

ROYAL METEOROLOGICAL SOCIETY: AUSTRALIAN BRANCH MEETING

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Water Commission Uses Earth Satellite

D. Currey

In opening his talk, Mr Currey, Supervising Geologist with the Victorian State Rivers and Water Supply Commission, briefly outlined the history and technical aspects of the Earth Resources Technology Satellite (ERTS).

Under the control of the US National Aeronautics and Space Administration, the Earth Resources program was initiated with the launching of its first experimental satellite, ERTS-1, on 22 July 1972 at a cost of US\$166 million. ERTS-2 is expected to be launched later in 1974, depending on the continuing performance of ERTS-1, while long-range plans call for operational earth resources satellites - the ERS series - to be flown in the late 1970s. The program is intended to provide complete inventories of the world's resources and to monitor the ecology of the biosphere.

ERTS-1, circling at an altitude of about 900 km, moves in a north-south orbit at an inclination of 12° east of north and is designed so that it appears over any particular longitude between 9 am and 10 am local time. Consecutive orbits are separate by 1.7 hours in time and, at Australian latitudes, by about 25° in longitude and the orbit is so adjusted that imagery of a single point on the ground can be obtained once every 18 days. Two independent instruments are carried on board: the return beam vidicon system consisting of three television cameras with filters in the green, red and infrared bands that simultaneously photograph a $185 \text{ km} \times 185 \text{ km}$ area below. These data are immediately transmitted to a ground station and, if so desired, transferred to a tape recorder on the satellite for later transmission on demand; and a multispectral scanner continuously scanning in four wave bands (three in the visible range and one in the infrared) along swaths 185 km wide centred on, and normal to, the orbit track at about 6.5 km s^{-1} ground speed.

The photographs overlap by about 10% in successive frames while there is a similar east-west overlap in both forms of imagery at the equator on successive days. The latter overlap is between 10 and 20% over Australia. Resolution is about 210 m but varies from wavelength to wavelength and with imagery contrast.

The remainder of the address consisted of a large number of slides illustrating various of the ERTS-1 products. The first was a colour photograph of the Australian Capital Territory and environs and Mr Currey pointed out that up to 200,000 shades were available from this form of imagery. Subsequent slides were derived from combinations of the scanned data composited to enhance certain aspects of the viewed area. Up to one million shades were possible in this form of imagery. Among slides of particular interest were those illustrating the system's applications in areas such as distinguishing between various eucalypt types in the Gippsland lakes, Western Port and Port Phillip Bay; deducing the ages and origins of various lakes formed to the north of Melbourne during the breaking of the recent drought; and snow inventories and water runoff.

One slide showed dramatically the effects of differing land use policies between the Australian States: consequently the South Australia-Victorian border was clearly distinguishable. In another two, both covering central Australia east of Lake Eyre and taken in August 1973 and February 1974, the different vegetation patterns were able to bring out the land systems and effects of the intervening widespread floods.

Although the program is aimed at earth resources and most data is obtained during near cloud free conditions, Mr Currey showed a few slides which included some cloud. One showed cloud in a southwesterly stream over and to the south of Lake Michigan, apparently forming downstream from smoke clearly emanating from the industrial areas around Chicago. Record snow falls were reported during this period. The fine detail apparent in the cloud structure suggested that these data may have some application to cloud studies although he pointed out that the 18 day interval between imagery of the same area may be a drawback.

The speaker briefly mentioned the application of computers in the automatic recognition and subsequent digital display of earth features: remarkably fine details could be deduced using these techniques. A group of three slides highlighting separately the distribution of commercial, industrial and recreational areas over a section of the west coast regions of the US were shown as examples of the final product.

In conclusion, Mr Currey spoke of possible future applications of the Earth Resources program. The amount of data that will become available will necessitate greater dependence on computer processing, while the SKYLAB projects suggest that extremely fine resolution data will be readily available. However, as a cautionary note, he said that, following the experimental ERTS-1 and ERTS-2, users will be expected to contribute substantially towards the operation of the satellites and data costs could be as much as \$1,000 per frame.

In reply to a question from Dr W. Bourke as to whether the instruments were operating continuously, Mr Currey said that both camera systems are activated on command from the ground. For this reason, data over any particular region would normally only be obtained if requested and if sufficient justification is advanced from the potential user to warrant its being obtained at the expense of imagery acquisition elsewhere. Dr J. Garratt queried the effects of surface temperatures on the imagery. These do not have a significant effect on water surface appearance but some shading changes can be detected in land features. Future satellites will include a specific channel for monitoring this parameter. The different shadings mentioned by Dr K. Spillane as apparent in a cloud free mosaic of Victoria which he had seen were probably a consequence of the differing sun angles at the times of the various individual frames.

Mr Gibson asked if the ERTS-1 data could be used for shipping navigation planning such as detecting leads in the arctic ice. Mr Currey said that in this field, Canada had taken advantage of the fact that at high latitudes the large east-west overlap of orbital strips on successive days enabled a semi-continuous monitoring of sea ice conditions and was acquiring the data for real-time advice to shipping. The use of such data to extend traffic through the Northwest Passage was also under active consideration.

In a final comment on ERTS-1 application, Mr Currey said that some of its data were shortly to be introduced by the Commission as legal evidence in a case involving the alleged improper use of flood mitigation through channel systems during the recent Victorian floods. This is probably a world first; however, he expressed some trepidation as to their admissibility, as on previous occasions when similar data from aircraft-borne cameras were introduced, the court demanded the appearance of the pilot!

P.G.P.