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13. Signature of the responsible <i>[Signature]</i>		15. Price	
16. Summary/Notes <i>The objective of this report is to present the products and services provided by INPE to its users in the area of remote sensing of LANDSAT data.</i>			
17. Remarks <i>This report was presented in the Senior User Services and Data Management Workshop from NASA, 12-13 June, 1980, Argentina.</i>			

DISTRIBUTION OF LANDSAT PRODUCTS AND SERVICES BY INPE

INPE offers its Landsat users several photographic and digital products, intending to fit most of many particular applications. Film products, both B&W and color (for MSS) are presented in sizes 70mm and 9 1/2". Paper products range in scales from 1:1,000,000 to 1:500,000 for color and from 1:1,000,000 to 1:250,000 (MSS) or 1:100,000 (RBV) for B&W. Radiometrically corrected CCT's are produced in band interleaved by pixel pairs (BIP2) format, in 800 bpi density tapes, using two 2400' reels for a complete MSS scene. Photographic products are radiometrically corrected, including sensor mismatch and Sun elevation compensation. The annotation format for INPE's photographic Landsat products is depicted in Figure 1, with explanations in Table 1. The MSS format is shown; the RBV format is basically the same, with the subscene code (A, B, C, or D) in place of the spectral band and with an "N" or "S" appended to the row number to specify Northern or Southern half of the nominal MSS frame covering that row*. Also the "gain" and "encoding" codes have no meaning for RBV and therefore are omitted.

To support the users in their quests for data or in their work with Landsat products, INPE provides several kinds of services and tools.

A main tool available to any user is the Landsat Catalog, which is published annually, with quarterly updates, containing the images made available during the last period. The entries are ordered by path, date and row to facilitate access. Information listed in the Catalog are (besides path, row and date) center latitude and longitude, cloud cover, quality and visibility (this one relating mainly to the amount of haze) assessments, Sun elevation angle, geometric correction level, satellite number, revolution number and the image identification code, for each image. A Sample page of the Catalog, along with explanations, is on Figure 3. The Catalog is subscribed to with a nominal fee, entitling the user to receive all the issues in that year and eventual corrections made in the future to entries appearing there.

(*) *For information on the Path/Row System, see the Coverage Map presented on Figure 2. A conversion table between the Worldwide Reference System, introduced in 1976, and the Brazilian Reference System, used since 1973, is listed on Table 2.*

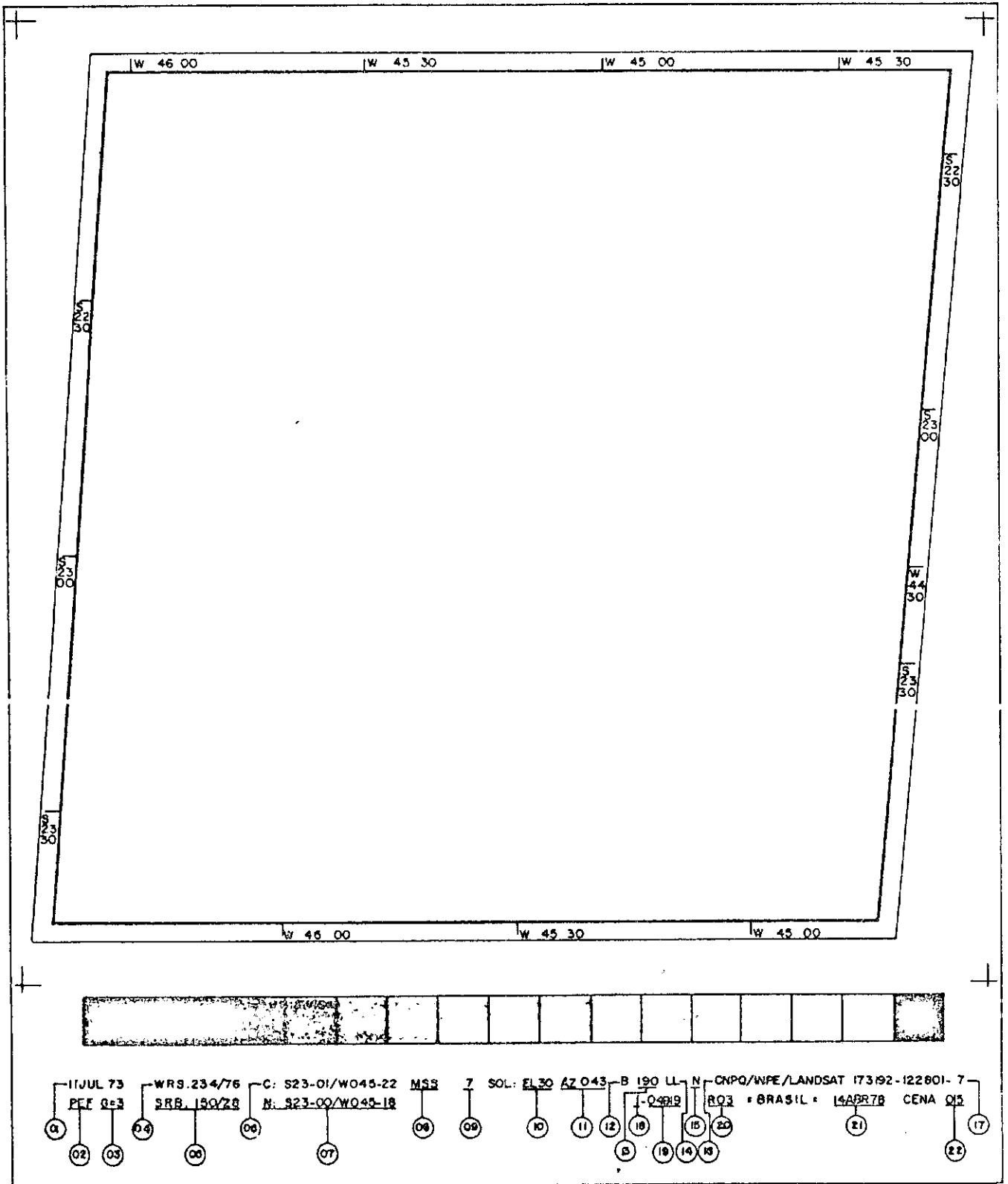


Figure 1

TABLE 1

ANNOTATION FORMAT EXPLAINED

1. Acquisition date.
2. Projection system used. PEF stands for Perspectiva Espacial por Faixas (Space Strip Perspective). A future option will be SOM (Space Oblique Mercator).
3. Geometric correction level:
 - 1: Compensation for intrinsic distortions of the film generation hardware only;
 - 2: Inclusion of orbital parameters in the model; the nadir coordinates are displayed but the image center coordinates are not;
 - 3: Full system correction; satellite attitude and sensor boresight angles are also taken in account;
 - 4: Full system correction plus compensation for systematic errors of the model, detected via measurement of selected images.
4. Path/Row codes in the Worldwide Reference System (WRS).
5. Path/Row codes in the Brazilian Reference System (SRB).
6. Image center coordinates.
7. Satellite nadir coordinates.
8. Sensing device.
9. Spectral band of this image.
10. Sun elevation.
11. Sun azimuth.
12. Type of ephemeris tape used for orbital parameters: B = best fit; P = predicted.
13. Satellite heading in degrees clockwise from North.
14. Gain (L = low, H = high) and encoding (L = linear, C = compressed) of the sensor.
15. Type of radiometric calibrations: N = normal; " — " (dash)=uncalibrated.
16. Station identifier.
17. Image identification.
18. Satellite number.
19. Revolution number.
20. Run number (sequential for each time an original is generated for this orbit).
21. Processing date.
22. Scene number within the run.

TABLE 2

CONVERSION TABLE FOR PATHS AND ROWS FOR THE LANDSAT SYSTEM

WORLDWIDE REFERENCE SYSTEM - BRAZILIAN REFERENCE SYSTEM

PATH		ROW	
WRS	SRB	WRS	SRB
001	151	49	01
002	165	50	02
003	179	51	03
004	193	52	04
005	207	53	05
006	221	54	06
007	235	55	07
008	249	56	08
009	263	57	09
010	277	58	10
011	291	59	11
012	305	60	12
228	317	61	13
229	331	62	14
230	345	63	15
231	359	64	16
232	122	65	17
233	136	66	18
234	150	67	19
235	164	68	20
236	178	69	21
237	192	70	22
238	206	71	23
239	220	72	24
240	234	73	25
241	248	74	26
242	262	75	27
243	276	76	28
244	290	77	29
245	304	78	30
246	318	79	31
247	332	80	32
248	346	81	33
249	360	82	34
250	123	83	35
251	137	84	36
		85	37
		86	38
		87	39
		88	40
		89	41
		90	42
		91	43
		92	44

INSTITUTO DE PESQUISAS ESPACIAIS (INPE)

* DEPARTAMENTO DE PRODUÇÃO DE IMAGENS * BANCO DE IMAGENS TERRESTRES *

CATALOGO DE IMAGENS LANDSAT - ATUALIZACAO 07/10/78 1

BASE 193(SRB) 2 PATH 4(WRS) 3 DATA DE PASSAGEM 14/ 6/77 4 PAG 1

LANDSAT 2 6 ORBITA 12185 7 MSS 8 5

IDENT.	LAT	LONG	PT	ROW	COB	EL	G	QUALID./VISIB.			POR BANDA	
								4	5	6	7	8
77165-135356	S14-25	W073-04	22	70	0%	32	3	8/9	8/9	8/9	8/9	/
77165-135421	S15-51	W073-25	23	71	20%	31	3	8/9	9/9	8/9	9/9	/
77165-135443	S17-07	W073-44	24+	72+	100%	30	3	8/1	8/3	8/5	8/7	/



01. Data desta emissão do Catálogo
02. Nº da órbita base para esta passagem, no Sistema de Referência Brasileiro (SRB)
03. Nº da órbita base no sistema universal (WRS)
04. Data desta passagem.
05. Nº de página para esta passagem.
06. Número de série do satélite.
07. Número sequencial da órbita correspondente a esta passagem.
08. Dispositivo sensor.
09. Identificação da cena.
10. Coordenadas do centro da imagem.
11. Número do ponto, no sistema brasileiro.
12. Número do ponto, no sistema universal.
13. Porcentagem de cobertura de nuvens estimada para a cena.
14. Ângulo de elevação do sol.
15. Nível de correção geométrica:
 - 1 = sem correções;
 - 2 = com correções orbitais;
 - 3 = com correções orbitais e de atitude do satélite;
 - > 3 = incluindo pontos de controle terrestre (imagens de precisão).
16. Pares qualidade/visibilidade individuais para cada banda presente.
Códigos: 1 a 3 = má; 4 a 6 = regular; 7 a 9 = boa.
"Visibilidade" é uma estimativa do teor informativo visível na imagem, que pode ser prejudicado por névoa atmosférica.
17. Este sinal ("+") indica que esta cena foi deslocada para cima ou para baixo de sua posição nominal na grade de bases e pontos.

01. Date of this issue of the Catalog;
02. Path number of this pass, in the Brazilian Reference System;
03. Path number in the Worldwide Reference System;
04. Date of this pass;
05. Page number within this pass;
06. Satellite serial number;
07. Revolution number;
08. Sensing device;
09. Scene Id;
10. Scene center coordinates;
11. Row number in the Brazilian Reference System;
12. Row number in the Worldwide Reference System;
13. Cloud cover percentage estimate;
14. Sun Elevation angle;
15. Geometric correction level:
 - 1 = no corrections;
 - 2 = orbital corrections included;
 - 3 = orbital + spacecraft attitude corrections;
 - > 3 = ground control points used (precision processing).
16. Quality/Visibility pairs for each band available:
Codes: 1 to 3 = poor; 4 to 6 = fair; 7 to 9 = good.
"Visibility" is an estimate of the informative context visible on the image, which can be lowered by atmospheric haze.
17. This sign ("+") indicates that this scene has been shifted north or south with respect to its nominal position in the path-row grid.

Fig. 3

When a period is closed, the images pertaining to that volume of the Catalog are microfilmed and, although not made available for purchase, copies of the microfilms are sent to the User Services Centers that INPE maintains throughout Brazil (there are five currently operating, with two more being planned) to enable users to view the images and personally evaluate their quality and cloud cover before ordering them. For MSS, band 5 is the one microfilmed, provided it's available.

Recently, INPE started selling quick-look images, which are lower-resolution, uncorrected versions of the final products, obtained from an original generated at the receiving site by photographing a CRT screen. These products can also be used, as they cost about half the price of the corresponding final product, to select images to be ordered in more expensive presentations. Quick-look is available only for MSS, in 1:1,000,000 B&W paper, normally from band 5.

INPE's prices were significantly raised in February/80, but are still below cost and compatible with those charged by EROS Data Center for corresponding products. This low-price policy is mainly intended to incentivate the use of LANDSAT data among the technical community of Brazil and South America (see our latest Price List in Table 3). A difference, though, is that we charge for the products after the users receive them. This was made so due to the fact that government agencies, which represent a reasonable percentage of our users, have regulations restricting paying for goods in advance. We have so far had less problems with this than one could anticipate. Once in a while some users has to be gently reminded of a delayed payment, but the great majority is rather punctual.

TABLE 3

LANDSAT PRODUCTS

PRICE LIST

PHOTOGRAPHIC PRODUCTS

<u>IMAGE SIZE</u>	<u>SCALE</u>	<u>FORMAT</u>	<u>BLACK & WHITE</u>	<u>COLOR COMPOSITE</u>
<u>MSS</u>			<u>UNIT PRICE</u>	<u>UNIT PRICE</u>
50 mm	1:3,704,000	Film positive	US\$ 15.00	US\$ N.A.
50 mm	1:3,704,000	Film negative	18.00	N.A.
185 mm	1:1,000,000	Film positive	29.00	37.00
185 mm	1:1,000,000	Paper	18.00	29.00
370 mm	1:500,000	Paper	34.00	58.00
740 mm	1:250,000	Paper	80.00	N.A.
<u>RBV</u>				
50 mm	1:1,963,000	Film Positive	15.00	N.A.
50 mm	1:1,963,000	Film Negative	18.00	N.A.
196 mm	1:500,000	Film Positive	29.00	N.A.
196 mm	1:500,000	Paper	18.00	N.A.
393 mm	1:250,000	Paper	34.00	N.A.

HIGH CONTRAST PHOTO PRODUCTS

A new electronic / photographic processing is available for photo products, at 3 X the price of the normal processing, in all sizes and formats except 50 mm. Recommended for the Amazonian Region.

COMPUTER COMPATIBLE TAPES (CCT)

<u>TYPE</u>	<u>TRACKS</u>	<u>bpi</u>	<u>FORMAT</u>	<u>SET PRICE</u>
Bulk	9	800	2 tapes (set)	US\$ 250.00
Edge-Enhanced	9	800	2 tapes (set)	450.00

There is an additional 30 days delay if an export licence to foreign countries is required. CCT's are normally shipped collect.

IMPORTANT:

- RBV data in the scale 1:100,000 also available under special request and controlled by EMFA (Armed Forces Ministry) based on present law for aerial material distribution (Unit Price US\$ 120.00)

- Minimum order: US\$ 30.00

- Prices valid from February 15 to August 31, 1980

February, 1980

To help control the debts and payments of the user community, a small accounting system has been developed on our support computer system, consisting of a Digital Equipment Corporation PDP - 11/34 with 96 K bytes of memory, 7.5 M bytes of disk (2.5 M bytes on a removable cartridge), one 80-column printer and two 800 bpi/75 ips magtape units that are shared with the production computer system (two PDP 11/15's working in parallel, each with 56 K bytes of memory). This accounting system keeps track of each user's balance from punched cards with shipping lists data and from terminal-entered payments information. Monthly, a printout is issued listing those users that are in debt for more than a reasonable amount of time and should therefore be contacted. When a user delays a payment for more than three months, his or her pending or new requests are suspended or not processed until the debt is cleared.

Concerning delivery times, a good figure for the average in fulfilling an order is one month. Some requests take less and some take longer, mainly when a part for a machine of a production line in the Photolab has to be imported, which is still a lengthy process for Brazil. We try to keep ourselves properly spared, but sometimes we fall short of an expected delivery or quick clearance in customs.

We intend to reduce the average above in what we can by implementing another small system in our PDP 11/34 which would help speeding up the pending requests by optimizing machine loads and efficiently scheduling production in a shorter period than the one we use now, when we are still totally manual with this respect.

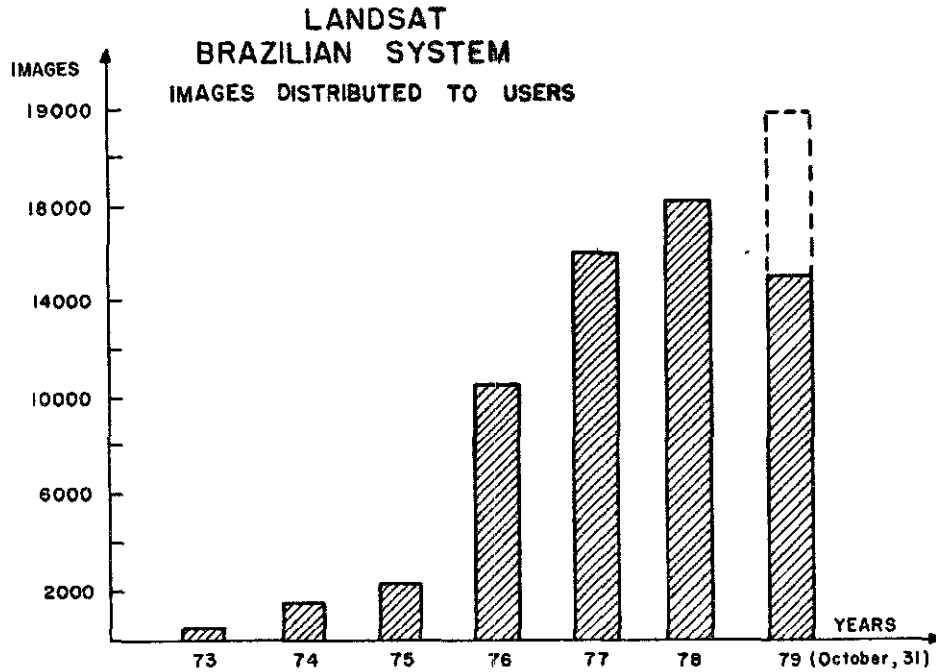
Back to user services, computer search printouts can also be provided under user's request. However, due to limitations in computer power and storage space in the system that handles our data base (the same PDP 11/34 described above), our index resides on tape and searches are not very flexible. Currently the only geographic access keys are the path-row codes. Options that can be specified are minimum quality, maximum cloud cover, minimum Sun elevation angle and the period of interest. The search program lists up to 12 images within the period, satisfying the selected restrictions. If there are more than 12 suitable images in the index, only the most recent 12 within the period are shown.

The information printed for each image are basically the same ones present in the Catalog, except for latitude and longitude.

In spite of the mentioned restraints, more flexible retrievals of INPE's index can be made through EROS Data Center, that is kept updated on it via interchange tapes that contain the additions made to our data base. INPE's images are integral part of EROS's index and thus can more easily be made available to the rest of the world.

Concerning support for the work with Landsat products, INPE has two automatic image classification systems which can be used with Landsat MSS CCT's for categorization of areas, using training sets selected by a human operator. One of them is a Bendix M-DAS, which is more oriented towards smaller training sets and lower-volume production. The other is a General Electric Image-100, which has higher throughput and has several additional flexibilities over the M-DAS. The I-100 is located at the main INPE facility, at São José dos Campos, SP, and operated by the Remote Sensing Department of INPE. The M-DAS belongs to the Image Production Department and is installed along with the Electronic and Photographic Processing Laboratories, in Cachoeira Paulista, SP. An experienced team of researchers working for INPE in Remote Sensing can give the users all the assistance needed in working with these systems and can also perform the job of interpretation of photographic products for the users, if so requested.

Since starting its activities with Landsat in 1972, INPE has achieved good results in disseminating this powerful helping tool through the user community. Product demand and number of users have grown steadily since 1973. In 1978 Brazil delivered more than 18000 images to users, which brought us to a position second only to the U.S. in terms of Landsat production (see Figure 4 - 1979's volume was over 19000 images). From 3 users in 1973 (see Figure 5) we are now with more than one thousand.



BRAZ. USERS	323	1230	2094	10025	14971	17273	13.003
NON-BRAZ. USERS	—	—	—	230	438	776	2031
TOTAL IMAGES	323	1230	2094	10255	15409	18049	15 034
BRAZ. USERS	—	4,808	26,020	56,015	115,257	224,805	181,321
NON-BRAZ. USERS	—	—	—	1,680	3,200	7,856	27,203
TOTAL US\$	—	4,808	26,020	57,695	118,457	232,661	208,524

LGSOWG Meet.
November, 1979

Fig. 4 - Images Distributed to Users

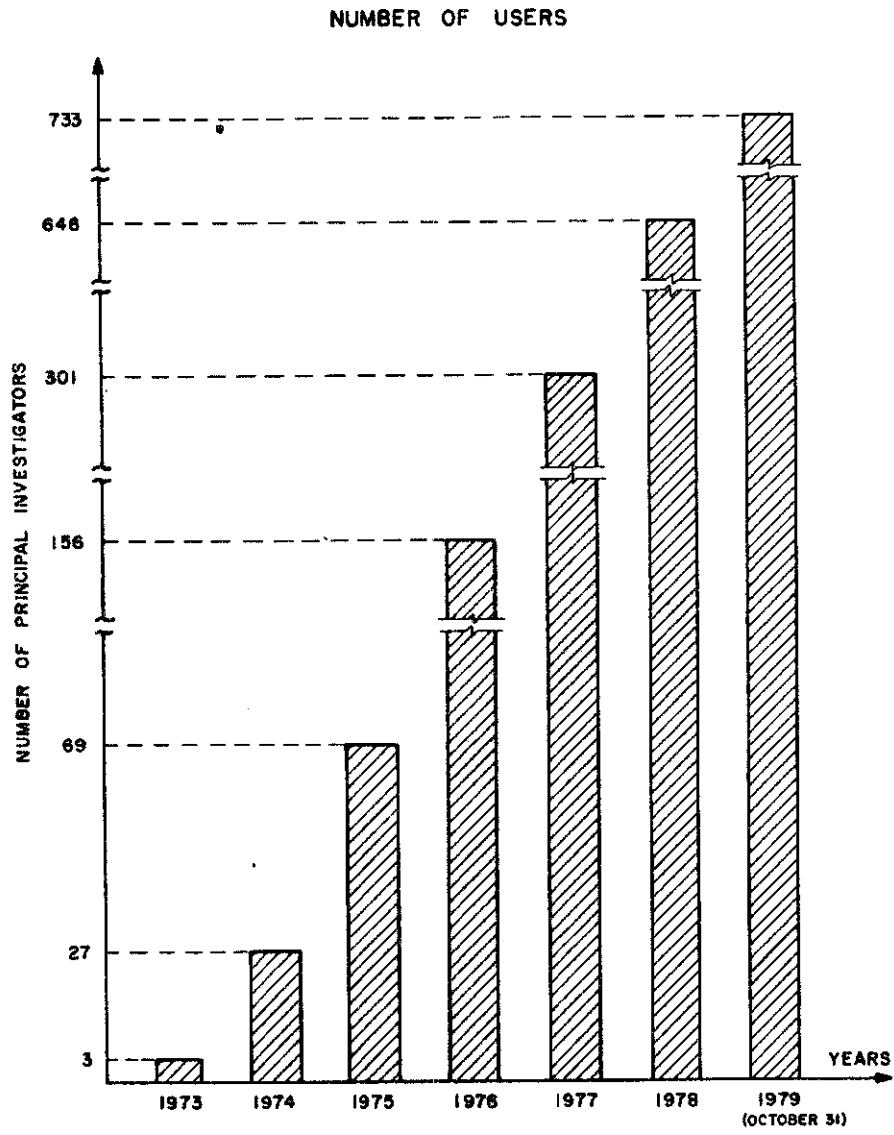


Fig. 5 - Number of Users

Presently, INPE is committed to technically improve its products (we are conducting several tests and experiments with the goal of bringing the geometric accuracy of our images down to 50 meters, so they can be used as a reliable source for updating existing maps and producing 1:250.000 maps for a vast portion of the interior of Brazil, which is very poorly mapped) and negotiating a system to acquire and process the Thematic Mapper of Landsat D. The better characteristics of this sensor, concerning geometric and radiometric resolution, allied to the spacecraft's better attitude measurement and control makes it an invaluable instrument to help our country better monitor, evaluate and plan the use of its prolific natural resources, in some respects so ignored, in some respects so wasted, in many aspects so unknown.

June, 1980.