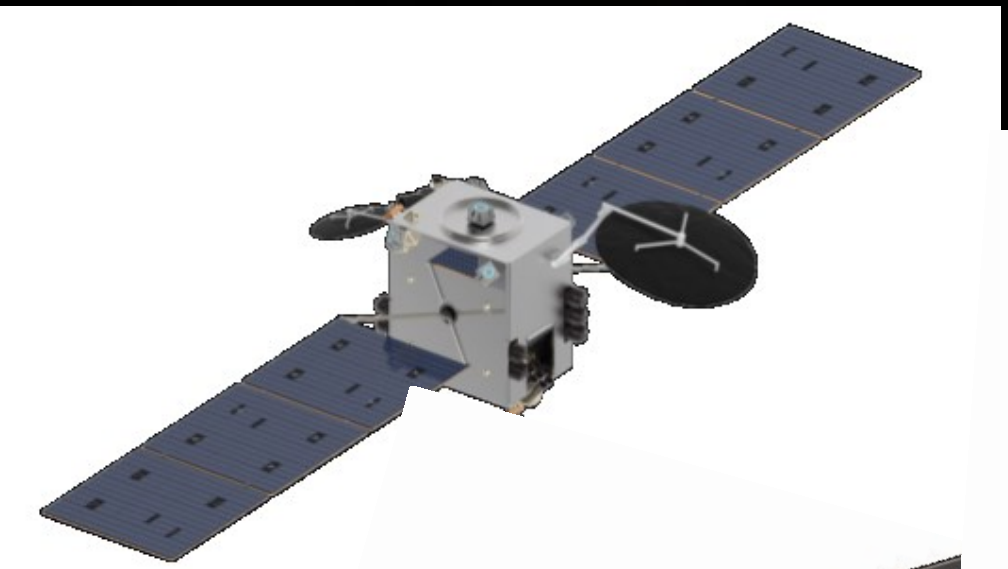
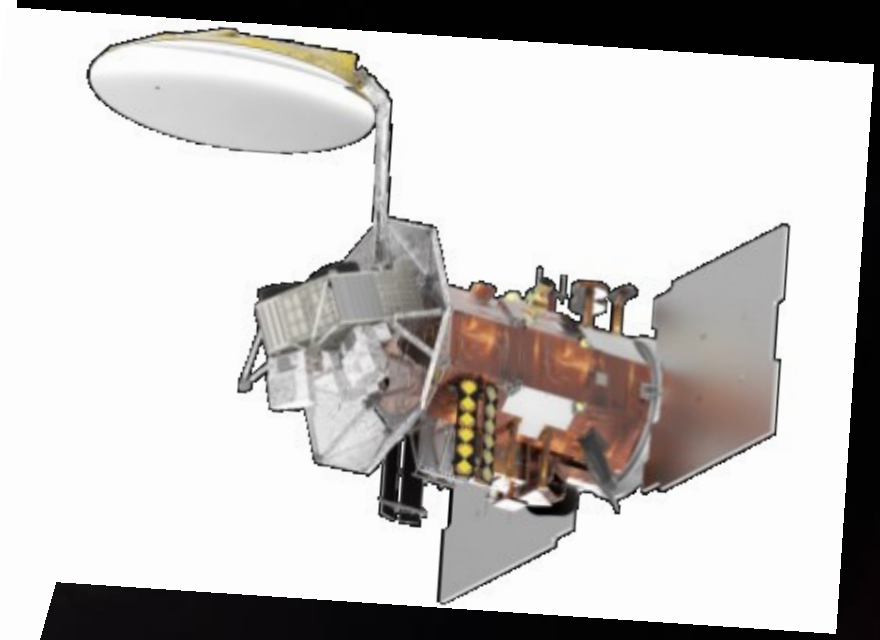
# INVAP in Space





# Company background

**OPERATION**

*INVAP operates as a private listed company*

*It has no public budget allocation and no tax exemptions*

*All dividends are reinvested*

**CREATION**

*September 1st, 1976*

**OWNERSHIP**

*Province of Río Negro, Argentina*

**AREAS OF ACTIVITIES**

*Nuclear – Aerospace – Government & Defense – Industrial Technology & Alternative Energies – Information & Communication Technology*

**ANNUAL REVENUES**

*200 million USD*

**WORKFORCE**

*1400 employees, 80 % of them are scientists, engineers and technicians*

**BRANCHES**

*Australia, Brazil, Egypt, USA, Venezuela and Saudi Arabia*

# Our Value Proposition

*INVAP supplies **high technology strategic products** to corporations and government agencies worldwide.*

*Products are developed by **interdisciplinary teams balancing technical challenges, budget and schedule constraints**.*

- INVAP works in **close association with our customers** to ensure a valuable **Know-How and Technology Transfer** process
- INVAP works in **multi-national, multi-cultural environment**
- INVAP´s **core activities are developed in-house:** Design, prototyping, manufacturing, integration, functional & environmental testing
- INVAP has full **control of technologies and processes** to ensure a **long-term commitment** to customers´ programs

# Business Units

## Nuclear Division

Design, construction and commissioning: Nuclear research reactors, radioisotope production plants, fuel manufacturing plants, waste management systems, spent fuel storage facilities.

## Digital Terrestrial TV Area

Design, implementation and deployment of terrestrial digital TV systems.

## Industrial & Alternative Energies Division

- Wind turbines
- Robots and special machines
- Food freeze-drying systems
- Chemical processes
- Hydro-kinetic, hydraulic turbines
- Equipment for the Oil & Gas industry

## Medical Systems Area

Design and construction of:

- Medical equipment
- Radio-therapy equipment
- Turnkey Radio- therapy centers

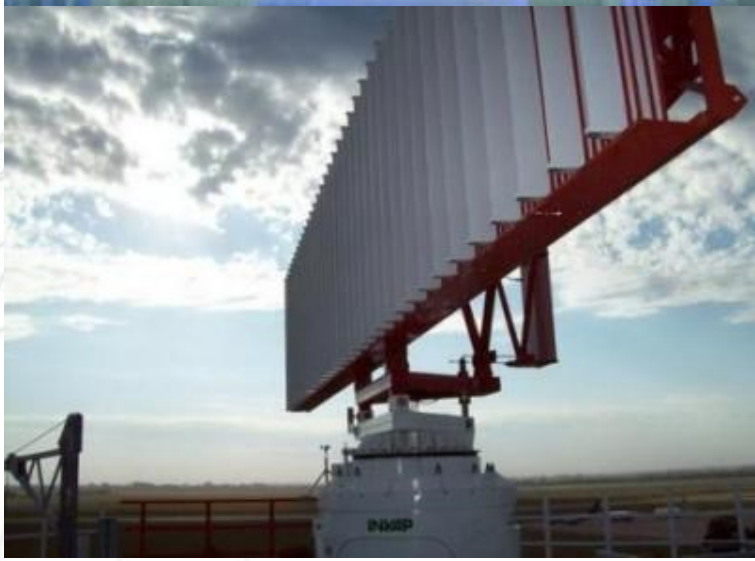
# Aerospace and Government Division

**AEROSPACE:**
Design and construction of space systems from concept definition to in-orbit operations:

- LEO and GEO satellites
- Spacecraft Bus
- Electro-optical, microwave & communication payload
- Ground Segment & Mission Control Center
- Products & Applications

**GOVERNMENT & DEFENSE:**
Design and construction of radar systems for:

- Air traffic control
- Defense
- Meteorological applications



# End-to-End Product Development

INVAP implements full satellite projects **offering end-to-end development, built-to-order products and custom turnkey solutions.**

**From Mission concept definition & design to manufacturing, assembly, integration and test capabilities in all systems and subsystems:**
Electronics, Software, Attitude & Orbit Control, Propulsion, Structures, Thermal Control, Harness, and
Electro-Optical, Communications, Microwave Payload.

Other In-house capabilities: Full spacecraft analytical modeling; satellite virtual simulators; alignment, metrology and calibration; flight operations engineering; L&EOP and Commissioning.





# World class facility for Satellite AIT

- Capacity for integration of up to **4 large satellites simultaneously**
- **500 m² class 100.000**
- **Low Bay clean room** for equipment level functional testing
- Bonded store for flight hardware storage
- 4 support rooms (300 m²) with feed-through connected to the Hi-bay

# Optical Facilities

In-house facilities (200m²) **class 1.000 and class 10.000** for electro-optical payload AIT since 1992

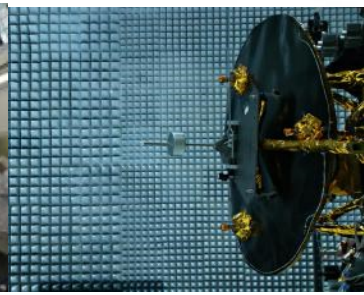
# CEATSA Environmental Testing Facilities

Environmental tests **at box, assembly and system levels** are performed in-house. The testing facility is strategically located next door to the high-bay clean room, easily allowing satellites and other space products to move from AIT High Bay to Environmental Testing.

The testing facility includes:
- **Thermal-Vacuu**m Chamber
- **Vibration** test system
- Direct Field **Acoustic** Test System
- **Mass Properties** Measurement equipment
- Near Field **Antenna Pattern Measurement** system
- **Electromagnetic Compatibility** Test System







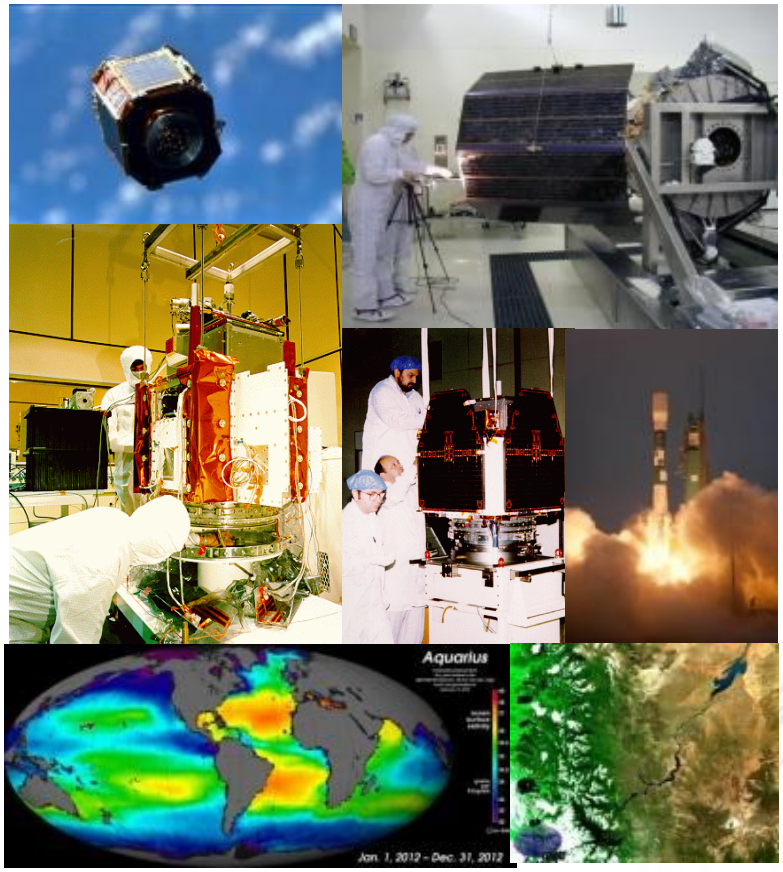


**CEATSA** is a joint company between **ARSAT & INVAP**

# Earth Observation Satellites:

## SAC Program

Cooperation agreement between CONAE and NASA since 1991.
**4 LEO satellites (SAC-A, SAC-B, SAC-C, SAC-D)**,
carrying Payload Instruments for Scientific and Earth Observation Applications.




**INVAP participation in the Program:**

- Mission design
- Project Management
- Systems Engineering
- Platform Design & Manufacturing
- Payload Design & Manufacturing
- Satellite Integration & Test
- Launch Base Operations
- Launch & Early Orbits Operations
- Platform & Payload Commissioning

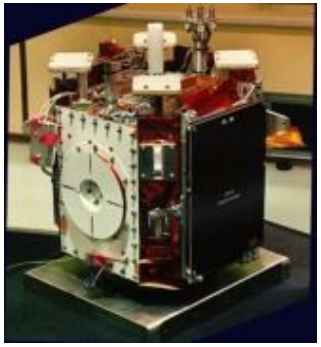
# SAC-D (2011)

| | |
|---|---|
| Highlight | NASA's decision to use a platform designed, manufactured and integrated entirely by INVAP, for the Aquarius instrument, is a clear sign of trust in INVAP´s capabilities |
| Objective | Provide monthly global maps of the sea water surface salinity, to understand the ocean processes and climate change. |
| Mass | 1350Kg |
| Payload | Main instrument: Aquarius.<br>Other instruments including: Atmospheric Sounder (Italy), Debris and Radiation mapper (France), High Sensitivity camera, NIR camera and MW Radiometer (Argentina) |

# SAC-C (2000)

| | |
|---|---|
| Highlight | SAC-C spacecraft became part of a "morning constellation", composed by Terra, Landsat-7, SAC-C and the EO-1. |
| Objective | Study the structure and dynamics of the atmosphere and ionosphere, and earth´s magnetic field |
| Mass | 485Kg |
| Payload | 3 Electro-Optical cameras (Argentina) and 4 instruments from: USA, Denmark, Italy, France |

# SAC-A (1998)



| | |
|---|---|
| Highlight | Designed, manufactured, integrated and tested in 10 months |
| Objective | Technology Demonstration |
| Mass | 68Kg |
| Payload | Electro-Optical camera |

# SAC-B (1996)

| | |
|---|---|
| Highlight | Gave birth to a new branch of technological development and engineering capabilities in the Argentina |
| Objective | Study solar physics and astrophysics through the examination of solar flares, gamma ray bursts and diffuse cosmic X-ray |
| Mass | 191Kg |
| Payload | 4 Scientific Instruments: 2 USA, 1 Italy and 1 Argentina |

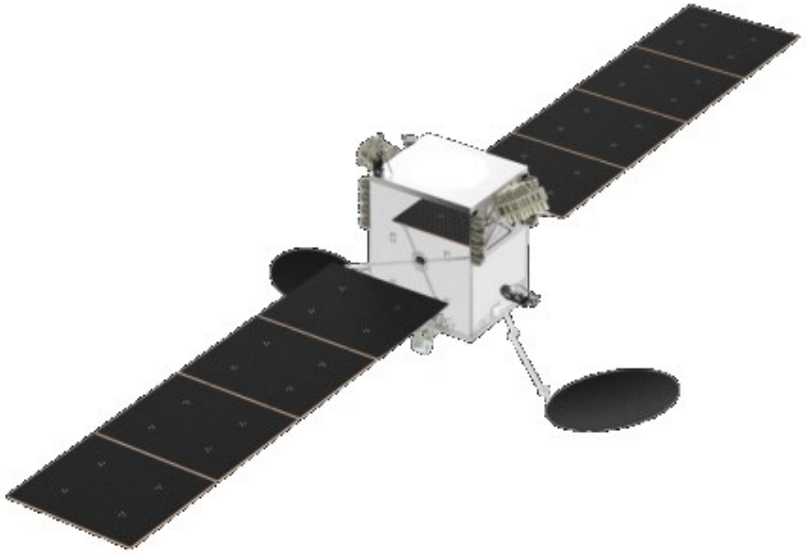
# Geostationary Telecommunication Satellites: ARSAT Program

INVAP is the **Prime Contractor** for the Telecommunication Satellites Program for ARSAT, the National Telecommunication Operator.
**ARSAT-1, ARSAT-2 and ARSAT-3** satellites comprise the Argentine Geostationary Telecommunications Satellite System.

**INVAP´s Participation:**
- Design, Manufacturing & Integration
- Functional and Environmental Testing
- Flight Operators Training
- Flight Operations Support

ARSAT-1 and ARSAT-2 were successfully launched by Ariane V launcher in 2014 and 2015. Fully operational at 72°W and 81°W orbital slots.

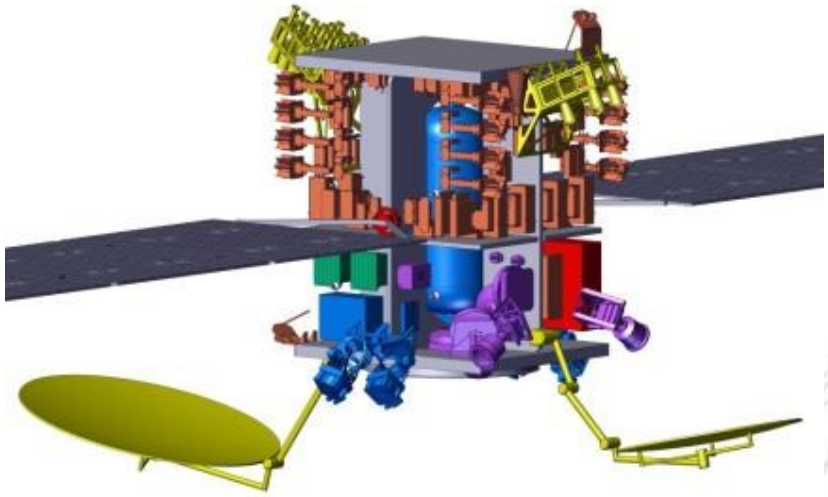
# Small GEO High Throughput System (HTS) Communications Satellite:

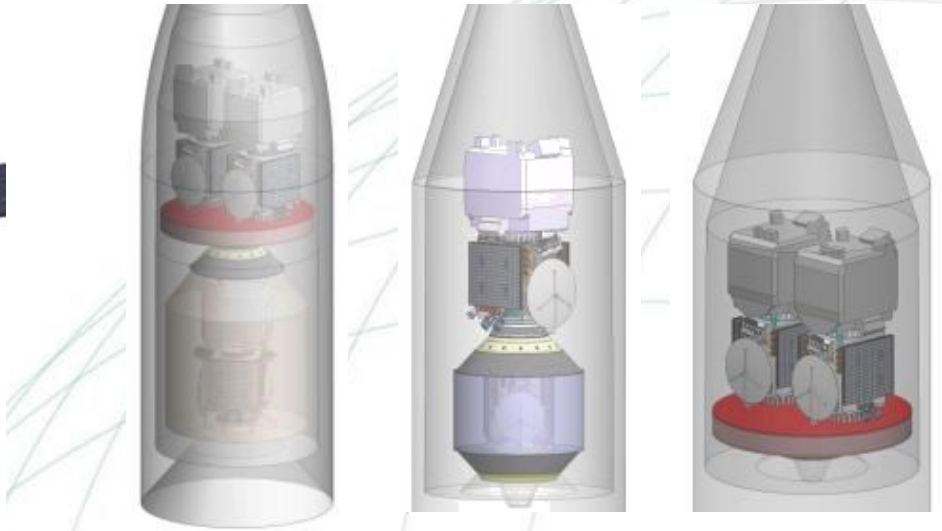


- Services in Ku, Ka and C bands
- Wet Mass < 1 Ton
- Payload Power up to 3 Kw
- Payload Mass up to 300 Kg
- Up to 30 Gbps Throughput Multi-Spo
- Full Electric Propulsion (OR+SK)
- Orbit Raising duration < 6 months
- > 15 years lifetime
- Launcher: Compatible with Falcon-9, Proton Light / Medium, Ariane 5 / 6 and other commercially available vehicles

# Satellite Main Features/Highlights:

- Service Platform using a centralized, modular and scalable avionics design, developed and manufactured fully in-house
- Communication Payload units and Attitude Control Sensors & Actuators supplied by recognized companies in the space business
- End to end cycle development: from design to manufacturing, payload and platform AIT, system level AIT and environmental test campaign, all performed in-house
- Satellite design compatible with a dual-stacked or side-by-side launch configurations for optimum envelope exploitation





- **+25 years of expertise** delivering custom designed satellites for the Argentinean Space Agency **CONAE,** the National Telecom Operator **ARSAT**, and flight components to other **international customers**
- **Flight Heritage** as Prime Contractor for LEO (Low Earth Observation) and GEO (Geostationary) missions
- Compliant with the **most rigorous standards**, including **NASA** and **ESA** space agencies
- **In-house** capabilities to cover the **full cycle development** from mission concept design to manufacturing, integration, testing and in-orbit operation
- Focus on **customer needs** including **Technology Transfer & Training**

Thank you for your attention
Any questions?

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