

A satellite image of Argentina, showing the Andes mountain range in the west, the Patagonian plateau in the center, and the Atlantic Ocean to the east. The image is a composite of two parts: the top part shows the northern and central regions, and the bottom part shows the southern and western regions.

# Argentina In Space

Juan A. Fraire  
juanfraire@unc.edu.ar



**SPACE FOUNDATION**

The logo for the Secure World Foundation, featuring a stylized globe with a satellite orbiting it, set within a blue arch.

**SECURE WORLD  
FOUNDATION**

Envisat image, acquired on 3 June 2011 - ESA

# Main Actors



*Government Company*

Telecommunications



*Space Agency*

Observation of the Earth



*Private and Government Companies*  
Engineering

# Ar-Sat Satellites



## Arsat 2 y 3

Posición Orbital: 81° Oeste

[Ver detalle](#)

## Arsat 1

Posición Orbital: 72° Oeste

[Ver detalle](#)

**Ar-Sat 2** (launched in 2015)  
- **26** Ku-Band Transponders  
- **10** C-Band Transponders

**Ar-Sat 1** (launched in 2014)  
- **24** Ku-Band Transponders

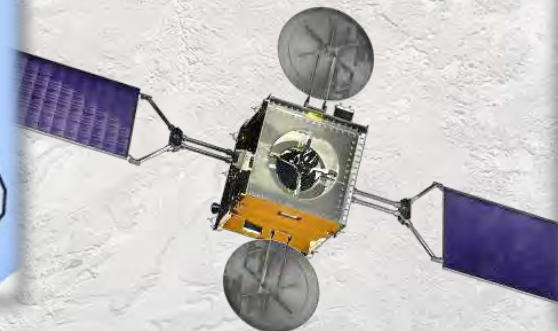
**Ar-Sat 3** (to be launched 2019)

# Ar-Sat Service Coverage

**Ar-Sat 1 Coverage:** Argentina, Chile, Paraguay, Uruguay, part of Bolivia and north Antártida.



**Ar-Sat 2 Coverage:** North and South América.



# CONAE - Past

## National Space Plan – Past



**1998**  
SAC-A  
(68Kg)  
Shuttle



**1996**  
SAC-B  
(190Kg)  
Pegasus



**2000**  
SAC-C  
(325Kg)  
Delta 2

*13 years in  
space!*



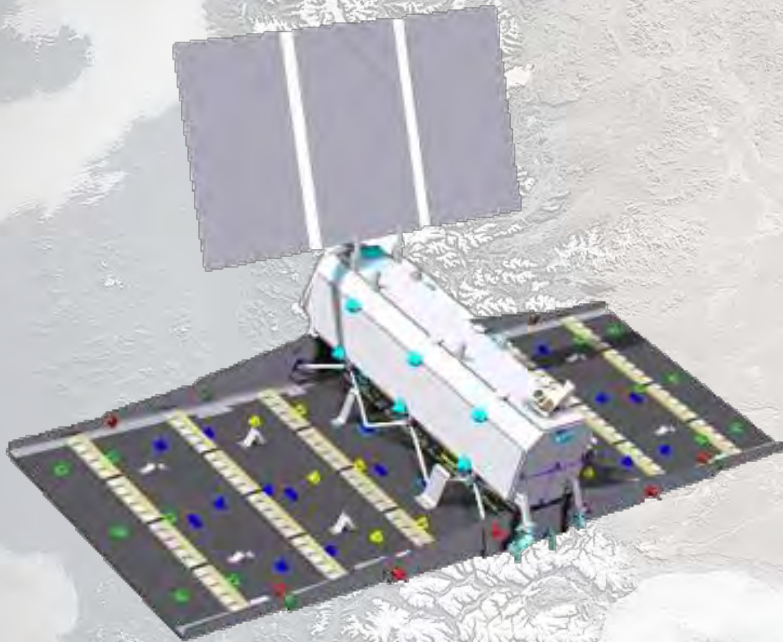
**2011**  
SAC-D  
(1600Kg)  
Delta 2

**Aquarius  
Payload  
(NASA)**

*Loss of  
contact in  
2015*

# CONAE - Present

## National Space Plan – Present



### SAOCOM 1A & 1B

L-Band SAR Radar (12 m antenna)  
(Moisture Measurement)  
Constellation with Cosmo Sky-Med (Italian)  
Launch Estimate: 2016 (SpaceX Falcon-9)

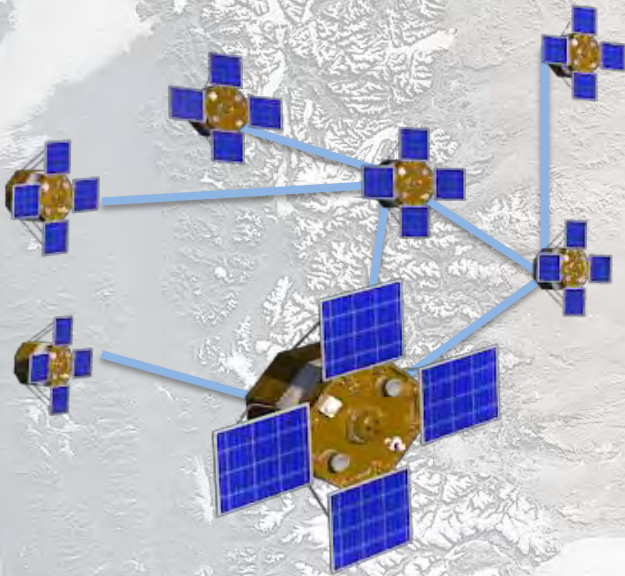


### SABIAMAR

Cooperation with AEB & INPE (Brazil)  
Analysis of environmental parameters,  
coasts and oceanic eco-systems.  
Launch Estimate: 2018

# CONAE - Future

## National Space Plan – Future



### Segmented Architecture

Constellations of cooperative Small-Sats (250 Kg) to achieve a common objective. Super-resolution, stereoscopic imaging, wide aperture sensing.



### Tronador II

27 m height, 2.5 diameter, 67 ton weight  
250 Kg @ LEO (700 km)  
Power: 90 (1<sup>st</sup> stage) + 3 Ton (2<sup>nd</sup> stage)  
Launch site: Argentina

# INVAP

- Created in 1976
- Based in **San Carlos de Bariloche**.
- More than **1300** people including highly qualified personnel.
- First in LatAm to be certified by **NASA**.



- Design, integration, construction and delivery of equipment, plants and devices.
- Services in nuclear, aerospace, chemical, medical, petroleum and governmental sectors.





# INVAP Facilities

Clean Room



Integrating Ar-Sat 1 and 2 in INVAP clean room

# INVAP Facilities (CEATSA)

## Thermal Vacuum Chamber



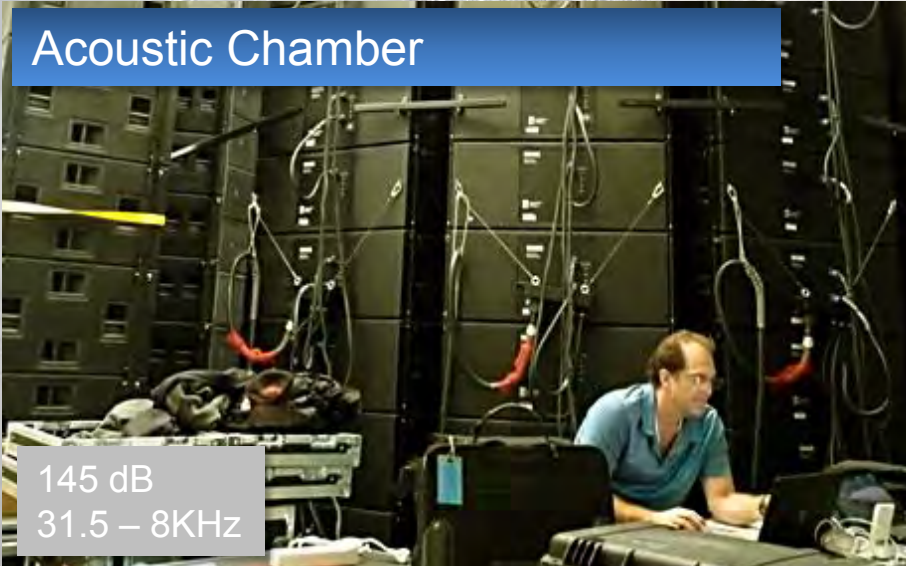
+/- 150 °C  
6m diameter  
10-7 Torr

## Shaker



289 kN  
63,5 mm Δ  
5 – 2000 Hz

## Acoustic Chamber



145 dB  
31.5 – 8KHz

## Anechoic Chamber



0.5 – 40 GHz  
18 x 19 x 6 m

# Other Actors

- Several space-oriented companies (STI, DTA, Satellogic)
- Ministry of defense (Gradicom III rocket – SARA UAVs)
- Malargüe (ESA) and Site 16 (China) **deep-space stations**
- Radiation facilities for electronic qualification



# Challenges

- External:
  - **Stable long-term politics**
- Internal:
  - **Realistic time and resources estimations**
  - **Commitment to delivery**
  - **Shorter development periods**

# Backup – Ar-Sat 1



Ar-Sat 1 in Anechoic Chamber - INVAP

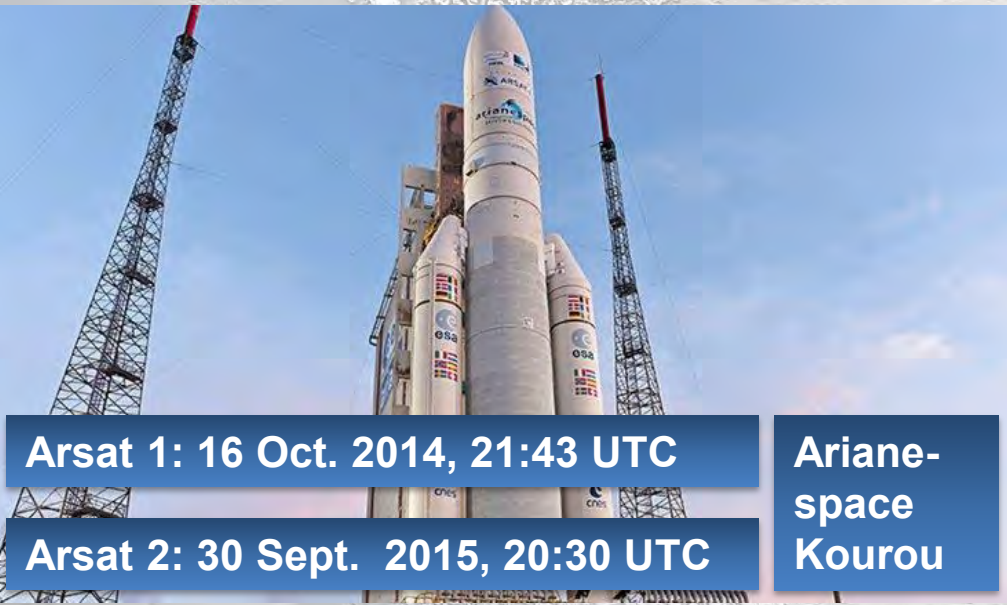
# Backup – Ar-Sat 1



Ar-Sat 1 in Kourou - Arianespace



# Backup – Ar-Sat 1



Arsat 1: 16 Oct. 2014, 21:43 UTC

Arsat 2: 30 Sept. 2015, 20:30 UTC

Ariane-space  
Kourou



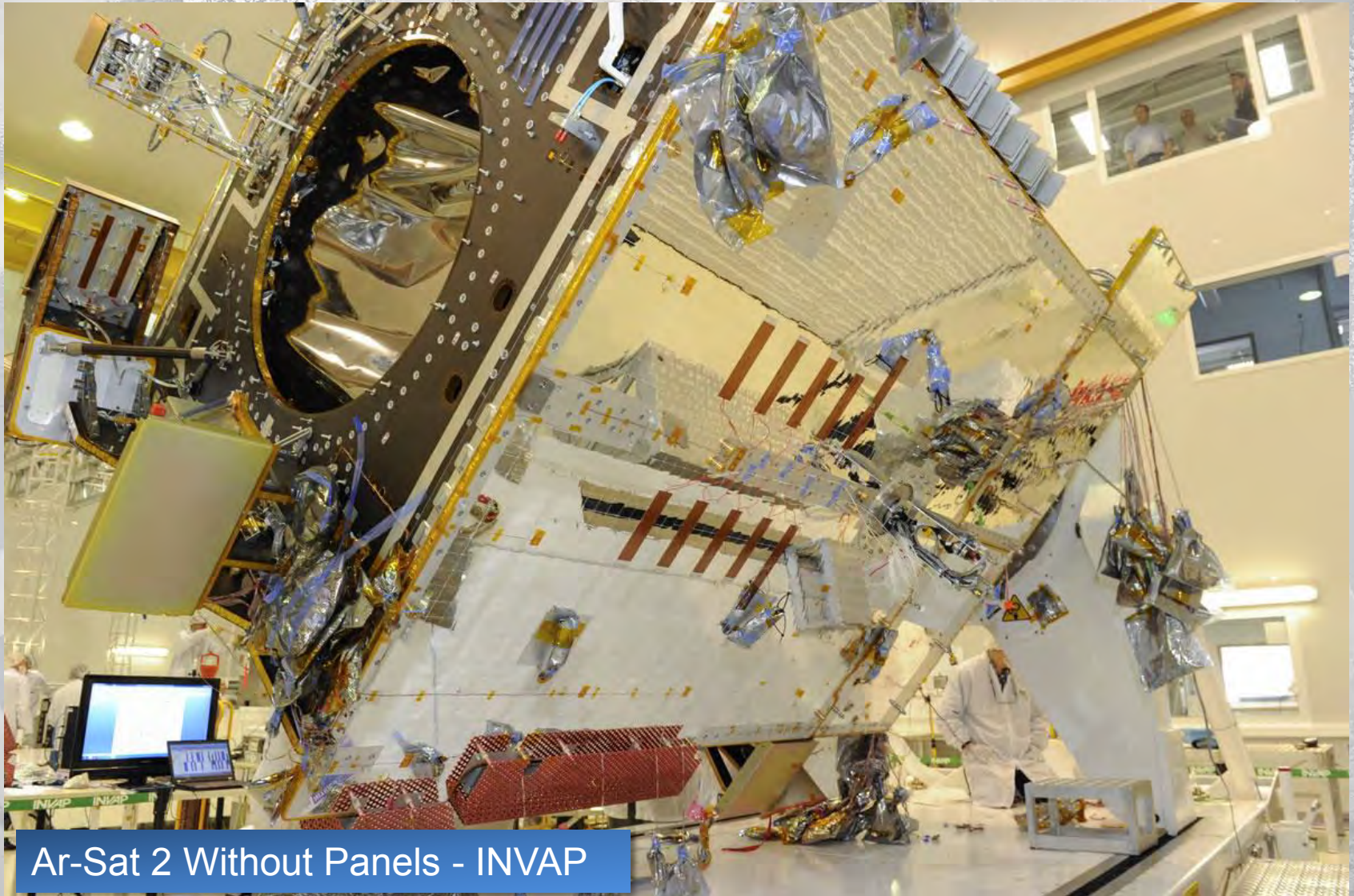
# Backup – Ar-Sat 2



Ar-Sat 2 launch configuration - INVAP



# Backup – Ar-Sat 2



Ar-Sat 2 Without Panels - INVAP

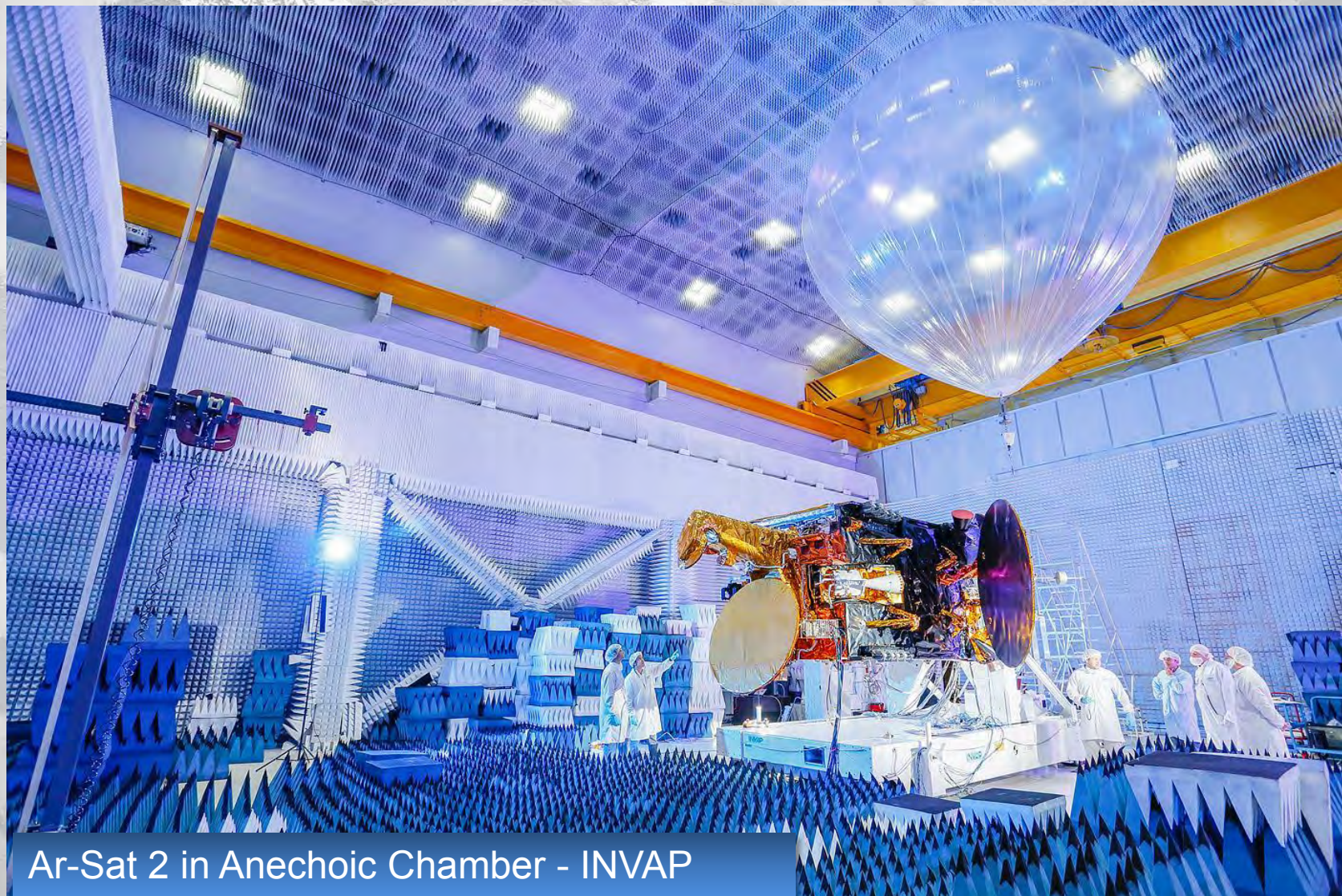
# Backup – Ar-Sat 2



© 2015 ESA, CNES, ARIANESPACE / Optique Vidéo du CSG - J. GULLON

Ar-Sat 2 in Kourou - Arianespace

# Backup – Ar-Sat 2



Ar-Sat 2 in Anechoic Chamber - INVAP

# Backup – Ar-Sat 2



*"Newcomer Satellite Operator of the Year"*  
By EuroConsult, Satellite Finance and SpaceNews

Home

Forums

L2 Sign Up

ISS

Commercial

Shuttle

SLS/Orion

Russian

E

## ARSAT-2: Argentina consolidates as Latin American satellite leader

September 21, 2015 by Alejandro G. Belluscio



When Ariane 5 flight VA226 launches on September 30, the orbital slot for the 81 West geostationary position will finally get its long-term dweller that it has been promised for over 17 years. Riding along with the Sky Muster satellite, ARSAT-2 is the second geostationary satellite designed and manufactured in Argentina (and all of Latin America).

Ar-Sat 2 in NASA Spaceflight.com

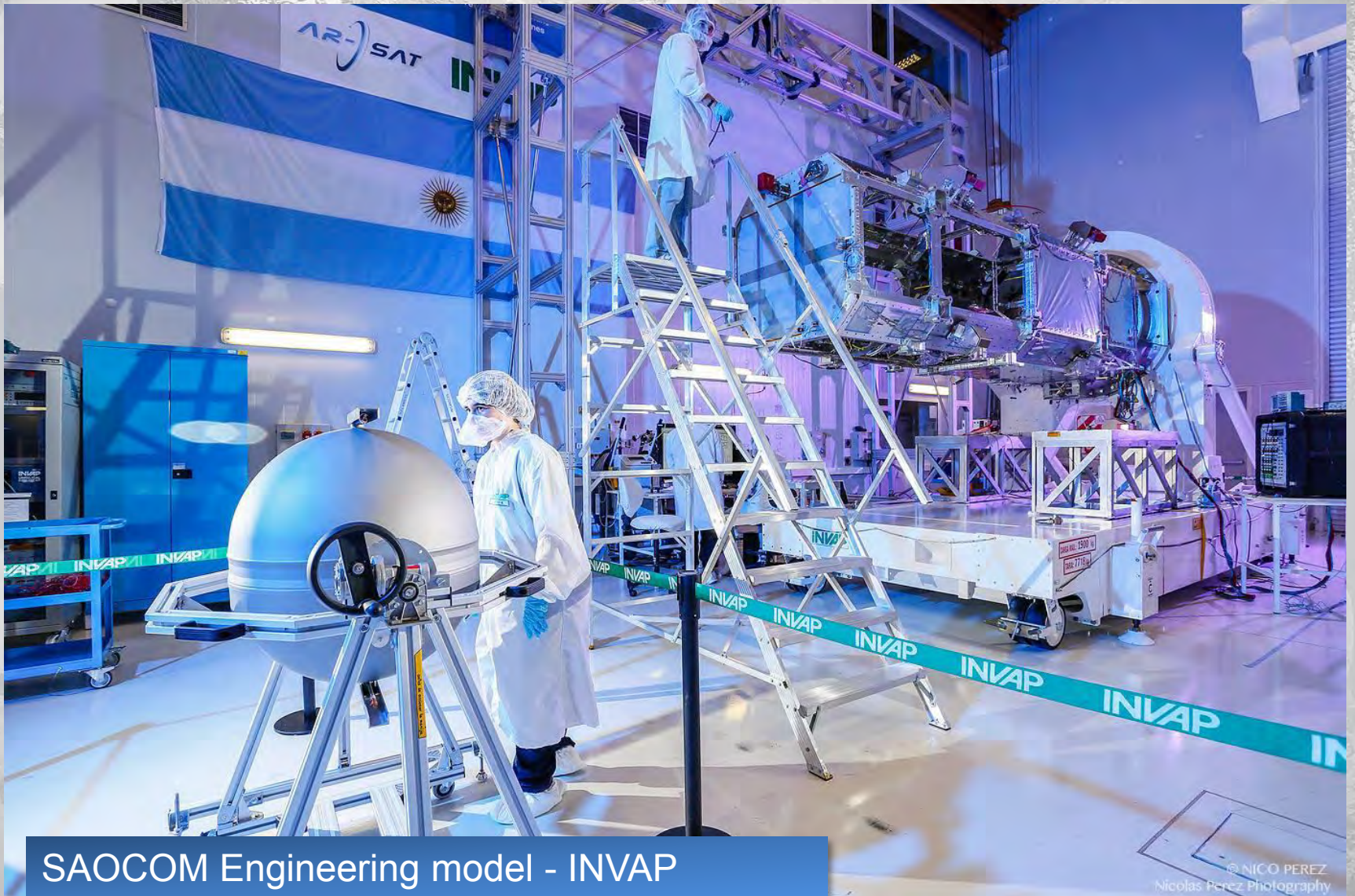
# Backup – SAC-D



SAC-D Launch (Vandenberg) - 2011



# Backup - SAOCOM



SAOCOM Engineering model - INVAP

# Backup - SAOCOM



SAOCOM SAR Antenna in Anechoic Chamber - INVAP

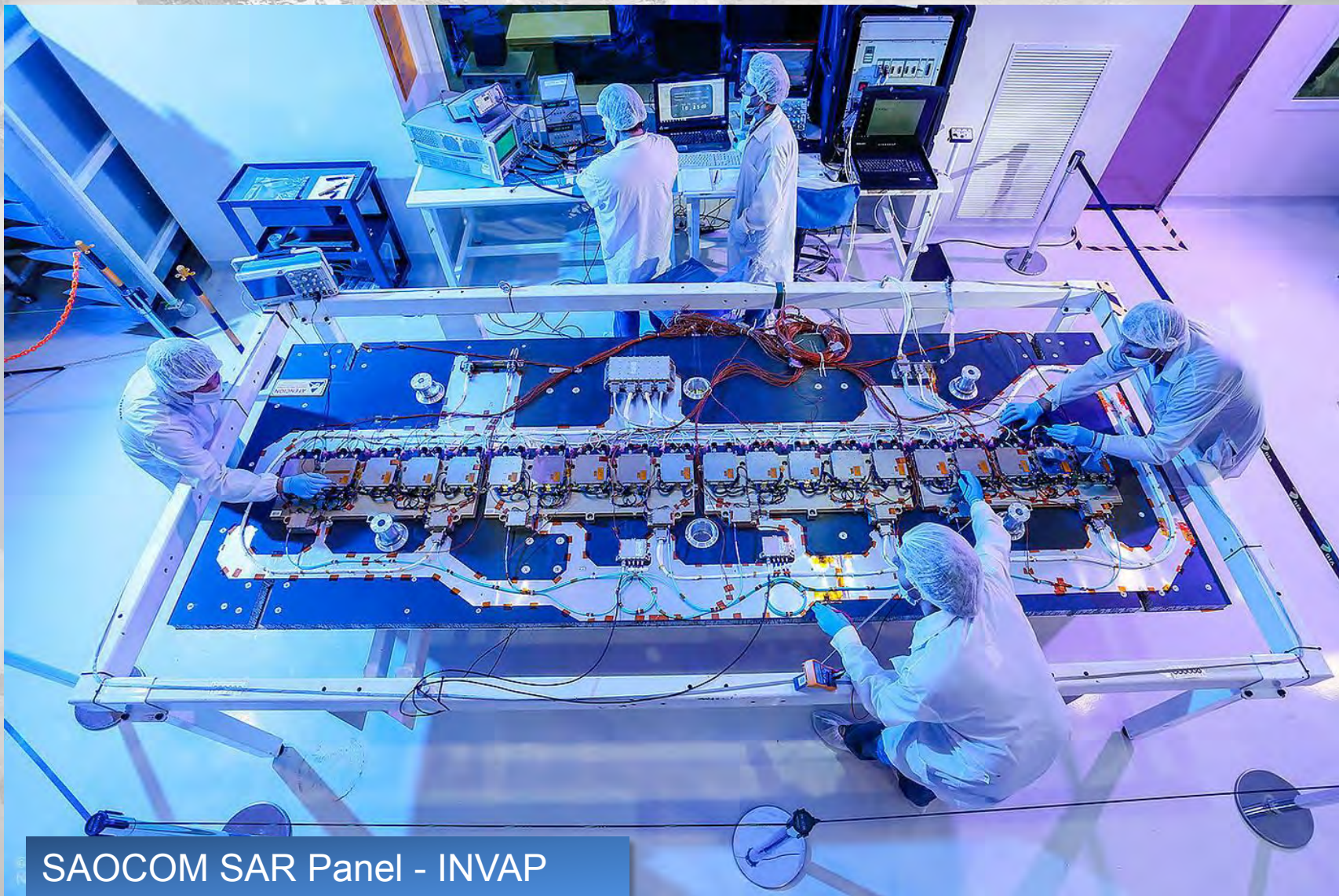
# Backup - SAOCOM



SAOCOM Satellite - INVAP



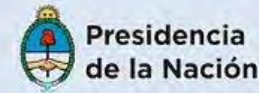
# Backup - SAOCOM



# Backup – Tronador II

## Proyecto TRONADOR II

Cronograma

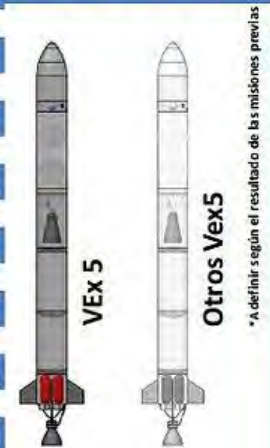


Desde  
**Pipinas**

- en Pipinas comienza el Proyecto CORCEMAR (ver anexo) y se mantienen otras pruebas -

Desde  
**Puerto Belgrano**

FASE de Pruebas del Lanzador



Feb 2014

Ago 2014

2015

**VEX 1**

Probar en vuelo el sistema de navegación, guiado y control.

**VEX 5**

Demostrar en vuelo de un motor de primera etapa y de un motor de última etapa del TII Ensayo del sistema de separación entre etapas y apertura de cofia.

**PAD Definitivo**

Lanzamiento de satélites hasta 250 kgs. (E). Satélite SARE -de arquitectura segmentada- fabricado por INVAP)

Ampliación al PAD de Lanzamiento. ÚLTIMA ETAPA

# Backup – Tronador II



Tronador II Project – Experimental Vehicle 5

© NICO PEREZ  
Nicolas Perez Photography

# Backup – Tronador II



Tronador II Project – Experimental Vehicle 5

# Backup - CETT



Centro Espacial Teófilo Tabanera – CONAE (Córdoba)

# Backup - Benavidez

EDICIÓN IMPRESA



Centro Espacial Benavidez – Ar-Sat (Buenos Aires)

# Backup - Benavidez



Centro Espacial Benavidez – Ar-Sat (Buenos Aires)

# Backup - Malargüe



Malargüe Deep-Space Station

**ESA DSA-3** (complements others in Spain and Australia)  
Built in 2011, operational 2013  
35m diameter antenna.  
Used for Rosseta and ExoMars missions.



# Backup - Satellogic

SATELL<sup>OGIC</sup>

## ROADMAP

2013-2015



3 prototypes Launched

Constellation Prototype  
Successful system test

2016-2017



25 Satellites launched  
1.2hr revisit times

1m resolution MS  
30m resolution HySp  
90m resolution TIR  
1m resolution video

2018-2019



>100 Satellites launched  
15m revisit times

Improved spectral,  
geometric and radiometric  
resolutions.  
Improved downlink and on-board  
processing

2020

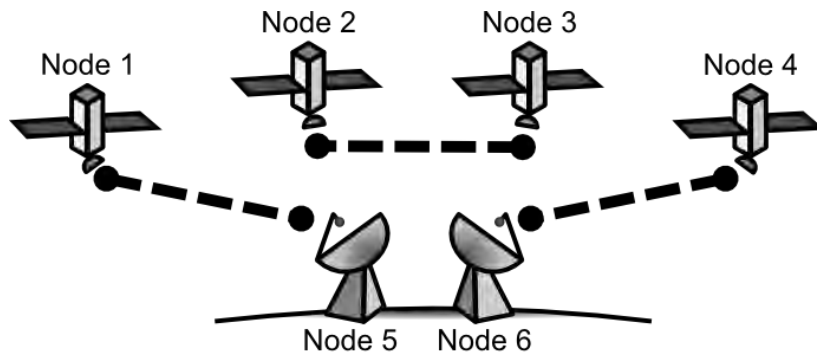


300 Satellites  
5m revisit times

Improved Capabilities  
5th Generation

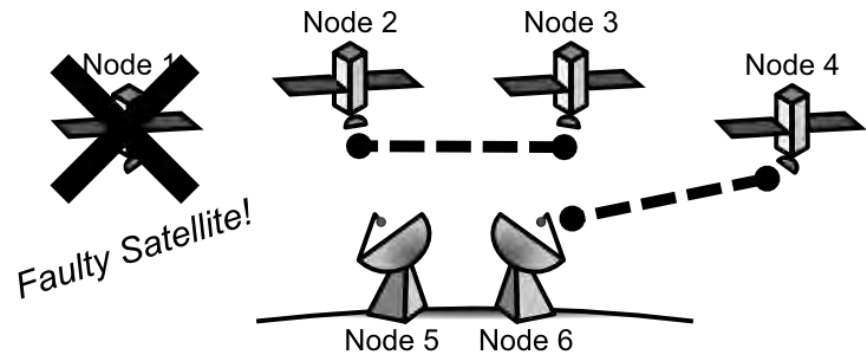
# Backup – Segmented Arch.

## □ Fault Isolation - *Gracefull Degradation*



Available down-link Throughput: **100%**

Non-Faulty Intra-Spacecraft DiSARM System.  
Two Earth Stations download spacecraft data



Available down-link Throughput: **50%**

In case of failure, traffic downlink capacity  
is degraded.

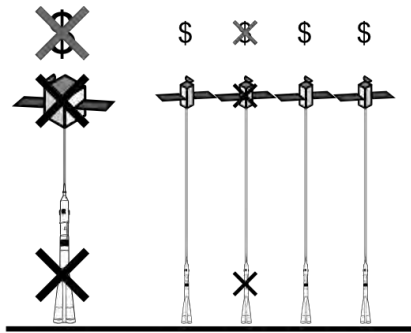
- La **confiabilidad** del sistema no sólo es producto de la **calificación** de los componentes si no que de la **cantidad** de los mismos.



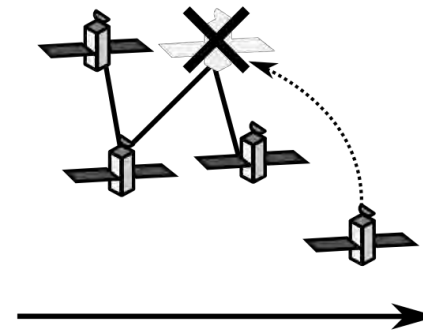
Consideración  
de componentes  
de **menor**  
**calificación**  
(COTS)

# Backup – Segmented Arch.

Pequeños lanzadores, varianza del riesgo mínima.



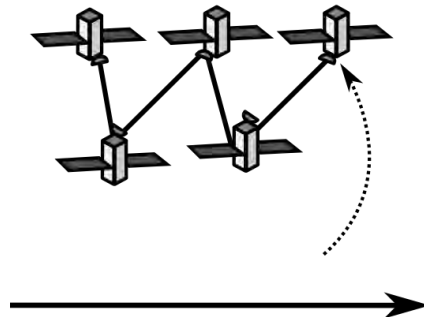
Launch Diversity



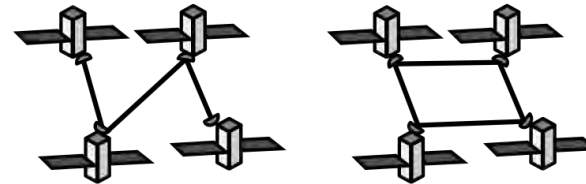
Replaceability

Nuevos módulos (segmentos)

Nuevos módulos (segmentos)



Upgradeability

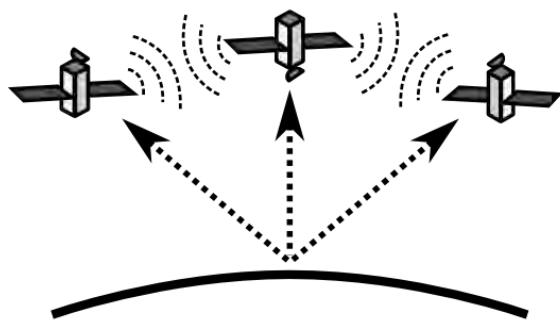


Adaptability

Adaptación

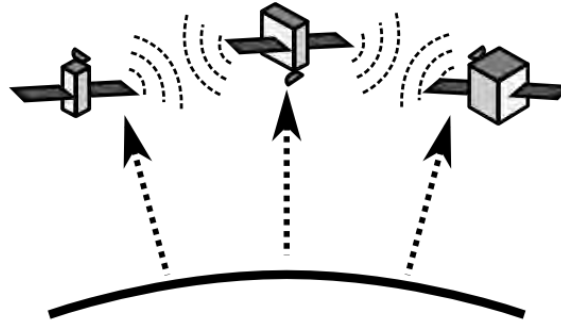
# Backup – Segmented Arch.

- **Combinar sensores cooperativamente** de diferentes maneras.



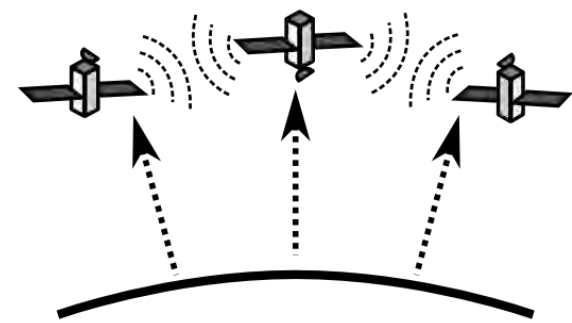
**Mayor Apertura**

Incremento de la **apertura** con un mismo sensor (super-resolución, antena partida)



**Diversidad de Sensores**

**Diferentes** sensores, diferentes plataformas (A-Train de NASA)



**Mayor Foot-Print**

Incremento de la **pisada** con un mismo sensor