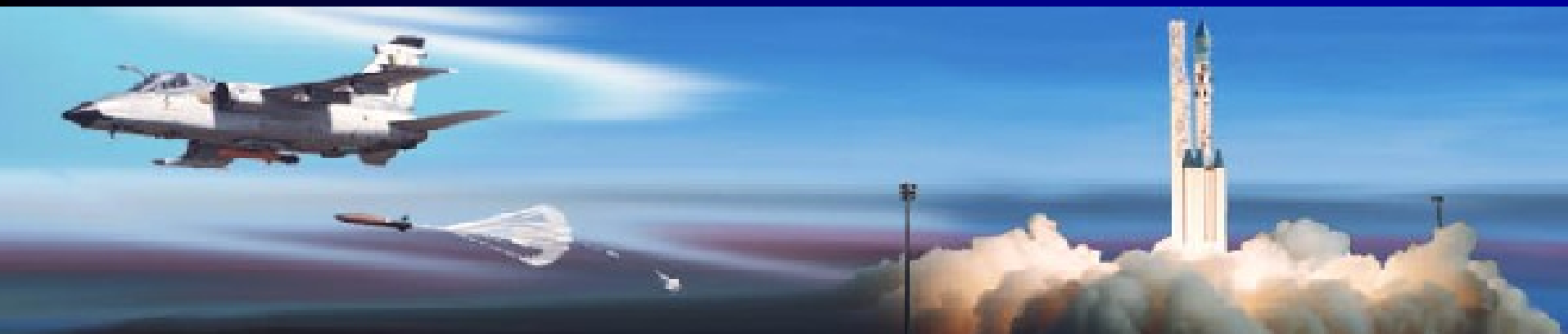




# Wireless Applications for Brazilian Air Force

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# Outline

- Introduction
- Aerospace sector
- Wireless applications
- Opportunities in Brazil

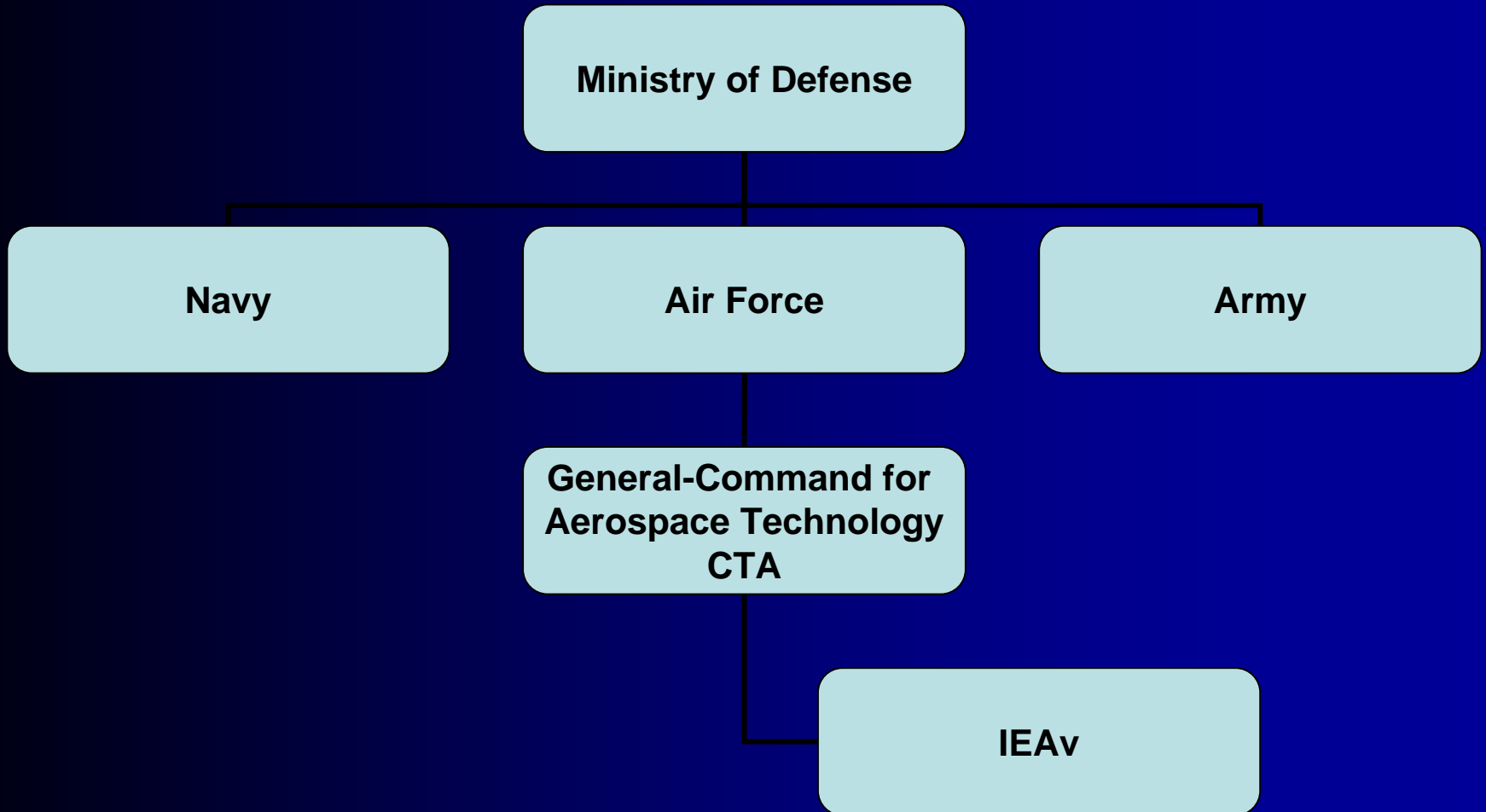


# MNT Workgroup

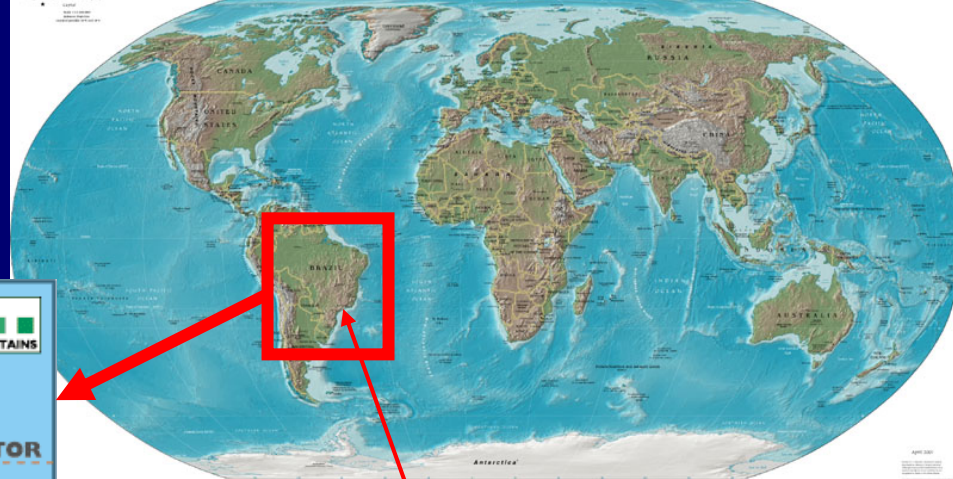
- Objective
  - Coordinate actions to foster the development of MNT for aerospace applications
- Organized by ABDI and IEAv
  - ABDI – Brazilian Agency for Industrial Development
  - IEAv – Institute for Advanced Studies (Air Force)



# Instituto de Estudos Avançados (Institute for Advanced Studies - IEAv)



# CTA



Location:  
São José dos Campos – SP  
(Aerospace cluster)





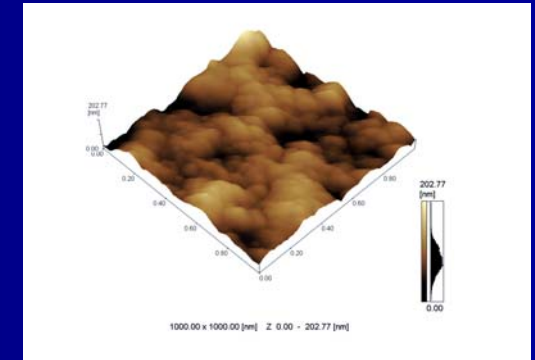
- College for Aerospace Engineering (ITA)
  - Undergraduate and graduate programs, basic research
- 2 Research Institutes
  - Applied Research and Development (IEAv) (IAE)
- Institute for Aerospace Homologation and Certification (IFI)
  - Technology transfer, aerospace metrology
- 2 Launching Centers
  - Alcântara, Natal
- Special Group for Flight Testing
- 1 Testing Site (defense systems)
  - Area: 21,588 km<sup>2</sup> (Israel = 21,946 km<sup>2</sup>, Switzerland = 41,295 km<sup>2</sup>)







- Institute for Advanced Studies
- Applied Research
- 320 people, 75 PhDs
- 8 Divisions
  - Photonics, Nuclear, Aerothermodynamics and Hypersonics, Applied Physics, Geo-intelligence, Administrative, Technical Support, Infrastructure.
- 39 Labs



AFM of a nano-composite coating



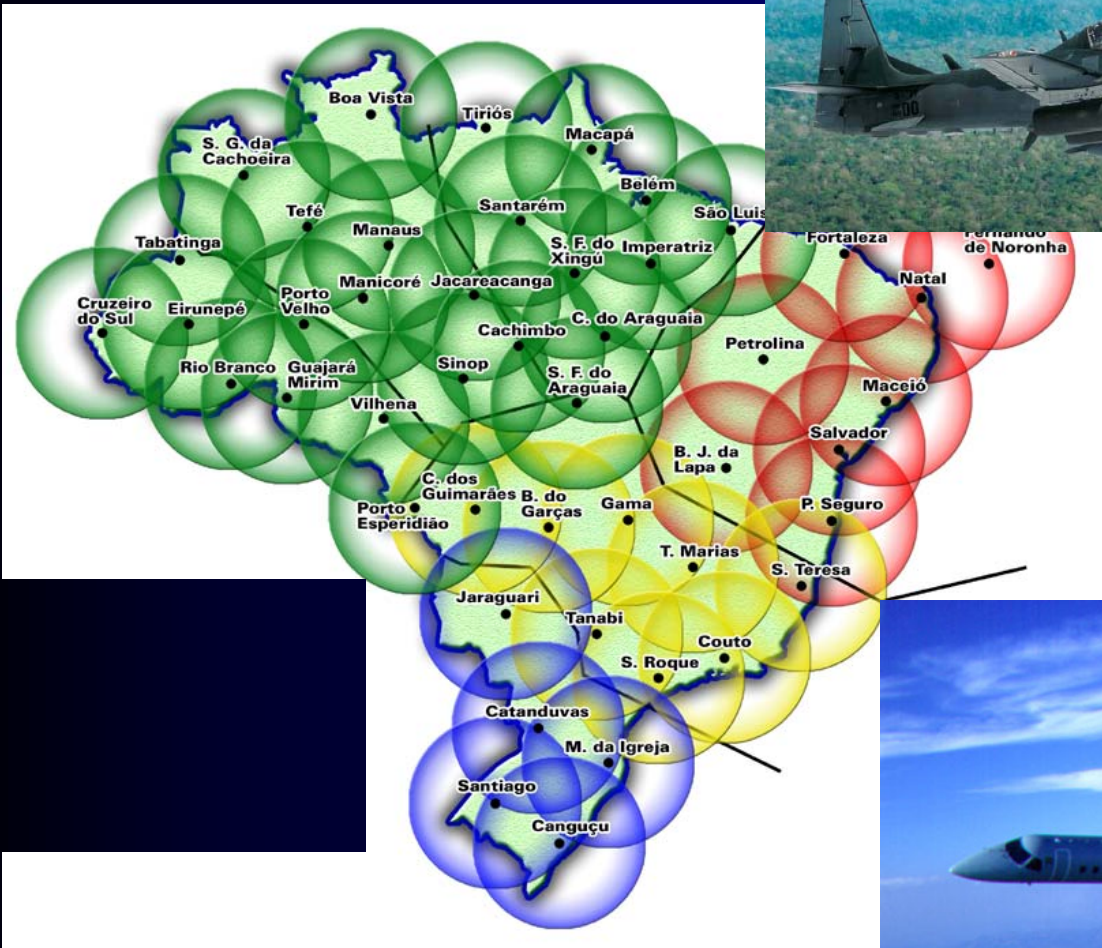
# Largest Countries in the World

#	Country	Area (km <sup>2</sup> )
1	Russia	17,075,400
2	Canada	9,976,140
3	United States	9,629,091
4	China	9,596,960
<b>5</b>	<b>Brazil</b>	<b>8,511,965</b>
6	Australia	7,686,850
7	India	3,287,590
8	Argentina	2,776,890





# Radar Coverage over Brazil



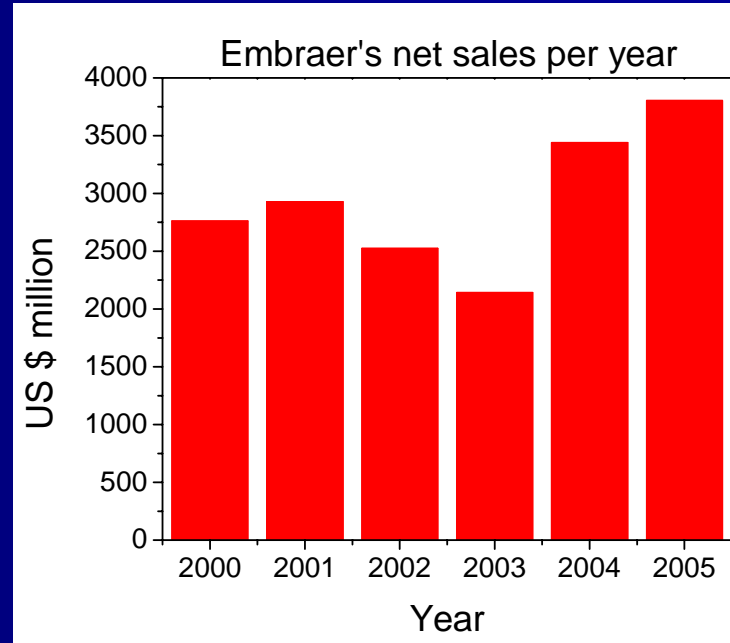


# Outline

- Introduction
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# Aerospace Sector

- Creation of CTA – 1945
- Embraer – 1969
  - Now: >150 aircrafts/year
- Other global companies
  - Mectron - defense systems
  - Avibras - aerospace and defense
  - Helibras – helicopters
  - Aeromot - motogliders



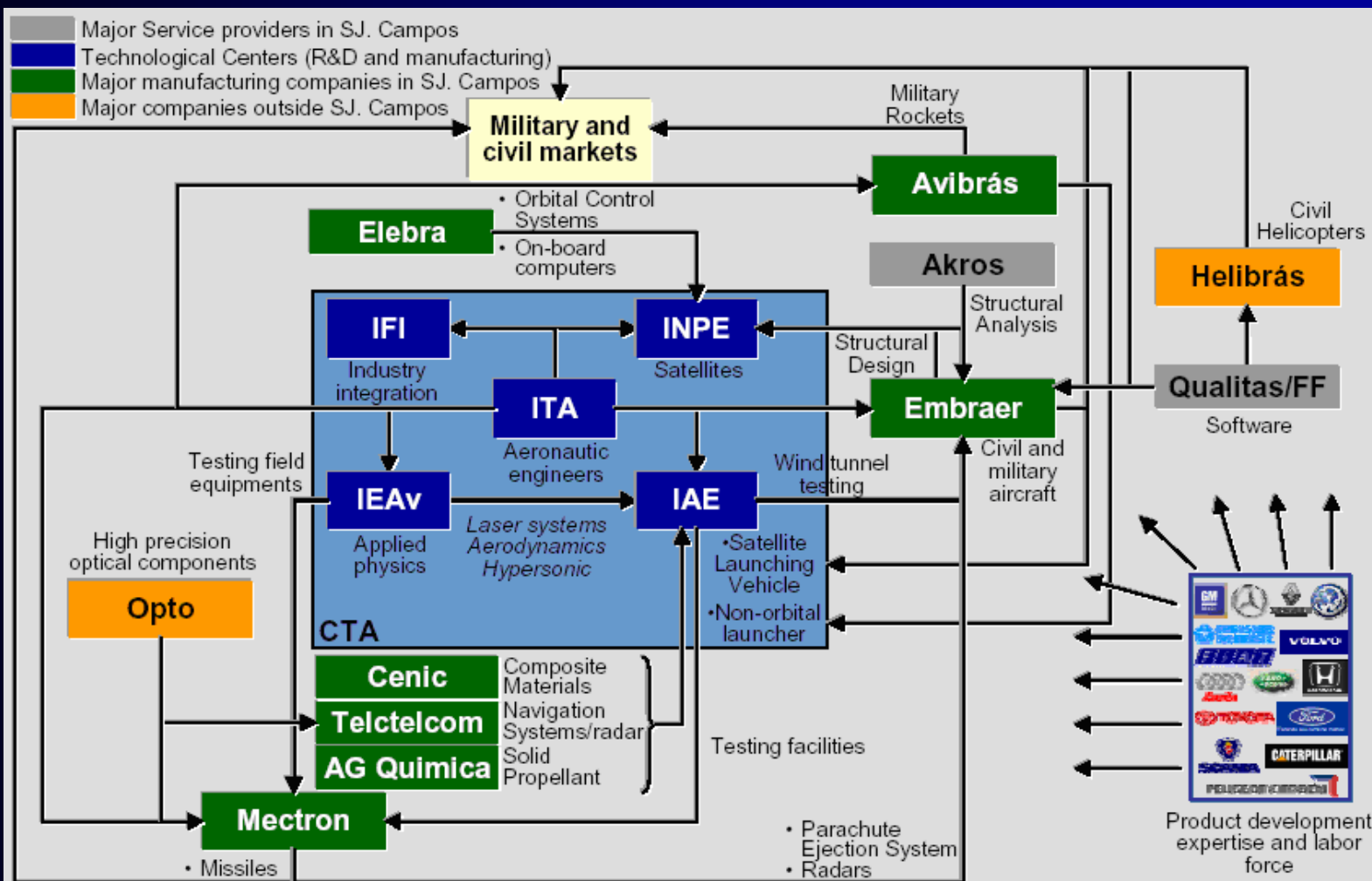
# Space Program

- Satellites, launchers and launching sites
- “Cruzeiro do Sul” Program
  - US\$ 850M
  - 15 years
  - Mini to large satellites
  - 250kg @ 750km up to 4 tons geostationary orbit



# Aerospace Cluster

Basic infrastructure, Education, Research, Production, Commercialization





# Outline

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# Air Force Needs

- Extended lifetime
  - Temperature, acceleration, stress/strain, loads, wear, corrosion, vibration
  - On-demand maintenance schedule
  - Easy to install
  - Central unit storages data to be downloaded on ground
- Increase security of regular operations
  - Tire pressure, icing, impact
- Special Missions
  - Amazon forest – humidity, SAR
  - Sea – corrosion
  - Attack: optical communications between aircrafts
- Non-critical systems
  - Cabin humidity, tire pressure, entertainment, smoke detectors



# Air Force Needs (cont.)

- Helicopters
  - Rotor vibration, self-powered sensors
- Flight test
  - Weapon launching (missiles, rockets)
  - Position, proximity, ground telemetry, displacement, temperature, acceleration
- Launching Rockets
  - Increase from 1,000 to 3,000 sensors
  - Vibration, fuel control (pressure, burning rate), pressure, acceleration, rotation, temperature, analog signal
- Satellites
  - Acs, position (solar panels), platform and payload systems



# Challenges

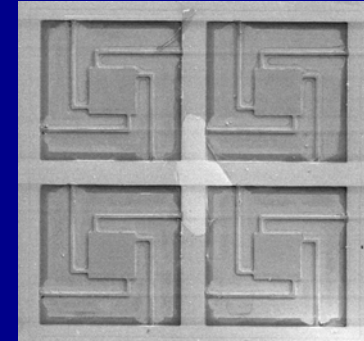
- Troubleshooting places with difficult access
- Interference
  - security of operations – critical functions
  - Coexistence among systems
- Frequency allocation
  - World range
  - RF approach frequencies
- Reliability
  - Available and secure
- Energy sources
- Certifiable
  - new set of standards



# Nanotechnology and Air Force Long Term Demands

	Possible areas of impact
Searching and Tracking	<i>Nanosensors.</i> Integrated nanoelectronics and nanophotonics; enhanced infrared recognition; high-speed image processing
Command and Control	<i>Nanodevices.</i> Nanoprocessors: orders of magnitude increase in computing power, information storage and processing abilities; radically improved decision making. <i>Quantum computing.</i> Eliminate multiple design iterations and prototype testing, extremely fast image reconstruction. <i>Nanostructured Materials:</i> distributed sensors and integrated as material constituent.
Controlled Effects	<i>Nanoscale energetic materials.</i> Improved energy release rate; accelerated burn; smaller munitions; safer propellants. <i>Nanoelectronics.</i> Counter radiation effects.
Reconnaissance	<i>Nanosensors.</i> Airborne and space-based long-range detection. <i>Coatings.</i> Dynamic stealth, dynamic shields.
Aerospace Presence	<i>Nanoparticles and nanostructured materials.</i> Advanced fuels, lubricants, and additives; power generation, storage, and delivery; long-life high-temperature components; self healing structures; smart skins. <i>Nanoelectronics.</i> Nano- and pico-satellite clusters.
Fast Aerospace Response	<i>Nanocomposites and nanostructures.</i> Lightweight structures; reduced cost to launch; high-performance and high-temperature materials and structures; high-efficiency propellants.

# Roadmap



- Technologies
  - Microfabrication/Packaging
  - Surface treatment and coating
  - Special composites
  - CNTs
  - Modelling (electromagnetic/mechanical, thermal)
- “Small/Nano” Satellite Mobilizing Projects – 15 years
  - Basic, scientific, remote sensing, autonomous, advanced
  - Payload, sensors, actuators, thermal control, structure





# Outline

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# Opportunities in Brazil

## Government Policy

### – Nationalization

- Only 10% of the space sector is made in Brazil
- S&T policies to strengthen the local supply chain

### – Air Force

- Offset contracts
- Direct investments and technology transfer

### – São José dos Campos Technology Park

- Aerospace, automobile and telecommunication
- Tax and real state incentives for the productive chain

## • Testing Platforms

- Satellites, sounding rockets, flight testing, ISS

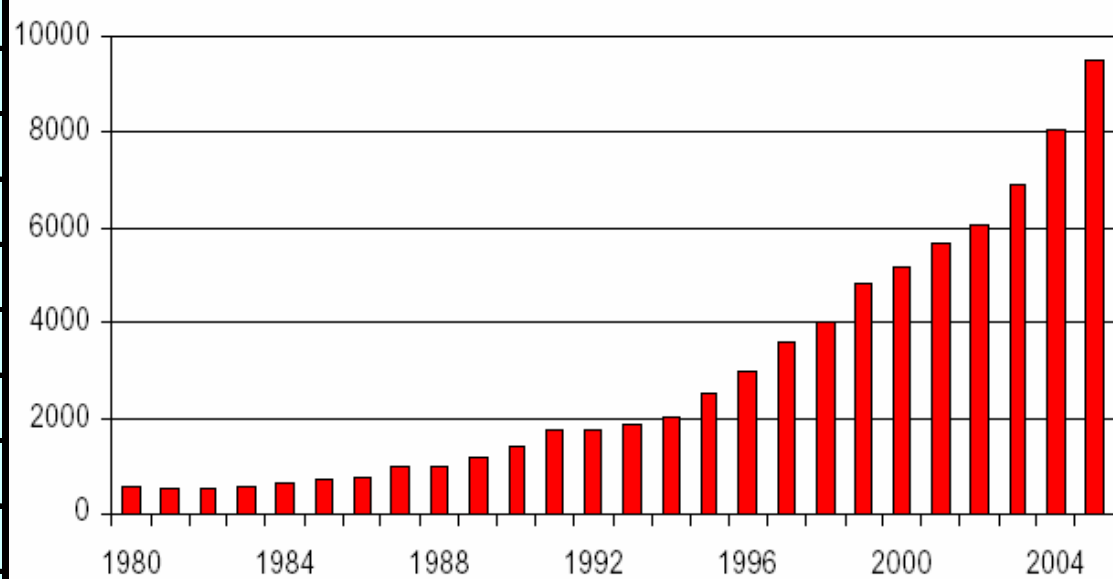
## • Dual markets

- Oil, naval, medical, automotive, security

## Estimated 2006 GDP - IMF

Rank	Country	GDP
-	World	46,746,844
-	European Union	13,484,345
1	United States	13,228,391
2	Japan	4,420,955
3	Germany	2,752,612
4	China	2,529,563
5	United Kingdom	2,229,138
6	France	2,092,532
7	Italy	1,751,074
-	Arab League	1,564,789
8	Canada	1,258,729
9	Spain	1,156,399
<b>10</b>	<b>Brazil</b>	<b>1,023,198</b>
11	Russia	900,003
12	South Korea	892,008
13	India	849,905
14	Mexico	846,782
15	Australia	729,165

## Number of Ph.D.s/year



**Transition from  
R&D to  
Production**

# Conclusion



***Thank you!***





# IEAv's Activities in Micro and Nanotechnology

- Bragg gratings
  - Fiber sensors: accelerometers, temperature, strain.
- IR Detectors (short, middle and long IR)
  - QWIP, QDIP.
- Sub-wavelength gratings in GaAs
  - Mirrors, lasers, MEMS.
- Photonic MEMS
  - Tunable filters, detectors and lasers.
- Integrated Optics
- Surface treatment, coating and analysis
- Spintronics, Excitons
- Quantum dot devices
  - Sensors, solar cells, communications, paints, etc.
- Nanoparticles obtained by laser irradiation