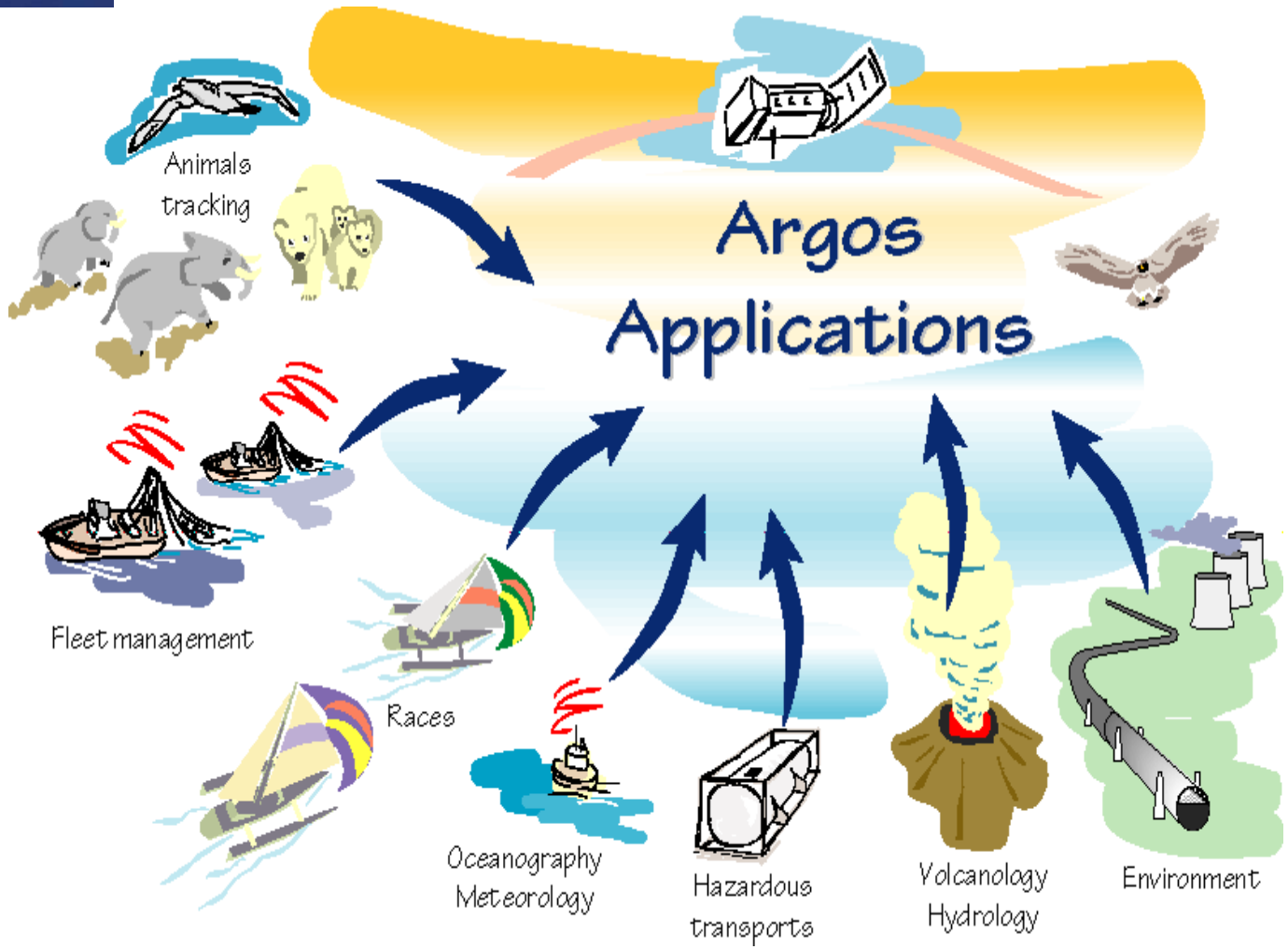
Argos-3 to Argos-4

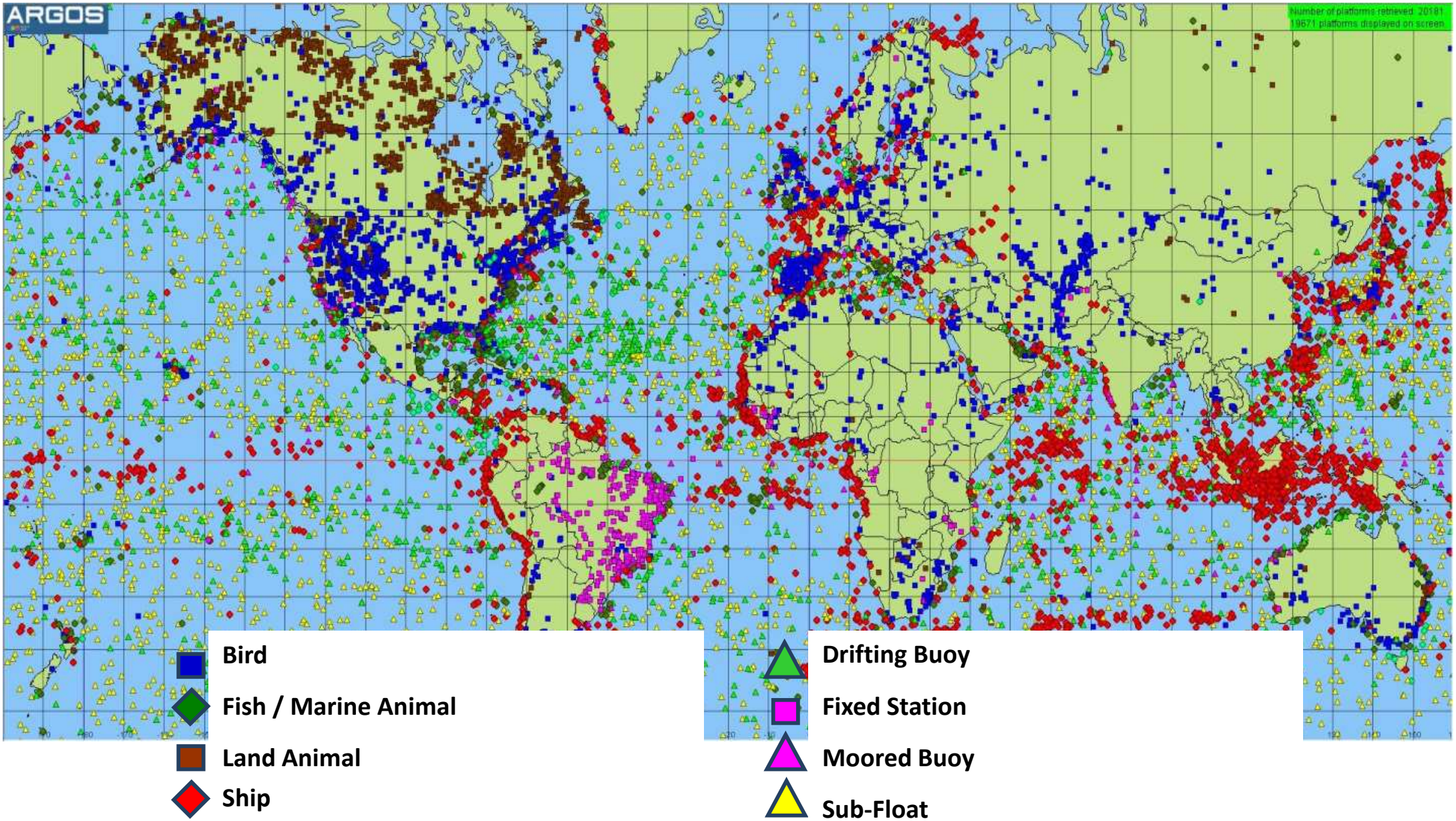
M. Sarthou – CNES Project Manager

ARGOS : 35 YEARS OF CRITICAL WORLDWIDE ENVIRONMENTAL DATA TRACKING AND RELAY

- ✓ 22 000 Argos active platforms end of 2014
- ✓ more than 1000 customers among 90 countries
- ✓ A large application diversity
- ✓ An independent localization system



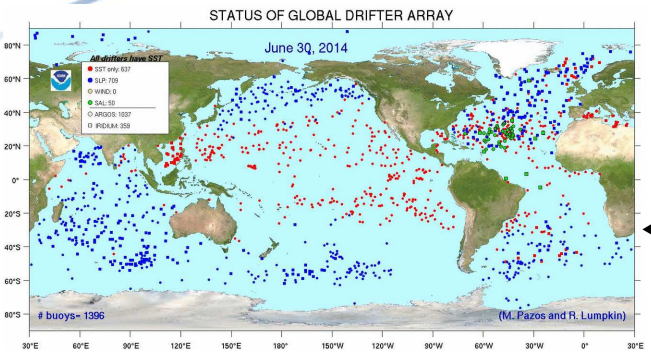
SNAPSHOT OF THE 22,000 PLATFORMS EQUIPPED WITH ARGOS TRANSMITTERS THAT ARE RECEIVED EVERY DAY



Oceanography

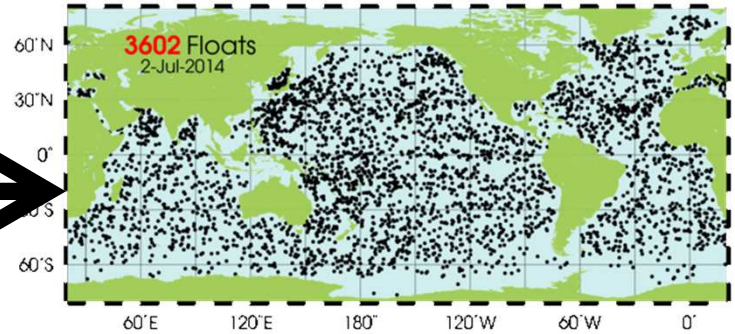
6000 buoys

Oceanography



SURFACE DRIFTING BUOYS

GLOBAL DATA COMES FROM HERE



AUTONOMOUS PROFILING FLOATS

- **Insitu Meteorological and Oceanographic Data is Routinely Transmitted to Argos Daily from Thousands of Instruments on the Global Ocean and Delivered Electronically in R/T to NWS – and to Global Centers**

  -24,000 insitu ocean surface and weather obs are collected <u>daily</u> by Argos and are sent to NWS for assimilation into their forecast models

  - 8,000 salinity, temperature, depth profiles of the upper 2,000 meters of the ocean are collected monthly that are assimilated into the NWS coupled ocean model for seasonal-interannual variability prediction

- **For years NWS has relied on this R/T operational Argos data stream to continually improve on and validate the skill levels of their analyses and forecasts**

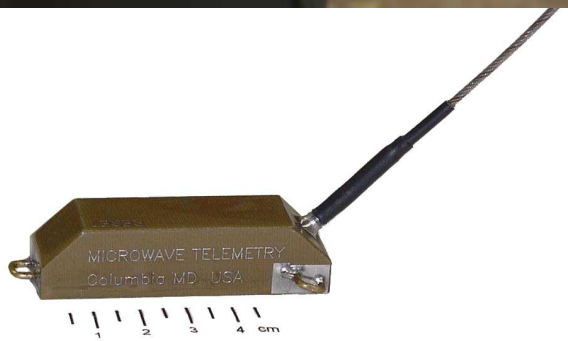
Wildlife

8500 animals

Wildlife

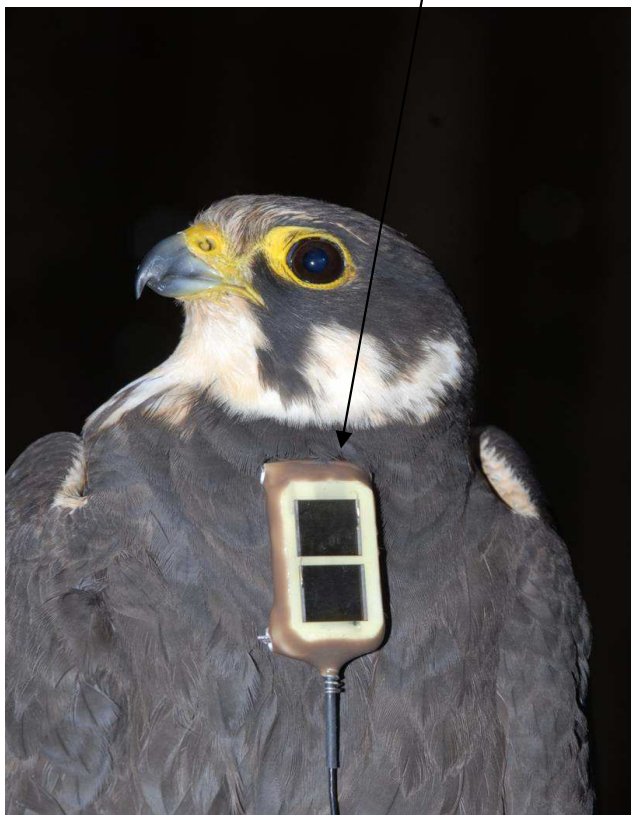
- Using Argos to study Diversity and Ecology
- Using Argos to understand Protected Habitat and Species
- Using Argos as a Tool to Advance Global Conservation
- Using Argos Tracking to Assess impact of Climate Changes on Wildlife

Smaller and smaller beacons



22 grams beacon used for bird tracking

The smaller one:
5 grams
(by Microwave Telemetry)



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VMS : Vessel Monitoring System

Governmental Regulation
Restricted fishing areas

4500 vessels

Developing countries
Security

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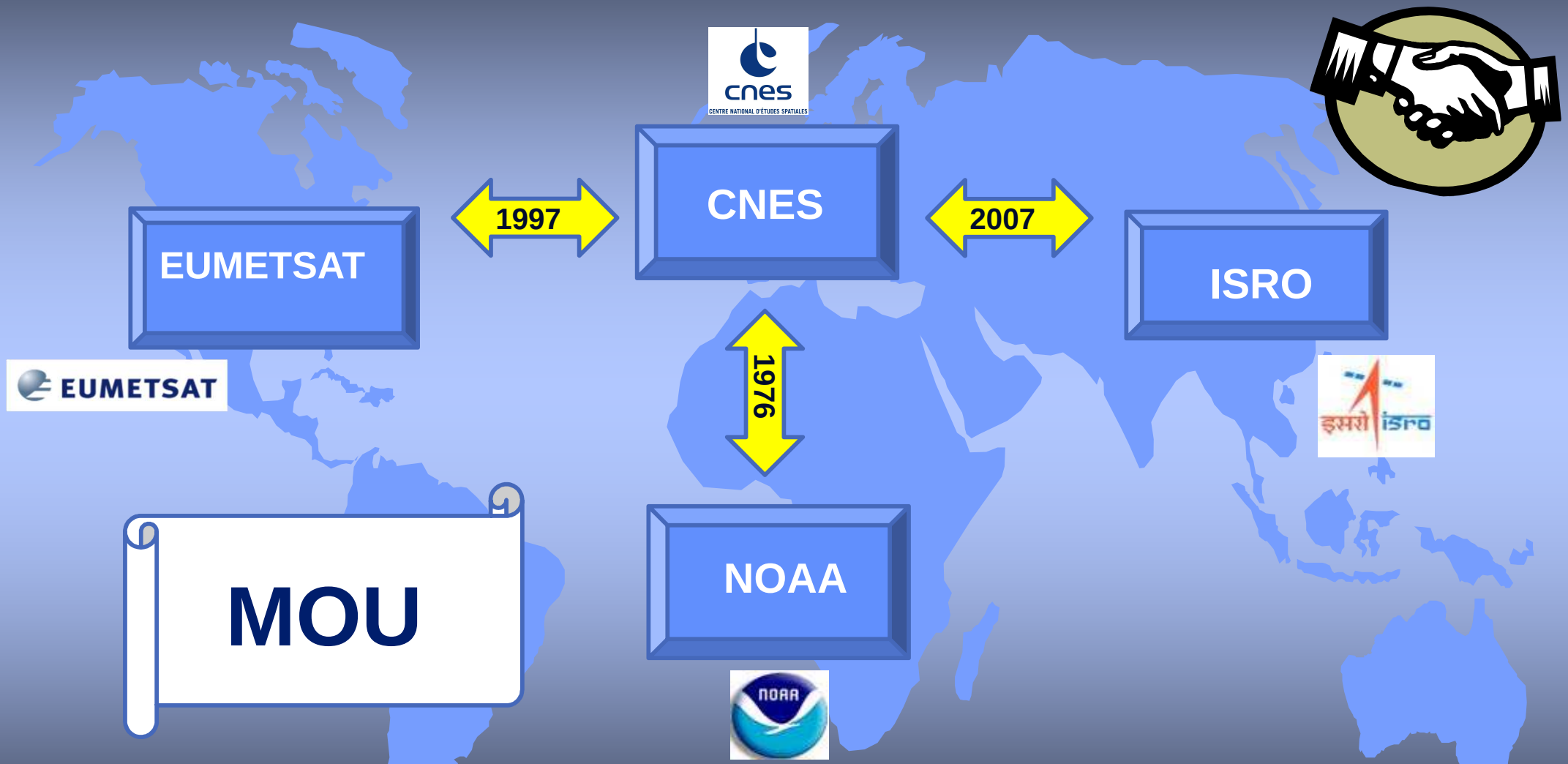
INTERNATIONAL AGREEMENTS



Roles & Responsibilities of MOU Partners

CNES

Provide Argos Instruments

CLS

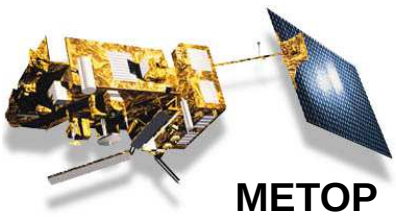
- Operate & Promote Argos System
- Redundant Processing Facilities
- QC, Products, Archiving, GTS…..
- 24/7 Technical Support
- User Service Offices – France & U.S.
- Operate/Maintain Ground System

NOAA **EUMETSAT** **ISRO**

- Spacecraft Integration, Launch & Operation
- Access to Global Preprocessed Data Stream

ARGOS : an International Cooperation

Baseline : 3 orbits, 3 partners



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

6 Operational ARGOS Instruments end of 2014

USA / NOAA

ARGOS 1 →

ARGOS 2 ↔
- NOAA -K 1998 ⇩
- NOAA -N 2005 ⇩

ARGOS 3 ↔
- NOAA -N' 2009 ⇩

ARGOS 4 ↔
- NOAA (2019) ? ⇩

EUROPE / EUMETSAT

ARGOS 3 ↔
- Metop-A 2006 ⇩
- Metop-B Sept 2012 ⇩
- Metop-C Oct. 2018 ⇩

ARGOS 4 ↔
- Metop-SG1 2022 ⇩
- Metop-SG2 2029 ⇩

INDIA / ISRO

ARGOS 3 ↔
- SARAL Fev 2013 ⇩

ARGOS 4 ↔
- OCEANSAT-3 (2018) ⇩

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Argos DCS: U.S. Customers

Department of Commerce/NOAA: OAR, NWS, NMFS, NOS

- Met/Ocean Monitoring/Research (e.g., Global Drifter Program), Tropical Cyclone Forecasting, Fishery Mgmt, Oil Spill Tracking (e.g., Deepwater Horizon in 2010), Tsunami Debris Tracking (2011)

Department of Defense: All Branches

- Met/Ocean Monitoring/Research, Weapons Tracking

Department of Homeland Security: USCG, Customs

- SAR Modeling, Anti-Piracy Alerting, Import/Export Tracking

Department of Interior: USGS, NPS, Fish & Wildlife Svc

- Endangered Species Studies, Migration Mapping, Wildlife Management

Researchers/Universities: Research Foundations, WHOI, SIO

- Whale Rescues, Profiling Ocean Floats (ARGO), Ocean Circulation, Deepwater Horizon (2010), Tsunami Debris Tracking (2011)

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-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 (22 000 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 Program Development

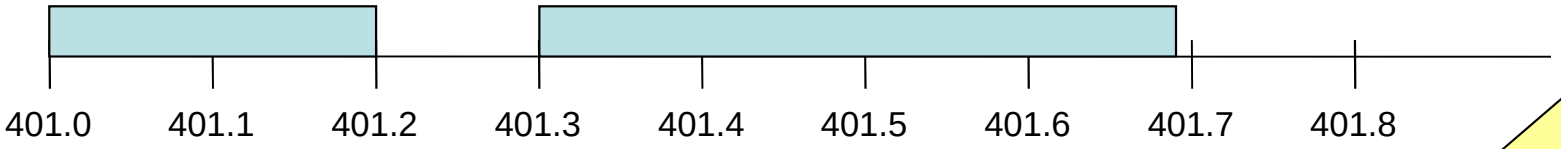
- Program decided in CNES in 2008 (originally for NPOESS) .
- 1st Launch in 2018 (Oceansat-3), other launchs through EUMETSAT (Metop-SG) and NOAA (USAF Hosted Payloads)
- Development of a new instrument , technology and components up-to date, software fully rechargeable on-board
- High Increase of Capacity (x 4)
- New downlink in spread spectrum
  - Compliance with RF regulation
  - Better resistance to noise
- New capabilities for Argos platforms
  - TX power down to 150 mWatt (requested for animal tracking)
  - New bands for sensitive use and maritime security
- New functionalities at Mission Center
  - Users I/F modernized
  - Upgraded performance for localization, reprocessing, archiving.

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



600 kHz available (6 or 7 sub-bands of 80 kHz)

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

Non- Environmental Applications

Argos 4
399.9 – 400.05 MHz

150 kHz available (1 or 2 sub-bands of 80 kHz)

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Evolution of Argos Instruments

	Argos-2	Argos-3	Argos-4
Frequency Range	80 kHz	110 kHz	640 kHz
Processing Units	8	9 low data rate 3 high data rate	32 low data rate 8 high data rate
Uplink Data Rate	400 bps	400 bps (low) 4800 bps (high)	124 bps (very low) 400 bps (low) 2400 (medium) 4800 bps (high)
Downlink (465.9875 MHz)	No	Yes (turned off on NOAA-19)	Yes
Downlink Data Rate	N/A	400 bps	1000 bps
Satellites	NOAA K,L,M,N	Metop A,B,C NOAA-N' SARAL	Metop-SG 1,2 NOAA Hops OCEANSAT-3
Data Transmitted per Satellite Pass	500 bit	Up to 30 kbit	Up to 30 kbit

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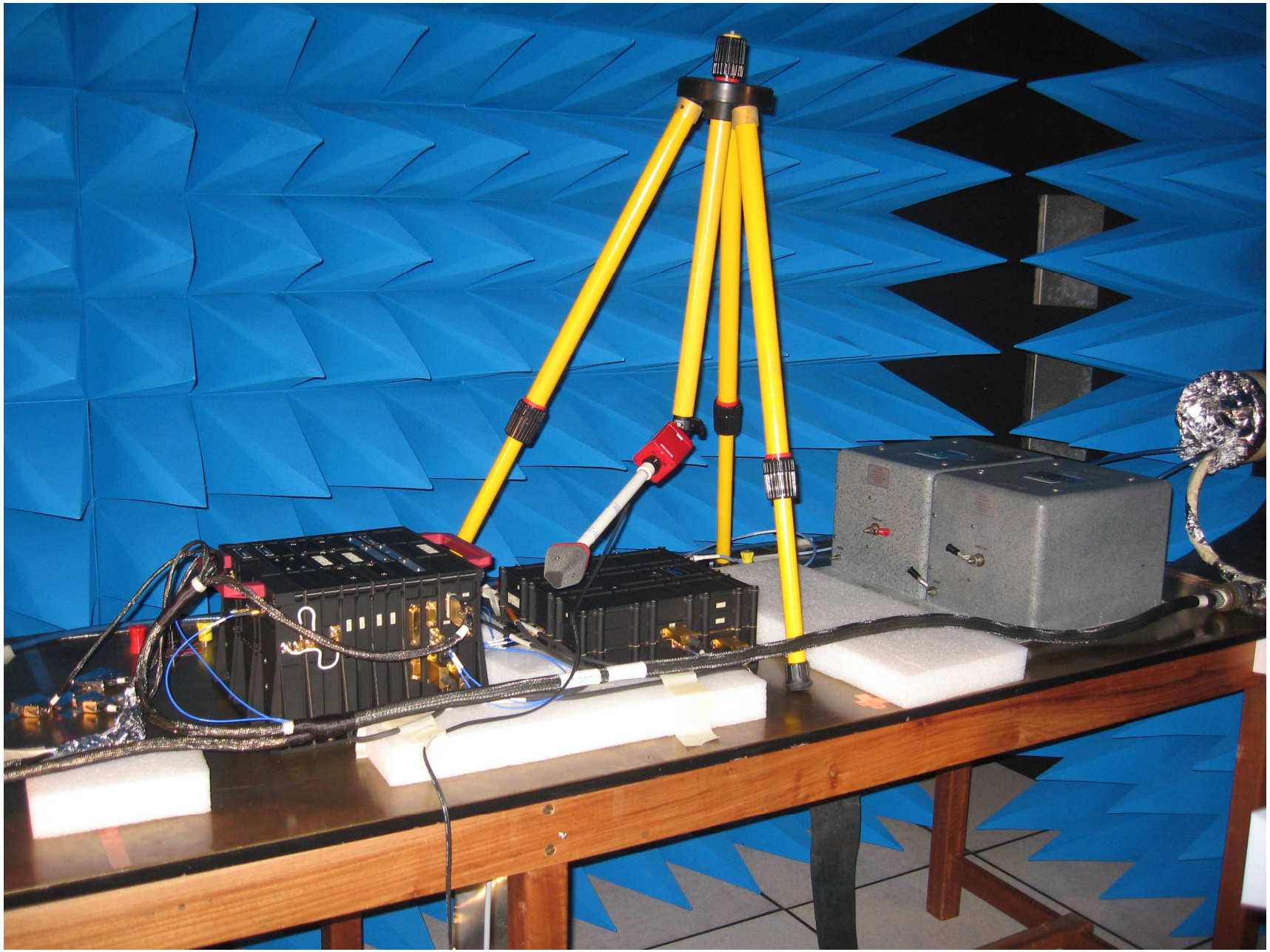
Argos-4 Instrument : PFM1 during EMC tests



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Thank You !