

AUSTRALIS - A HISTORY OF THE DEVELOPMENT OF THE AUSTRALIAN STUDENT-BUILT SATELLITE.

1. Historical Background.

In 1965, Australia was considered, at least by those of us living here, to be a significant player in the “space race” which was then dominated by the Soviet Union and the United States. For we were host to ELDO, the European Launcher Development Organisation, which was trying to produce an independent European satellite launcher, using Woomera as its testing ground.

Australia was also host to lots of American tracking stations for their manned and unmanned satellites and deep space probes, so we considered ourselves to be pretty important in the space business. Alas, this was an illusion. In fact, we were just an ideal launching and tracking site, a big island between the Indian and Pacific Oceans with lots of vacant land to have other people’s burnt out rocket stages fall onto. We were not doing any significant space research ourselves and, when the Europeans packed up and left in 1970, taking the last ELDO rocket with them (which failed just as well in French Guiana as it had at Woomera), there was little to show except for rotting concrete and rusting gantries.

2. “It seemed like a good idea at the time.”

It was against this heady background of Australia thinking of itself as a spacefaring nation that a group of undergraduate science and engineering students, together with a lone law student (myself), members of the Melbourne University Astronautical Society, met in a tiny, dusty rooftop garret behind the air conditioning plant in the Physics Building at the University to plan something more exciting than the Society’s usual activity of showing old NASA films. Sputnik had been launched only a few years earlier, the space age was young, so were we, the world was our oyster, we could do anything - and we would, we would build Australia’s first satellite.

There were, of course, a couple of problems to face. First, how do you build a satellite? Despite ELDO’s presence in the country, nobody in Australia had ever built a satellite before. Assuming we could overcome that little difficulty, there was then the small matter of getting it launched. ELDO had its own, Italian satellite to orbit (it never did) and an all-British launcher, Black Arrow, was still years away from putting up anything. Anyway, those professionals would not be interested in launching an “amateur” satellite. There, however, lay the answer to both problems. In America, Project OSCAR (Orbiting Satellite Carrying Amateur Radio), had already built and launched, as piggyback payloads on Air Force rockets, three amateur radio satellites, and were about to send up a fourth.

We wrote to Project OSCAR (those were slower and more tranquil days - there was no email), significantly, on the 4th of October, 1965, the eighth anniversary of Sputnik. We told them that we, together with the University’s Amateur Radio Club (their inclusion was supposed to make the whole thing respectable), wanted to build

an amateur radio satellite and, if we did, would they launch it ? The letter was long on rhetoric and short on specifics (it was written by the law student). ELDO's then good reputation (they had not yet got past testing the first stage, and that had worked), must have reached America, for they wrote back and said that, if we built a satellite and got it to the United States, they will try to get a launch - no promises, but they would try. That, of course, was more than enough for we young Turks - we heated up our soldering irons and we started bending metal.

3. **"The Simplest Design".**

Sergei Korolev chose "the simplest design possible" for Sputnik 1. We also chose the simplest design, mainly because we had no idea how to build a satellite (nobody in Australia did). In fact, I think we invented the K.I.S.S. principle - Keep It Simple, Stupid. We called our satellite AUSTRALIS - it sounded nice and Australian - certainly better than "Kanga", "Koala" or "Wombat", and nobody else had launched anything called AUSTRALIS.

AUSTRALIS was a rectangular box, about the size of a large briefcase. It carried two transmitters, operating in the 2 and 10 metre amateur radio bands, a receiver to enable us to turn the 10 metre transmitter on and off by ground command, a simple telemetry system and a unique passive attitude control system designed to partially orient the satellite in orbit. AUSTRALIS weighed in at just under 18 kilograms, a microsatellite by today's standards, but it was the biggest thing we 22 year olds had ever done.

4. **(Owen's technical description, which he will, in his own words, make "light-hearted and amusing.")**

5. **"Where did you get the money from to build a satellite ?"**

Having decided to build a satellite, having been encouraged by the OSCAR people that they may be able to launch it, and having worked out what would be in it and what it would do, we started to wonder how we would pay for AUSTRALIS. Now, this is not, of course, the way modern, professional spacecraft are built. It does help these days if you have a budget and somebody who is going to pay for it. But, at the time, I don't think those considerations worried us. We had decided to build a satellite and get it launched, and we would. Oh, to be 22 again !

Of course, as the team building AUSTRALIS was not getting paid anything for what became two years of very hard thinking and even harder work, squeezed in amongst undergraduate studies and a barely discernable social life, that took care of the major budget item. My co-author, Owen Mace, owned an almost new Volkswagen Beetle, purchased for him by his loving parents to take nice girls out to even nicer parties. Little did they know that Owen had no time for that - he was building AUSTRALIS. The Volkswy ferried the team members to and from Sydney (a not inconsiderable journey in a Beetle) and all over Victoria, on missions to beg, scrounge and generally remove valuable electronic components from usually willing and generous manufacturers. We went to Union Carbide and asked them for batteries -

solar cells were far too expensive in those days. "Sure," said Union Carbide, "What do you want them for?" "To send into space", we said. "Space?" they asked. "Yes, you know, Outer Space." After their initial shock and disbelief came a practical solution. They did not have those sort of batteries in Australia but, a few weeks later, a set of space-qualified ones arrived from the United States. We duly drowned them in epoxy (we didn't know how rough a ride we were going to get into orbit - Vanguard was still a recent memory in those days), and eventually sent them back to America in the satellite. I'm sure somebody should have, but I am equally sure that they didn't, pay any import or export duties on those batteries.

We needed antennae for the satellite, ones we could wrap around it and which would spring open by themselves when we got into orbit. We went to a Melbourne tool making company. "How about carpenter's steel rule?" they asked. "Great, we said, but make them strong and flexible - they have to fly in space." We picked them up a few weeks later. To our dismay, they had the inches and feet marked on them (we hadn't converted to metrics then). We said, "We can't send up Australia's first satellite with feet and inches stamped on it's antennae!" "Sorry," they said, "That's how they come out of the machine - we can't take it off." To this day, AUSTRALIS orbits the Earth with it's Stanley Carpenters Steel Rule antennae proudly showing their humble origins.

We heated our little satellite in the kitchen ovens of our friends' homes, we froze her in the Physics Department freezers at the University, moving aside priceless Antarctic core samples to fit the satellite systems in and we launched the transmitters on balloons, chasing them all over Victoria in the Beetle. That was fun.

6. Ready to go.

Eventually, on the 3rd of June, 1967, less than two years after we had written to Project OSCAR, AUSTRALIS was ready to go. Owen Mace, Paul Dunn and I flew to San Fransisco to deliver the satellite to the OSCAR people. Unfortunately, AUSTRALIS was not with us. The command receiver played up the day before we left and had to stay here and be repaired. However, as a big reception had been planned for us in San Fransisco, and as we had missed a lot of parties in the last two years, we three went and left the satellite behind. It arrived a few days after we did, duly fixed, and the baulky receiver actually worked well during the flight.

We then had a long, long wait for the launch. The Air Force classified their space program, so another host had to be found. The AMSAT group was founded by amateur radio enthusiasts working at NASA's Goddard Space Flight Centre in Maryland. They had contacts with the weather satellite program and, on the night of Friday, the 23rd of January, 1970, our little "bird" sat nestled just forward of the second stage engine nozzle of a Delta launch vehicle carrying the ITOS-1 weather satellite, at South Vandenberg Air Force Base, California, awaiting her moment in history.

7. GO ! GO ! GO!

Now, Delta launches in 1970 were not the smooth ride they usually are today. The flight two before ours had ended in the Pacific, so it was with some considerable apprehension that our little group gathered in that tiny rooftop garret in the Physics Building at Melbourne University that January night as the last seconds ticked away at Vandenberg. There was so much riding on that delicate Delta. We had no backup satellite, nor did we have time to build one. We had studies to finish, careers to start, girls to chase. This was the only chance for us to have a place in space history.

The countdown reached zero at 9.31 that night in Melbourne. The Delta lit up, roared off the pad and worked like a good Delta should. Fifteen minutes later, AUSTRALIS-OSCAR 5, as our little masterpiece was now called, was in her planned, sun-synchronous, polar retrograde orbit at 1450 kilometres, and working well. We had done it. We had built a satellite, literally from a clean sheet of paper, we had got it launched and it was in orbit and transmitting to radio amateurs around the world.

Alas, the honour and glory of being Australia's first satellite was not to be ours. On the 29th of November, 1967, WRESAT, a scientific satellite built by the Weapons Research Establishment in South Australia, was put into orbit by an American Redstone-Sparta rocket from Woomera. In a nice gesture from the winners, the WRESAT people asked me to the launch and I represented our team at the liftoff. So, while AUSTRALIS was the first satellite built in Australia, it was the second into orbit.

8. Results (Owen) - with more whimsical humour.

9. Conclusion.

AUSTRALIS was a unique chapter in the lives of those of us who built her. Some people climb mountains, some build business empires, others create works of art. We just built a satellite. It was fun, it was frustrating, it was hard work, but it was great. We were young and enthusiastic, we really didn't know what we were doing, but we did it. It is a real shame that the talents, the drive, the energy that built AUSTRALIS and WRESAT were not harnessed by successive Australian governments. As it was, until the Queensland-built WESTPAC satellite was launched on a Russian booster earlier this year, there had not been an Australian-built satellite launched in the 28 years since AUSTRALIS. Just imagine where this country would have been today in space research and development if the WRESAT and AUSTRALIS teams had been moulded into an Australian Space Agency.

Sometimes, around 10 o'clock at night, when I am putting the dogs to bed, I look up into the sky. AUSTRALIS is there, 1450 kilometres up, where she will orbit for another 450 years - a piece of space junk now, but a proud reminder of what can be done with energy and will. But we are all much older now, with lives, careers and families - my friend and colleague on the project, Owen Mace, became a grandfather last week.

A few years ago, there was an anniversary celebration at Cape Canaveral for Explorer I, America's first satellite. I end this whimsical tale by changing slightly the

words on a sign on the wall of the old blockhouse there, “AUSTRALIS, in truth, was part of our youth, and not only orbits decay.”