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INSTITUTO DE PESQUISAS ESPACIAIS

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14. Abstract/Notes

This report presents the current status of the Brazilian Landsat facilities operated by INPE and the results achieved during the period from October 01, 1984 to August 31, 1985.

15. Remarks: Prepared for the LGSOWG (Landsat Ground Station Operators Working Group) and LDDMWG (LGSOWG Data Distribution and Marketing Working Group) meetings of September, 1985, in Washington, D.C., U.S.A.

CONTENTS

1. RECEIVING AND RECORDING

INPE's Receiving Station at Cuiabá, MT, operates normally the two tracking and receiving systems it has installed, the old one (1973) for Band S and the new one (February 1983) for dual S- and X-band. Both MSS and TM recording capabilities are functional. Support to the NASA Backup Plan for MSS data also remains active.

Routine recordings are being made for Landsat-5 only, for both MSS and TM. Originally, MSS was recorded over the full acquisition range. However, since December, 1984, due to severe need for further reduction of operational expenses, both instruments are being recorded over Brazilian territory only.

Limited Landsat-4 MSS recordings have also been made, under user request, over selected areas where special interest demands an 8-day revisiting cycle (for instance, the monitoring of the filling up of a hydroelectric power plant reservoir).

After NOAA extended the number of TM scenes allowed for direct transmission to ground stations, INPE defined a policy for special TM acquisition, which was published within the TM Products Price List distributed last April (see item 3 - "Distribution" - of this report).

Although some users have expressed interest in TM products over areas outside Brazil, up to the moment we have received no firm placement of requests for special acquisitions.

From October 1984 to August 1985 the Station recorded:

- 130 MSS passes from Landsat-4
- 347 MSS passes from Landsat-5
- 439 TM passes from Landsat-5.

A table showing the evolution of the number os scenes acquired by INPE since 1974 is presented in Annex A.

2. PROCESSING

2.1 - MSS SUBSYSTEM

The Processing Laboratories operated again with some restrictions during the period of this report. The mean time between failures of the equipments is low due to age (more then 12 years for most machines). The Electronic Lab has received the addition of two new magnetic tape units to support CCT production with increased reliability. Anyhow, the most critical equipments (the Ampex HDDR and the Electron Beam film recorder) are unfortunately the hardest ones to replace. On the Photolab side some processing machines are also needing replacement, but budget has not allowed for that up to now.

On the other hand, in the first months of 1985 the Processing Labs, profiting from an international cooperation agreement between Brazil and East Germany, received several cartographic equipment of the Zeiss line to support Cartography applications activities and extend the scope of the MSS Precision Products line. The equipment includes measuring and plotting devices, as well as a mono/stereo comparator, a rectifier/enlarger and a Topocart/Ortophot system.

MSS first generation film originals and CCTs were produced under user request only. Generation of Quicklook imagery was suspended after recordings started to coincide with TM acquisition. The MSS Acquired Images database will be updated based on the corresponding TM passes. The required software is still not implemented and its development was assigned a lower priority in face of tasks related to TM.

Up to August 31, the Processing Labs produced:

- 1511 MSS scenes in high resolution 70 mm film;
- 225 MSS CCTs for external use.

2.2 - RBV SUBSYSTEM

The processing of RBV images was definitely discountinued by INPE in face of the availability of TM imagery (equivalent in spatial resolution and far superior in cosmetic and spectral characteristics) and of the still unsolved problem of adequately de-shading the images. Therefore, RBV products are provided by INPE just as reproduction from existing originals.

2.3 - TM SUBSYSTEM

The TM subsystem, considering just the Electronic Laboratory, operated normally during the period of this report, except for some weeks of downtime due to an HDDR failure, which affected the generation of both high resolution and Quicklook imagery.

Unfortunately, the TM production lines employ, on the Photolab side, the same machines utilized for MSS, and are therefore equally affected by the frequent corrective maintenance periods.

Besides that, the existing enlargers gave unsatisfactory results when used for generating TM color master negatives, due to factors related to the smaller pixel size of TM compared to MSS. Therefore, delivery of color TM products was expected to begin in January, 1985, after the installation of the Zeiss precision rectifier/ enlarger. Unfortunately again, the enlarger electronics failed a few days after installation and the replacement parts were received just some weeks ago. Such a long delay was not expected, and the May, 1985 Price List still listed the TM color line as operational. Effective distribution of TM color products started only late August.

Quadrant photographic TM products were also delayed by the fact that the original approach for generating the film originals relayed on drawing double-width lines with the electron beam film recorder, and this resulted in an unacceptable line structure associated

with the spot wobble function. Therefore, the software had to be redesigned to draw each line twice instead. Currently this production line is operational.

Up to August, 31 the Processing Labs produced:

- 7,644 scenes in Quicklook form;
- 646 scenes in high resolution 5" film;
- 38 full frame CCTs;
- 164 quadrant CCTs.

3. DISTRIBUTION

From October, 1984 to August, 1985 INPE distributed a total of 3197 Landsat products, 2769 of them as photographic frames and 428 as digital products (CCTs). Summaries for the quarters of Oct-Dec 1984, Jan-Mar 1985 and Apr-Jun 1985, showing also the user profile by revenue and by number of products delivered, are included in Annex B, as well as tables and charts, showing the evolution of data distribution by INPE since 1974, in Annex A.

In August 31, 1985, INPE registered 1716 Landsat data users, 266 of them from foreign countries.

The MSS/RBV products Price List was updated twice during the period covered by this report:

- in November, 1984, when the high-contrast additional fee was reduced from US$ 100 to US$ 50 and the 800 bpi BIL CTT was discontinued, and

- in May 1985, when 1:100.000 scale RBV products were discontinued and replaced by the 1:125.000 scale.

No changes in price or products are envisioned for the next MSS/RBV Price List, with validity starting on November 1, 1985.

The TM products Price List was also updated twice:

- in November, 1984, when photographic quadrant products were included, and

- in May, 1985, when the policy for special TM acquisition was defined and published.

This policy basically bills on the interested user the recording costs for his area during a 3-month or a 1-year period, receiving all the related Quicklook prints. There is no commitment from the user to buy any product but also no reimbursement if satisfactory imagery (concerning cloud cover) is not obtained. This scheme has good and bad points compared to the NOAA special acquisitions options, but in our case we were restricted to a cost recovery fee, since there is just one TM tape recorder on the station and this precludes tape dubbing as a possibility to keep just the satisfactory acquisitions.

The current Landsat Price Lists for MSS/RBV and for TM products are enclosed as Annex C and Annex D respectively.

Concerning user accession aids, INPE has presented, in the LTWG framework, a proposal for a WRS unification around a geographic concept, at user interface level (see Annex E). This proposal was considered technically feasible but the members are divided concerning the convenience of its implementation and even its definition. As an action item from LTWG 7, INPE polled the members about their agencies' position and sent a consolidated report to the LTWG chairperson for presentation at the LGSOWG. Several members suggested LGSOWG/LDDMWG as the appropriate forum for further discussions on the matter. The Working Group on Data (WGD) of the Comittee on Earth Observation Satellites (CEOS) was also suggested.

In the order handling procedures, INPE is currently devoting effort towards its integration with the Accounting software and the User index.

ANNEX A

DATA ACQUISITION, PROCESSING AND DISTRIBUTION

SUMMARIES

BRAZIL

INPE - LANDSAT SYSTEM

Scenes Received and Recorded
and
Scenes Converted to Images
(Accumulated figures)

	SATELLITES		1973 (may)	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985 (Aug.31)
RECEIVED & RECORDED	LANDSAT 1	MSS	6114	14674	23112	32528	==>	==>	==>	==>	==>	==>	==>	==>	==>
		RBV	---	---	---	---	---	---	---	---	---	---	---	---	---
	LANDSAT 2	MSS	---	---	1550	3370	19632	23952	32532	38626	51958	52948	==>	==>	==>
		RBV	---	---	---	---	288	==>	==>	==>	==>	==>	==>	==>	==>
	LANDSAT 3	MSS	---	---	---	---	---	11487	17364	25748	==>	29869	==>	==>	==>
		RBV	---	---	---	---	---	1579	9477	23161	37329	43155	45201	==>	==>
	LANDSAT 4	MSS	---	---	---	---	---	---	---	---	---	4383	18199	30233	31201
		TM	---	---	---	---	---	---	---	---	---	---	---	---	---
	LANDSAT 5	MSS	---	---	---	---	---	---	---	---	---	---	---	1364	8602
		TM	---	---	---	---	---	---	---	---	---	---	---	6948	12816
	TOTAL	MSS	6114	14674	24662	35898	52160	67967	82424	96922	110254	119728	133544	146942	155148
		RBV	---	---	---	---	288	1867	9765	23449	37617	43443	45489	==>	==>
		TM	---	---	---	---	---	---	---	---	---	---	---	6948	12816
PROC.	TOTAL	MSS	---	---	2232	5581	11162	19722	25281	27136	35364	40591	42309	43849	45019
		RBV	---	---	---	---	---	---	802	3470	9410	9497	9531	==>	==>
		TM	---	---	---	---	---	---	---	---	---	---	---	89	738

LGSOWG MEETING
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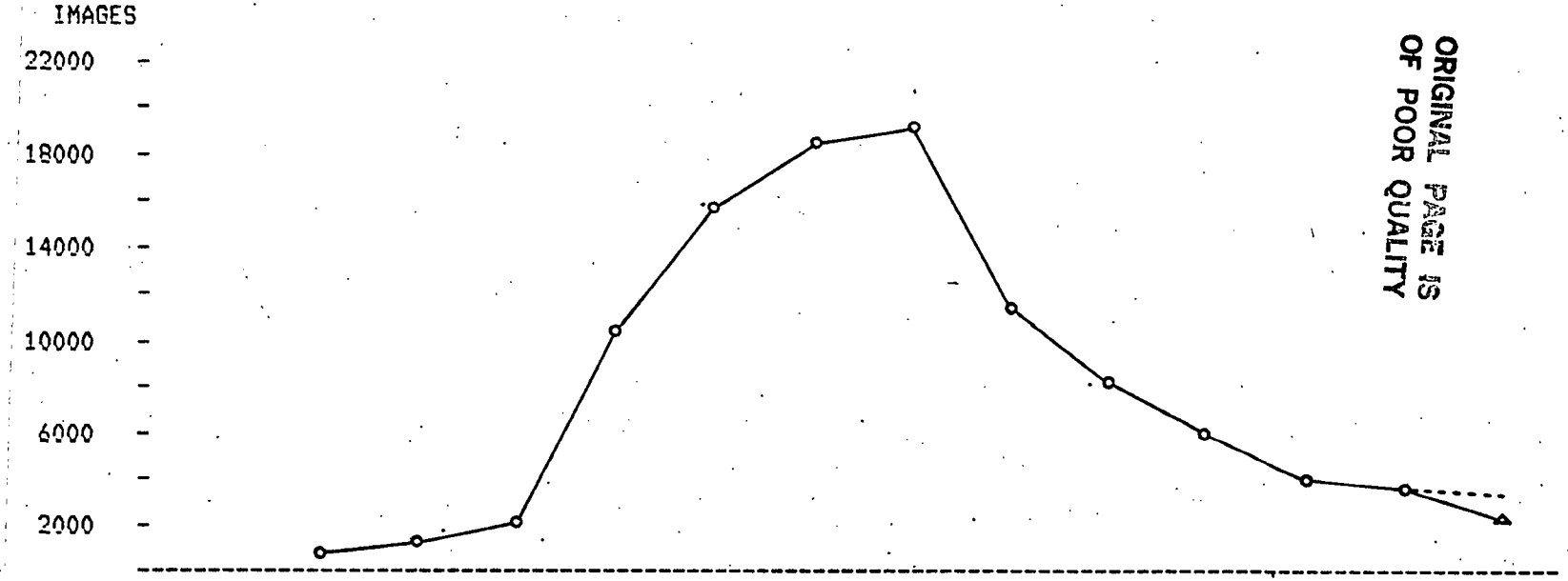
BRAZIL

INPE - LANDSAT SYSTEM

Images Distributed to Users



	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Brazilian Users	323	1230	2094	10025	14971	17273	16269	10216	6986	5350	3488	3332	1886
Foreign Users	---	---	---	230	438	776	2782	1184	1305	748	573	368	342
TOTAL IMAGES	323	1230	2094	10255	15409	18049	19051	11400	8291	6098	4061	3700	2228

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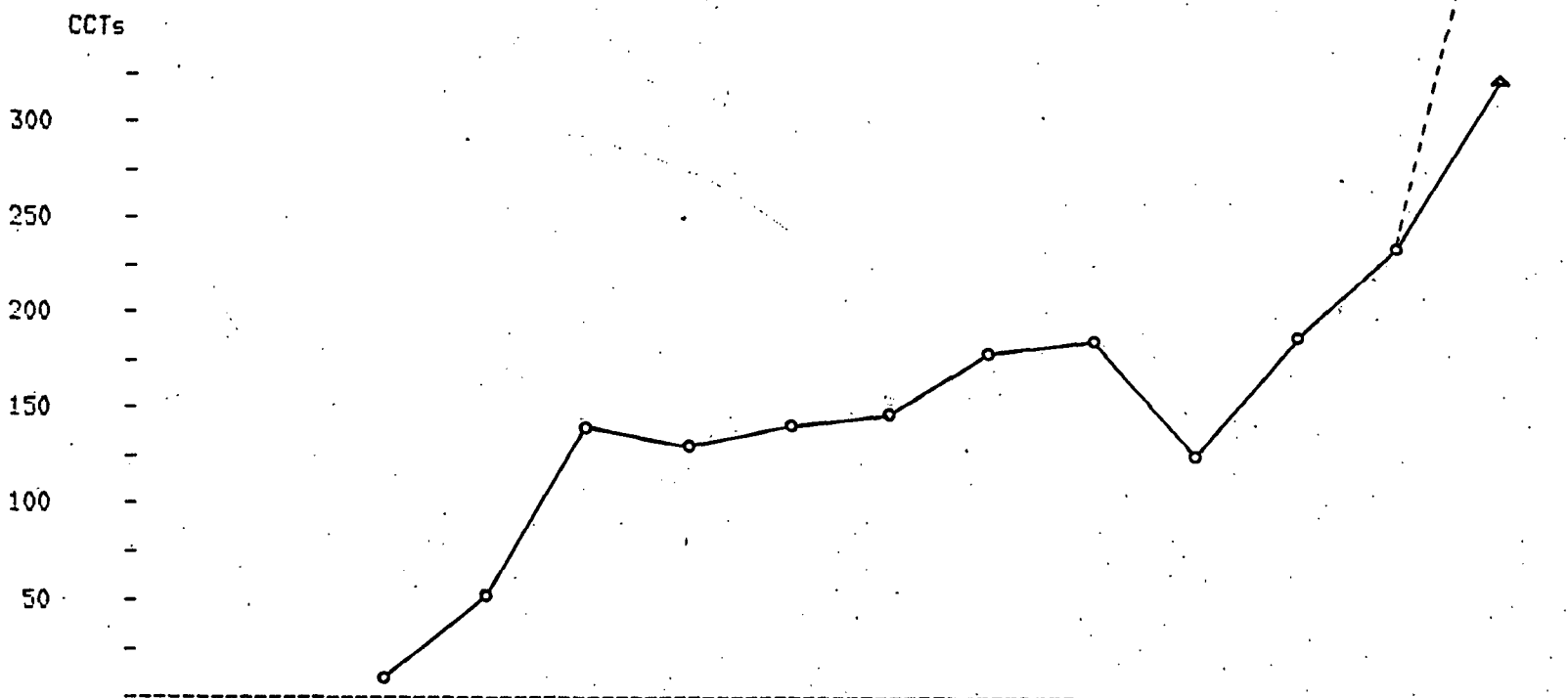
BRAZIL

INPE - LANDSAT SYSTEM

CCTs Produced to Users



	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Brazilian Users	---	10	55	120	95	105	107	99	103	78	131	129	177
Foreign Users	---	---	---	21	37	36	39	77	81	47	57	110	151
TOTAL CCTs	---	10	55	141	132	141	146	176	184	125	188	239	328

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BRAZIL

INPE - LANDSAT SYSTEM

Images and CCTs Distributed

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985(Aug31)
QTY	Images	323	1230	2094	10255	15409	18049	19051	11400	8291	6098	4061	3700	2228
	CCTs	--	10	55	141	132	141	146	176	184	125	188	239	328
REVENUE	Images	---	4808	26020	57695	118457	232661	251367	338556	291492	484508	263396	143825	73348
	CCTs	---	---	---	4200	7400	7200	20853	39345	32019	64425	77557	89661	84310
	TOTAL US$	---	4808	26020	61895	125857	239861	272220	377901	343511	548933	340953	233486	157658

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Sept, 85

ANNEX B

QUARTERLY DATA DISTRIBUTION SUMMARIES

Note: In 1985 the quarterly summaries started to be presented in a new format, grouped by instrument.

INPE/BRAZIL

LANDSAT PRODUCT SALES/DISTRIBUTION SUMMARY

FOR THE 4TH QUARTER (OCT-DEC) 1984

1 - Total number of LANDSAT images by frames sold or distributed to users and revenue (converted to US$)

1.A - All satellites and instruments:

	FRAMES		SCENES ON CCT	TOTAL
	B & W	COLOR		
QUANTITY	1146	114	100	
US$	29,370,00	3,734,00	35,680,00	68,784,00

1.B - LANDSAT-4 MSS only:

	FRAMES		SCENES ON CCT	TOTAL
	B & W	COLOR		
QUANTITY	186	87	24	
US$	9,297,00	2,923,00	15,732,00	27,952,00

1.C - LANDSAT-5 TM only:

	FRAMES		SCENES ON CCT	TOTAL
	B & W	COLOR		
QUANTITY	231	-	2	
US$	18,617,00	-	3,776,00	22,393,00

2. Classification of sales and distribution of photographic products and CCTs by type of user

USER TYPE	PHOTO PRODUCTS		CCTs	
	% by money	% by frames	% by money	% by frames
A. National Government	18,97	60,35	8,08	46,00
B. State/Provincial Govt	10,55	3,17	-	-
C. Academic	8,12	4,76	0,34	1,00
D. Industry	48,29	24,60	0,66	2,00
E. Individuals	1,74	0,63	-	-
F. Outside the country	12,33	6,49	90,92	51,00
TOTAL	100,00%	100,00%	100,00%	100,00%

INPE/BRAZIL

LANDSAT PRODUCT SALES/DISTRIBUTION SUMMARY

FOR THE 1st QUARTER (JAN-MAR) 1985

1 - RBV products

	PHOTOGRAPHIC		DIGITAL(CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	8	N/A	N/A	
US$	358,	-	-	358,00

2 - MSS products

	PHOTOGRAPHIC		DIGITAL(CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	162	87	15	
US$	14,228,	3,516,	10,195,	27,939,00

3 - TM products

	PHOTOGRAPHIC		DIGITAL(CCTs)		TOTAL
	B & W	COLOR	FULL	QUAD	
QUANTITY	164	-	12	24	
US$	7,838,	-	2,500,	2,985,	13,323,00

4 - Distribution by product type vs. user type

USER TYPE	PHOTOGRAPHIC		DIGITAL	
	% by money	% by number	% by money	% by number
A. National Government	40,22	47,85	36,00	35,00
B. State/Provincial Govt	3,65	2,38	-	-
C. Academic	0,59	0,96	-	-
D. Industry	47,81	22,21	-	-
E. Individuals	0,55	0,24	-	-
F. Foreign	7,18	17,81	64,00	50,00
Internal	-	8,55	-	15,00
TOTAL	100,00%	100,00%	100,00%	100,00%

INPE/BRAZIL

LANDSAT PRODUCT SALES/DISTRIBUTION SUMMARY

FOR THE 2nd QUARTER (APR-JUN) 1985

1 - RBV products

	PHOTOGRAPHIC		DIGITAL(CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	14	N/A	N/A	
US$	760,	-	-	760,00

2 - MSS products

	PHOTOGRAPHIC		DIGITAL(CCTs)	TOTAL
	B & W	COLOR		
QUANTITY	595	81	100	
US$	40,984,	4,518,	70,071,	115,573,00

3 - TM products

	PHOTOGRAPHIC		DIGITAL(CCTs)		TOTAL
	B & W	COLOR	FULL	QUAD	
QUANTITY	334	-	12	65	
US$	13,490,	-	12,377,	8,114,	33,981,00

4 - Distribution by product type vs, user type

USER TYPE	PHOTOGRAPHIC		DIGITAL	
	% by money	% by number	% by money	% by number
A, National Government	56,82	65,82	82,65	73,14
B, State/Provincial Govt	0,66	0,49	-	-
C, Academic	1,86	2,92	0,22	1,69
D, Industry	9,85	7,93	0,35	0,75
E, Individuals	0,28	0,65	-	-
F, Foreign	30,53	9,32	16,78	11,61
Internal	-	12,87	-	12,81
TOTAL	100,00%	100,00%	100,00%	100,00%

ANNEX C

CURRENT MSS/RBV PRODUCTS PRICE LIST

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PRICE LIST -- MAY 01, 1985 TO OCTOBER 31, 1985

LANDSAT DATA -- MSS & RBV

ATTENTION: Add US$ 5.00 for each photographic product and US$ 65.00 for each digital product involving MSS images from Landsats 4 or 5 (distribution fee paid to NOAA-USA).

PHOTOGRAPHIC PRODUCTS

A) Quick-Look products (MSS only; uncorrected/low resolution images meant for cloud cover and quality evaluation; available in just one spectral band; generally Band 5; scale and size approximate)

Scale	Medium	Sensor	Size	Code	Price(US$)
1:3,704,000	Paper	MSS	50mm	1 36	3.00
1:1,000,000	Paper	MSS	185mm	2 36	10.00

B) Bulk products (System-corrected geometrically and radiometrically; Sun elevation-compensated)

B.1) Black-and-white

Scale	Medium	Sensor	Size	Code	Price(US$)
1:3,704,000	Film negative	MSS	50mm	1 26	53.00
1:3,704,000	Film positive	MSS	50mm	1 25	44.00
1:1,980,000	Film negative	RBV	50mm	0 40	53.00
1:1,980,000	Film positive	RBV	50mm	0 39	44.00
1:1,000,000	Film positive	MSS	185mm	2 25	89.00
1:1,000,000	Paper	MSS	185mm	2 27	53.00
1:500,000	Film positive	RBV	198mm	3 39	89.00
1:500,000	Paper	RBV	198mm	3 41	53.00
1:500,000	Paper	MSS	370mm	3 27	116.00
1:250,000	Paper	RBV	396mm	4 41	116.00
1:250,000	Paper	MSS	740mm	4 27	228.00
1:125,000	Paper	RBV	790mm	5 41	230.00

B.2) Color (MSS only; normal band usage 4/5/7)

Scale	Medium	Sensor	Size	Code	Price(US$)
1:1,000,000	Film positive	MSS	185mm	2 28	113.00
1:1,000,000	Paper	MSS	185mm	2 29	89.00
1:500,000	Paper	MSS	370mm	3 29	149.00

Special High Contrast processing (recommended for the Amazonian Region) available for any MSS bulk product above; flag it on your request if desired. Additional fee -- US$ 50.00 per image.

(over)

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CACHOEIRA PAULISTA-SP - ROD PRES DUTRA, Km 40,0 - CX POSTAL 01 - FONE (0128) 61377 - TELEX(012)1160 - CEP 12 630
CUIABA-MT - MORRO DA CONCEIÇÃO S/N - CX POSTAL 714 - FONE (065) 321-9514 - TELEX(0652)114 - CEP 78 000
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FORTALEZA-CE - DISTRITO DE EUZEBIO - CX POSTAL 1281 - FONE (085) 224-4966 - CEP 60 000
SÃO PAULO - SP - RUA TRAIPU Nº 423 - FONE (011) 67-2747 - TELEX (011) 34061 - CEP 01235

DIGITAL PRODUCTS (MSS only; system-corrected just radiometrically; bands 4, 5, 6 and 7)

A) BIP2 (Band Interleaved by Pixel Pairs) CCTs in the traditional format

Density	Tapes	Image organization	Code	Price(US$)
800 bpi	2x2400'	eight 432-pixel-wide strips	35	605.00
1600 bpi	2x2400'	eight 432-pixel-wide strips	34	605.00

B) BIL (Band Interleaved by Lines) CCTs following the international format standards

Density	Tapes	Image organization	Code	Price(US$)
1600 bpi	1x2400'	single 3240-pixel-wide strip	32	675.00

NOTES:
1) Payments must be made in advance through a nominal check to Instituto de Pesquisas Espaciais. An account can also be maintained for quickest servicing.

2) Prices include airmail delivery for photographic products; CCTs are normally airfreighted collect.

3) Normal servicing time is 10-15 days; CCTs can suffer an additional 10 days delay to obtain the necessary export license.

April 1985

Marco Antonio Raupp
Director General

ANNEX D

CURRENT TM PRODUCTS PRICE LIST

PRICE LIST -- MAY 01, 1985 TO OCTOBER 31, 1985

LANDSAT DATA -- THEMATIC MAPPER (TM)

========== ** ATTENTION ** ==========

- Prices include the NOAA distribution fees of US$25.00 for each photographic product and from US$75.00 up to US$300.00 for each digital product. These fees do not apply to Quick-look products.
- Payments must be made in advance through a nominal check to Instituto de Pesquisas Espaciais (INPE). An account can also be be maintained for quickest servicing.
- Prices include airmail delivery for photographic products; CCTs are normally airfreighted collect.
- Normal servicing time is 15-20 days; CCTs can suffer an additional 10 days delay to obtain the necessary export license.

==========

PHOTOGRAPHIC PRODUCTS

A) Quick-Look products (uncorrected/low resolution images meant for cloud cover and quality evaluation; available in just one spectral band, generally Band 3; full frame only; scale and size approximate)

Scale	Medium	Size	Code	Price(US$)
1:4,000,000	Paper	40mm	0020	3.00

B) Bulk products (System-corrected geometrically and radiometrically; Sun elevation-compensated)

Obs.: FF = full frame; QD = quadrant

B.1) Black-and-white

FF/QD	Scale	Medium	Size	Code	Price(US$)
FF	1:1,000,000	Film negative	185mm	0302	110.00
FF	1:1,000,000	Film positive	185mm	0312	100.00
FF	1:1,000,000	Paper	185mm	0322	75.00
FF	1:500,000	Paper	370mm	0323	140.00
FF	1:250,000	Paper	740mm	0324	250.00
QD	1:500,000	Film negative	185mm	4302	135.00
QD	1:500,000	Film positive	185mm	4312	125.00
QD	1:500,000	Paper	185mm	4322	100.00
QD	1:250,000	Paper	370mm	4323	165.00
QD	1:125,000	Paper	740mm	4324	275.00

B.2) Color (normal band usage 2/3/4 for false color and 1/2/3 for true color)

FF/QD	Scale	Medium	Size	Code	Price(US$)
FF	1:1,000,000	Film positive	185mm	1312	200.00
FF	1:1,000,000	Paper	185mm	1322	180.00
FF	1:500,000	Paper	370mm	1323	240.00
QD	1:500,000	Film positive	185mm	5312	225.00
QD	1:500,000	Paper	185mm	5322	205.00
QD	1:250,000	Paper	370mm	5323	265.00

Additional fee for band combinations different from the above (master color negative retained): US$100.00.

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NATAL-RN - AV SALGADO FILHO Nº1000 - CX POSTAL 130 - FONE (084) 231-4733 - TELEX(0842)185 - CEP 59 000
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SÃO PAULO - SP - RUA TRAIPU Nº 423 - FONE (011) 67-2747 - TELEX (011) 34061 - CEP 01235

DIGITAL PRODUCTS (system-corrected radiometrically; geometric corrections not applied, except for those relative to the along-line scanning mirror movement, which are applied through nearest-neighbor resamplins.)

A) Full frame

Bands	Format	Density	Tapes	Code	Price (US$)
1	BIL	1600 bpi	1x2400'	2411	685.00
1	BSQ	1600 bpi	1x2400'	2431	685.00
2	BIL	1600 bpi	2x2400'	2412	1,265.00
2	BSQ	1600 bpi	2x2400'	2432	1,265.00
3	BIL	1600 bpi	3x2400'	2413	1,845.00
3	BSQ	1600 bpi	3x2400'	2433	1,845.00
4	BIL	1600 bpi	4x2400'	2414	2,430.00
4	BSQ	1600 bpi	4x2400'	2434	2,430.00
5	BIL	1600 bpi	5x2400'	2415	2,935.00
5	BSQ	1600 bpi	5x2400'	2435	2,935.00
6	BIL	1600 bpi	6x2400'	2416	3,445.00
6	BSQ	1600 bpi	6x2400'	2436	3,445.00
7	BIL	1600 bpi	7x2400'	2417	3,950.00
7	BSQ	1600 bpi	7x2400'	2437	3,950.00

B) Quadrant (all 7 bands or just 3 in any combination)

Bands	Format	Density	Tapes	Code	Price (US$)
3	BIL	1600 bpi	1x2400'	6413	645.00
3	BSQ	1600 bpi	1x2400'	6433	645.00
7	BIL	1600 bpi	2x2400'	6417	1,300.00
7	BSQ	1600 bpi	3x2400'	6437	1,340.00

SPECIAL ACQUISITIONS (recordings over areas outside Brazil)

TM data are normally recorded only over Brazilian territory. Users can request acquisitions over other South American countries within range of the Cuiaba' Station following the price schedules below (add US$200 handling charge per order).

A) Short term (6 acquisitions - approximately 3 months coverage):

US$ 1,500 for each Path involved in the order plus
US$ 320 for each scene center requested.

B) Long term (22 acquisitions - approximately 1 year coverage)

US$ 2,000 for each Path involved in the order plus
US$ 1,200 for each scene center requested.

Examples: a) single scene center, short term:
200 + 1,500 + 320 = US$ 2,020 total
b) two centers in the same Path, long term:
200 + 2,000 + 2x1,200 = US$ 4,600 total
c) two centers side by side (2 Paths), short term:
200 + 2x1,500 + 2x320 = US$ 3,840 total

Conditions: a) the prices above entitle the client to receive only the quicklook prints of all images recorded under his (her) request. All recorded data will remain as INPE property and be available to any user at standard product prices thereafter.
b) cloud cover restrictions are not accepted, i.e., acquisitions are counted regardless of cloud cover. On the other hand, there is no commitment from the client to buy products.
c) acquisitions may start from 5 to 20 days after prepayment is received at INPE, depending on the coverage cycle phase.
d) gaps in the acquisition period due to satellite or ground malfunction will be compensated with subsequent passes.

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April 1985

Marco Antonio Raupp
Director General

ANNEX E

WRS STANDARDIZATION PROPOSAL AS PRESENTED

TO THE LTWG

Worldwide Reference Systems:
A CALL FOR STANDARDIZATION

Since Landsat D came to stage with a new coverage pattern, the concept of the Worldwide Reference System, ideally suited for repetitive satellite coverage, began to face its first problems. We have now two Worldwide Reference Systems instead of one and, with the several other satellites expected to be launched in years to come, some confusion is likely to arise if the WRS concept is not revised.

At INPE we have gotten used to referring to the two existing WRSs as the 'old' and the 'new' ones, instead of using the full names of 'WRS of Landsats 1,2 and 3' and 'WRS of Landsat 4' (which, by the way, should now be changed to mention also Landsat 5). Needless to say that a third system would invalidate these nicknames.

The next remote sensing satellite available to the international user community will be expectedly the French SPOT. For this satellite, with its side-looking capability, the concepts of Paths and Rows will be definitely inadequate.

Therefore, evidence seems to point to a geographically-oriented WRS, independent from any particular coverage pattern, as a long term solution to allow users to specify their area of interest in a reasonably concise form.

Some countries have already geocoded products based on a chart index; which gave to the output of their systems this characteristic of universality. What we feel the need for, however, is an international consensus, perhaps to be presented to the LGSOWG, on a recommendation for a grographic WRS that all countries could use and would fit not only all Landsats but future satellites as well.

In our point of view, this system should have the following characteristics:

- be simple to explain, to represent and to use;

- have a 'resolution' of 15' (approx. 30km at the equator) to allow good separation of scene centers for images like SPOT's (60x60km) and also that users can express more precisely the location of their areas of interest, but support also the specification of larger areas;

- stand above national chart indexing conventions and avoid the somewhat confusing articulation rules of the international World Geographic Reference System (NF23-Y-A-IV-3, etc.).

A possible implementation, given herein to illustrate the points above, is that we keep the well-known East-West/North-South latitude and longitude scheme to define a 1-degree grid, and subdivide each cell in 4x4 subcells of 15', addressed by a pair of 4-valued codes, one code for X and one for Y. If we defined these 4 values as A,B,C and D, for example, São José dos Campos (S23:10/W45:53) would be in 'Path' S23A/'Row' W45D. A Landsat-5 scene showing the city (Path 218/Row 76 of the Landsats 4 and 5) would be coded as S23A/W45A for its scene center at S23:06/W45:00.

A special code denoting 'range' of interest or coverage could be also defined to give an idea of the size of a scene or the extension of an area of interest whose center is expressed in this WRS. This range code should be expressed in terms of distance rather than in coordinates, due to the convergence of meridians, and correspond to a nonlinear sequence (like 10, 20, 50, 100, 200) to limit the number of ranges. The code could be applied optionally to each direction or both, depending on the convenience of specifying this information and also on whether the image or the area extends beyond or is smaller than the subcell containing its center. For instance: the Landsat 5 scene over São José dos Campos mentioned above, sized about 185x185 km, could be coded as S23Ae/W45Ae if 'e' denoted a range on the order of 200 km; the city itself could be described by S23Aa/W45Da if 'a' was associated to a 10-km range and one desired to specify the approximate size of the city.

If a geographic WRS such as the one above is defined, it will become the third (and hopefully the last) one 'in scene'. We suggest that short and unequivocal names be assigned to each one in order that

confusion among them is minimized, mainly between the first two, by always prefixing the WRS name to the Path and Row codes. Just for illustration, let's say that WRS-A, WRS-B and WRS-G (for Geographic) are the names. We would have then São José dos Campos as WRS-A 234/76, WRS-B 218/76 or WRS-G S23A/W45A. The use of the geographic WRS should anyway be encouraged among the user community, even for early imagery.

It was our feeling that the LTWG would be the best forum to discuss and convey upon the subjects above. Therefore, our suggestion is that a subgroup be appointed with this task, for presentation at the next LGSOWG meeting if so agreed.