6. DISCUSSION

The types of instruments available for deployment are listed and described in Table 1. These instruments currently have the capability of mapping water and sediment movements, primary productivity and even bioluminescence. In addition to providing a basic research complement for the GBR this set of instruments provides possibly the most realistic set of tools for monitoring and mapping pollutants - such as oil-spills.

The design task is therefore to assess how the planned combinations of remote sensing platforms and sensors apply in the GBR system for research, planning and management. Where significant gaps exist the task is to assess how the needs of GBR management might promote research into specific combinations of platforms and sensors.

Table 2 lists the available data platforms and sensors together with potential sensors by scale of application. The abbreviations used for the sensors are from Table 1.

At the whole GBR scale the NIMBUS-7 CZCS, the NOAA AVHRR and Landsat MSS data provide a significant data set for general definition of biological productivity and the movement of water masses. Taken together, the variations in the pattern of suspended sediment, phytoplankton and sea surface temperature over space and time provide indirect measurements of ocean structure and movement as well as being significant direct parameters in themselves (Gower et al., 1980).

One problem is that CZCS is an experimental instrument. Data continuity will depend on an OCI (Ocean Color Instrument, see Stewart, 1981) being flown in the mid 1980's on board the NOAA series of satellites, or on the availability of data from the Japanese Marine Observation (MOS-1) satellite or the European Space Agency's ERS-1, each of which may carry a set of ocean mapping instruments including an optical scanner.

At the regional reefs scale, there is scope for using high resolution satellite data in conjunction with the existing satellite data. Further radar missions on the Space Shuttle (such as SIR-B), the Canadian RADARSAT and the MOS-1 and ERS-1 satellites referred to previously could provide significant wave and current data at this scale.

At the reef-to-reef and within-reef scales the remote sensing tools must be flown from high resolution satellites, from aircraft or deployed from boats and buoys. It is at this level and the point events level that the major deficiencies in data availability exist for the GBR at this time.

One example of a point event is an oil spill. To assess and model oil-spills it is necessary to combine rapidly collected data about a detected oil slick (oil type and quantity) with environmental data such as surface winds and currents. Oil thickness information is also important for planning cleanup and containment activities. Microwave radiometers, SLAR and Laser fluorosensors mounted on aircraft platforms provide the most practical instrument systems for detecting, monitoring and assessing the fate of oil slicks (Klemas, 1982; O'Neil et al., 1980; Hoge and Swift, 1983). They also may be used at other times for more general remote sensing purposes. However, no aircraft equipped in this way is available for the GBR region. A separate list of references outlining the range and abilities of remote sensing tools for oil spill detection and assessment has been appended to this report.

TABLE 2

Scale	Platform(s)	Existing(+) Systems	Potential(+) Sensors
Oceanic |1,000 Km	Satellite	NIMBUS-7 OCI, MR NOAA-6,7 MSS, IR	ALT, SCAT, SAR
Whole Reef |500 Km	Satellite	NIMBUS-7 OCI, MR NOAA-6,7 MSS, IR LANDSAT-5 MSS	ALT, SCAT, SAR
Regional reefs |100 Km	Satellite	NIMBUS-7 OCI, MR NOAA-6,7 MSS, IR LANDSAT-5 MSS LANDSAT-5 TM	ALT, SCAT, LFC, MSC, SAR, ISS
reef-to- reef |10 Km	Satellite Aircraft Ship	LANDSAT-5 TM AC -	MSS, MR, IR MSC, LIDAR, ISS, SAR
Within- reefs |1 Km	Aircraft Ship	AC -	MSS, MR, IR, MSC, LIDAR, ISS, SAR
Point Events 1 Km	Aircraft Ship	AC -	MSS, MR, IR MSC, LIDAR, ISS, SAR

(+) Abbreviations from Table 1.

The full value of the available tools and future space and aircraft platforms for GBR research, planning and management will only come when adequate research and development has been done. A series of research and development projects which will assess and modify the existing opportunities must therefore be of prime importance.

7. CONCLUSIONS

Remotely sensed data from satellite and aircraft platforms are providing, and can continue to provide, operational information about GBR structure and dynamics of value to Marine Park management.

In the context of the whole of the GBR a design for research and application is feasible using existing and planned satellite data which could improve the overall information base on fronts, water circulation and general biological productivity of the GBR waters. At the finer, and possibly more important, scale of coast-reef, inter-reef or within-reef communication and flows there is a range of tools available and at present under development which with effective research could be immensely valuable for research, management and planning in the GBR region. These tools could map and monitor suspended sediment and biological dynamics within the space and time scales occupied by these phenomena. They would also be at hand in the event of spillage of oil or other pollutants for monitoring and assessment.

To accomplish this there is a need to research the essential limits to spectral resolution of GBR phenomena and events and to develop an operational system encompassing broad scale satellite data, aircraft based data as well as instruments deployed on ships and buoys. This system could be similar to (but with greater emphasis on fine scale data from aircraft platforms) the OCS Working Group's (1982) MAREX sampling strategy.

In the initial stages research could be started using existing satellite data and an airborne multispectral camera or spectroradiometer in company with in-water measurements. The most useful piece of equipment for such a project would be an airborne MSS with adjustable band widths and locations. Such an aircraft based system could be used in a number of ways. The pilot projects should also investigate an optimum deployment of such an aircraft based monitoring system.

On the basis of such research a designed, rather than ad hoc, approach to fine scale remote sensing of the GBR may be developed and applied to fill data needs for GBR management.

To summarize, the major conclusions from the report are that:

(i) Remote sensing technology exists to address many of the remaining information acquisition problems faced in the GBR region,

(ii) there is a range of currently available satellite data (AVHRR, CZCS and Landsat) which should be incorporated into the current GBR data base,

(iii) future satellite data, and even more especially, airborne scanner data from a variety of instruments, have a significant ability to address the GBR data needs if developed carefully through applied research,

(iv) in order to take advantage of the data provided by remote sensing they need to be integrated with data from other instruments and from ground survey, and

(v) among the remote sensing tools of greatest future potential are the active Lidars and Radars which are under development in a number of overseas research centres.