SPEECH BY PROFESSOR R.L.F. BOYD AT OPENING OF THE MULLARD SPACE SCIENCE LABORATORY MAY 3RD 1967.

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It is a happy thing that you, Sir Harrie, should be presiding, and that Dr. Jones should be our distinguished guest on this occasion. To have the founders of British Space Science together and to be making a public speech involving that subject is the strongest temptation for reminiscence. I recall, for example, our visit to see Dr. Jones at Farnborough at the very start of the programme, and the excitement of discovering that we were to get not just a little rocket reaching 80 Km, but one that, when fully developed, would reach about 300 Km - Skylark, as it became known, is still one of the best vertical sounding rockets in the world. With all its many and varied facilities that Dr. Jones and his staff at Farnborough foresaw back in 1954 and, what is more, determined we should have, the British University teams have had, and still have, advantages for which they are sincerely grateful.

But with this praise of a first-class rocket, I shall allow myself but one more backward glance before telling you of the future.

It must have been early in 1953 when Professor Massey remarked to me, on coming into the lab one morning - "How would you like some rockets for your research?". There is no need to tell you my reply, but it would be helpful to tell you what research I was doing at that time. When I rejoined Professor Massey after the war, he suggested as a research project that I try to simulate in the laboratory some of the conditions in the ionosphere. The six years that followed served to show us the hopelessness of the task as we originally conceived it, but during that time we unwittingly laid a foundation for several of those techniques for which our work in the ionosphere is especially known. Amongst these techniques are: the use of gridded probes so that fluxes of positive and negative particles may be analysed separately; precise differentiation of current-voltage characteristics of probing

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electrodes so as to obtain energy distributions, and the production of the smallest ion mass spectrometers in the world.

Dr. Willmore - the deputy head of this Laboratory (who combines the characteristics of an opening batsman and a ubiquitous long stop - I use the metaphor with some trepidation in Sir Harrie's presence) - Dr. Willmore and his co-workers are using the energy distribution analysis with great effect over a tremendous range of problems. Recently, they made the first direct detection of the negative ions in the D-region by measuring their energy of arrival at a rocket, and soon they expect to probe the rarified plasma of interplanetary space by a version of the instrument so sensitive that it will operate on ten electrons per cc.

There is not time for me to outline the whole of our extensive programme of space plasma studies at all levels and latitudes. Instead, I must tell you now something of our astrophysical work. It became clear to us quite early on that to understand the ionosphere we must, at the same time, study the flux of energetic photons from the Sun which give rise to it. We started with some very simple instrumentation to monitor the X-rays and the strongest ultraviolet line. Soon we got more ambitious, and at the same time began to take an interest in the Sun for its own sake, not merely for its influence. From the Sun it is but a short step in research interest - if not in space - to the stars, and now we have thriving groups devoted to both solar physics and stellar physics.

In both of these fields we have made a special contribution by introducing proportional counters in the soft X-ray region, together with reflecting

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telescope systems. Using proportional counters alone we obtained, on Ariel I, with our collaborators at Leicester University, important results on the changing flare spectrum of the Sun. That was in 1962, but the instruments now awaiting launching on ESRO II and OSO-D should give us better resolution in time and wavelength and cover a far wider wavelength range.

Using the reflecting telescope, we have obtained dissected X-ray pictures of the Sun and expect to obtain many more of higher quality from our instrument on OSO-F. This kind of study is important in exploring active regions which have not yet flared into an intensity which dominates the whole disc. Also using reflecting telescopes, we hope to be the first to fly a system capable of examining on command individual X-ray stars, with sufficiently high spatial resolution to make their positive identification possible. Hopefully, we shall find some new sources. This identification of X-ray stars is an important next step in X-ray astronomy. This work is to be carried out on NASA's OAO-C, and I cannot mention yet another American satellite without saying how very much we are indebted to our friends across the Atlantic for the many flight opportunities they have given us.

In the ultraviolet region we have, ready for flight or under preparation, both rocket and satellite instruments for obtaining resolved spectra. Some of these are associated with simultaneous ionospheric measurements, and others are solar physics experiments. One is arranged to give a dissected image, that is, a spectroheliogram of the Sun in the ultraviolet.

This year is the centenary of the death of Michael Faraday, and I have recently re-read his biography. I am struck afresh by the half-century

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interval between his discoveries in electromagnetism and their exploitation. His simple-hearted devotion to scientific discovery was appropriate, and certainly no scientist ever did so much on so poor a budget. I have a feeling that we will not have to wait for fifty years for the practical rewards of space science, which is just as well, for to be in the field at all requires a substantially larger budget than Faraday's.

But there are ways in which we do pay an interim dividend to society. We are able to take on as many research students as we can get grants for, and to give them the breadth of training and experience that industry is crying out for today. Then, too, our work leads to inventions and techniques of value beyond the limits of space science. Our mass spectrometer of exceptionally short path length is the subject of an agreement being negotiated with a foremost electronics firm. A new image storage technique for spectroscopy is the subject of an agreement with a leading optical instrument manufacturer, and only within the last few weeks the N.R.D.C. has given us support for a new type of ion motor which we hope will become of importance for communication satellite propulsion, station-keeping and orientation.

We know well that the generosity of Mullard's which has made this lab possible was not occasioned by either the thought or likelihood of direct returns. But in expressing my gratitude and that of my co-workers, I would like to say that we shall do our best to ensure that this laboratory achieves that which I know our benefactors want for us - the highest in scientific research, the best in technology and the finest training for those who will go out to serve the community in the laboratories of industry, university or government.