A STATUS REPORT FOR LANDSAT 2, 3 & D

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Introduction

The Landsat series of satellites has been producing observations useful for studying and monitoring the dynamics of surface features of the earth and the performance of earth resources management activities. These observations have been found to be useful in monitoring agricultural practices including the acreage, growth and development of crops and forests, the extent of snow and ice cover and other water resources management surface features such as water bodies, irrigation practices and wetlands, the scope and character of geologic features aiding mineral and petroleum exploration, and general land cover mapping useful in land use planning and management and demographic studies.

The observations from the Landsat satellites, in total, have been found to be sufficiently useful in resources management to provide the fundamental impetus for the issuance of a presidential directive (PD 54) in 1979 establishing the National Oceanic & Atmospheric Administration (NOAA) as the agency to manage all operational civilian remote sensing activities from space (NOAA 1980). This was a significant development in that it provides an institutional framework within which continuity of data is assured. This subsequently signals agencies and industries that have found these data to be useful in the past that they may proceed with long term plans and commitments that will enable them to incorporate Landsat data and acquire associated equipment and personnel in such a way as to allow them to better meet their responsibilities and commitments.

This paper will summarize the status of the existing Landsat 2/3 satellites and the associated NASA ground data processing activities. It will also provide an updated view of the progress in the Landsat D program, because the Landsat D program is to provide the primary systems and observations that will support the operational earth resources satellite system in the 1980's.

Landsat 1/2/3 Status

Landsat 1 was launched in July 1972 followed by Landsat 2 in January 1975 and Landsat 3 in March 1978. For much of the period between 1975 and 1980, there were two satellites in operation although Landsat 2 did

experience difficulties during the period of November 1979 to May 1980. Landsat 1 ceased operations in March 1978. The MSS instruments on Landsat 1/2/3 have provided the substantial majority of observations in four spectral Bands (0.5-0.6, 0.6-0.7, 0.7-0.8 and 0.8-1.1 micrometers), at 80 meter spatial resolution. Return Beam Vidicon (RBV), panchromatic cameras for Landsat 3 have also provided a very useful set of observations at a spatial resolution of less than 40 meters. Due to a failure in the multiplexer circuitry associated with the MSS on Landsat 3, the MSS was removed from operational service in December 1980. Figure 1 shows the progress of Landsat RBV and MSS scene acquisitions in 1979 and 1980.

With Landsat 3 MSS not in operation, only MSS data from Landsat 2 will be available until the launch of Landsat D in 1982. The tape recorder associated with MSS data on Landsat 2 have been inoperative for sometime. MSS data for US applications, other than that available from direct readout of Landsat 2 over the United States (except Hawaii), must be obtained by other means. Tape recorders able to store MSS data for routine shipment to the US are being placed at ground stations in Brazil, Sweden and Australia. A recorder developed by the Japanese is being used in Japan. RBV data are still being acquired from Landsat 3 and the on-board tape recorder.

Since February 1979 (September 1980) the processing and archiving of the Landsat MSS (RBV) data has been digitally based as opposed to the image-based system used earlier. This strategy has encountered some significant challenges in achieving a fully operational status. The image processing facility (IPF) at Goddard Space Flight Center wherein this strategy was instituted, accumulated a backlog of MSS and RBV images to be processed. The MSS backlog status is shown in Figure 2. Data production rates for MSS data are expected to range between 850 to 950 scenes per week over the next year. The scene production rate for the RBV data has been near 175 full frames per week and is expected to be near 200 full frames per week during the next year. This should gradually reduce the backlog to zero by the end of 1981 or shortly thereafter. The median cycle time in the IPF, extending from receipt of current data at the IPF to shipment date to the EROS Data Center (EDC), has been near 14 days.

Landsat D

The Landsat D program has been revised and updated in the past year and this section will describe the essence of the program as it now stands. For a more extended discussion of these plans, see Salomonson (1981). Landsat D is now scheduled for launch in the third quarter of 1982. A second spacecraft, Landsat D (Prime) is to be ready for launch 12-15

months following the launch of Landsat D. Data will be acquired from Landsat D using the present Ground Station, Tracking & Data Network (GSTDN), until the Tracking & Data Relay Satellite System (TDRSS) becomes available in 1983. Both Landsat D and D prime, will have an MSS instrument in the payload. The advanced multispectral scanner termed the "Thematic Mapper" will be flown on Landsat D if it is ready in time for launch and will definitely be included in the payload of Landsat D prime. Figure 3 provides an overall concept of Landsat D systems. Figure 4 schematically describes basic elements involved in the Thematic Mapper (TM) operation.

In concert with the establishment of NOAA as the operational earth resources satellite agency, the processing capability for MSS data from Landsat D will be developed and transferred to NOAA by January 1983. Much more research and development is required for the TM data products. This processing capability, therefore, is not planned for transfer to NOAA until January 1985. Table 1 summarizes Landsat D production requirements. The total ground processing system for Landsat D and D prime, has been conceived to separate the processing of the MSS and TM data, to accomplish operational status independently.

Conclusions

Landsat MSS data are being provided for domestic use by Landsat 2 using real time US readout capability and recorders placed at some foreign ground stations. Return Beam Vidicon data continue to be received from Landsat 3. The processing and delivery of these data is gradually improving with the disappearance of backlog in RBV or MSS data by 1982. This should set the stage for the acquisition of data from Landsat D MSS and, possible the TM. Pending the firm establishment of the operational earth resources satellite system, the production of Landsat D MSS data for the user community should be achieved by 1983 and TM data by 1985.

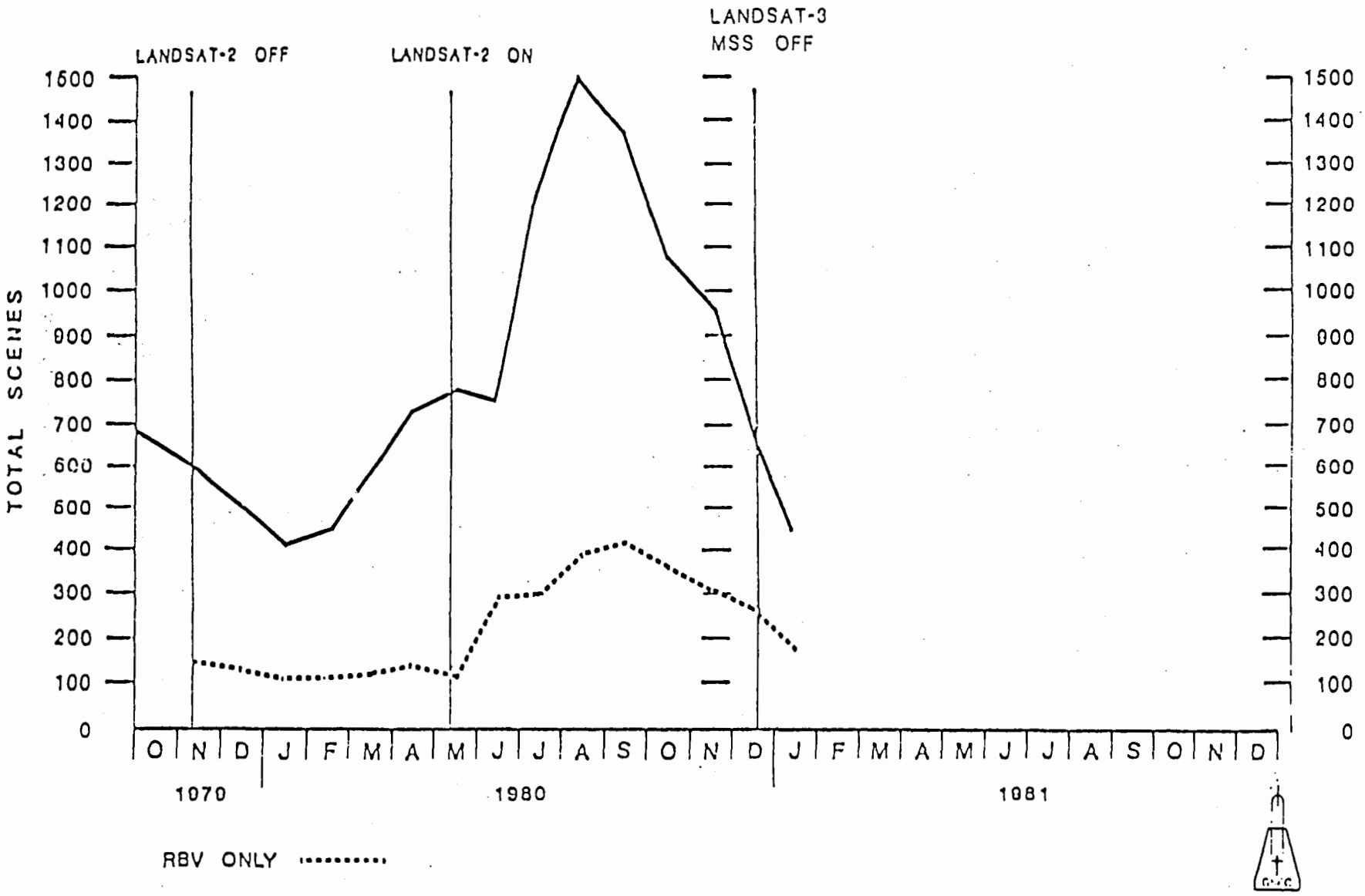


Figure 1 Landsat 2 MSS & Landsat 3 RBV/MSS Acquisitions

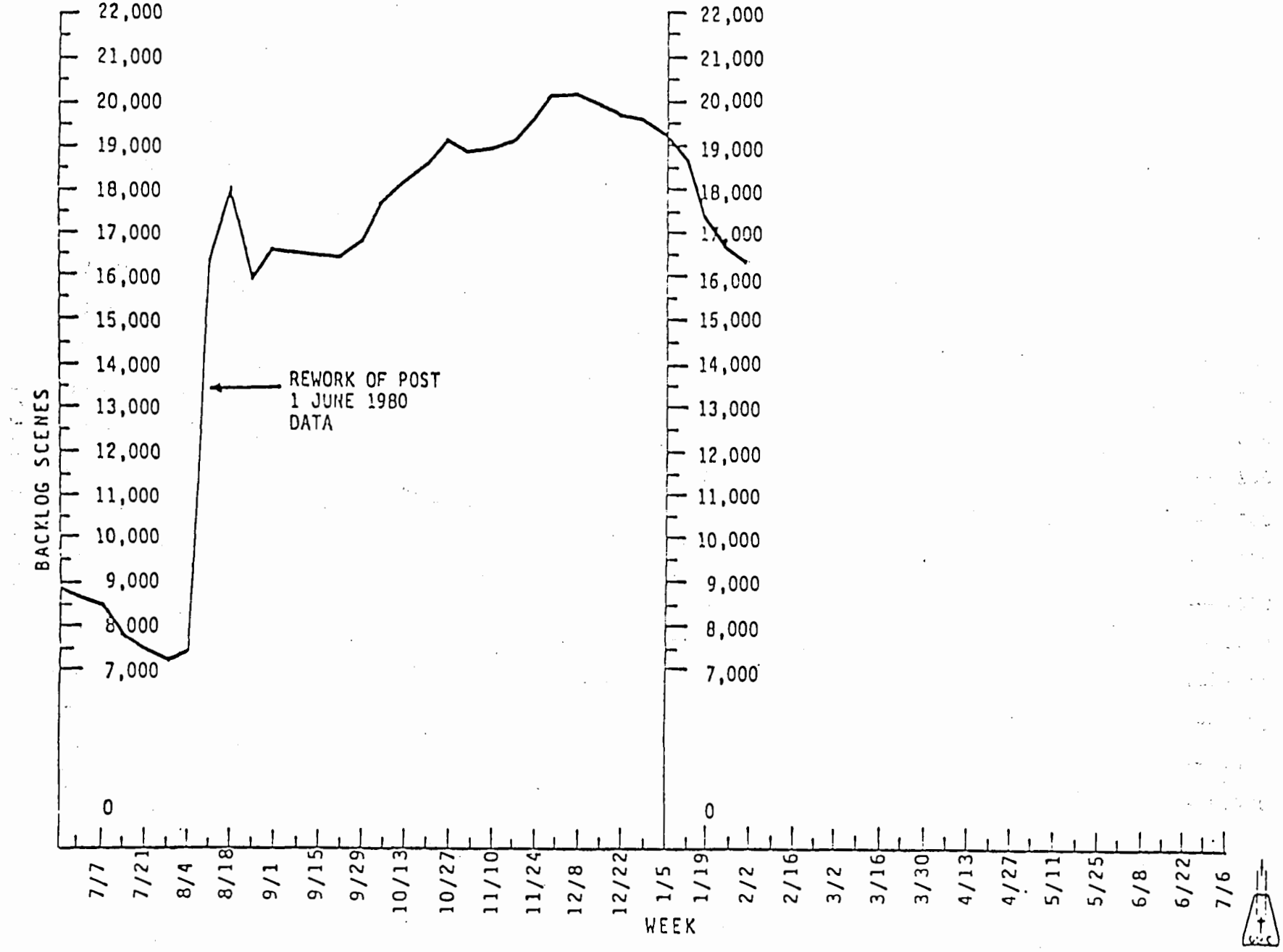


Figure 2 Landsat IPF Backlog (MSS)

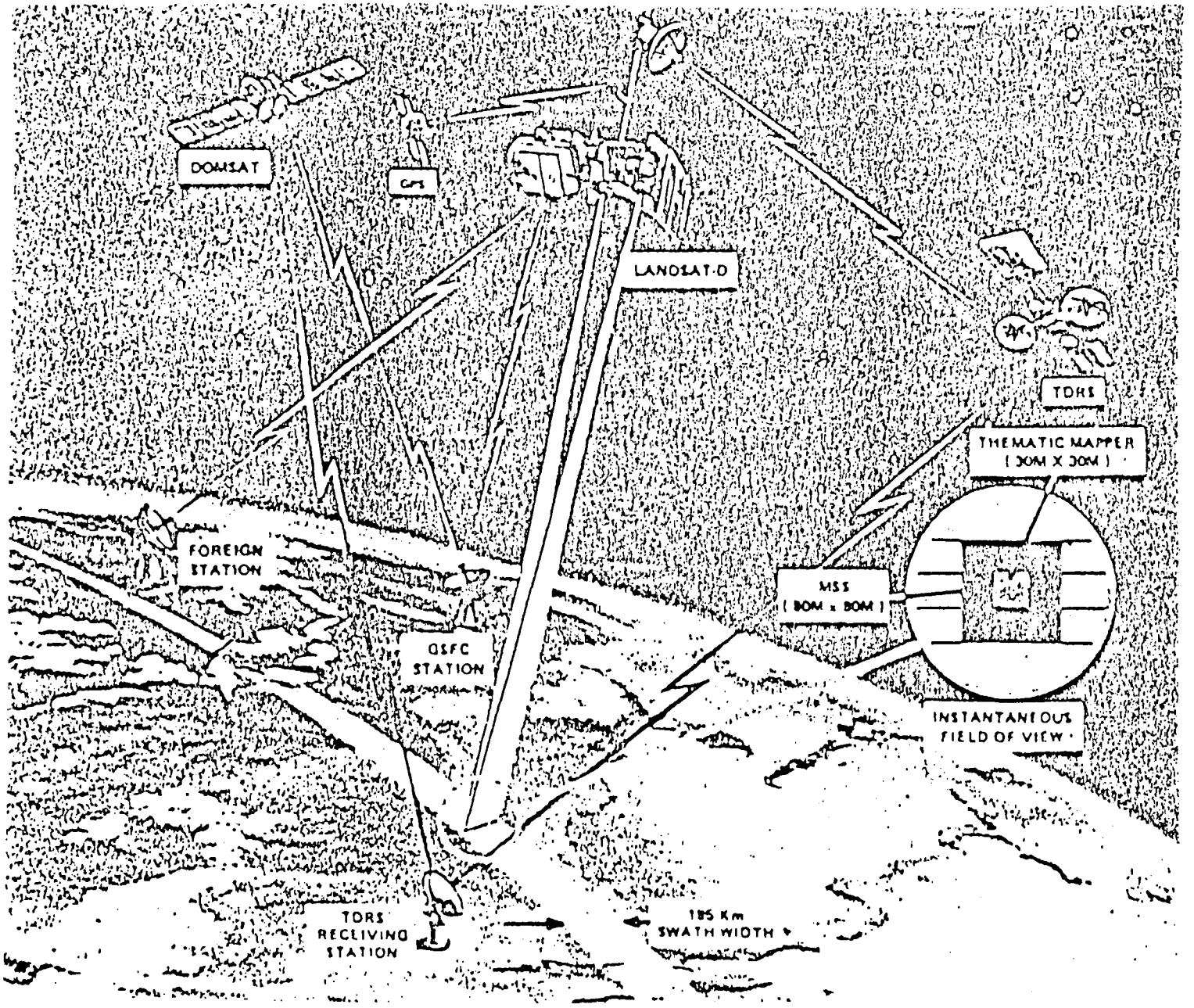
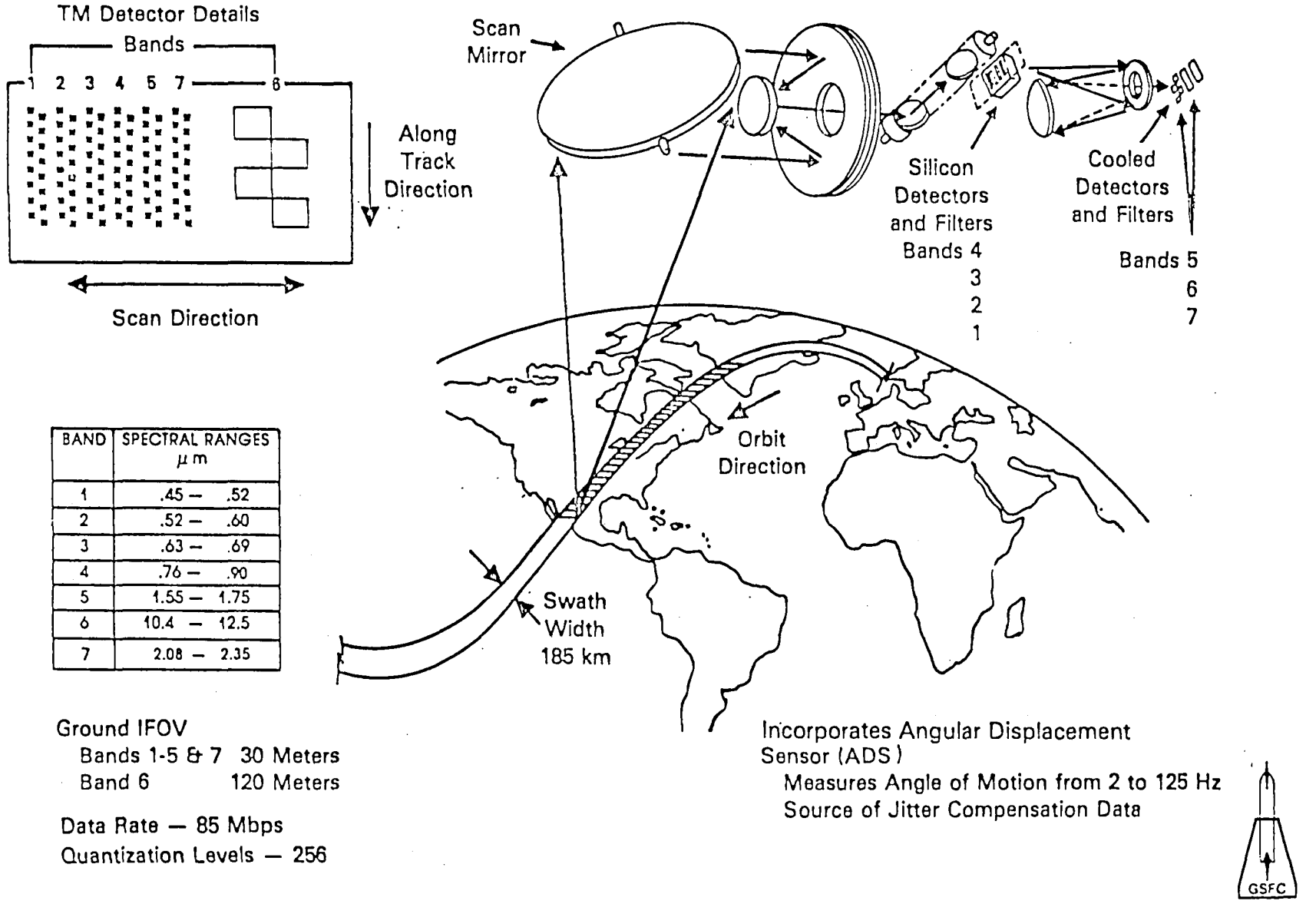


Figure 3 Landsat D System



BAND	SPECTRAL RANGES μm
1	.45 — .52
2	.52 — .60
3	.63 — .69
4	.76 — .90
5	1.55 — 1.75
6	10.4 — 12.5
7	2.08 — 2.35

Figure 4 Landsat D Thematic Mapper (TM) Sensor

Table 1 Landsat D Production Requirements

Product	Quantity Required for NOAA (Scenes/Day)	When Available
1) MSS A Tape (HDT) (User Product) MSS 70 mm Film (Q.C. Product) (One Band)	200	A. Capability for 200 Scenes/Day at Launch B. Turn Over Operational System to NOAA, 200 Scenes/Day at D Launch Plus 6 Months
2) MSS CCT (A or P) (Q.C. Product)	2	At Launch of Landsat-D
3) MSS 241 mm Film (Q.C. Product)	4	A. At Launch of Landsat-D: 2 Scenes/Day B. Launch + 90 Days: 4 Scenes/Day
4) TM A Tape (HDT) (User Product)	100	A. In July 1983, 12 Scenes/Day With A Priori Jitter Correction B. By April 1984, 12 Scenes/Day Must be Demonstrated* C. Turn-Over Operational System To NOAA, 100 Scenes/Day, in January 1985*

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Table 1 Landsat D Production Requirements (Cont'd)

Product	Quantity Required for NOAA (Scenes/Day)	When Available
5) TM P Tape (HDT) (User Product)	50	A. In July 1983, 12 Scenes/Day With A Priori Jitter Correction B. By April 1984, 12 Scenes/Day Must Be Demonstrated* C. Turn-Over Operational System To NOAA, 50 Scenes/Day in January 1985*
6) TM CCT (A or P) (User Product)	10	A. In July 1983, 2 Scenes/Day B. By April 1984, 2 Scenes/Day Must be Demonstrated C. Turn-Over Operational System to NOAA, 10 Scenes/Day in January 1985*

NOTE Scenes/Day are Defined as Output With a 48-Hour Turn-Around Averaged Over a 10-Day Period.

*Assumes a Thematic Mapper was Launched by July 1983