22 Part 4, NAA, and Piper to Prime Minister's Department and other Departments, Memoranda, 20 and 28 August 1965, A1209/106, 1961/777 Part 2, *NAA*.

[100] Department of State to US Embassy, Buenos Aires, Telegram CA-3143, 17 September 1965, in Burr (ed), *Documents on the US Atomic Energy Detection System*, http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB7/nsaebb7.htm.

[101] Morris to Department of Supply, Letter, 9 March 1966, A1838/369, 694/7/15 Part 2, *NAA*.

[102] Press Release by Howson, 1 February 1966, A1838/369, 694/7/22 Part 4, *NAA*.

[103] Although monitoring of global krypton-85 levels has been discontinued owing to the proliferation of nuclear activity around the world, atmospheric sampling of this element continues to be used to detect and monitor clandestine plutonium production programs such as that in North Korea. (See for example "Russia helps US on Nuclear Spying Inside North Korea", *New York Times*, 20 January 2003; Jon Wolfsthal, "The intelligence black hole over N Korea", BBC News, 17 July 2003, http://news.bbc.co.uk/go/pr/fr/-/2/hi/asia-pacific/3073677.stm; and Rob Edwards, "Krypton clue to North Korean nuclear progress", *New Scientist*, 21 July 2003, http://www.newscientist.com/article.ns?id=dn3960.) The usefulness of krypton-85 detection as a means investigate clandestine plutonium production has most recently discussed by Michael Schoeppner , Alexander Glaser and Mark E. Walker, "Detecting clandestine plutonium separation activities with krypton-85", Princeton University, Program on Science and Global Security, Paper presented at the Institute of Nuclear Materials Management.(INMM) 56th Annual Meeting, July 12-16, 2015,

https://www.nti.org/media/pdfs/Glaser_detecting_clandestine_plutonium.pdf?_=1442349967.

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