CENTRE NATIONAL D'ÉTUDES SPATIALES

The Argos Program

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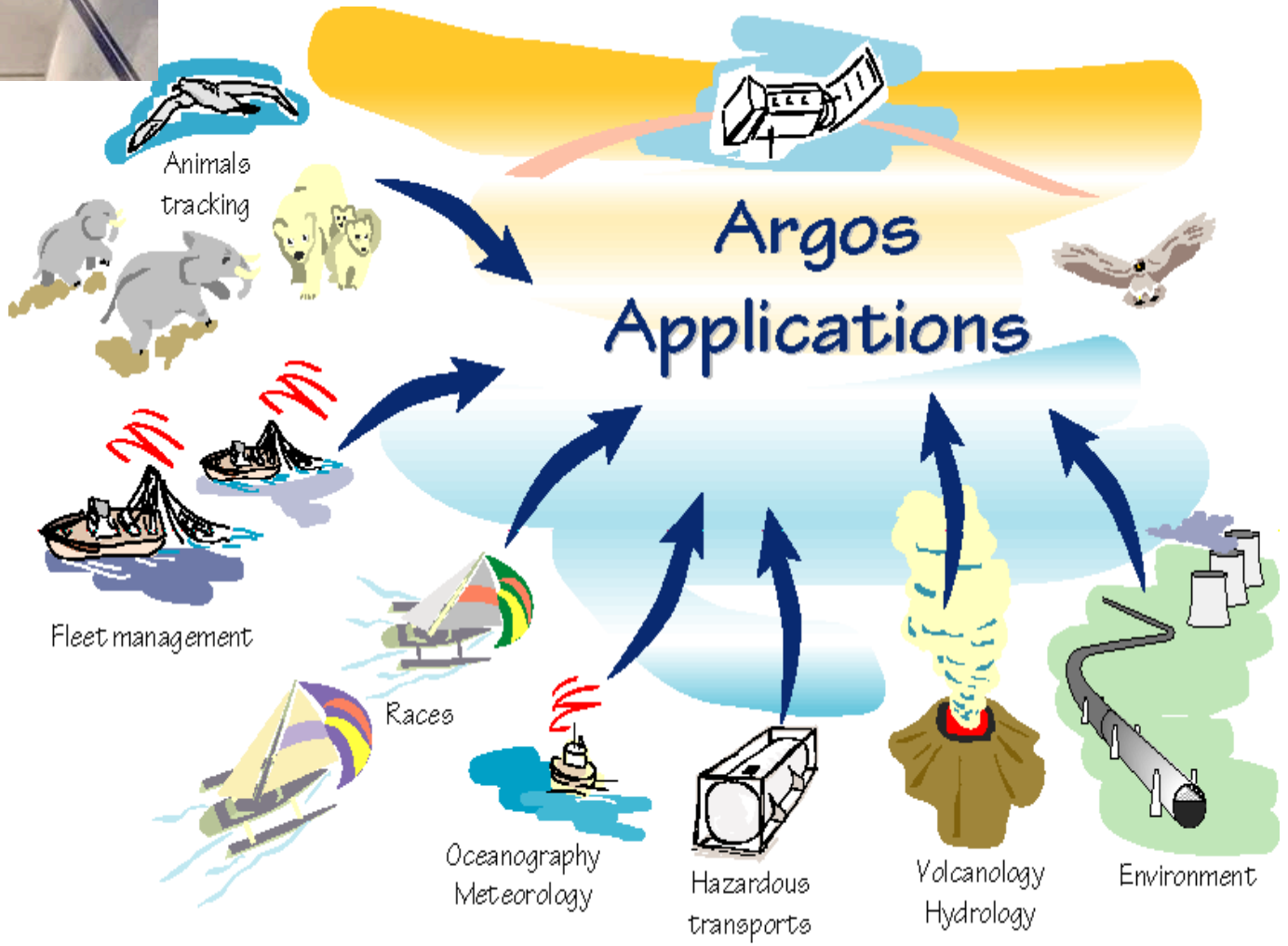
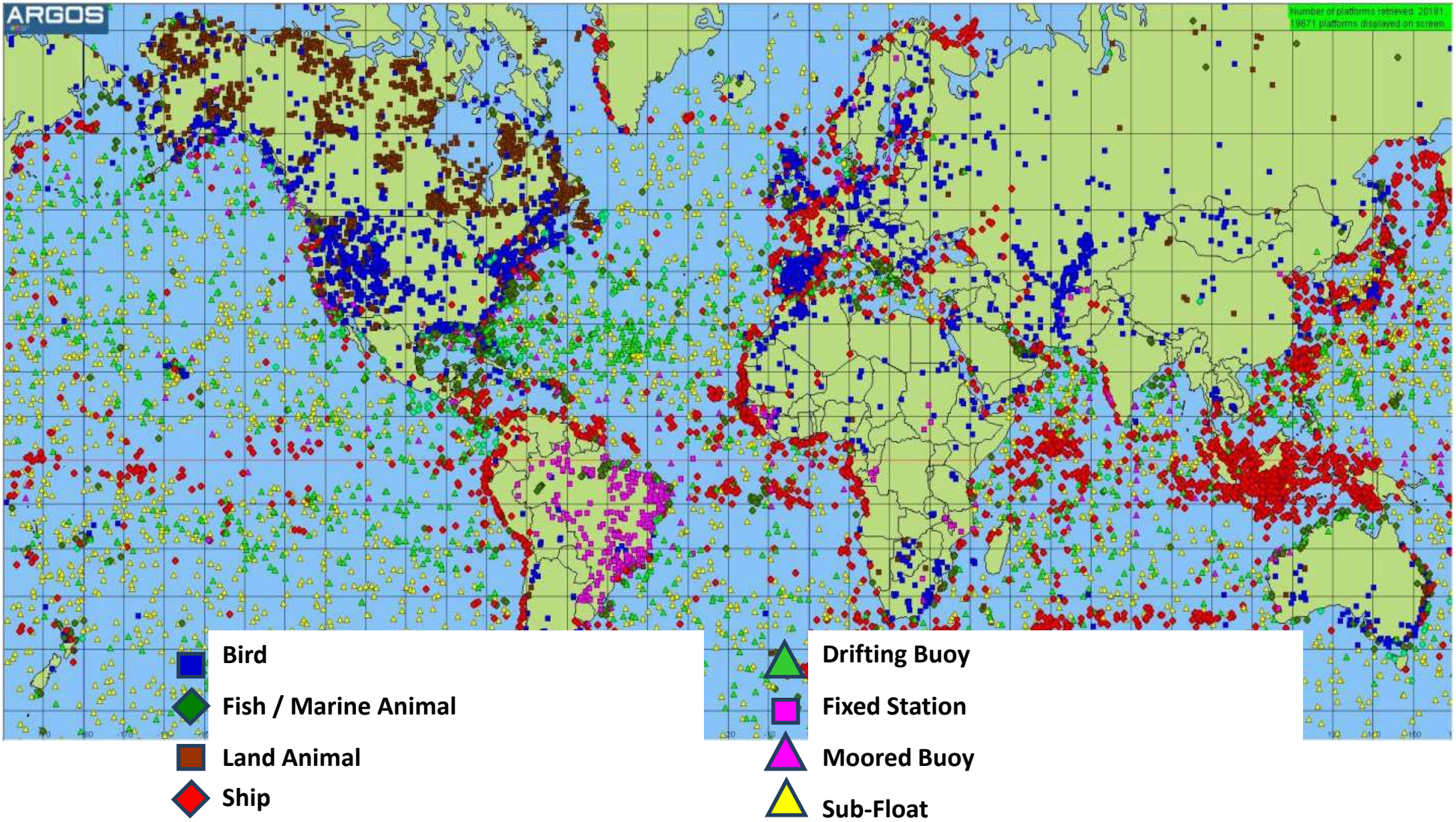
ARGOS : 38 YEARS OF CRITICAL WORLDWIDE ENVIRONMENTAL DATA TRACKING AND RELAY

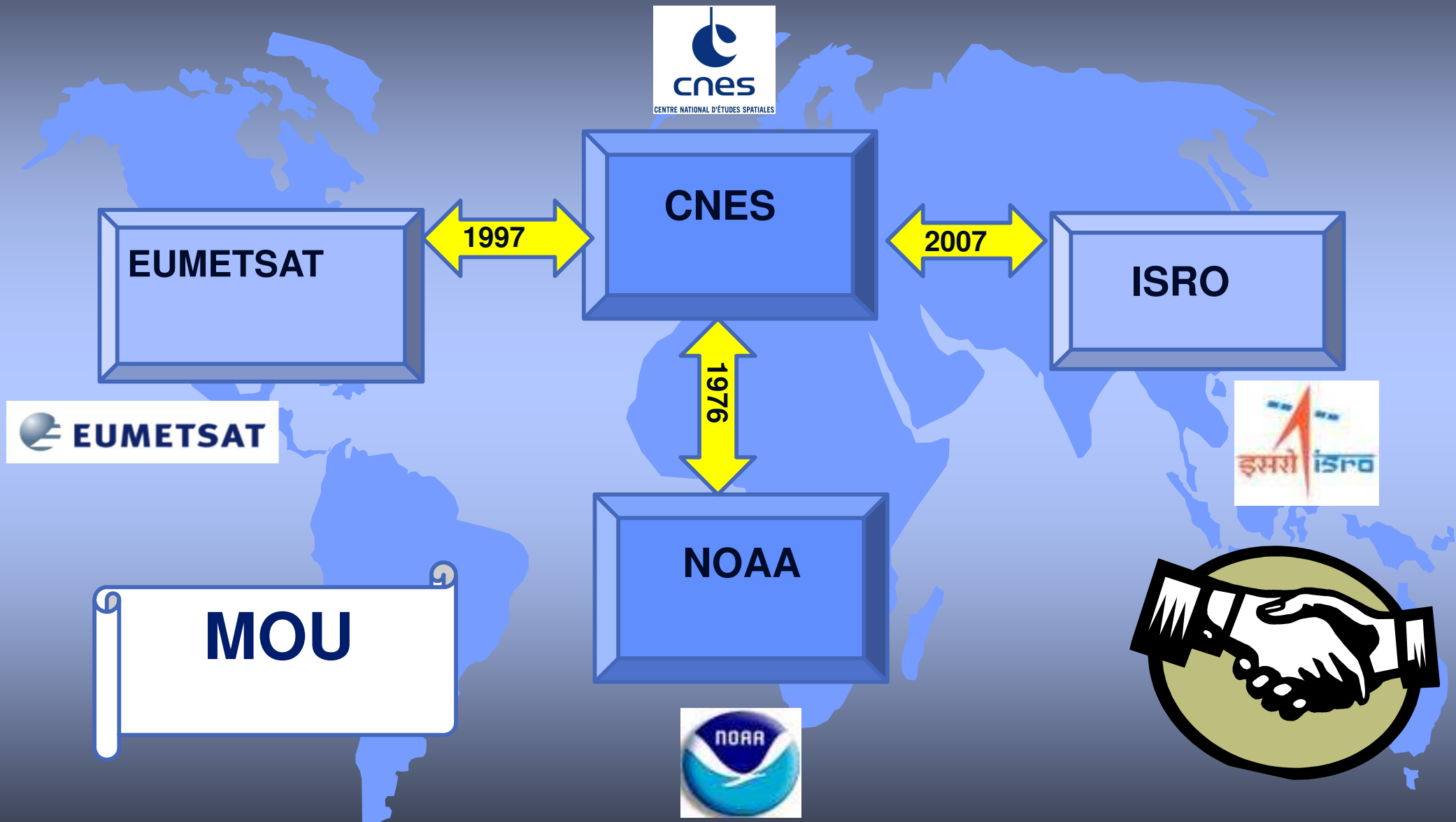
- ✓ **20 000 Argos active platforms mid-2016**
- ✓ **around 2000 customers over 100 countries**
- ✓ **A large application diversity**
- ✓ **An independent localization system**



SNAPSHOT OF THE 20,000 PLATFORMS EQUIPPED WITH ARGOS TRANSMITTERS THAT ARE RECEIVED EVERY DAY

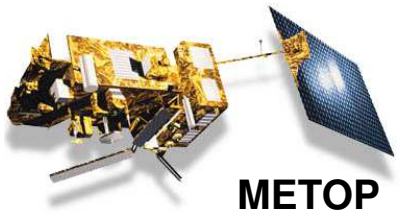


INTERNATIONAL AGREEMENTS



ARGOS : an International Cooperation

Baseline : 3 orbits, 3 partners



NOAA @ 13:30
ISRO @ 17:30
EUMETSAT @ 21:30

6 Operational ARGOS Instruments mid-2016

USA / NOAA

- ARGOS 2: NOAA -K 1998; NOAA -N 2005
- ARGOS 3: NOAA -N' 2009
- ARGOS 4: CDARS 2021

EUROPE / EUMETSAT

- ARGOS 3: Metop-A 2006; Metop-B 2012
- ARGOS 4: Metop-C 2018; Metop-SG1 2022; Metop-SG2 2029

INDIA / ISRO

- ARGOS 3: SARAL 2013
- ARGOS 4: OCEANSAT-3 2018

Argos- 3 is fully operational

- **Argos-3 Service is fully open since April 2013**

- **Uplink service :**
  - 4 sat : Metop-A, Metop-B, NOAA-19, SARAL
  - The 3 Argos “reference orbits” are covered
  - Low data rate through standard PTT-A2 but also PTT-A3 (provide coding function, allowing to receive error-free messages)

- **Downlink Service**
  - 2 sat : Metop-A, SARAL
  - Transmission of ephemeris, constellation status, dedicated information (beacon position, beacon configuration, etc.)
  - Low data rate in interactive mode
  - High data rate available over « quiet » areas (oceans , America, South Hemisphere) in interactive mode

Argos Terminals

The two last PTTs from Microwave Telemetry are making use of one of the new Argos-3 uplink QPSK Modulation.

Weigth is 3 grams only.

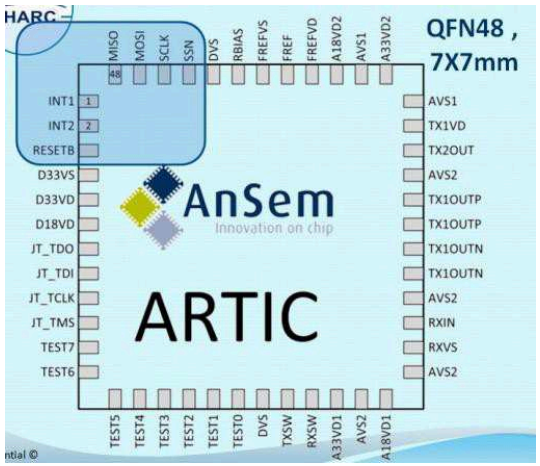
It allows the transmission of messages of smaller size with regards to Argos-2 PTT and hence increases the overall consumption of the transmitter and allows message reception by the satellite segment in harsh radio environment with PTT transmitting at very low power (below 100mW).

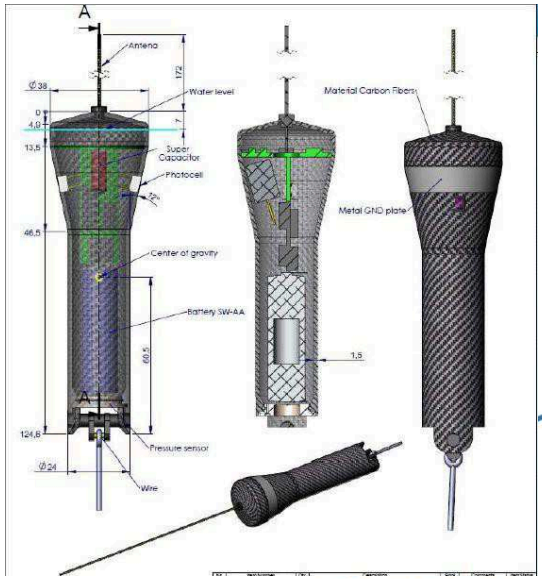
Argos Chipset

- The objective of the "Argos chipset" project is to design, manufacture and test a prototype of a miniaturized and low-cost ARGOS-3/-4 satellite chipset (Asic) that enables two way communications and provides improved battery lifetime.

- Project is in final stage :
  - Development of a low cost Argos 3/4 chipset (5 mm x 5 mm)
  - Development of a low cost pop-up tag integrating the Argos chipset
  - Certification for Argos-2 and Argos-3 transmission modes and for Argos-3 reception mode have been obtained from CNES/CLS
  - Deployment of the pop-up (from StarOddi) in sea in 2017

- Some chipset samples will be available for manufacturers in the coming weeks





Argos-4 Program Development

- Program decided in CNES in 2008
- Development of a new instrument , technology and components up-to date, software fully rechargeable on-board
- 4 instruments manufactured by THALES SA (France)
  - PFM1 (CDARS) and FM2 (Oceansat-3) already available
  - FM3 and FM4 (MetopSG-1 and 2) expected in 2017/2018
- UHF antennas (quadri-helix) developed by COBHAM
- Development of platform prototypes to validate new modulations and new downlink.
- Support for development of a A3/A4 chipset

Argos-4 : a new challenge

- To fulfill Science user requirements for the [2018-2035] time frame
- To reinforce Argos unique capabilities for very small transmitters
  - Objective : down to 100 to 200 mWatt for transmitters
  - Objective : the “3 grams” platform, “2 grams” in the future
- To enhance the system capacity
  - Up to 50 000 platforms to be processed (20 000 today)
  - 40 processing units instead of 12 (Argos-3)
- To support more governmental applications thanks to dedicated “non-environmental” bands
  - Defense, Security
  - Maritime Security
  - Humanitarian

Argos-4 New Functionalities

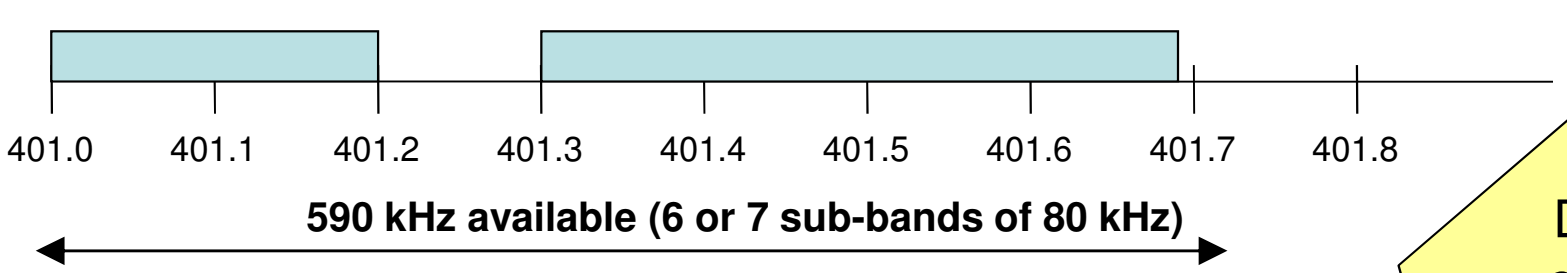
- Large increase of frequency bandwidth (590 kHz instead of 110 kHz)
- New band 399.9 to 400.05 MHz for non-environmental use (MSS Band)
- Dedicated sub-bands for “High Data rate platforms” but also for “Low Power platforms” transmitting with output power < 500 mWatt
- Frequency measurement and time tagging (for platform location) for all platforms : low and high data rate
- Two new platforms:
  - High Data Rate HD-A4 that supports two data rates 4800 bps and 1200 bps.
    Improvement of link budget by 4 dB @ 4800 bps and by 10 dB @ 1200 bps
  - Very Low Data Rate VLD-A4 dedicated to any applications requesting low output power (around 100 mW) and low data rate at 124 bps

Argos-4 Frequency bands

Environmental Applications

Argos 4
401.0 – 401.2 MHz
401.3 – 401.69 MHz

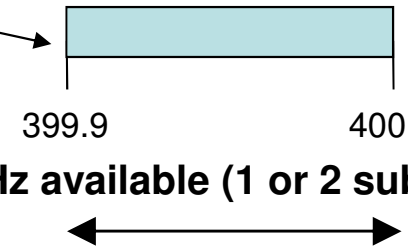
Argos 3
401.58 – 401.69 MHz



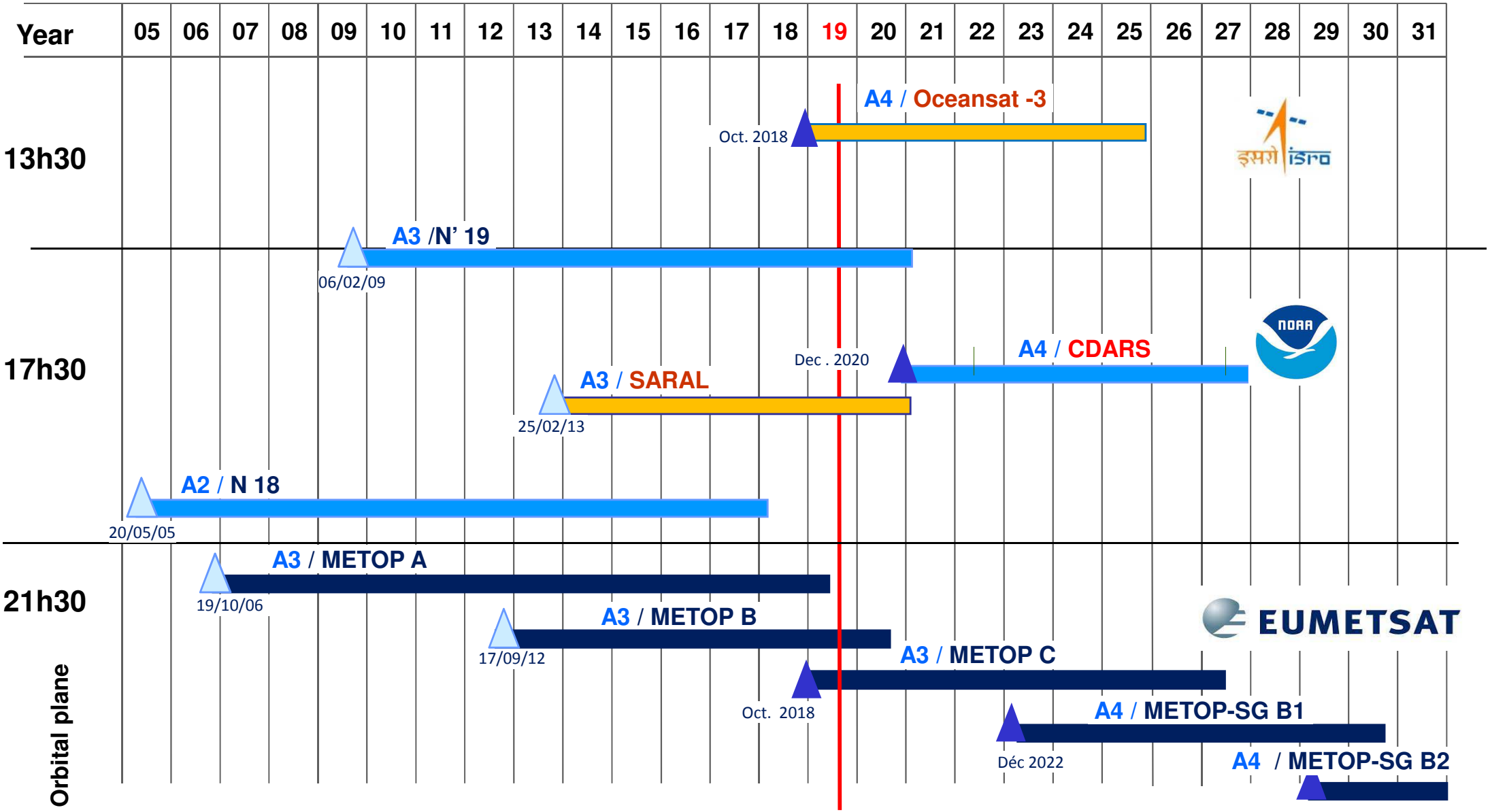
Dedicated sub-bands for « low power » platforms < 500 mWatt

Non- Environmental Applications

Argos 4
399.9 – 400.05 MHz

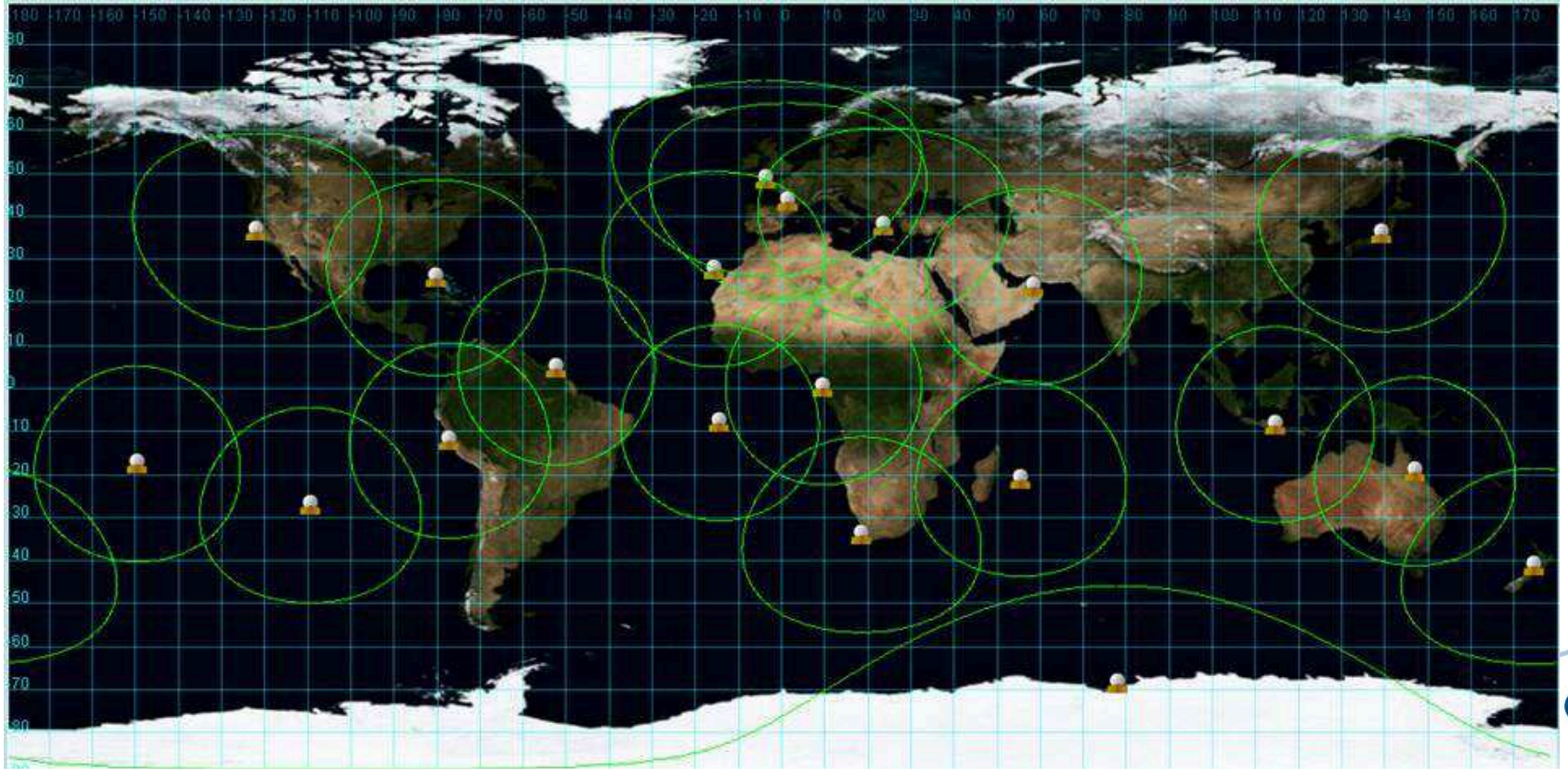


Argos constellation in 2019



Argos-4 Program Development

- **Upgrade of Mission Ground Segment**
  - General upgrade of Argos Processing Centre
  - Implementation of Argos-4 functionalities
  - Improvement of Users services
- **Upgrade of 20 “prime” L-Band Stations Network (all Argos satellites can be received, good availability ratio, short latency time)**



Argos : the Future

The Future (studies in progress at CNES)

- Use of new technologies and to integrate all “signal processing” in one single SOC (System on Chip) component
- Argos instrument could be accommodated on very small satellites (nano satellite type)
- To fly Argos on a constellation in order to minimize the latency time.

Any questions ?

Thank You !

ARGOS

CLS™