UPPER ATMOSPHERE AND SPACE RESEARCH AT THE UNIVERSITY OF ADELAIDE

“Balloons, rockets and satellites”

Ken McCracken

Jellore Technologies and the University of Maryland
jellore@hinet.net.au

Adelaide, 1 September, 2012.
Sputnik 1,
4 October, 1957
The Adelaide Advantage

(1) The “Weapons Research Establishment” (WRE) at Salisbury;

(2) The UK-Australia “Joint Project”

(3) The Woomera Rocket Range;

Woomera was the only rocket range with a view of the whole southern sky. Big Problem - the WRE was developing an intercontinental ballistic missile. There was no access for Australian Universities.

(4) John Carver achieved the impossible, and secured access for Adelaide to the WRE facilities and rocket programme.

(5) A well established balloon launching facility was in operation, year round, at Mildura.
UV detectors in 10 cm diameter rocket
“Ultraviolet extinction measurements of molecular oxygen density”.


The good news- we will give you a Redstone (i.e., V2) rocket and launch it for you, all for free..........
Fig. 2. Arrangement of detectors in the WRESAT satellite.

“Ultraviolet ion chamber measurements of the solar minimum brightness temperature”,

J.H. Carver, B.H. Horton, G.W.A. Lockey, and B. Rofe,

Laboratory Support Programme - The Ultraviolet Monochromator
HIGH IMPACT ATOMIC AND MOLECULAR STUDIES


J.L. Bahr, A.J. Blake, J.H. Carver, J.L. Gardner, and V. Kumar, Photoelectron spectra and partial ionization cross sections for NO, N₂O, CO, CO₂, and NH₃, 1972

Atmospheric Sounder, Antarctica

Mawson Institute, Fred Jacka et al

Photo Credit, Greg Stone
Balloons to above 99.7% of the atmosphere

Cheaper, gentle, long exposure, and you got it back in one piece (with luck)

The discovery of "X-ray" Stars, 1962
The U of Adelaide balloon borne X-Ray Observatory, containing two separate X-ray telescopes.

Flown to an altitude of 32 Km from Mildura, 1968 onwards.

Controlled by radio to scan selected X-Ray “stars”.

Figure 2
The complete X-ray observatory. The active collimator telescope is on the left, the passive collimator telescope on the right. The total width of this assembly is 1.2 metres.
“Spectral properties of the X-ray objects GX3+1, GX354-5, and Sco XR-1”


Skylark Launch, Woomera

-however, a small problem
"A strong X-ray source in the vicinity of the constellation Crux".

J. Harries, K. McCracken (U of A) 
R. Francey and A. G. Fenton (U of T) 
Nature, 1967

Gioconi to Lewin – "Walter, do you believe this rubbish"
THE BIG ONE

Skylark 781

1969
Tuohy  ??  Francey (Uof T)  Barnden??
PIONEER 7, 1966.
Cosmic ray anisotropy instrument - Pioneers 6 and 7
The Pioneer “Flotilla”, 1969

- PIONEER 6: $R_6 = 0.96 \text{ AU}$
- PIONEER 7: $R_7 = 1.12 \text{ AU}$
- PIONEER 8
- EARTH
- PIONEER 9: $R_9 = 0.75 \text{ AU}$

Angles:
- $150^\circ$
- $24^\circ - 24^\circ$
- $92^\circ$
The “wet spaghetti” model of the interplanetary magnetic field, 1966

Fig. 3. A schematic diagram of a few interplanetary filaments, as viewed from the north ecliptic pole and as sampled by Pioneer 6 on December 30, 1965. Compare this figure with the azimuths recorded in Figure 2.
Understanding the distribution of ionizing radiation in the Solar System following a major solar flare /CME.

Fig. 4. Average hourly cosmic ray flux of >7.5 MeV observed by Pioneer 6, 7 spacecrafts during the period March 29–April 10, 1969. The data acquisition on Pioneers 6 and 7 was not continuous due to reasons mentioned in the text. The particle flux in the range 7.5–45 MeV observed by Pioneers 8 and 9 during the same period are also shown for comparison.
Cosmic ray modulation in the Heliosphere
I.H. Urch (Uof A) and L.J. Gleeson (Monash)

Properties of interplanetary shock waves and coronal mass ejections, L. Barnden

The production of energetic particles by the Sun
I.D. Palmer
IN RETROSPECT. It was an era of great risks and even greater rewards. Inter alia, the research at Adelaide led to

1. Understanding the distribution of ozone, and other components in the upper atmosphere.

2. Provision of high precision atomic data used world wide in the interpretation of space data.

3. Discovery of southern hemisphere X-ray stars and their variability, and high precision measurements of their spectra at high photon energies.

4. Understanding the properties and effects of solar energetic particle events, the interplanetary magnetic fields, and the solar wind.
THANK YOU

Skylark Launch, Woomera
jellore@hinet.net.au