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# John Bolton and the Rainmakers*

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*Abstract*

Between 1953 and 1955 John Bolton disappeared temporarily from the world of astronomy to work with the Radiophysics Laboratory's Rain and Cloud Physics group. This paper is a brief account of what he was doing during this period.

## 1. Background

In 1953, J. L. (Joe) Pawsey reviewed the work of his radio astronomy group and made a few sweeping changes. Amongst these, he brought John Bolton back from the Dover Heights field station to the Radiophysics Laboratory in the grounds of the University of Sydney. At the time, a general feeling existed in the United States that they should become further involved in radio astronomy. One result of this was that the California Institute of Technology decided to set up a radio astronomy observatory. As we all know, it ended up being at Owens Valley.

In about August 1953, the then chief of Radiophysics, E. G. (Taffy) Bowen, struck a deal with Bolton. It seems that John agreed to work in Taffy's Rain and Cloud Physics group for about two years and, in return, Taffy would put in a good word for him at Caltech with Lee DuBridge, an old wartime mate of Taffy's and then president of Caltech. Taffy, of course, hoped to get something out of this deal, and I can still hear him, in his rather strange and somewhat hybrid accent, telling us at a Rain Physics group meeting: 'I am putting Bolton into the group to do for cloud physics what he has done for radio astronomy.' It was clear that Taffy considered John Bolton to be a person who did not let experimental difficulties stand in his way—he got results.

## 2. Rainmaking

At that time E. J. (Pat) Smith (see Fig. 1) and K. J. (Mick) Heffernan were measuring the decay of silver iodide—the most commonly used rainmaking agent (Smith *et al.* 1955). To do this they were flying back and forth in a C47 Dakota (Fig. 2), sampling a silver iodide smoke plume emitted from the ground

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along with a plume of fluorescent zinc sulfide dust (for comparison in the decay measurements), and a procession of hydrogen-filled balloons (to make it easier for the pilot to find the smoke plume). The balloons were weighed down with toilet paper so that they would lift at the same rate as the smoke and dust plumes. As a young technical assistant, I spent most of the time inflating balloons and tearing off toilet paper.

These experiments were a bit fragile. First, the weather had to be stable with no wind shear, no rain and good visibility. Second, it was better, if possible, not to fly an aeroplane around all day 100 feet above suburban rooftops. So we did all this in the country, either at Dubbo in N.S.W. or at Bundaberg in Queensland. In Dubbo the locals complained (understandably) because we left toilet paper in the paddocks, in the fences and in the trees. In Bundaberg they complained because we chose sugar-cane-burning-week to start burning our silver iodide. In fact, we added only a little smoke to that already being produced by the sugar-cane burners. Nevertheless, Pat Smith had to do a bit of explaining and smooth a few ruffled feathers. Meanwhile, Taffy was impatient to get the results he wanted.

So, to return to John Bolton's involvement in the rainmaking experiments. Pat Smith was ex-airforce (in World War II) and loved flying; John was ex-navy and did not. John decided, therefore, that he could do the necessary experiments in a large box, which he had the Radiophysics' carpenters make. The box was a 4-ft cube and I remember his remarking to me that he had not realised just how big a 4-ft cube was. It was so big that it could not be removed from the carpenters' shop and so he conducted this vital piece of research right there, amongst the carpenters. Typically, this was fine with him.

During this time, John had a large Pakistani colleague whose face was almost completely covered with hair. His name was Ahmed Qureshi and he was visiting from the Pakistan Meteorological Office. The way he and Ahmed tackled the decay problem was to fill this 4-ft-cubed storage box with a goodly concentration of silver iodide smoke which was then tested every few minutes for its ice-nucleating abilities. The smoke was made by burning the double salt, sodium silver iodide dissolved in acetone, in a very large commercial blowlamp—the sort that you primed with burning methylated spirits and then pumped-up. But, John and Ahmed had Bill Thompson assisting, and Bill always used an oxy-acetylene welding torch to prime the blowlamp.

The samples were syringed out of the storage box and squirted into a cold cloud chamber (Fig. 3) where the number of resulting ice particles could be counted. This of course was then an estimate of the concentration of silver iodide particles still effective as freezing nuclei.

The experiments went well until Ahmed got too close to the blowlamp and lost a lot of whiskers. Then Bill managed to burn a hole in the priming coil with his oxy torch, producing orange flames in all directions (Fig. 4). This could have been disastrous and, indeed, John alluded to a related near-disaster in his written report: 'The use of water to prevent the storage box catching fire resulted in fairly high relative humidities.'

Despite these setbacks, John and Ahmed measured the decay of silver iodide as a function of temperature and pressure (using an air-compressor receiver as a storage tank). From these measurements they constructed a table of predicted

**Fig. 1.** E. J. (Pat) Smith (spectacles) with a typical silver iodide burner, which produces a distinctive orange-coloured flame.

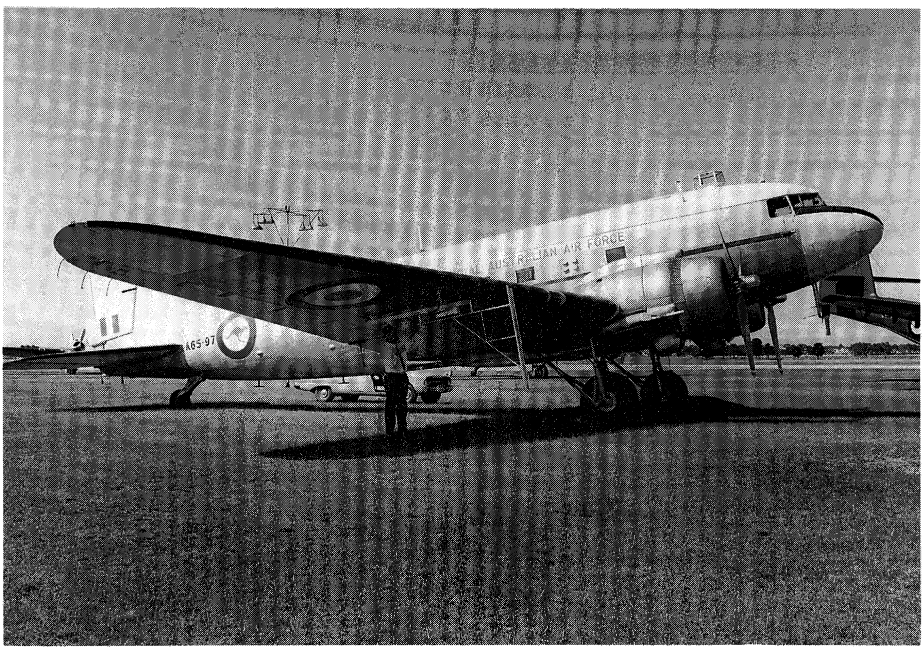


**Fig. 2.** One of the RAAF Detachment B Dakotas used for airborne experiments.

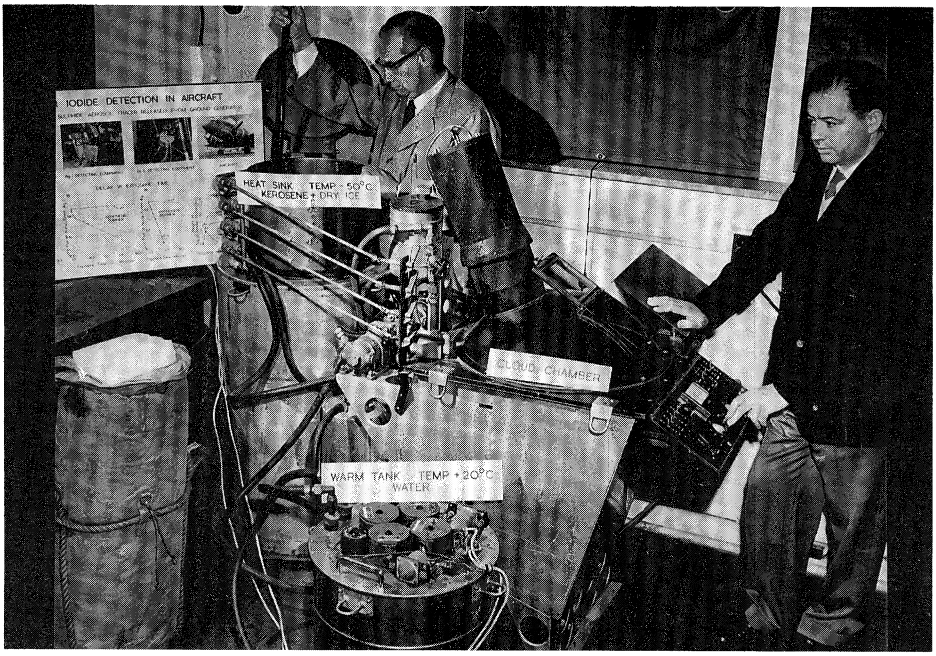


**Fig. 3.** K. J. (Mick) Heffernan (right) and Bill Thompson demonstrating the type of cloud chamber flown in the Dakota, and which John Bolton used in his laboratory experiments.

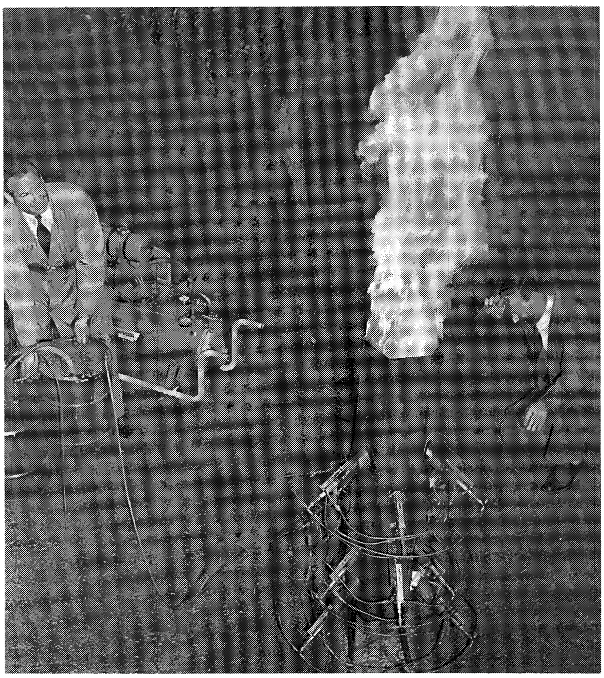

**Fig. 4.** This is not quite Bill Thompson (left) burning a hole in the blowlamp, but it is typical of Bill and his apparent love of fire. We once got quite used to the smell of burning hair. Eric Miller (with matches) is on the right.

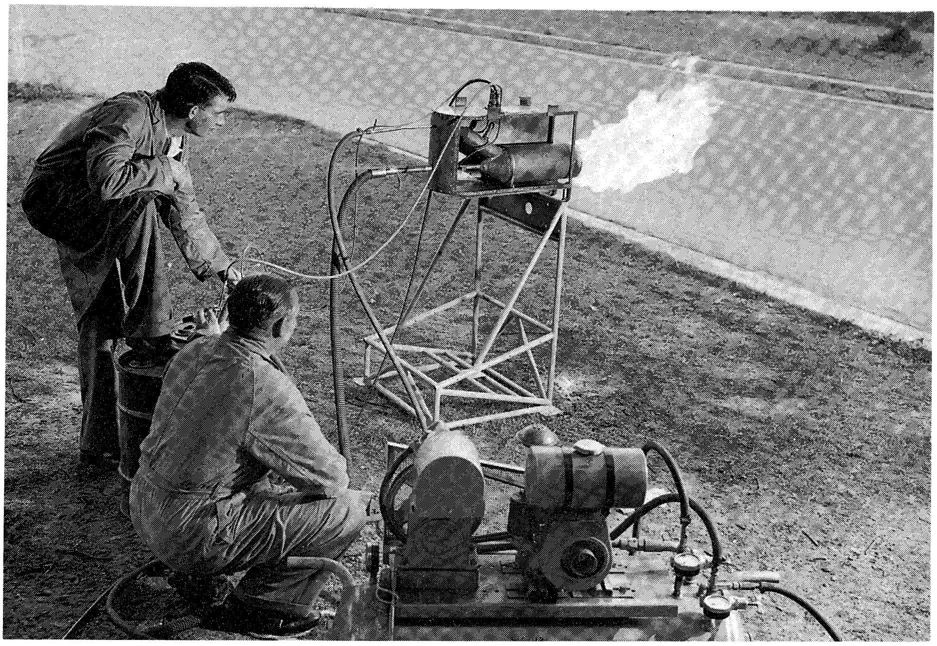

**Fig. 5.** John Bolton (left) and Bill Thompson testing a silver-iodide burner of the type used in ground-based rainmaking trials.

decay rates at various heights in the ICAN standard atmosphere, and concluded: '... the use of ground generators in warm climates is unlikely to be of any value' (Bolton and Qureshi 1954).

John was then involved in developing silver iodide burners for rainmaking trials in Queensland and Tasmania. Fig. 5 was taken during that period, one of the few photographs in existence of John Bolton, the Rainmaker. In January 1955 he left rain physics and moved to the 'promised land'—to a professorship of astronomy and physics at Caltech.

It is only fair to state that, just two years after the Bolton and Qureshi (1954) paper was published, their experiments were repeated by Jack Warner and Keith Bigg, who concluded: '... the decay rates reported by Bolton and Qureshi were due to the use of smokes at high and varying concentrations and their correlations with temperature and pressure were purely fortuitous' (Warner and Bigg 1956). But these were the barnstorming days of rainmaking, the halcyon days. Within a few years, a much more exact science of cloud physics was to emerge.

**Acknowledgment**

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