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- IMAGE PROCESSING - IMAGE DISTRIBUTION

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This report presents the current status of the Brazilian LANDSAT facilities operated by INPE and the results achieved during the period from April 1, 1987 to June 30, 1988.

OBSERVAÇÕES / REMARKS
Prepared for the LGSOWG (LANDSAT Ground Stations Operations Working Group) and LDDMWG (LGSOWG Data Distribution and Marketing Working Group) meetings of August, 1988 in São José dos Campos, SP, Brazil.

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1. RECEIVING AND RECORDING

INPE's Receiving Station at Cuiabá, MT, is operating normally. Its two receiving systems (Band S, installed in 1973, and Band X/S, installed in 1983) are operational, enabling full MSS and TM acquisition capability. SPOT reception capability was added in late 1987, using the same X/S antenna subsystem and the same high density digital tape recorder employed for TM.

Routine recordings were performed over the whole Brazilian territory for MSS and TM, both from LANDSAT-5, up to October, 1987. Until that date, special TM acquisitions were performed under request of users from Argentina, Chile, Peru and Ecuador and no NASA requests were received for MSS recordings within the scope of the Backup Plan supported by INPE.

From that date on, considering the limited amount of TM data available over non-Brazilian territory in South America, the approaching end of the operational life of Landsat 5 and the virtual absence of user requests for recent MSS data, decision was taken to discontinue routine MSS recordings and start recording TM over the whole acquisition range.

As a consequence, the only MSS recordings made at Cuiabá since October, 1987 were those requested by NASA through the Backup Plan.

The procedure of recycling TM HDDTs with passes showing more than 80% cloud cover, established in 1986, was maintained.

From April, 1987 to June, 1988 INPE's Receiving Station recorded:

- 268 MSS passes (recordings discontinued October, 1987)
- 705 TM passes.

All the data above came from Landsat-5. The figures do not include passes erased due to high cloud cover.

Figure 1.1 below shows the evolution of the number of scenes acquired and recorded since the start of operations at Cuiabá. The numbers shown for RBV and MSS indicate the totaled amount when acquisition was discontinued. TM, of course, keeps being recorded and a sharper increase in its figures is expected for 1988 due to the full-range reception policy implemented last year.

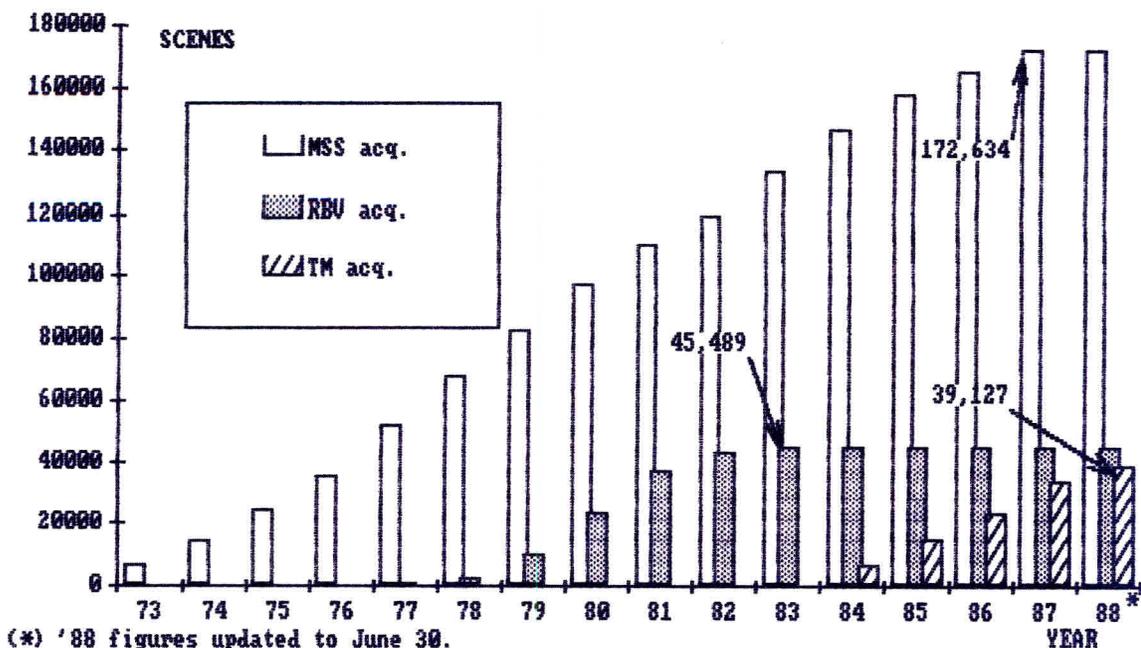


Figure 1.1 - Scenes acquired at Cuiabá (accumulated figures)

2. PROCESSING

2.1 RBV Subsystem

As already mentioned in past reports, RBV processing of new originals at INPE was stopped in 1983 and definitely discontinued in face of the lack of interest from the users, who have now in TM a far better sensor, and the low visual quality imposed by RBV's inherent shading effect which could not be satisfactorily removed in an operational basis with our non-digital RBV processing subsystem.

2.2 MSS Subsystem

Although with a very low demand consisting basically of requests for historical data, the MSS processing subsystem is being maintained by INPE, despite the age of the equipment (15 years), which imposes a low MTBF and restrains the availability of parts.

Last March the film output device, the Electron Beam Recorder, had a burnout of one of the deflection coils and film production has stopped since then. A new coil was ordered from the manufacturer but since it is no longer a listed item delivery is not expected before some months yet. CCT production is operational.

From April, 1987 to June, 1988 the MSS subsystem produced:

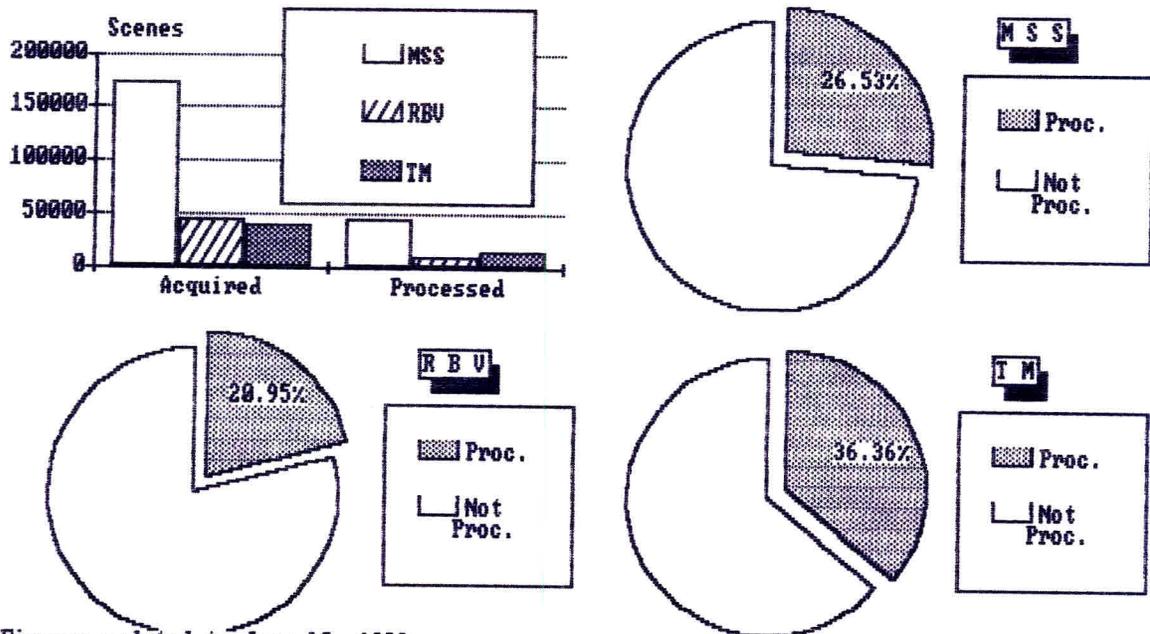
- 221 new MSS scenes in 70mm high resolution film originals;
- 39 MSS CGTs for external users.

No quick-look images were produced since cloud cover information can be taken from the corresponding TM imagery, acquired simultaneously with MSS from the same satellite.

2.3 TM Subsystem

The TM subsystem experienced a quick growth in its production figures during the first two years of operation and is showing a steady behavior since 1985, at levels comparable to the best years of the MSS era.

An interesting issue to mention is the high (more than 36%) percentage of TM images processed to high resolution originals in comparison with RBV (less than 21%), MSS (26.5%) or even other countries' figures (see Figure 2.1). We believe this to be at least partially due to the tape recycling scheme mentioned in Section 1.



Figures updated to June 30, 1988.

Figure 2.1 - Processing vs. Acquisition

INPE's TM subsystem is operational for both photographic (5" EBR originals) and digital production. However, it is feeling the impact of time and resource sharing with the SPOT production chain, which utilizes the same hardware and started last March. Planned hardware extensions (a second HDDR, an array processor, additional image disks and VAX internal memory, a 6250 bpi magtape unit and a 9.5" color laser film recorder) which will reduce the interference between the two production lines are not expected to be integrated before 1989.

From April, 1987 to June, 1988 the TM subsystem produced:

- 13,857 TM images in quick-look form;
- 5,958 new TM scenes in high resolution 5" film;
- 78 full frame CCTs;
- 392 quadrant CCTS.

Figure 2.2 below summarizes the evolution of the processing figures for MSS, RBV and TM at INPE since its debut as a Landsat ground station operator. There we can see that the number of processed TM scenes surpassed in 1987 the RBV figure.

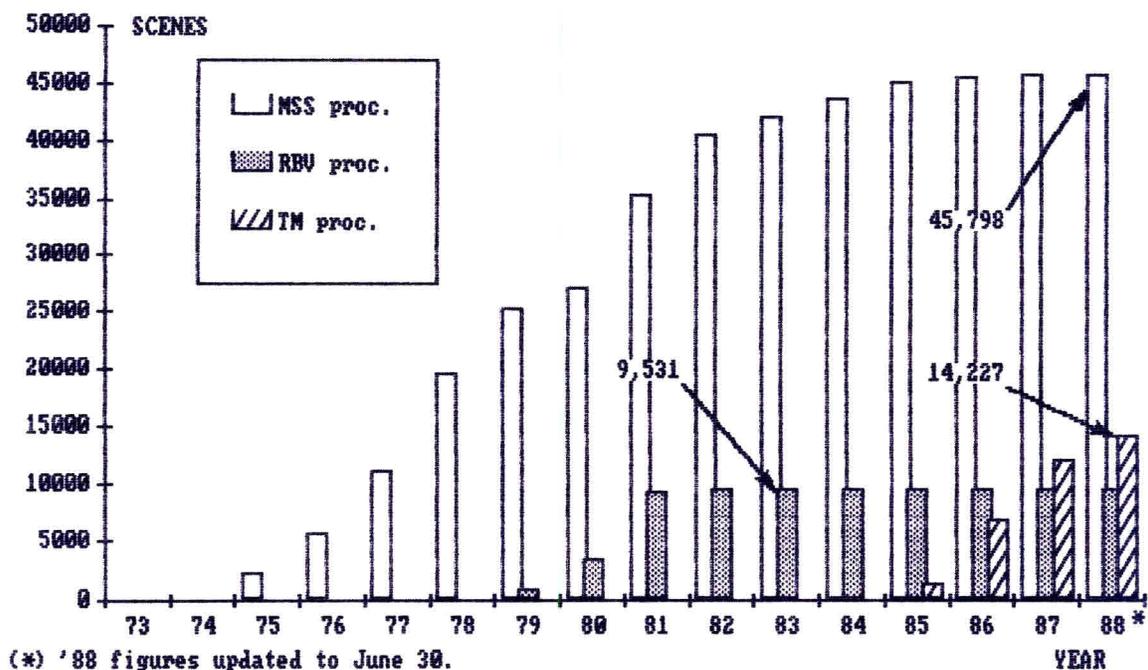


Figure 2.2 - Processing History (accumulated figures)

3. DISTRIBUTION

After a peak in 1979, when almost 20,000 images produced at INPE were delivered to users, distribution dropped to less than 3,000 images in 1984, at least partly due to the economic difficulties faced nationwide and worldwide at that time. From 1985 on, probably boosted by the availability of the new Thematic Mapper sensor, Landsat sales from INPE showed a slow but steady recovery.

In 1988, working with the figures available up to June 30 and projecting distribution up to the year's end, we notice (see Figure 3.1) a retraction of the foreign market, which will tend to level 1988's total figures with 1987's (about 8,200 images) despite a continuing domestic increase in sales. It is difficult to blame that on SPOT, once INPE has just started putting out SPOT products.

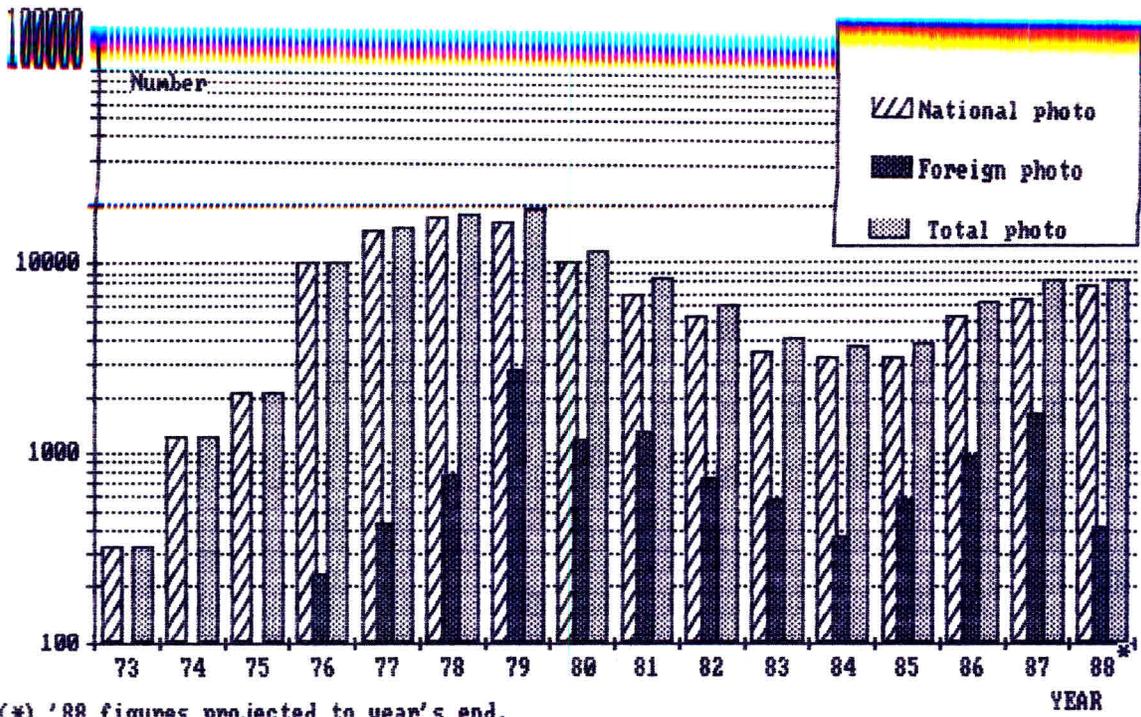


Figure 3.1 - Photographic Images Distributed to Users

Foreign users could be, of course, holding back their orders waiting for SPOT data over South America to become available, but since INPE's SPOT acquisition is selective and no foreign standing orders from users or from SPOT Image itself have reached us so far, this seems not to be the case.

It is interesting to observe that digital products (see Figure 3.2) have not suffered a sharp decrease in sales through the

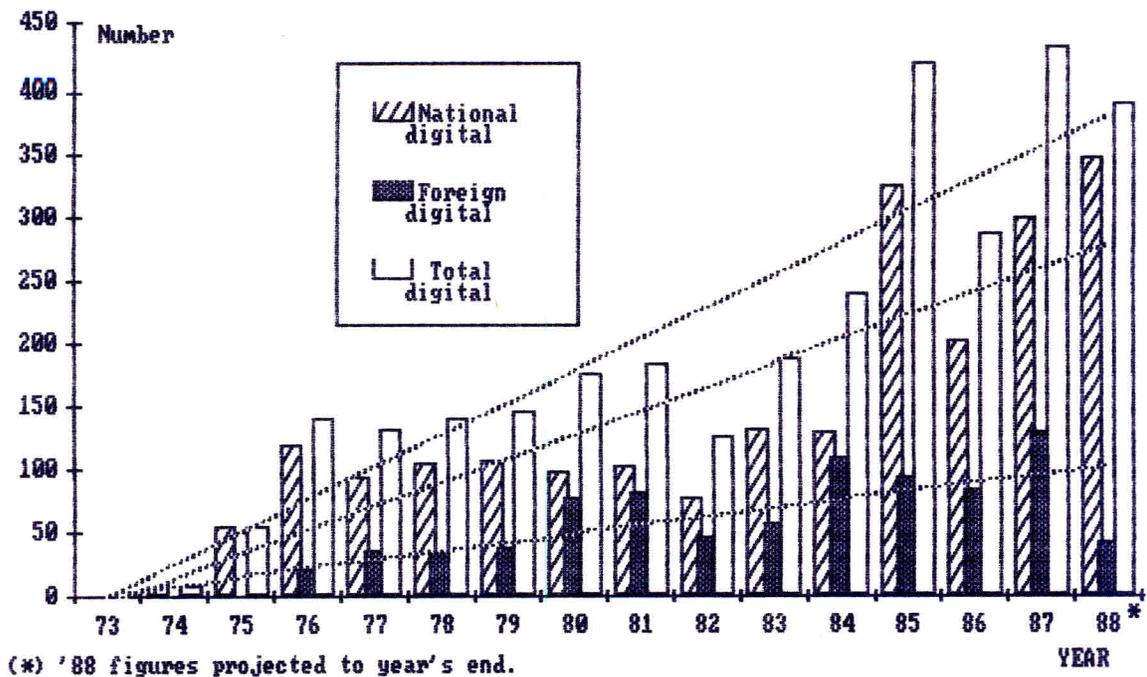


Figure 3.2 - Digital Images Distributed to Users

1979-1984 timeframe as photographic products did. Although very modest in comparison to other countries', the digital to photographic sales ratio in images has peaked to more than 10% in 1985 and, despite the subsequent drops, still shows a positive trend (see Figure 3.3) and is currently around 5%. The ratio in revenue is about 20%, due to the higher prices of digital products.

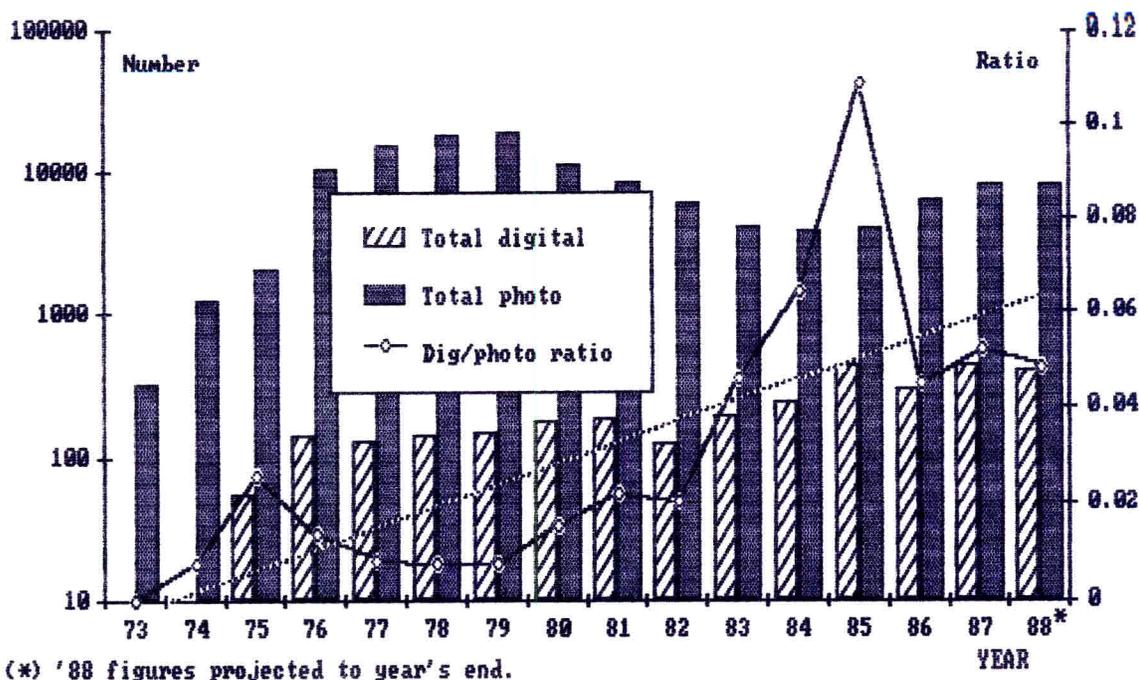


Figure 3.3 - Photographic vs. Digital Distribution along Time

From April, 1987 to June, 1988 INPE distributed:

- 10,274 photographic frames, worth US\$ 1,074,298, and
- 520 digital products, worth US\$ 235,433, giving
- 10,794 images in total, worth US\$ 1,309,731.

Figures 3.5 to 3.7 at the end of this report illustrate the statistics of sales and distribution for the period from April, 1987 to June, 1988. The corresponding tabular data are presented in Annex A.

In June 30, 1988 INPE registered 2286 Landsat data users, a 12% increase over 15 months. The number of foreign users inside it (303) has not changed over the same period, though.

The Data Distribution Network coordinated by INPE in Brazil received the addition of two new User Service Centers established in the Regional Remote Sensing Laboratories of Campina Grande, PB, and Porto Alegre, RS. The Regional RS Labs program is a 1.5 million dollar investment funded by the Brazilian Ministry of Science and Technology and coordinated by INPE, with the objective of disseminating Remote Sensing tools and techniques among the academic and research community in

Brazil. Six such laboratories have been established and seven more are planned for the '88-'89 timeframe, within universities or research centers, in thirteen different cities in eleven states. Some of these laboratories may also operate User Services Centers as and in addition to the two mentioned above. Currently, the Data Distribution Network includes eight such centers (see Figure 3.4 below).



Figure 3.4 - User Services Centers and Regional Labs in Brazil

New product - A new TM product was just announced for the Brazilian user community and consists of digital images in 60-MB streaming 1/4" tape cartridges. This medium is the one normally used for backing up hard disks on IBM-compatible personal computers. The product uses the same Superstructure concept employed in the CCTs and was developed to allow a cheaper configuration for the INPE-developed, PC-based image analysis systems which the private sector is already manufacturing and selling in Brazil. The magnetic tape unit used up to now as the image input for these systems represents almost half of their price, and its replacement for a streaming cartridge unit is expected to significantly increase the number of potential users.

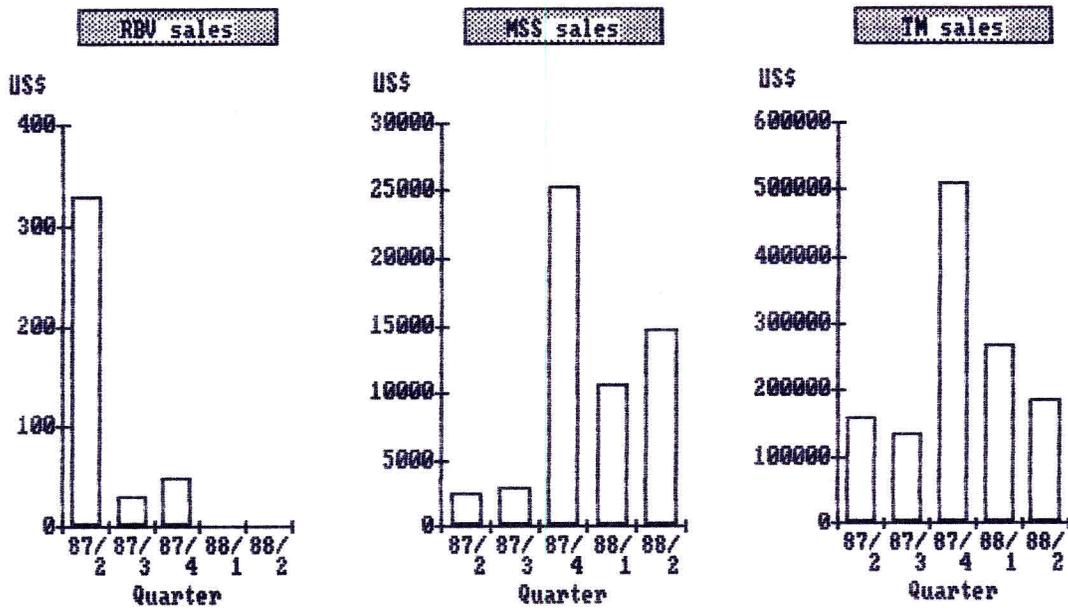


Figure 3.5 - Sales by Quarter and Sensor

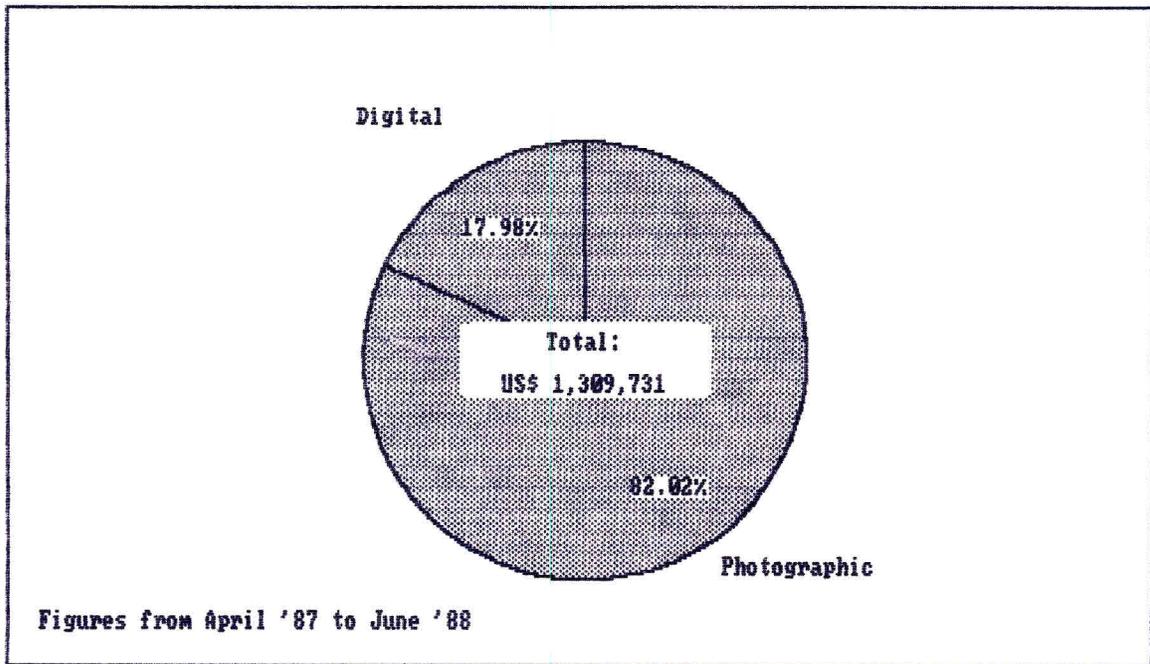


Figure 3.6 - Sales by Product Type

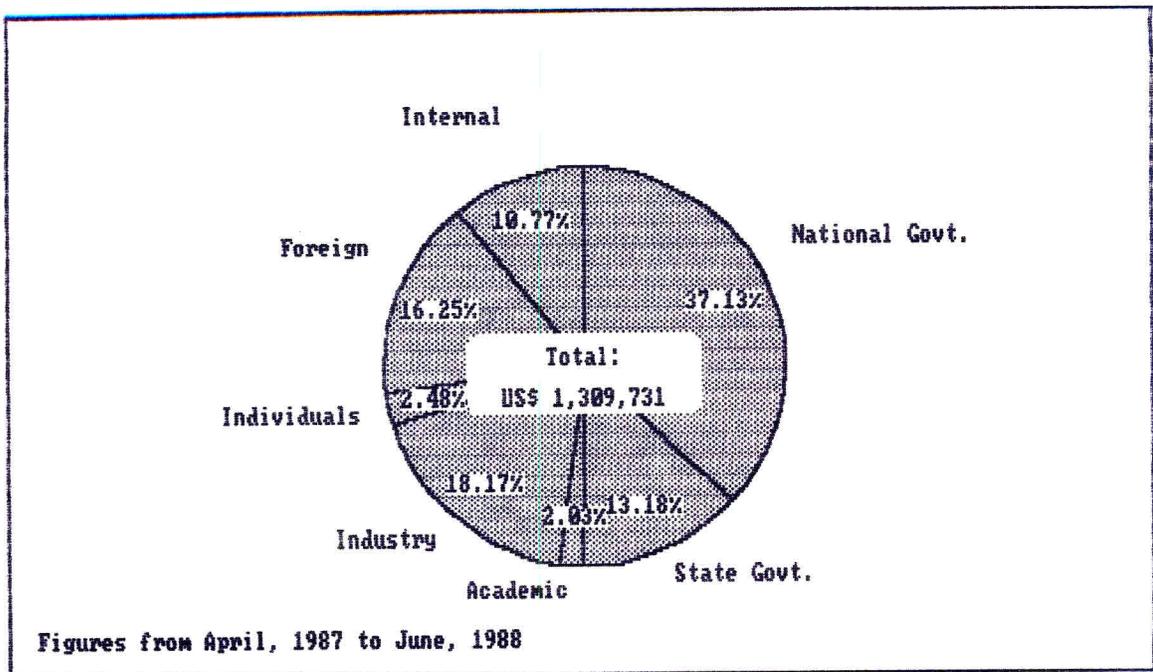


Figure 3.7 - Sales by User Type

ANNEX A

QUARTERLY SALES & DISTRIBUTION SUMMARIES

INPE/BRAZIL

LANDSAT PRODUCT SALES/DISTRIBUTION SUMMARY
 FOR THE 2ND QUARTER (APR-JUN) 1987

1 - RBV Products

	PHOTOGRAPHIC		DIGITAL (CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	15	N/A	N/A	
US\$	329.	-	-	329.

2 - MSS Products

	PHOTOGRAPHIC		DIGITAL (CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	29	31	5	
US\$	1,065.	774.	812.	2,651.

3 - TM Products

	PHOTOGRAPHIC		DIGITAL (CCTs)		TOTAL
	B & W	COLOR	FULL	QUAD	
QUANTITY	1491	551	16	77	
US\$	87,148.	34,648.	13,431.	22,841.	158,068.

4 - Distribution by product type vs. user type

USER TYPE	PHOTOGRAPHIC		DIGITAL	
	% by money	% by number	% by money	% by number
A. National Government	39,03	44,15	61,37	44,17
B. State/Provincial Govt	7,63	3,90	38,63	13,71
C. Academic	1,42	2,69	-	-
D. Industry	23,08	13,22	-	-
E. Individuals	1,72	1,11	-	-
F. Foreign	27,12	11,89	-	-
G. Internal	-	23,04	-	42,12
TOTAL	100,00%	100,00%	100,00%	100,00%

INPE/BRAZIL

LANDSAT PRODUCT SALES/DISTRIBUTION SUMMARY
FOR THE 3RD QUARTER (JUL-SEP) 1987

1 - RBV products

	PHOTOGRAPHIC		DIGITAL (CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	4	N/A	N/A	
US\$	31.	-	-	31

2 - MSS Products

	PHOTOGRAPHIC		DIGITAL (CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	67	11	4	
US\$	1,935.	569.	390.	2,894.

3 - TM products

	PHOTOGRAPHIC		DIGITAL (CCTs)		TOTAL
	B & W	COLOR	FULL	QUAD	
QUANTITY	1600	588	16	156	
US\$	60,337.	36,432.	6,662.	32,657.	136,088.

4 - Distribution by product type vs. user type

USER TYPE	PHOTOGRAPHIC		DIGITAL	
	% by money	% by number	% by money	% by number
A. National Government	41,27	44,12	56,29	36,25
B. State/Provincial Govt	7,94	4,08	32,40	39,58
C. Academic	1,31	2,70	-	-
D. Industry	24,68	13,45	-	-
E. Individuals	1,83	1,08	-	-
F. Foreign	22,97	10,24	11,31	9,47
G. Internal	-	24,33	-	14,70
TOTAL	100,00%	100,00%	100,00%	100,00%

INFE/BRAZIL

LANDSAT PRODUCT SALES/DISTRIBUTION SUMMARY
FOR THE 4TH QUARTER (OCT-DEC) 1987

1 - RBV Products

	PHOTOGRAPHIC		DIGITAL (CCTs)		TOTAL
	B & W	COLOR			
QUANTITY	1	N/A	N/A		
US\$	50.	-	-		50.

2 - MSS Products

	PHOTOGRAPHIC		DIGITAL (CCTs)		TOTAL
	B & W	COLOR			
QUANTITY	164	48	16		
US\$	11,663.	7,862.	5,716.		25,241.

3 - TM Products

	PHOTOGRAPHIC		DIGITAL (CCTs)		TOTAL
	B & W	COLOR	FULL	QUAD	
QUANTITY	1949	505	10	64	
US\$	223,289.	200,692.	26,472.	56,181.	506,634.

4 - Distribution by product type vs. user type

USER TYPE	PHOTOGRAPHIC		DIGITAL	
	% by money	% by number	% by money	% by number
A. National Government	40.15	43.21	52.46	32.68
B. State/Provincial Govt	7.79	3.99	35.51	26.65
C. Academic	1.37	2.12	-	-
D. Industry	23.88	16.35	-	-
E. Individuals	1.78	2.01	-	-
F. Foreign	25.03	9.46	12.03	10.53
G. Internal	-	22.86	-	30.09
TOTAL	100.00%	100.00%	100.00%	100.00%

INPE/BRAZIL
 LANDSAT PRODUCT SALES/DISTRIBUTION SUMMARY
 FOR THE 1ST QUARTER (JAN-MAR) 1988

1 - RBV Products

	PHOTOGRAPHIC		DIGITAL (CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	-	N/A	N/A	
US\$	-	-	-	-

2 - MSS Products

	PHOTOGRAPHIC		DIGITAL (CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	16	14	11	
US\$	2,131.	4,262.	4,323.	10,716.

3 - TM Products

	PHOTOGRAPHIC		DIGITAL (CCTs)		TOTAL
	B & W	COLOR	FULL	QUAD	
QUANTITY	847	340	26	34	
US\$	153,192.	74,862.	26,993.	13,191.	268,238.

4 - Distribution by Product type vs. user type

USER TYPE	PHOTOGRAPHIC		DIGITAL	
	% by money	% by number	% by money	% by number
A. National Government	29.68	30.84	35.83	21.14
B. State/Provincial Govt	17.42	18.27	-	-
C. Academic	1.93	1.18	4.36	6.13
D. Industry	20.12	16.91	21.32	26.39
E. Individuals	3.28	2.98	8.63	9.72
F. Foreign	6.12	3.12	6.74	8.45
G. Internal	21.45	26.70	23.12	28.17
TOTAL	100.00%	100.00%	100.00%	100.00%

INPE/BRAZIL
 LANDSAT PRODUCT SALES/DISTRIBUTION SUMMARY
 FOR THE 2ND QUARTER (APR-JUN) 1988

1 - RBV Products

	PHOTOGRAPHIC		DIGITAL (CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	-	N/A	N/A	
US\$	-	-	-	-

2 - MSS Products

	PHOTOGRAPHIC		DIGITAL (CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	132	20	14	
US\$	11,578.	1,230.	1,952.	14,760.

3 - TM Products

	PHOTOGRAPHIC		DIGITAL (CCTs)		TOTAL
	B & W	COLOR	FULL	QUAD	
QUANTITY	1423	428	9	62	
US\$	107,073.	53,191.	971.	22,841.	184,076.

4 - Distribution by product type vs. user type

USER TYPE	PHOTOGRAPHIC		DIGITAL	
	% by money	% by number	% by money	% by number
A. National Government	21.92	27.91	15.11	10.37
B. State/Provincial Govt	9.96	8.63	15.64	15.84
C. Academic	6.34	4.68	-	-
D. Industry	10.86	11.79	13.34	19.31
E. Individuals	5.24	7.74	-	-
F. Foreign	4.64	5.18	19.17	10.89
G. Internal	41.04	34.07	36.74	43.59
TOTAL	100.00%	100.00%	100.00%	100.00%