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Civil Commercial Imagery Evaluation Workshop

CBERS: a Reference in the Brazilian Space Program

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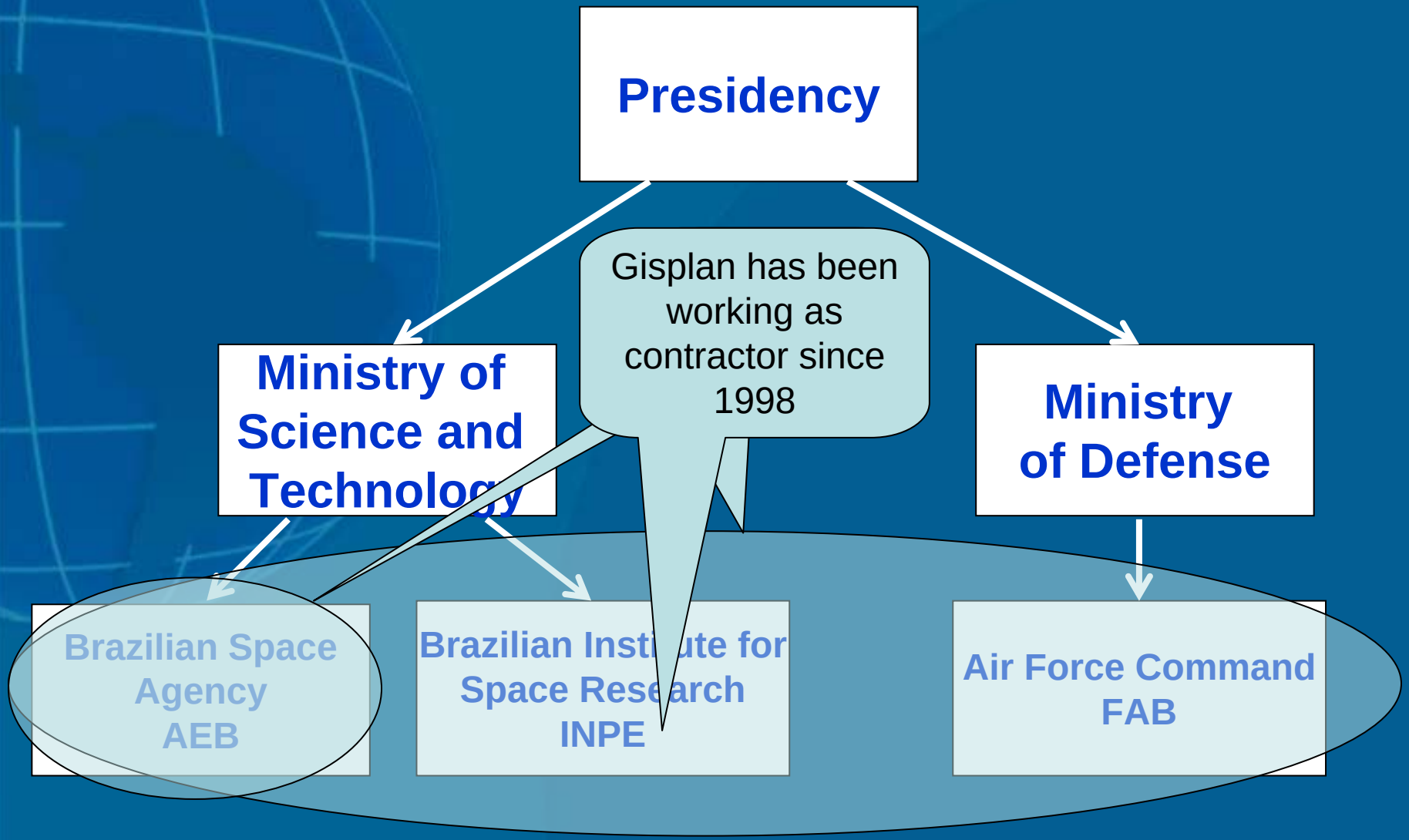
Roadmap

- The Brazilian Space Program
- CBERS Program
  - Past (CBERS-1)
  - Present (CBERS-2, 2B)
  - Future (CBERS 3,4)

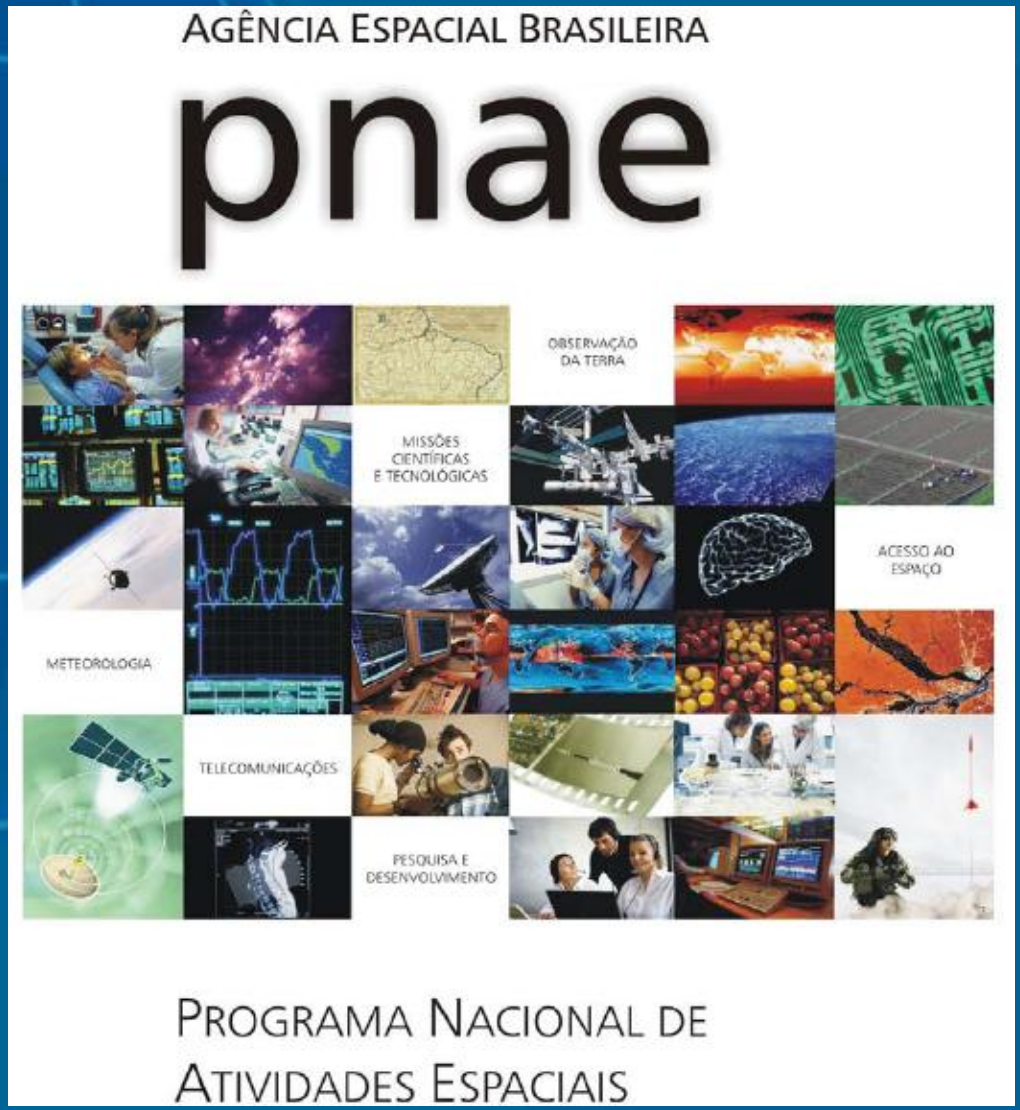
Policy, Program, Execution

- PNDAE
  - The policy
  - Establishes objectives and guidelines to be implemented in the national space programs and projects
- PNAE
  - National Program for Space Activities
  - 10 years, revised yearly
- SINDAE
  - National System for the Development of Space Activities
  - The execution

Organization



PNAE



2005 a 2014

Priority Areas

- Earth observation
- Scientific and Technological missions
- Telecommunication
- Meteorology
- Access to the space
- Infra-structure
- Research and development
- Human resources
- Industrial policy
- Cross themes

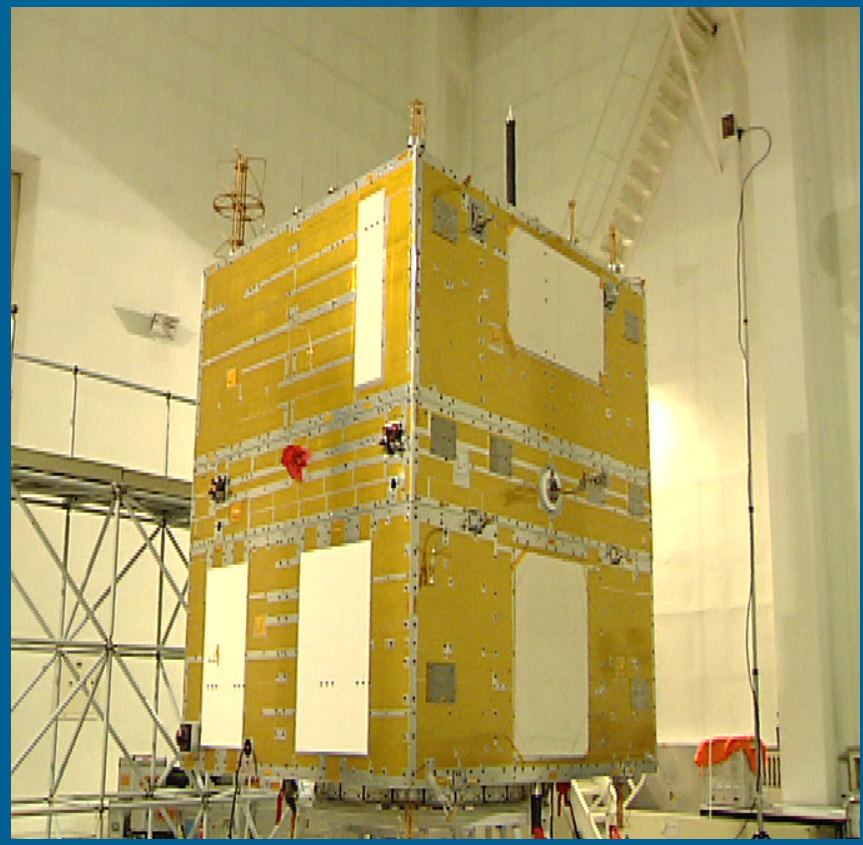
Earth Observation

- Remote Sensing Satellites – SSR
  - Synthetic Aperture Radar – SAR
    - Equatorial orbit, 20ºS to 20ºN, Amazon monitoring
  - Optical
    - Equatorial orbit, 45ºS to 45ºN, covering all the Brazilian territory, with frequent visits
  - Brazil-China Program
    - CBERS
- Data collecting program
  - SCD-1 – 1993
  - SCD-2 – 1998

Brazil China Program

- CBERS-1 (1999)
  - Decommissioned Sept. 2003
- CBERS-2 (2003)
  - Same technical specs, differences in image distribution policy
- CBERS-2B (2007)
- CBERS-3 (2009)
- CBERS-4 (2011)

- Brazilian participation
  - 30% for CBERS 1,2
  - 50% for CBERS 2B, 3 and 4



CBERS 1 & 2

Payloads:

- CCD – Charge Coupled Device
  China
- IRMSS – Infra-Red Multi Spectral Scanner
  China
- WFI – Wide Field Imager
  Brazil

CCD + IRMSS + WFI

Multi-spectral			
CCD.1	450 –	520 nm	visible (blue)
CCD.2 – WFI.1	520 –	590 nm	visible (green)
CCD.3 – WFI.2	630 –	690 nm	visible (red)
CCD.4	770 –	890 nm	NIR
IRMSS.1	1,550 –	1,750 nm	SWIR
IRMSS.2	2,080 –	2,350 nm	SWIR
IRMSS.3	10,400 –	12,500 nm	TIR
Panchromatic			
CCD.5	510 –	730 nm	
IRMSS.4	500 –	900 nm	

CCD

- Push-broom
- FOV 8.32º
- Swath 113 km
- IFOV 25 μrad / 20m
- GSD 20 m
- Radiometry 8 bits/pixel
- Data rate 2 x 53 Mbits/s
- OBR 6 Gbytes (15 minutes)
- Stereo ± 32º (step: 2') - off nadir

IRMSS

- Scanner
- FOV 8.8º
- Swath 120 km
- IFOV 100 μrad / 78 m
- GSD 80 m / 160 m
- Radiometry 8 bits/pixel
- Data rate 6.1 Mbits/s

WFI

- Push-broom
- FOV 59.6º
- Swath 890 km
- IFOV 330 μrad / 256 m
- GSD 240 m
- Radiometry 8 bits/pixel acquisition 6 bits/pixel compressed transmission
- Data rate 1.1 Mbits/s

CBERS 1 & 2

- CBERS-1
  - Data policy similar to Landsat
  - Some ground station subsystems developed in Brazil
- CBERS-2
  - New data policy: free imagery for South American countries
    - 2,000 images per week (peak)
    - +300,000 scenes in 3 years
    - +25,000 different users in 15,000 organizations
  - Brazilian ground station system
    - From ingestion up to higher products

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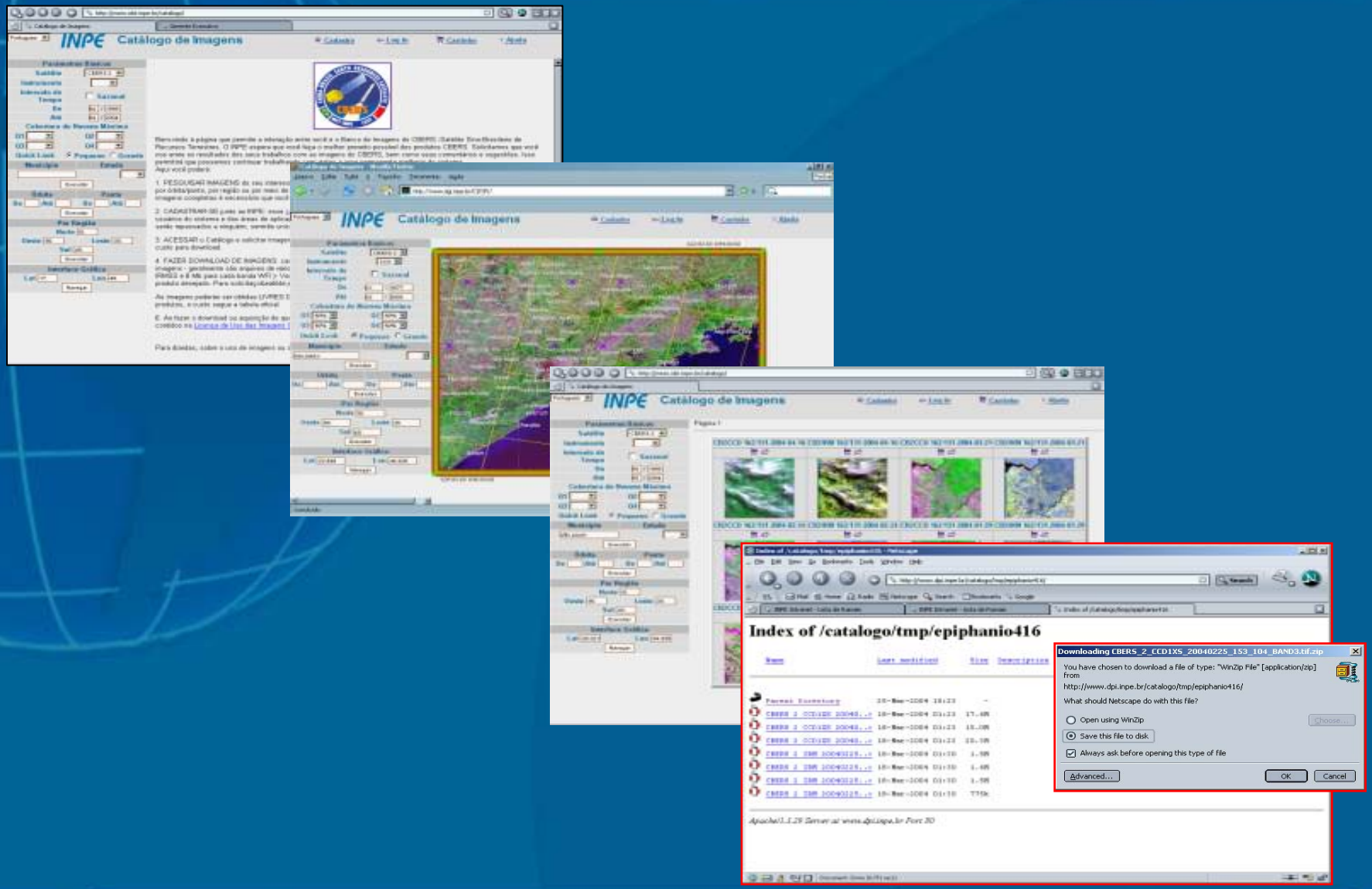
CBERS 1 & 2



CBERS

- Public
- Private
- NGO

- Agro-business
- Education
- Environment
- Mining
- Oil and gas
- State and local
- Utilities

Market Research

- General views of the market
- Doubts > Prejudices

PESQUISA

MER

SA

Aplicaç

INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

"In 2004 we had 26 big fiscalization operations; this year I had 197 operations. From those 197, 41 were big operations and the remaining were operations that were not possible before. Why I had 26 big Operations in 2004? (...) because I had only one scene per region per year.

- Impact of discontinuity
- About INPE, suggestions

- About INPE
- Suggestions
- Conclusions

CBERS 2B

- Challenges
  - improve radiometric and geometric precision
- Differences
  - GPS included
  - Star sensor included
  - IRMSS replaced by HRC (High Resolution Camera)
  - Digital Data Recorder
- International data policy
  - Privileges for those who adopt free imagery distribution
  - Target of at least 2 countries, other than Brazil and China, with CBERS2B ground stations before launch

HRC

- Push-broom
- FOV 2º
- Swath 27 km
- IFOV 3 μrad / 2.4 m
- GSD 2.5 m
- Radiometry 8 bits/pixel
- Data rate 60 Mbits/s
- OBR 15 Gbytes

CBERS 3 & 4

Payloads:

- PANMUX – Panchromatic and Multi-spectral China Camera
- CCD – Charge Coupled Device Brazil
- IRMSS – Infra-Red Multi-Spectral Scanner China
- AWFI – Advanced Wide Field Imager Brazil

PANMUX

- PANMUX: push-broom
- 4 spectral bands
  - Pan 510 – 730 nm 5m
  - Green 520 – 590 nm 10m
  - Red 630 – 690 nm 10m
  - NIR 770 – 890 nm 10m
- Swath 60 km
- Stereo ±32º

CCD

- CCD: push-broom
- 4 spectral bands
  - Green 520 – 590 nm 20m
  - Red 630 – 690 nm 20m
  - NIR 770 – 890 nm 20m
  - SWIR 1,550 – 1,750 nm 20m (new)
- Swath: 120 km
- Stereo: ±32º

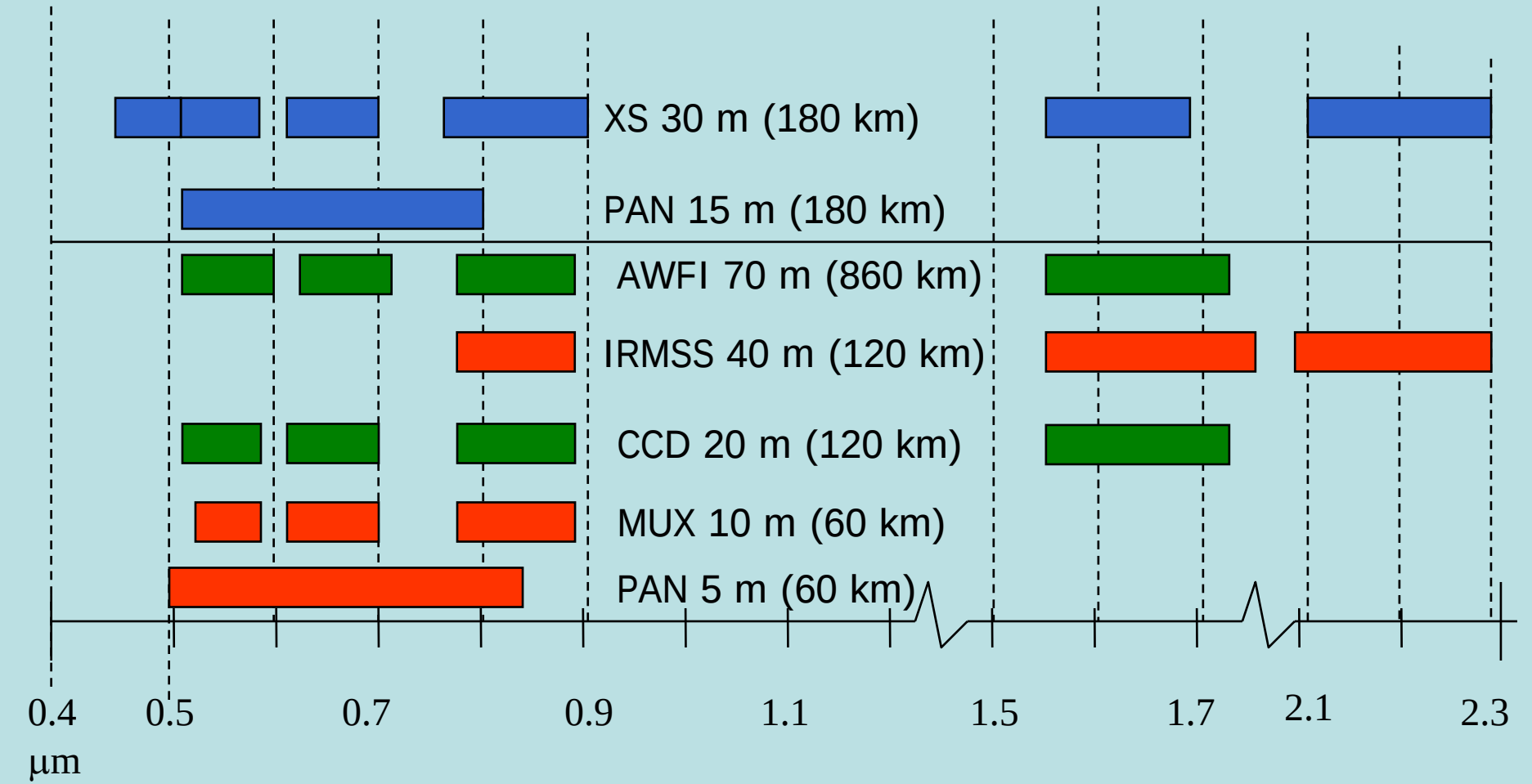
IRMSS

- IRMSS: scanner
- 4 spectral bands
  - NIR (new) 770 – 890 nm 40m
  - SWIR 1,550 – 1,750 nm 40m
  - SWIR 2,080 – 2,350 nm 40m
  - TIR 10,400 – 12,500 nm 80m
- Swath: 120 km

AWFI

- AWFI: push-broom
- 4 spectral bands
  - Green (new) 520 – 590 nm 70m
  - Red 630 – 690 nm 70m
  - NIR 770 – 890 nm 70m
  - SWIR (new) 1,550 – 1,750 nm 70m
- Swath: 860 km faixa

CBERS 3/4 e LANDSAT-7



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Further Information

- CBERS International Data Policy
  - Dr. Gilberto Camara,
  - INPE´s Director
  - gilberto@dpi.inpe.br
- CBERS Data Distribution Policy & Technical Specs
  - José Bacellar (INPE)
  - jose.bacellar@dpi.inpe.br
- Market Research
  - Dr. José Epiphanio (INPE)
  - epiphanio@dsr.inpe.br
- Ground System Development
  - Frederico Liporace (Gisplan)
  - liporace@gisplan.com.br
  - Poster session today
  - Presentation on Thursday

Thank You