John Bolton and the Apollo 11 Moonwalk

Peter Robertson tells the story of John Bolton's involvement in the first moonwalk by Apollo astronauts in 1969

ABOVE LEFT
Unknown photographer
John Bolton in the tower control room at Parkes, 1969
Papers of John Gatenby Bolton (1922–1993)
Manuscripts Collection
MS 9063/4/3
Courtesy CSIRO Australia Telescope National Facility Photographic Archive, image ref. B8223-16

ABOVE CENTRE
CSIRO Division of Radiophysics
Radio Telescope at Parkes, NSW 1961
b&w photograph
19.9 x 24.6 cm
Pictures Collection
nla.pic-vn3627079
Courtesy CSIRO Australia Telescope National Facility, Photographic Archive, image ref. B6573-11

ABOVE RIGHT
NASA Images
The prime crew for the Apollo 11 Mission: Neil Armstrong, Michael Collins and Edwin 'Buzz' Aldrin, 1969
Papers of John Gatenby Bolton (1922–1993)
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This year marks the fortieth anniversary of the Apollo 11 mission to the moon. The widely acclaimed Australian film, *The Dish,* is the story of the part played by the giant radio telescope at Parkes, New South Wales, in the first moonwalk. Well-known actor Sam Neill plays the lead role in the film, a character known as Cliff Buxton, the director of the Parkes dish. In real life, Buxton was the Australian astronomer John Gatenby Bolton. In 1994, Bolton's family donated his personal papers to the National Library of Australia. These papers provide an interesting insight into the experiences and observations of a man who might otherwise be remembered by another name.

Bolton was one of the early pioneers of the new science of radio astronomy. Born in Sheffield in 1922, he grew up under the tutelage of his parents, both school teachers. Gifted academically, Bolton won a scholarship to study at the University of Cambridge, where he graduated with a Bachelor of Arts degree in 1942.

After joining the Royal Navy, Bolton saw service as a radar officer on an aircraft carrier in the Pacific. At the end of the war, he decided that his future was in Australia. In 1946, he joined the Commonwealth Scientific and Industrial Research Organisation (CSIRO) as a junior research officer. Within a few short years, Bolton and his group discovered the first 'radio stars', astronomical objects that emit prodigious amounts of radio energy.

In 1955, Bolton was recruited by the California Institute of Technology, in Pasadena, to start the first major radio astronomy group in the United States. Bolton returned to Australia in 1961 to become the first director of CSIRO's newly completed Parkes dish, which at the time was the most advanced radio telescope in the world. The dish was used to discover hundreds of new radio sources, including a new class known as quasars, the most distant objects in the universe.

Although the primary purpose of Parkes was for astronomy research, a small amount of time in the early 1960s had been devoted to tracking spacecraft for the National Aeronautics and Space Administration (NASA). However, the collaboration did not get off to a good start. Parkes was used to track the Mariner IV spacecraft and the data collected helped to produce the first close-up photographs of the surface of Mars. When NASA scientists published the findings of the Mariner IV mission, Bolton was angered that no acknowledgment had been made of the role played by Parkes.

In 1968, Bolton was again approached by NASA with the request that the Parkes dish take part in the Apollo 11 mission and the first moonwalk, scheduled for July 1969. The request was in a different league from the earlier work tracking NASA spacecraft. To have refused the offer would have been highly damaging diplomatically, especially when the lives of three astronauts were at stake. Bolton and the hierarchy in CSIRO had no hesitation in agreeing to NASA's request.

Parkes was to provide backup in case the moonwalk was delayed or any failure occurred with NASA's own network of tracking stations, which included a 26-metre diameter dish at Honeysuckle Creek near Canberra. NASA's prime tracking station was a 64-metre diameter dish built at Goldstone in California in 1966. Goldstone had been modelled on the Parkes dish but there were differences, such

as extra stiffening of the dish structure which would allow it, if necessary, to operate in gale force winds.

The preparations for Apollo 11 began at Parkes several months before the scheduled launch date. Banks of electronic equipment supplied by NASA were installed in the control room, duplicating all the equipment at Goldstone. However, in May 1969, two months before the launch, NASA made a crucial decision. In the original flight plan, the astronauts were to begin the moonwalk shortly after landing on the surface. NASA now decided that the astronauts needed an extended rest period after landing, allowing them to adjust to the moon's lighter gravity and to start the moonwalk refreshed. The revised flight plan meant that the moonwalk would begin shortly after the moon had set at Goldstone, but when the moon would be high overhead at Parkes. Suddenly, Parkes had been upgraded from backup to prime receiving station.

The upgrading meant that all the NASA equipment already installed at Parkes had to be duplicated. Among the several tonnes of equipment was a prototype of the first home video recorder to capture the televised moonwalk. Bolton and the Parkes crew took responsibility for ensuring the telescope's drive and control systems were in perfect working order. An analysis was made of the failure rates of every part of the telescope dating back to 1961, with identical backup equipment made ready should the need arise. Nothing was left to chance. If all else failed, teams of men had been organised to drive the telescope using their own muscle power!

According to Jasper Wall, a young PhD student at Parkes:

> *John Bolton's preparation for this event was immaculate. He pored over the NASA procedures and flow charts until he knew the mission by heart. He tried to understand and anticipate every eventuality. The NASA team arriving … found that they were interfacing with someone who knew the mission better than they did!*

During a press conference before the mission began, a reporter asked about the possibility of a malfunction. In a prophetic reply, Bolton answered:

> *We have a number of 100 to 1 chances and a number of 1000 to 1 chances. All these have been backed up. Perhaps our biggest weakness is the weather. If we get a very severe storm with very high winds then we'll no longer be able to keep tracking. But this period of the year is the best we have for this kind of situation at Parkes.*

The launch went according to schedule on 16 July. Over the next four days, the equipment at Parkes was thoroughly tested using signals sent from the command module *Columbia* during its outward journey. A regular visitor to the control room was Bolton's wife, Letty, delivering sandwiches packed in a picnic basket for the staff.

On reaching the moon, Neil Armstrong and Buzz Aldrin transferred to the lunar module *Eagle*, leaving Michael Collins in the command module, and began their descent to the Sea of Tranquility. As the lunar module approached the surface, it overshot the chosen landing point and headed straight for a large rocky crater. A disastrous crash seemed inevitable. Armstrong immediately switched off the automatic guidance system and took manual control of the landing. With fuel running dangerously low, he desperately searched for a safe landing place. Finally, with less than 30 seconds of fuel remaining, he found a flat area free of boulders and brought the module down safely. With heart pounding, Armstrong uttered the now famous words, 'Houston, Tranquility base here, the Eagle has landed'.

Armstrong decided to overrule the idea of a rest period—the adrenalin rush on finding a safe landing place would make it impossible for the two astronauts to sleep. Instead, the scheduled moonwalk would be brought forward by four hours. With this change in plans, all the elaborate preparations at Parkes now seemed in vain—the moonwalk would be over before the moon rose at Parkes. Goldstone would assume the role of prime tracking station.

However, Armstrong had underestimated the time needed to prepare for the moonwalk. The process of donning their space suits in low gravity proved more difficult than anticipated. Another difficulty arose with the hatch, which could not be opened until the pressure in the cabin dropped low enough and this was taking much longer than expected. The hours began to pass. By the time the two astronauts were finally ready for the moonwalk, almost as much time had passed as the original rest period. The moon was about to come into view at Parkes.

BELOW LEFT
Bolton's papers include a telex of thanks sent from NASA shortly after the mission's conclusion
Papers of John Gatenby Bolton (1922–1993)
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BELOW CENTRE
Neil Armstrong Buzz Aldrin looks back at Tranquility base, 20 July 1969, after setting up scientific instruments to study the moon—the activity that he and Armstrong spent most of their time doing during the moonwalk.
Courtesy NASA

BELOW RIGHT
Newspaper clippings about the moon mission and the telex from NASA
Papers of John Gatenby Bolton (1922–1993)
Manuscripts Collection
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On Monday 21 July 1969 just before 1 pm (AEST) at Parkes, Armstrong backed out of the hatch while Aldrin switched on the small television camera to capture the event. The world watched as the hazy figure descended the small steel ladder. As his boots sank into the finely powdered lunar surface, Armstrong delivered his immortal line, 'That's one small step for [a] man, one giant leap for mankind'.

At Parkes, events had taken a dramatic turn for the worse. As Bolton recalled:

> *For several days during Apollo's outward flight to the moon the weather had been perfect at Parkes. Incredibly, moments before the moonwalk began a violent squall could be seen approaching. With the dish down at full tilt it was in its most vulnerable position. In any other circumstances we would have hurriedly driven the dish to its upright position where it can be safely stowed. The wind gust hit at over 100 km per hour, tipping the dish back. In the control room we felt the tower sway several centimetres. The atmosphere was tense, with the wind alarm ringing and the telescope ominously rumbling overhead. It was an extraordinary piece of bad timing. The gust was the strongest ever recorded during our eight years of operation.*

The battering wind kept up throughout the afternoon but, despite the dangerous conditions, the telescope was able to continue operation.

When the moonwalk began, the NASA Command Centre in Houston received lunar television signals from three sources—Goldstone, Honeysuckle Creek and Parkes. For the first few minutes, NASA switched between Goldstone and Honeysuckle. With the moon almost directly overhead, the Goldstone dish had been perfectly placed to be the prime station, but events again took a strange twist. The quality of the Goldstone picture was very poor, probably caused by faulty settings in the video equipment. When Houston switched to Parkes, the TV picture was of such superior quality that NASA decided immediately to use Parkes for the remainder of the moonwalk.

Bolton and the Parkes team carefully tracked the moon to produce the strongest possible TV signal. The signal was transmitted to Paddington in Sydney where it was split in two. One split was sent to ABC television and to its Australian audience. The other split was beamed via satellite to California, transmitted by cable to Houston, and then sent out by satellite for worldwide distribution. Australians got to see the moonwalk about 0.3 seconds ahead of the rest of the world!

At 6 pm, after five hours of reception, Parkes shutdown the telecast. The television transmission from Houston was seen by an estimated 600 million people in 50 countries. For the first time, the entire global telecommunications system had been focused on an event of unique historical importance.

The *New York Times* reported:

> *The tracking crew at the Parkes antenna in Australia won praise today for its work in picking up television signals of the Apollo 11 moonwalk last Sunday. The flight controller, Cliff Charlesworth, said he wanted to give the crew a 'special bouquet' for getting into operation quickly when the signals were suddenly shifted from the Goldstone tracking disc in California. 'It's obvious that the support they provided us was pretty outstanding,' Mr Charlesworth said, 'because I think it will be years before anyone can beat that TV spectacular'.*

PETER ROBERTSON is a science writer based in Melbourne and is writing a biography of John Bolton. In 2008, he was awarded a Harold White Fellowship by the Library to study the Bolton papers