achievement in many respects, notably:

(a) it was the first time that a satellite had been placed in orbit from Australia,

(b) success was achieved at the first attempt - a performance not elsewhere equalled,

(c) useful telemetered data were received until the batteries were exhausted, which occurred in accordance with the maker's specifications,

(d) the satellite was tracked worldwide by all the NASA stations, French stations in Africa and France, British stations in UK and the Falkland Islands, German university stations and posts in Brazil.

Reduction of the large amount of data is continuing at present. A film covering the more important phases of the WRESAT project completed the talk.

In subsequent discussion, the speaker was asked about the accuracy of the temperatures measured at 85 km. In reply Mr. Rofe said that the limiting factors were primarily the accuracies of the sphere drag coefficient and of the radar tracking system. About 5 to 10 percent was a realistic figure.

A member of the audience mentioned the apparent large diurnal temperature changes noted by W.L. Webb (U.S.A.). The speaker commented that the heat bulge of about 10-15°C at 2 p.m. local time near the stratopause was not confirmed by the Carnarvon measurements which indicated a diurnal variation of about 5°C.

Dr. Bourne said that echo sounder results indicated that there appeared to be a heat pool at about 73 km in the Southern Hemisphere. Mr. Rofe said that the explanation for the echoes probably lies in the existence of a temperature inversion at this height.

F.C.

13 November 1968

ACOUSTIC SOUNDING OF THE LOWER TROPOSPHERE

By L.G. McAllister

Mr. McAllister, Principal Officer of the Telecommunications Group, Weapons Research Establishment, Salisbury, S.A., stated that one of the problems in radiometeorology is to explain the anomalous radio propagation which occurs in a stable atmosphere, and the first difficulty encountered is in observing the profiles of temperature and humidity along the path. Acoustic sounding was expected to show low level inversion structures, with the advantage over other available techniques that it is adaptable to continuous display.

The first results at Salisbury were obtained with a centre-fed parabolic concrete dish 50 feet in diameter acting as transmitting and receiving antenna for 10 ms acoustic pulses at 950 Hz directed vertically once every two seconds, the echoes returned by the atmosphere being displayed against height and time through a facsimile recorder. The strength of the echo returned from any level is related to the turbulence and temperature gradients in the atmosphere. Mr. McAllister showed slides of sounder records which illustrated various atmospheric structures, including subsidence inversions at heights up to 5000 feet, surface inversions, and the Adelaide "gully wind" inversion with an apparent hydraulic jump.

Portable antennas have been constructed, consisting of a square array of loudspeakers with wooden sideplates, an aperture of 50 square feet, and 100 watts peak power. One of these was used in an attempt to calibrate the sounder in terms of temperature and wind structure in an experiment on the Nullarbor Plain in June 1968, in conjunction with the Postmaster-General's Department and the Bureau of Meteorology. The equipment was set up near a 250 ft tower, fitted with a movable platform on which were mounted two temperature sensors and an anemometer. Mr. McAllister showed slides of records obtained from the sounder and from the meteorological instruments, which showed that acoustic echoes were returned from temperature fluctuations in the atmosphere. Some of the atmospheric structures and processes revealed by the sounder were:

(i) arrival of weak shallow front-like disturbances;

(ii) breaking waves in stable air, with temperature and wind records indicating vertical motion within the wave structure, occurring in many situations with a wide range of periods and amplitudes;

(iii) pronounced sinusoidal vertical oscillations in stable air;

(iv) separation of the atmosphere into clearly demarcated layers with strong echoes, separating other layers with weak or undetectable echoes;

(v) formation and breakup of a nocturnal inversion, the breakup occurring with solar heating after sunrise;

(vi) thermal plumes during the time of strongest heating.

Concluding, Mr. McAllister pointed out that an acoustic sounder can be used to obtain information on turbulence within the pulse volume, and that the time-height pattern of turbulence also gives information on atmospheric structure and motion on a larger scale. The equipment so far used is relatively simple and many developments can be foreseen. In particular, three further applications he is considering are:

(i) obtaining mean wind speed by measuring the angle of arrival of the return echo;

(ii) using higher power and frequency to detect echoes which at present are below the threshold of the equipment, so that there may be almost continuous echoes from all heights up to the maximum range;

(iii) using higher power and lower frequency to detect turbulence up to 40,000 ft.

P.J.R.S.

11 December 1968

AN INTRODUCTION TO THE IBM 360 SERIES SOFTWARE

By G.J. Knox

Mr. Knox, Senior Programmer (Software), Operations Branch, Automatic Data Processing Division of the Bureau of Meteorology, spoke on this non-meteorological subject, which nevertheless is becoming increasingly significant to the local meteorological community, particularly since the installation of the Bureau of Meteorology's IBM 360/65 computer in early 1968.

After brief remarks on the configuration and organisation of the Bureau's system, Mr. Knox defined and discussed the concepts of "Hardware" and "Software", pointing out that the latter normally includes:

(i) the monitor system;

(ii) compilers and their supporting programmes;

(iii) generally applicable routines and packages.

Mr. Knox then briefly retraced the historical development of the computer from the early 1940s to the present time, highlighting the increase in speed and sophistication and the development of such concepts as time-sharing, multiprogramming and multiprocessing.

The speaker then discussed at some length the facilities of a software monitor system, dealing with:

(i) usual facilities (management, input-output control, file management and retrieval);

(ii) range of softwave; and then in more detail

(iii) multiprogramming with a fixed number of tasks (M.F.T.).

The final topic was support software.

In the ensuing discussion Mr. Knox elaborated on some of his earlier remarks on terminology and IBM programme support, and answered several questions on the more general aspects of computer operations.

J.W.Z.