Special facilities had to be developed and a proving flight was conducted in August 1975. The balloon was launched on 5th August from a site in north-west Sicily and the automatic ballast system maintained the balloon’s altitude very satisfactorily until the ballast supply was exhausted. The on-board radio navigation system located the balloon with very good precision at all times during the flight. Commands were reliably communicated to the payload throughout the flight and data were recovered for almost all of the 80-hour period that the balloon was at float altitude. The flight was terminated soon after crossing the eastern coast of the United States.

Following the success of this proving flight, three or four flights are planned for 1976. Whilst these initial long-duration flights will take place across the North Atlantic during the months of June, July or August, a similar consistent wind pattern occurs in the southern hemisphere six months later. Flights across the Southern Pacific or Southern Atlantic would provide valuable opportunities to observe the galactic centre region.

The President. Thank you, Dr. Ramsden. I will start the questions. Has Professor Fowler developed his plastic sandwiches yet?

Dr. Ramsden. I haven’t heard that he has, but I am sure that the work is in hand.

Dr. J. Shakeshaft. And the gamma-ray bursts?

Dr. Ramsden. We received the data tapes three or four weeks ago and are working on the analysis. The detector certainly worked during the flight.

Professor G. C. McVittie. What is the advantage of a transatlantic flight, rather than, say, New York to San Francisco which would enable you to use as many ground stations as you wished?

Dr. Ramsden. It is only one-third of the distance from Sicily to California, and also it is logistically difficult to share control of a flight from a number of ground stations.

Mr. R. L. Strawford. What is the terminal velocity of the stainless steel ballast you eject?

Dr. Ramsden. The ballast has the texture of sand and is not dangerous.

Dr. W. C. Seslaw. How easy is it to maintain the pointing stability of such a payload?

Dr. Ramsden. We were aiming for one-third of a degree which is typical of X- and gamma-ray astronomy payloads. A stabilized balloon platform is being developed which should give offsets accurate to minutes of arc and with rms noise of ten arc seconds. This has not been specifically developed with long balloon flights in mind but could probably be adapted to this use. A star tracker provides the accurate positional information and a version to work at balloon altitudes during the daytime is under consideration.

The President. We must congratulate Dr. Ramsden and his team on this achievement and wish him well for future flights. Our next talk is by Dr. Wynn-Williams on W3.

Dr. C. G. Wynn-Williams. W3 is one of the most popular H II regions among both radio and infrared astronomers. This is partly because of its ideal location in the northern winter sky, partly because it is one of the nearer of the giant galactic H II regions, and partly for the variety of the data, including optical data, available on it.

The main piece of work I want to describe is a new map made with the Cambridge five-kilometre telescope at 5 gigahertz. With the two-arc-second resolution of this map we have confirmed that most of the radio flux from
the central few arc minutes of W3 comes from four or five very well defined condensations. The two largest condensations, W3(A) and W3(B) have sharp edges which indicate the presence of ionization fronts between the H II regions and the surrounding neutral, probably molecular hydrogen. W3(A) has a clumpy, thick shell structure surrounding two very highly reddened O stars; an analysis of the angular distribution of the radio emission around these stars has provided additional evidence that the H II condensations are ionization bounded. We have also re-examined the infrared colours of the exciting stars of W3(A) and have shown that they are probably an O5 plus a later OB star obscured by about 14 and 10 magnitudes of apparently normal interstellar dust. Finally, our new observations have allowed us to set an improved upper limit to the radio emission from W3-IRS5, supporting the hypothesis that this object is an infrared proto-star.

A complementary study of W3(A) and W3(B) has recently been completed with the Westerbork telescope to study the H109a recombination line. This work shows that the two condensations have significantly different systemic velocities. W3(A) shows no obvious rotation, but possesses some velocity symmetry about the line joining its exciting stars. There is evidence in favour of a model in which some of the ionized gas is escaping towards us through a partial gap in the surrounding neutral material.

At Caltech the one-millimetre thermal dust emission from W3 has been mapped with the 200-inch telescope, which gives a resolution of about 1 arc minute. It appears that this very far infrared emission is peaked near the "proto-star" W3-IRS5, rather than on any of the H II condensations. Scans of W3-IRS5 show it to be a one-arc-second double star, the two components of which have considerably different depths of silicate absorption. This latter result provides yet further evidence for dense neutral gas within W3.

The very nearby compact, isolated H II region W3(OH) has been mapped at 15 gigahertz, using the Cambridge five-kilometre telescope. The resolving power here is 0.6 arc seconds, the highest yet achieved. The size of the H II condensation is about 4 arc seconds, comparable with the overall separation of the OH components associated with this object. The extent of the W3(OH) source is much smaller than that of the main group of W3 objects I have been discussing; the importance of the W3(OH) is that it may represent an evolutionary link between the infrared proto-stars such as W3-IRS5, and the larger H II condensations such as W3(A).

The President. Are there any questions?
Dr. B. J. T. Jones. What is the distance to W3?
Dr. Wynn-Williams. Two to three kiloparsecs.
Dr. M. Rowan-Robinson. I would query your conclusion about the nature of the dust in these molecular clouds; the surface brightness of the Orion cloud at one millimetre is too high to be due to small silicate grains, which would be very inefficient radiators at one millimetre.
Dr. Wynn-Williams. My comment that the dust appeared normal applied only to the wavelength range from the visible to 2.2 microns. However, as regards properties of the dust at one millimetre wavelength, Werner has produced a model which he believes can explain the very far infrared emission without invoking very large grains.
Dr. D. McNally. What is the difference in absorption between the two components of the infrared binary?