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Chapter 15

Australis-OSCAR 5 and WRESAT: The Possible Origins of an Australian Space Program*

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Abstract

In 1966 and 1967, the first two Australian satellites were built: Australis-OSCAR 5, developed by students at the University of Melbourne, was the first to be constructed, although it would be the second to be launched; WRESAT, a joint project of the Weapons Research Establishment (WRE) and the University of Adelaide, was designed, built and launched in 1967.

The first amateur radio satellite constructed outside the United States, Australis-OSCAR 5 was a wholly student project, yet it incorporated a number of important innovations, being the first amateur radio satellite to be command controlled from the ground (like a commercial communications satellite), as well as the first to contain a magnetic self-stabilizing system to reduce spin, roll and signal fading. WRESAT, by contrast, was the product of the engineers, technicians and scientists of the WRE and the University of Adelaide, developed as a follow on to the upper atmosphere research work using sounding rockets that they were already undertaking.

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What these two satellite projects had in common was that they represented important steps in Australian space-capability building and, in conjunction with other space activities occurring in the country at the time, could have formed the nucleus of an Australian space program, such as that proposed by the Weapons Research Establishment in 1968. It was certainly the hope of both the WRESAT and Australis-OSCAR 5 teams that further satellite projects would result from their successful missions. This paper will examine these two Australian satellite projects and their relationship to the WRE space program proposal. It will also look at the reasons for the rejection of this proposal by the Australian government of the day.

I. Introduction

In mid-2017, the Australian media applauded the launch of three locally-built CubeSats from the International Space Station, as part of the international QB50 ionospheric research project. Forgotten in the praise for this modest space activity was the fact that Australia's first satellites had been constructed fifty years previously, in 1966 (Australis-OSCAR 5) and 1967 (WRESAT), at a time when Australia was considered a strong participant in world space activities, due to the range of British, American and Australian space projects that were being undertaken at the Woomera Rocket Range and elsewhere in the country [Ref. 1, Chapters 2–5].

Although developed within a year of each other, Australis-OSCAR 5 and WRESAT were completely separate projects—the first, a student-built amateur radio satellite, and the latter a joint project between the Weapons Research Establishment (WRE) and the University of Adelaide that built upon the Australian sounding rocket program being conducted at Woomera.

The fact that a relatively minor nation like Australia could produce two independently-developed high quality satellite projects demonstrated the country's technical skills and ingenuity in innovation. They were important space capability-building projects during a period in which it appeared that Australia would move forward to become a significant spacefaring nation. Yet neither satellite would have successors and their potential to contribute to Australia's space development was lost when the Australian Government rejected the WRE's 1968 proposal for the development of a combined national civil and defense space program.

This paper will examine these two Australian satellite projects and their relationship to the WRE space program proposal. It will also look at the reasons for the rejection of this proposal by the Australian government of the day.

II. Australis-OSCAR 5: An Australian Student Initiative

The first of Australia's two early satellites to be constructed was Australis-OSCAR 5 (AO5), developed by students at the University of Melbourne. Although it would be launched second, AO5 had actually been under construction before WRESAT was even on the drawing board: it was completed five months before WRESAT soared into orbit in November 1967.

Figure 15–1: Members of the Melbourne University Astronautical Society with the engineering model of Australia-OSCAR 5. In the top row, left to right, are: John, Paul, Steve, Richard Tonkin (behind the antenna) and Geoff. Kneeling in the drain are Owen Mace, Peter and Steve. Credit: Owen Mace.

Formed at the beginning of the 1960s, the Melbourne University Astronautical Society (MUAS), whose members were mostly engineering and science students,* began to track and receive signals from various American and Soviet satellites in 1962. With assistance from university staff and lecturers, MUAS commenced the first regular reception of cloud images from the TIROS 8 weather

* A notable exception was Richard Tonkin, a dedicated space enthusiast who was studying Law and became the Project Manager for AO5.

satellite, following its launch in December 1963. These images could be printed out on equipment loaned to the society from the Bureau of Meteorology: until the Bureau established its own receiving facilities, MUAS supplied it daily with visible and infrared weather images from the TIROS and NIMBUS satellites.

The Australis-OSCAR 5 satellite project was inspired by Project OSCAR, a US amateur radio satellite program that had been formed in 1960 by a group of Californian amateur radio ‘hams’ already working in the space field. They constructed the first Orbiting Satellite Carrying Amateur Radio (OSCAR), which was launched in December, 1961 [Ref. 2].

With amateur radio operators among its members, MUAS tracked these early OSCAR satellites, which were launched by the US Air Force as secondary payloads on intelligence satellite launches. These small satellites enabled radio amateurs to gain experience in satellite tracking and conduct experiments in radio wave transmission through the atmosphere. After receiving signals from OSCAR-3 and 4,* MUAS, which had approximately 20 members [Ref. 3, p. 33], was inspired to consider, in conjunction with the Melbourne University Radio Club, building their own amateur radio satellite.

The satellite project, which the students called Australis, to recognize “the Southern Hemisphere and Australia” [Ref. 3, p. 42], commenced in March 1966, with the MUAS team deciding to build a small ‘beacon’ satellite that would transmit telemetry data back to Earth on fixed frequencies. With the assistance of volunteers from MUAS, the Radio Club and other university societies, as well as university staff, the satellite went from concept to completion in little more than a year, being ready transport to the United States by the beginning of June 1967.

THE AGE, Thursday, June 1, 1967

OUR FIRST SATELLITE

Three members of the project team (from left) Owen Mace, 21, an engineering student, Richard Tonkin, 24, a law student, and Paul Dunn, 22, an applied science student, with the satellite.

Australia's first satellite was being prepared for shipment to America yesterday, at the University of Melbourne.

From the outside, it looked like nothing more than a plain aluminium box, but as one of the makers explained: "There's 18 months of hard work in that and ...

... form-fitting alcove in one of the big orbiting rockets. As it climbs into space, an explosive charge will be activated, and Australis Oscar will shoot free of the rocket about 900 miles above the earth.

The antenna (made from steel measuring tape) will whip out, and the two radio transmitters will begin broadcasting on wavebands which can be picked up by radio amateurs.

The Americans, possibly ...

Most drar

Figure 15–2: Headline in Melbourne newspaper *The Age* recognizing Australis as Australia’s first satellite. This article appeared on June 1, 1967, the day the MUAS team left Australia to deliver the completed satellite to the United States. Credit: Owen Mace.

* OSCAR 3 was launched in March 1965, with OSCAR 4 following in December that year.

Australis was a classic example of the Australian tradition of 'making do.' With limited funding, electronic and other components were acquired by donation from suppliers where possible, although the Australis team paid most expenses out of their own pockets. Valuable technical and financial assistance was also received from the Wireless Institute of Australia [Ref. 3, pp. 41, 75]. Some companies that supported the satellite project even based their own advertising on their donations [Ref. 1, p. 47]. University facilities were pressed into service to assist during the construction and testing of the satellite, with the then-Post Master General's Department (which was responsible for Australia's domestic communications) and the Department of Supply also providing testing facilities which the university did not have available. A number of components, including the transmitters and command system, were tested by being flown on weather balloons and high altitude research balloons, to ensure that they were working correctly and were robust enough to withstand the rigors of spaceflight.

The NASA representative in Australia, Wilson Hunter, gave the project significant assistance in arranging matters in the United States, especially when AO5 was finally allocated to a NASA weather satellite launch [Ref. 3, p. 48].

III. Australis-OSCAR 5 in Orbit

Although Australis was delivered to the San Francisco headquarters of Project OSCAR in June 1967, there were substantial delays in finding a launch for it—so much so, that WRESAT would be launched, and even decayed from orbit while Australis waited to hitch a ride into space. With the formation of AMSAT (Radio Amateur Satellite Corporation), which took over Project OSCAR [Ref. 2], the satellite was shipped to its headquarters in Washington DC in March 1969 [Ref. 3, p. 111] where it took a further nine months for AMSAT to put the satellite into final shape, so that it would be approved by NASA as suitable for launch, and arrange the launch itself.

As NASA required that Australis have some scientific or technological merit in order to qualify for a free ride to space, AMSAT justified the launch on the basis that the satellite would provide experience and training for radio amateurs and allow for the investigation of unusual radio signal transmission through the Earth's atmosphere and ionosphere.

At last, more than two and a half years after it was shipped to the United States, the first non-American OSCAR satellite was launched from Vandenberg Air Force Base on January 23, 1970, piggy-backing on a Thor-Delta rocket carrying, appropriately considering MUAS' early weather satellite reception program, the TIROS-M (ITOS-1) weather satellite. The Melbourne University satellite was placed into a 115 minute orbit, varying in altitude between 1416–1464 kilometers. Once in orbit, the satellite was designated Australis-OSCAR 5, making it officially part of the OSCAR series. It was the first Project OSCAR satellite launched since 1965 and the first time an amateur radio satellite had launched with a NASA satellite.

Weighing only 39 pounds (17.7 kilograms) AO5 was constructed in the form of two aluminum shells, with external dimensions of 43cm x 30cm x 15cm. It carried two small transmitters, each broadcasting the same telemetry signal on 29.450 MHz in the 10-meter band and 144.050 MHz in the 2-meter band. The telemetry system was sophisticated, but designed for simple decoding without expensive equipment. The start of a telemetry sequence was indicated by transmitting the letters HI in Morse code, which was then followed by seven telemetry parameters providing data on battery voltage, current, and the temperature of the satellite at two points as well as information on the satellite's orientation in space from three horizon sensors [Ref. 3 p. 51]. The electronics were mounted in a frame built around the chemical batteries that supplied power for the satellite.

Although AMSAT applied an experimental paint pattern to the satellite's outer skin, intended to control its internal temperature, this was apparently not effective, as temperature data indicated that the satellite was operating with an internal temperature of around 48–49ºC: it was fortunate that AO5's instruments were robust and had been designed to function at high temperatures [Ref. 3, p. 122].

Figure 15–3: Australis-OSCAR 5 displayed by Own Mace, showing the experimental paint pattern applied by AMSAT. Credit: O. Mace.

The satellite's antennae were cut from a flexible steel measuring tape. Instead of being folded, to be extended once in orbit, they were simply attached at one end to the satellite's casing and wrapped around it to await deployment. When released from its launcher, springs pushed AO5 away into its own orbit.* At the same time, the steel tape antennae unwound themselves and the electronics were turned on. A passive magnetic attitude stabilization system, which main-

* These springs were made by a mattress manufacturer in Melbourne who produced a carefully matched pair of equal force, so that the satellite would not spin when released.

tained the satellite's orientation by reference to the Earth's magnetic field, was used for the first time in an amateur satellite to stabilize Australis and reduce its rate of spin. This helped to reduce signal fading, making it easier for ham radio operators to detect the satellite's transmissions.

The first radio amateur to report receiving the beacon transmission was on the island of Madagascar: he detected the 2-meter signal 66 minutes after launch. Another amateur in Darwin, Australia reported reception of the 10-meter signal a few minutes later. Other radio amateurs in Western Europe and North America also reported receiving both the 2- and 10-meter signals on the satellite's first orbit. The use of the 10-meter band was also a first for AO5, as it had not previously been used for satellite transmission. During its initial orbits Australis- OSCAR 5 passed within range of Melbourne and members of the Melbourne University Radio Club were able to tune in to the satellite. At the end of the first orbit, however, problems developed with the 10-meter transmission, which eventually became very difficult to decode.

By the end of Australis' first day of operation, AMSAT headquarters had received more than 100 tracking, telemetry and reception reports: eventually, reports were received from several hundred stations in more than 27 countries [Ref. 1, p. 49]. Several radio clubs performed extensive tracking and telemetry data recording, with the observations recorded on standard reporting forms that were suitable for computer analysis.

AO5's 2-meter signal operated until February 14, although the 10-meter transmission continued until the satellite's batteries failed around March 9. Utilizing the first successful command system installed in an amateur satellite, ground stations in Australia and the US used a prearranged schedule to switch the transmitter on (mainly on weekends) and off (during the week) to conserve the battery power. This demonstration of command capabilities played an important role in securing US Federal Communications Commission licenses for later amateur radio satellite missions which carried the same equipment. Performance measurements of the 10-meter beacon confirmed that this band would prove suitable for transponder downlinks on future spacecraft, and led to its use on OSCARs 6, 7 and 8.

IV. Australis-OSCAR 5's 'OSCARS'

Although its batteries failed more quickly than anticipated [Ref. 3, p. 123], only operating for six weeks, Australis-OSCAR-5 remains in orbit and will continue to do so for several thousand years. Despite its 'amateur' origins as a student-led project, the satellite achieved a number of significant firsts:

- First Australian-built satellite (before WRESAT).
- First non-US amateur radio satellite.
- First satellite developed by university students.
- First non-government secondary payload and the first amateur radio satellite launched by NASA.
- First satellite, along with Tiros M, to be launched by the then-new Delta N rocket.
- First 10-meter band transmitter flown on an amateur satellite.
- First command system flown on an amateur satellite.
- First passive magnetic stabilization and orientation system on a satellite.
- First use of 'Standard Orbits' method for predicting passes and for tracking.*
- First direct transmission of satellite predictions (equator crossings) from a computer to users via radio without human intervention.

The Australis-OSCAR 5 program provided valuable training in satellite construction and operation (not only for the MUAS team but for all those involved) and the satellite's success encouraged the MUAS students to consider ambitious follow on projects, including the development of a solar-powered multi-channel repeating satellite, which would both transmit and receive signals [Ref. 3, p. 127]. However, due to the difficulty of finding project funding and the need for the students to concentrate more on their studies and family life, this and similarly ambitious projects were to remain unrealized, although team member Peter Hammer, did provide the command system for OSCAR 6 and the telemetry system for OSCAR 7.†

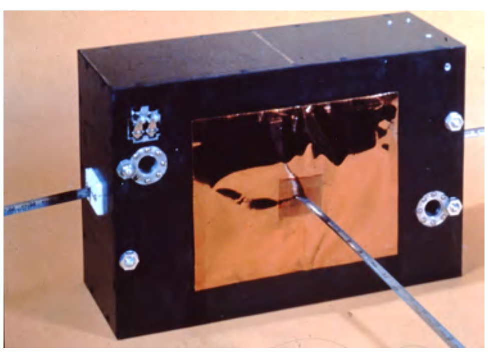

Figure 15–4: Australis-OSCAR 5 as delivered to Project OSCAR in 1967. Note the antennae made from steel measuring tape. Credit: O. Mace.

Owen Mace, one of the leaders of the Australis-OSCAR 5 project went on to work on a number of space projects in Australia and overseas. In an interview in 1992, he noted that the AO5 project represented a lost opportunity for the MUAS team, and for Australia, to create a small satellite industry, as the satellite

* According to Owen Mace (Ref. 3, p. 141) this method was later adopted and improved by NASA for use by US Antarctic expeditions.

† OSCAR 7, launched in 1974, is still operational after more than 40 years in orbit and at the time of writing is the record holder for the longest working satellite in Earth orbit.

project had created a nucleus of skills and experience around which a satellite company could have been established [Ref. 4, p. 54].

V. WRESAT: First Australian Satellite in Orbit

In contrast to Australis-OSCAR 5's student origins, WRESAT, the first Australian satellite in orbit, was a joint project of the Weapons Research Establishment (WRE), the managing agency for the Woomera Rocket Range, and the University of Adelaide, with the assistance of the United States. The satellite's genesis drew together the civil sounding rocket programs and defense-related reentry research being conducted at the Woomera Range in the 1960s.

A previous paper by the lead author outlined the history of the Australian sounding rocket program, which commenced at Woomera in 1957, as part of Australia's participation in the International Geophysical Year [Ref. 5]. Partnering with the WRE in this Australian upper atmosphere research program was the School of Physics at the University of Adelaide. Under the supervision of Professor John Carver, the university provided scientific instrument packages for the WRE-developed sounding rockets. By the mid-1960s, this program had attained a level of technological and scientific maturity that enabled it to take advantage of the fortuitous availability of a launch vehicle to make the leap from sounding rocket to satellite.

In 1966, Britain and Australia were participating in a US-led defense research project to investigate the physics of high velocity warhead reentry into the Earth's atmosphere [Ref. 1, pp. 75–76]. Dubbed Project SPARTA (Special Antimissile Research Tests, Australia), this program used American Redstone boosters[*] with two small upper stages, to launch its reentry test heads. Ten Redstone rockets were brought to Woomera for this program, but by the latter part of 1966 it had been determined that only nine would be needed to complete the research.

Senior officers in the WRE sounding rocket program realized that this spare vehicle could be used as a satellite launcher and became excited by the possibility of extending the WRE's upper atmosphere research into orbit with the development of an Australian satellite. An informal approach to the US SPARTA team in regard to the intended fate of the spare booster received a positive response: instead of being shipped back to America, the last SPARTA Redstone would be formally offered to Australia. The US team also offered to prepare and fire the Redstone for the satellite launch. Taking advantage of this US offer,

[*] The Redstone had formed the basis of the launcher used to place both the United States' first satellite and its first astronaut, Alan Shepard, into space.

however, placed the project on a very tight schedule, as the satellite would have to be ready for launch by the end of 1967, when the SPARTA project would be complete and the Americans returning home. WRESAT (Weapons Research Establishment Satellite) was therefore designed, constructed, tested and finally launched in just 11 months, a pace of development as rapid as that of AO5.

Australian government approval was necessary to proceed with the project and authorize a budget: however, the Australian Government, which had been in under the same political party since 1949, had not shown any particular support for developing an Australian space program, as will be further discussed below. The Minister of Supply, responsible for the WRE, ultimately obtained Cabinet approval for the satellite project by persuading his colleagues that WRESAT offered Australia the chance to gain international prestige and become a member of the 'Space Club,' at a very low cost, since the launch vehicle and launch services were being provided free of charge. In addition, the University of Adelaide was contributing part of the cost of the satellite's experiment package. NASA and the European Launcher Development Organization (ELDO) had agreed to provide free tracking of the satellite and many other expenses could be absorbed within Woomera's operating budget [Ref. 6].*

VI. Constructing and Testing WRESAT

With such a short development period available for the satellite, WRESAT became, like Australis, an excellent example of Australian skill at 'making do' in order to have the satellite completed on time. Many compromises were made, and 'on the fly' solutions to problems were developed to keep the program on schedule. To simplify the development of WRESAT's scientific payload, it was decided to use instruments very similar to those already used in the sounding rocket programs. This would enable the upper atmosphere research program to be extended to orbit, providing data that could be directly compared with that already obtained from sounding rockets.

Together, the University of Adelaide team and the Upper Atmosphere Research Group at the WRE developed a suite of instruments to detect and record solar radiation at three of the wavelengths that most directly influence the temperature and chemical composition of the upper atmosphere. These detectors were also used for measurements of the temperature of the solar atmosphere. An-

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* The only significant cost that Australia had to pay for the launch was to the TRW company for reprogramming the Redstone's inertial navigation system to the orbital trajectory for WRESAT.

other experiment took advantage of the sunrise and sunset observed in each 90 minute polar orbit, to detect the absorption of the Sun's rays at these times in order to measure molecular oxygen density [Ref. 7, pp. 486–487].

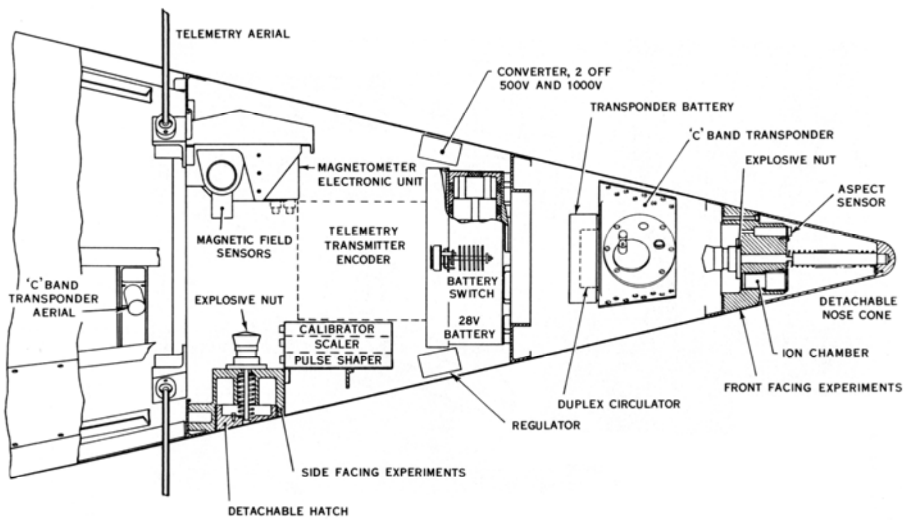

FIGURE 4. WRESAT INSTRUMENTATION LAYOUT

Figure 15–5: Diagram showing WRESAT's internal instrumentation layout. Credit: Defence Science and Technology Group.

For speed and engineering simplicity, WRESAT was designed to conform to the conical shape of the existing SPARTA test nosecones, meaning that the satellite's physical parameters and its launch weight were completely determined by the SPARTA launcher. WRESAT would be built around the vehicle's third stage motor, which would go into orbit with it. Because the satellite also served as the rocket's nosecone, WRESAT would be subjected to vibration and high aerodynamic heating at launch, so a sturdy aluminum internal "skeleton" was designed, to which the outer skin was attached [Ref. 8, p. 62].

To ensure that the satellite could withstand all the rigors of its launch and orbital environments, it had to be thoroughly tested, and a WRESAT prototype, fully equipped with back-up or dummy instrumentation was constructed for this task. Because, in many cases, suitable test equipment did not exist, WRE engineers and technicians jury-rigged the necessary test apparatus: for the longitudinal impact test, for example, an improvised rig was used to drop the satellite onto a block of lead [Ref. 8, p. 62].

Figure 15–6: WRESAT being readied for vibration testing on a shaker-table constructed in-house by the Weapons Research Establishment. Credit: Defence Science and Technology Group.

Without time to design a solar power array, WRESAT had to be battery-powered, which doomed it to a very limited operational lifespan. Data from WRESAT's 14 instruments and information from 15 different housekeeping functions would be transmitted back to Earth and recorded at NASA tracking stations.* A transportable telemetry receiving station was built to monitor the satellite's signals during launch and orbital insertion. It was improvised from components found in the WRE's warehouses and material borrowed from other facilities, including the NASA tracking station at Orroral Valley, near Canberra, [Ref. 6].

The SPARTA launcher's second and third stages were spin stabilized, for accurate orbital insertion. However, once in orbit the satellite was designed to assume a stable end-over-end rotation that better suited the scientific instrument package. An extremely efficient energy dissipation assembly was designed to speed up the transition from WRESAT's initial spin to the required orbital attitude. Consisting of a loop of tube containing viscous silicone oil which dissipated the satellite's rotational energy as heat, this device functioned so rapidly that WRESAT was ready to commence data gathering within minutes of entering orbit [Ref. 6].

Because of the use of spin stabilization, the entire launcher and satellite had to be dynamically balanced to within certain limits. Since a low-speed verti-

* NASA stations could receive WRESAT's data but not decode it, as the WRE used internally developed equipment to unscramble the signals.

cal balancing machine for the satellite was not available in Australia, the WRE developed a technique to use a commercially available horizontal dynamic balancing machine, normally used for truck engines. So crucial was the dynamic balance that WRESAT was designed so faulty components could be removed and replaced without disturbing it [Ref. 8].

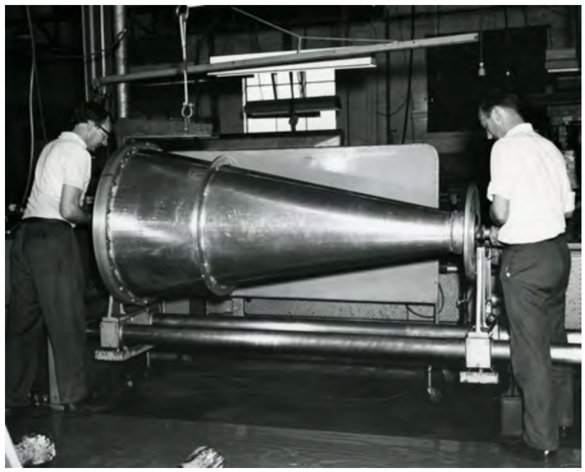

Figure 15–7: Australian ‘make do’ ingenuity: WRESAT being dynamically balanced on equipment usually used for truck engines. Credit: Defence Science and Technology Group.

The large vacuum chamber at the University of Adelaide, which had been established by Professor Carver (with funds from the Australian Research Council) to facilitate the Department of Physics’ upper atmosphere work, was used for WRESAT’s week-long hot and cold soak, to ensure its readiness for flight. This chamber had been designed to be large enough to contain complete sounding rocket nosecones and large balloon instrumentation packages and so was just capable of containing the satellite [Ref. 9].

Originally scheduled for November 28, 1967, WRESAT’s first launch attempt was scrubbed due to a minor technical problem. The launch was rescheduled for the following day, with a six-hour countdown commencing at 8.19 am. This second countdown was flawless and at 2.19 pm on Wednesday November 29, Australia’s first satellite lifted off.

WRESAT was placed into a 169 x 12,445 km elliptical orbit. The ELDO downrange tracking station at Gove (Nhulunbhuy), Northern Territory, and NASA tracking stations received signals as the satellite made its first orbit: final confirmation that it was actually established in orbit come from the NASA

Manned Space Flight station at Carnarvon in Western Australia, which picked up WRESAT's signals on time, 99 minutes after launch [Ref. 7, pp. 492–493].

Figure 15–8: Australia's first satellite successfully lifts of on November 29, 1967. Credit: Defence Science and Technology Group.

WRESAT's battery only allowed five days of operation, but during this time the satellite gathered a large amount of data on upper atmospheric conditions, with most instruments working as planned. However, the short duration of the mission meant that WRESAT could do little more than provide a check on the data already gathered by the Australian sounding rocket program and was unable to contribute to the long term sounding rocket studies of fluctuations in the levels of ozone and molecular oxygen over time. Three days after WRESAT's launch, a British Skylark rocket fitted with identical instruments was fired from Woomera. Reaching a height of 100 km, against the 196 km low point of WRESAT's orbit, the two craft provided complementary data that also provided a check on the satellite's instruments, demonstrating that they were functioning correctly.

WRESAT's low perigee led to rapid orbital decay and the satellite reentered on January 10, 1968, vaporizing somewhere between Ireland and Iceland.

VII. Australia's Place in the Space Club

WRESAT's successful launch and on orbit operation placed Australia in the company of a select group of nations that had, either totally independently, or with US assistance, launched a satellite of their own. For a country not considered by the rest of the world to be a major technological nation, it was an important technical and scientific achievement and clearly demonstrated the space capabilities of Australian science and industry.

The WRESAT launch is often lauded as placing Australia was either the third or fourth in the ranking of nations that have launched their own satellites. However, the exact order of precedence is, in fact, a more complex matter. France had developed its own independent launch vehicle and orbited its first satellite in 1965 from a base in Algeria, which had previously been a French colonial territory. Canada had built a satellite that was launched on its behalf by the United States in 1962. In the same year, the UK provided the instruments for a 'British' satellite built and launched by NASA. An Italian-built satellite was launched by the US in 1964, while a second Italian satellite was launched, using an American-supplied Scout rocket, in April 1967, from Italy's San Marco mobile launch platform, based off Kenya.

The lead author believes that the most appropriate sequence is for France to be recognized as third after the USSR and United States, since it independently developed both its rocket and satellite, with Italy fourth and Australia fifth, since both nations used American rockets to launch their own satellites from national launch facilities.

The successful launch of WRESAT earned Australia congratulations and praise from the international community: US President Johnson was quoted as saying that WRESAT "shines as brightly as the Southern Cross" and even the USSR expressed a welcome to the 'Space Club' [Ref. 7, p. 492]. The Australian media, initially dismissive after the first aborted launch attempt, heaped euphoric praise on the satellite project after the launch and Australian politicians were quick to bask in the glow of the achievement, despite their lukewarm support for WRESAT when it was first proposed.

In February 1968, Fairchild Australia presented the WRESAT team with its Planar Award for outstanding achievements in the Australian electronics industry. A WRESAT display was presented internationally at conferences and trade fairs as a demonstration of Australian technological prowess.

Figure 15–9: WRESAT under construction. The project logo is visible, depicting a leaping kangaroo in the foreground with a stylized Aboriginal woomera (throwing stick) that symbolizes the Woomera Rocket Range, where the satellite was launched. Credit: Defence Science and Technology Group.

VIII. WRESAT, Australia-OSCAR 5 and an Australian Space Program

The Weapons Research Establishment and the University of Adelaide hoped that if WRESAT was successful it might lead to funding for further satellites: the official designation of the satellite was actually WRESAT-1, for just that reason [Ref. 9]. Carver's team at Adelaide University were particularly interested in establishing a long-term database of measurements from orbit that would complement the data being obtained with sounding rockets.

Although Australis-OSCAR 5 would not fly until 1970, the WRE was aware of the program, since it invited three representatives of the MUAS team (Owen Mace, Richard Tonkin and Peter Hammer), to the WRESAT launch [Ref. 3, p. 104] and was most likely well aware of some, if not all, of its technical capabilities and innovations [Ref. 3, pp. 104, 135].

WRESAT and Australis-OSCAR 5 together demonstrated that Australia had the capability—in technological, engineering and scientific skills; and in innovation, ingenuity, problem solving and project management—to establish a modest satellite construction industry that, coupled with its experience in developing sounding rockets, could serve the country's space technology needs in the civil, scientific and defense sectors.

Although the WRE lacked experience in the construction of satellite launch vehicles, its various divisions encompassed many of the technologies required for launcher development (such as guidance, propulsion, propellants and launch facility operation), which were already honed over more than a decade of missile and sounding rocket development [Ref. 10], in addition to supporting the ELDO Europa satellite launch vehicle program. Transferring these skills to the development of larger national launch vehicles could be accomplished over time—and in the meantime, the United States was apparently willing to make a number of surplus Redstone vehicles available at very cheap rates [Ref. 3, 136; Ref. 9].

Shortly after the conclusion of the WRESAT project, the WRE put forward to Government a 'space policy' submission that contained a proposal for the establishment of an Australian space program [Ref. 11]. The modest, well costed, proposal was designed to support the defense, civil and scientific space sectors, and suggested the development of an ongoing program of 'WRESAT-class' satellites that could be customized for defense or civilian use, launched by Redstone vehicles purchased from the United States. It also suggested an extension of the sounding rocket program, since the data from upper atmosphere research could have both scientific and defense applications.

However, WRESAT-1 was never to be followed by WRESAT-2, much less WRESAT-3 or 4. Cabinet had been convinced to support the satellite project on the basis that it represented a cheap way for Australia to achieve international prestige as a 'player' in the Space Age. However, there was no interest within the Australian Government in establishing a permanent Australian 'space presence' and no willingness to expend further funds on space projects.

National Archives of Australia file NAA: A1209, 1967/7740 also makes it clear that interdepartmental turf wars within the Commonwealth bureaucracy meant that individual government Departments would not willingly cede control of whatever piece of the much-segmented space pie they oversaw.

As a result, the WRE space program proposal was rejected, on the basis of cost, and the opportunity to build an Australian space program, based upon the expertise developed for the WRESAT and AO5 programs, was lost.

It should be noted that the rejection of the WRE proposal in 1968, was merely repeating a pattern that began as early as 1959, when the Australian National Committee for Space Research (ANCOSPAR) of the Australian Academy of Science, put forward a proposal for a purely civil, scientific space program [Ref, 12]. Although only requesting funding for six sounding rockets flights per year (roughly the average number of flights that the University of Adelaide gained access to annually as a result of its joint programs with the WRE [Ref. 9]), this proposal was also rejected by Government on the basis of cost.

Another lost opportunity soon followed. Commencing in 1959, the United States offered to launch satellites for allied nations. Britain, France, Canada, West Germany and Italy would all accept the invitation and fly national satellites on US launchers in the 1960s. The offer was extended to Australia in 1960. Despite strong support from the Commonwealth Scientific and Industrial Research Organisation, the WRE, ANCOSPAR and other sections of the Australian scientific community, the offer was rejected, ostensibly on the basis of cost, but primarily due to the same kind of interdepartmental turf wars that bedeviled the later WRE space program proposal. [Ref. 13, pp. 206–207].

IX. Conclusion

WRESAT and Australis-OSCAR 5 represented important steps for Australia in building space-capability building. In conjunction with other WRE space activities they could have formed the nucleus of an Australian space program. The fact that these projects lacked successors was not due to any failure on the part of their technical and scientific development teams. Rather, government disinterest and an inability to perceive the long term benefits to Australia that could have accrued from a home-grown satellite program built upon the expertise developed in these two space projects, meant that they remained 'orphans' until 2002, when Australia's next 'national satellite,' FedSat was launched, during a brief period of renewed space activity. That, however, is a paper for the future.

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