ITU Seminar for Americas Region

Overview on Data Collection systems: case of low orbiting satellites

Jean PLA, Frequency Management
CNES, Toulouse, FRANCE
jean.pla@cnes.fr

Michel SARTHOU, ARGOS project manager
CNES, Toulouse, FRANCE
michel.sarthou@cnes.fr

WHAT IS DATA COLLECTION?

Data collection system using low orbit satellite is the possibility of gathering information on any "object" equipped with a certified transmitter, **anywhere in the world, in the oceans, deserts or polar regions**.

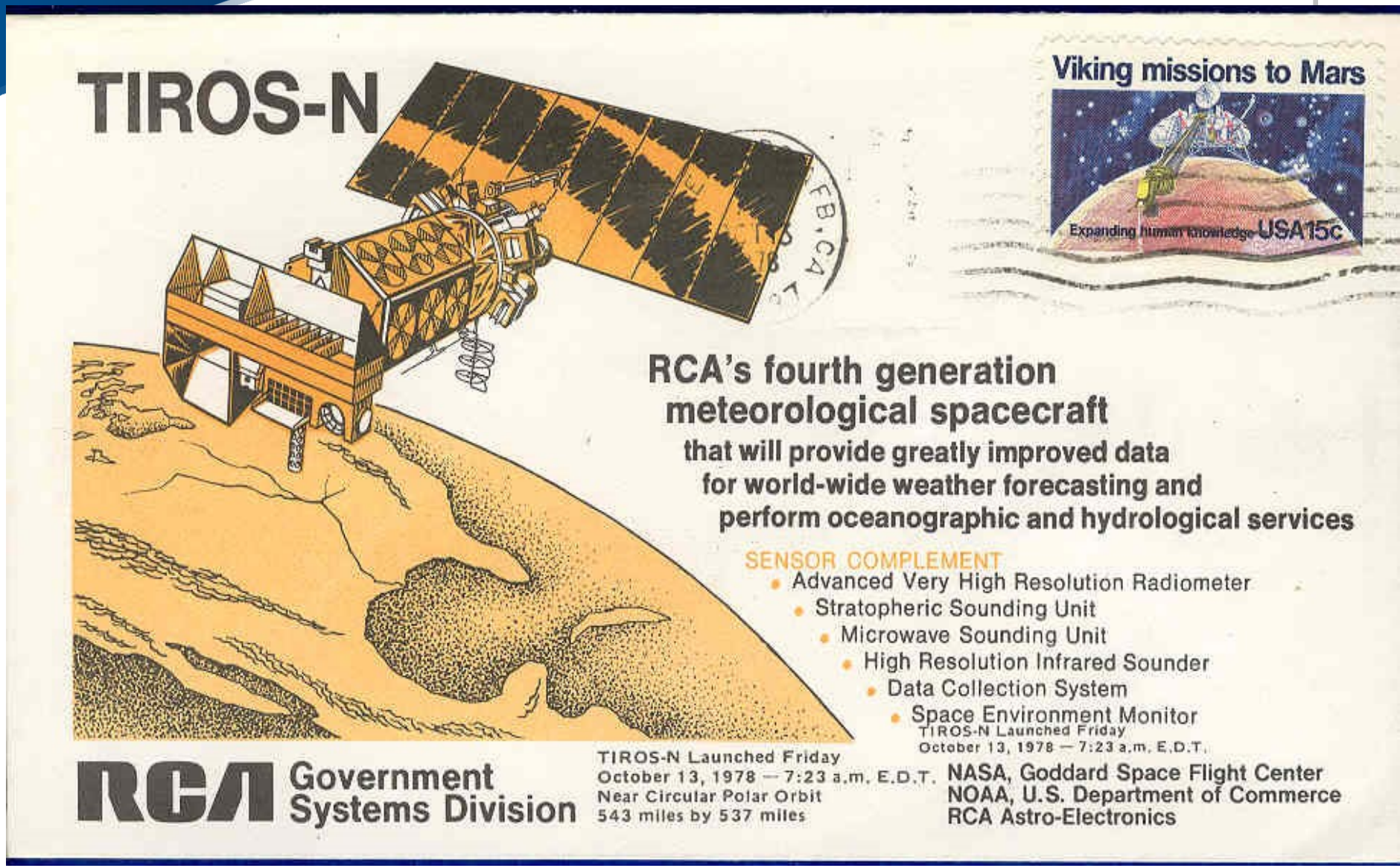
The **messages are recorded by a constellation of satellites carrying instruments, and then relayed to dedicated processing centres**.

This presentation is mainly focused on the **ARGOS system, operational since 1978**, and was initiated jointly by France and the United States.

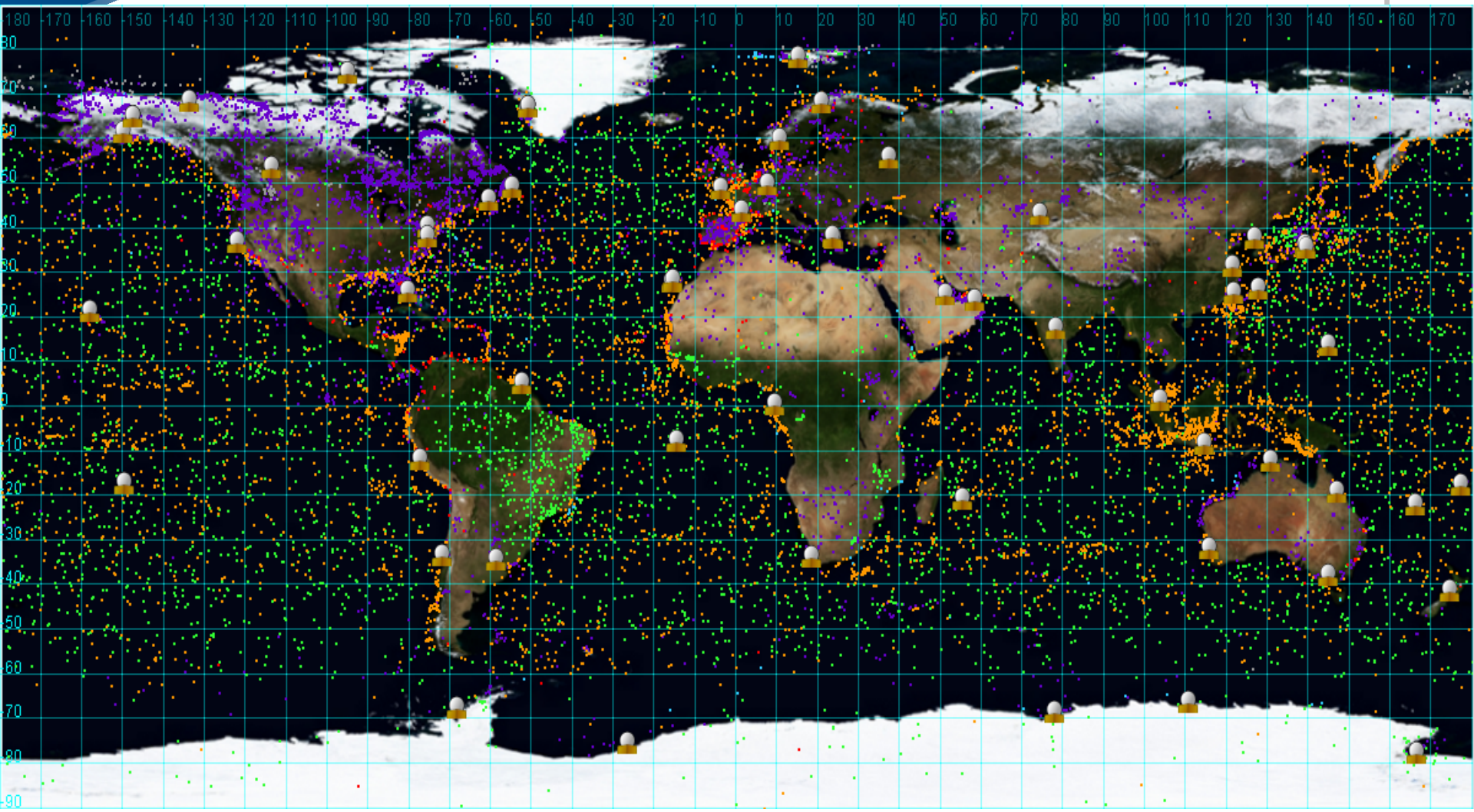
How Argos works?

1. Transmitters send signals to satellites on dedicated frequencies.
2. Low orbiting satellites collect the signals as they fly over a transmitter.
3. Messages are recorded on board satellites and then sent to processing centres in France and the USA.
4. The signals are processed and the data are sent to users: **data, location**.

First ARGOS DCP launched in 1978: TIROS N satellite



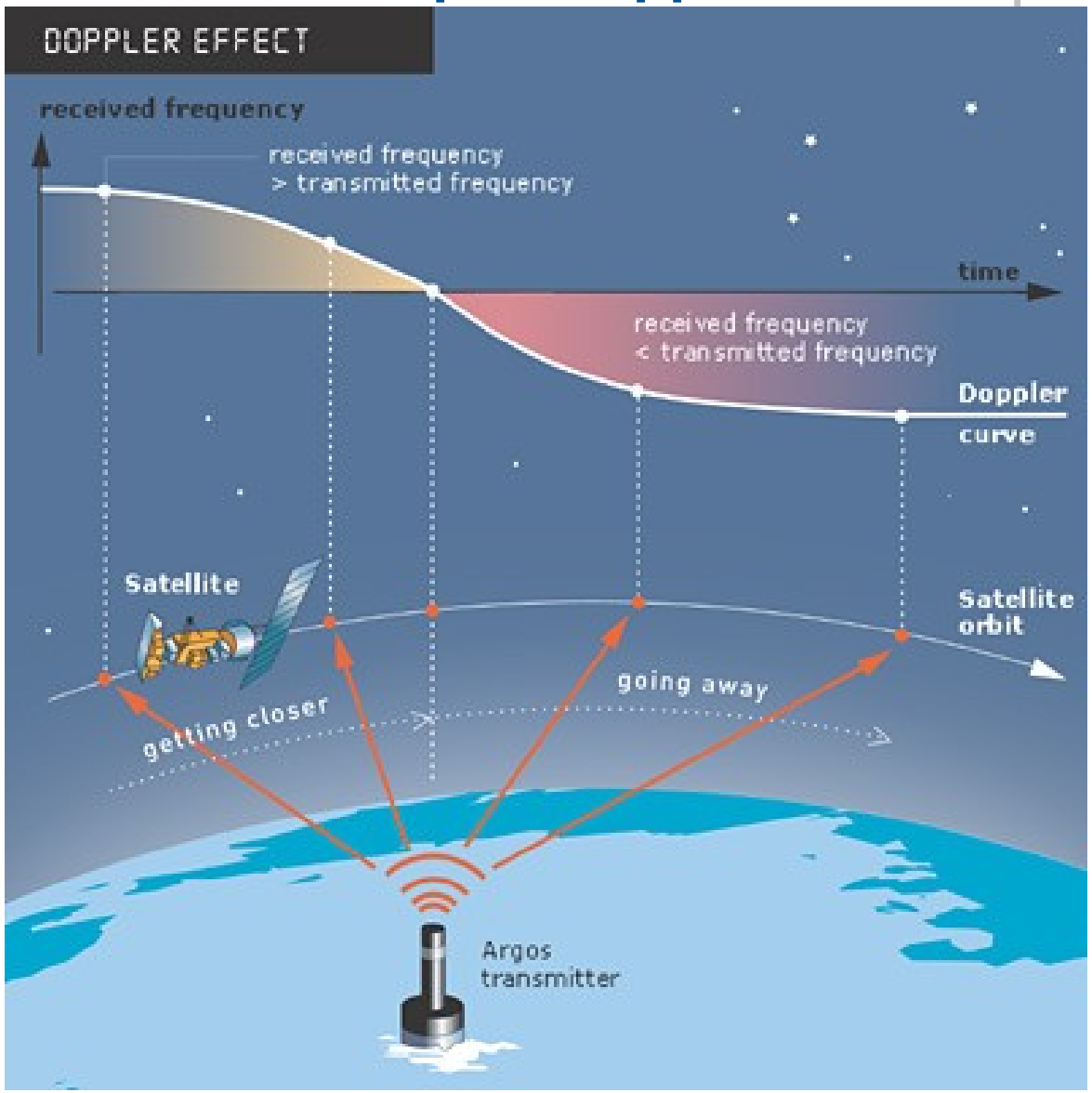
Distribution of the ARGOS platforms



Location technique: Doppler effect

Doppler effect (same like a train in a station)

When the satellite approaches a transmitter, the frequency of the transmitted signal measured by the onboard receiver is higher than the actual transmitted frequency, and lower when it moves away.



Doppler location principle(½)

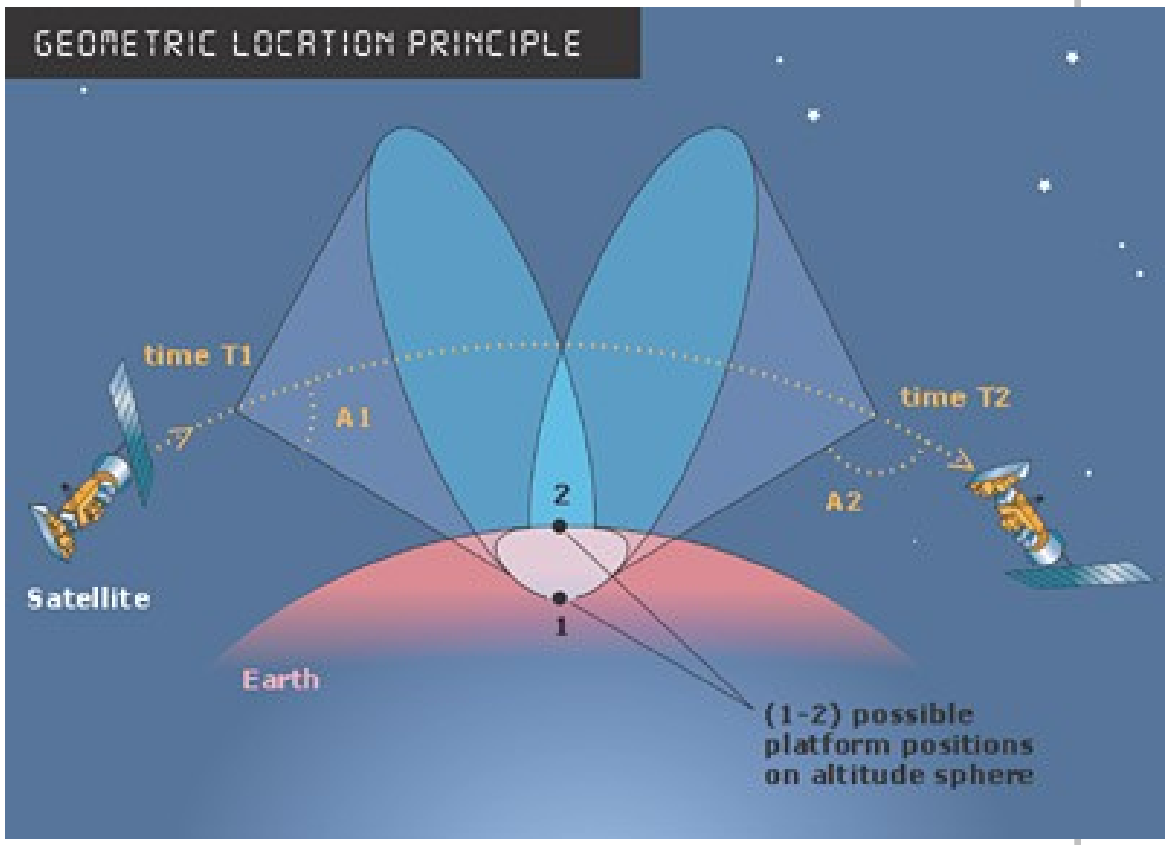
Each time the satellite instrument receives a message from a transmitter, it **measures the frequency and time-tags the arrival**.

Existence of two possible positions of the platform that give exactly the same frequency measurements on board the satellite:

the **nominal ("true")** location

the **mirror ("virtual")** location.

Locations symmetrical about the sub-satellite track and **a priori not distinguishable**.



Doppler location principle(2/2)

Good location found using **all messages received during the satellite pass** over the platform.

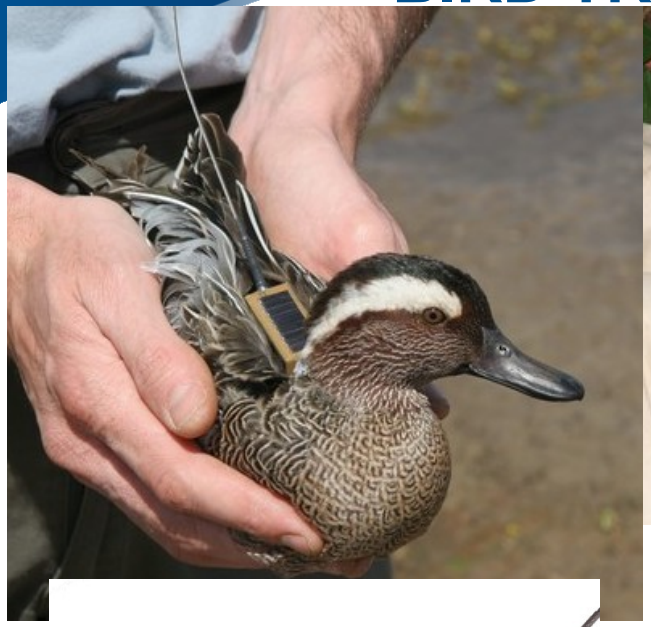
A **least-squares analysis** is used to refine the estimates of the transmitter's position. If this analysis fails, the location calculation process cannot continue and no location is provided. The location with the minimal residual error is chosen, and its plausibility is tested.

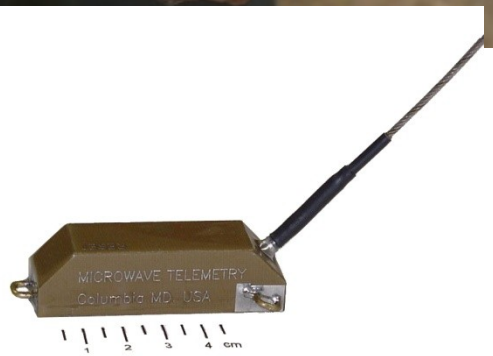
Accuracy: depending on the number of received messages and their quality, the accuracy varies between **100 meters** and **more than 1500 meters**.

OCEANOGRAPHY: A MAJOR APPLICATION FOR ARGOS

ANIMAL TRACKING: ANOTHER APPLICATION FOR ARGOS

BIRD TRACKING: VERY SMALL BEACONS

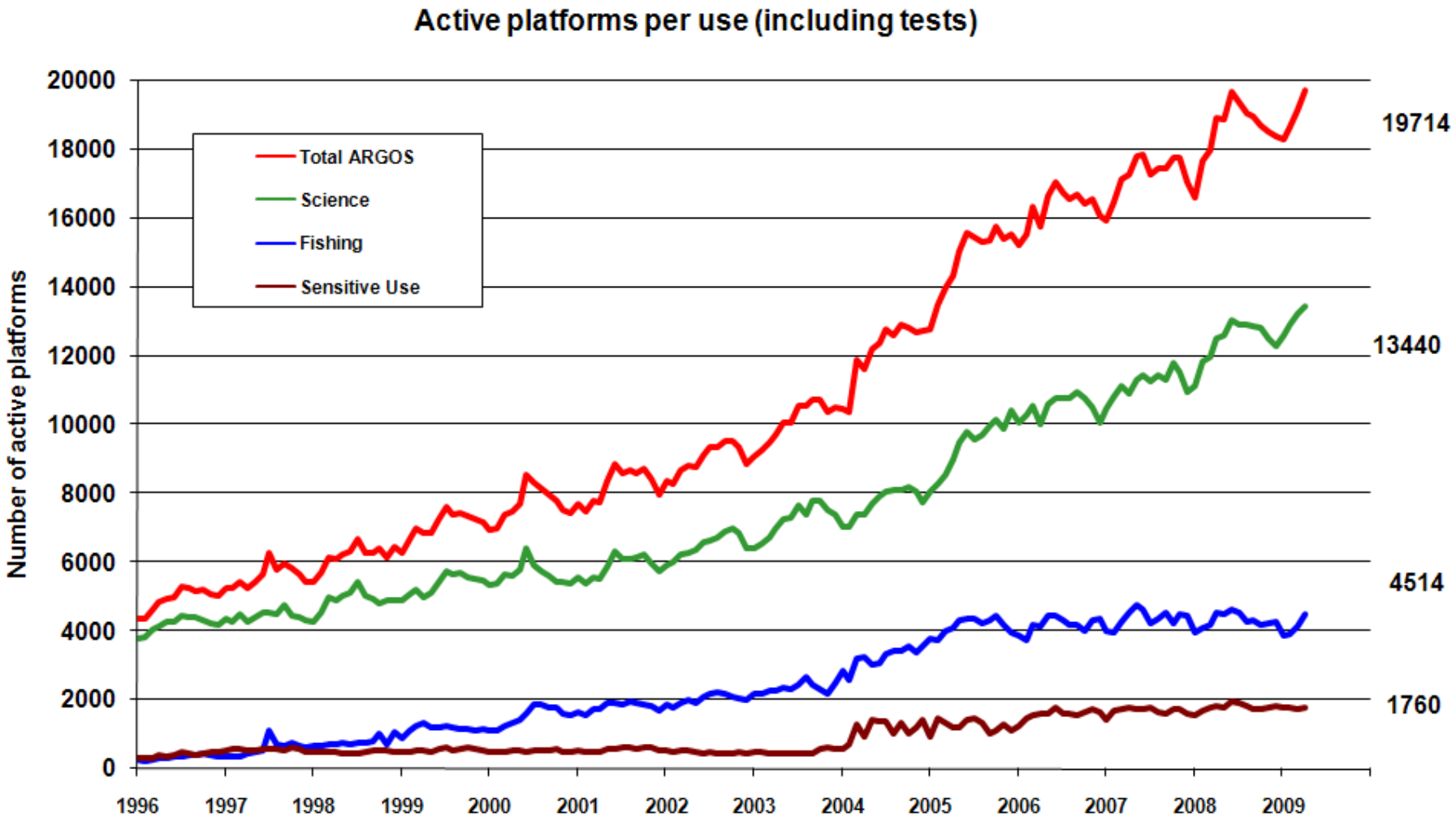




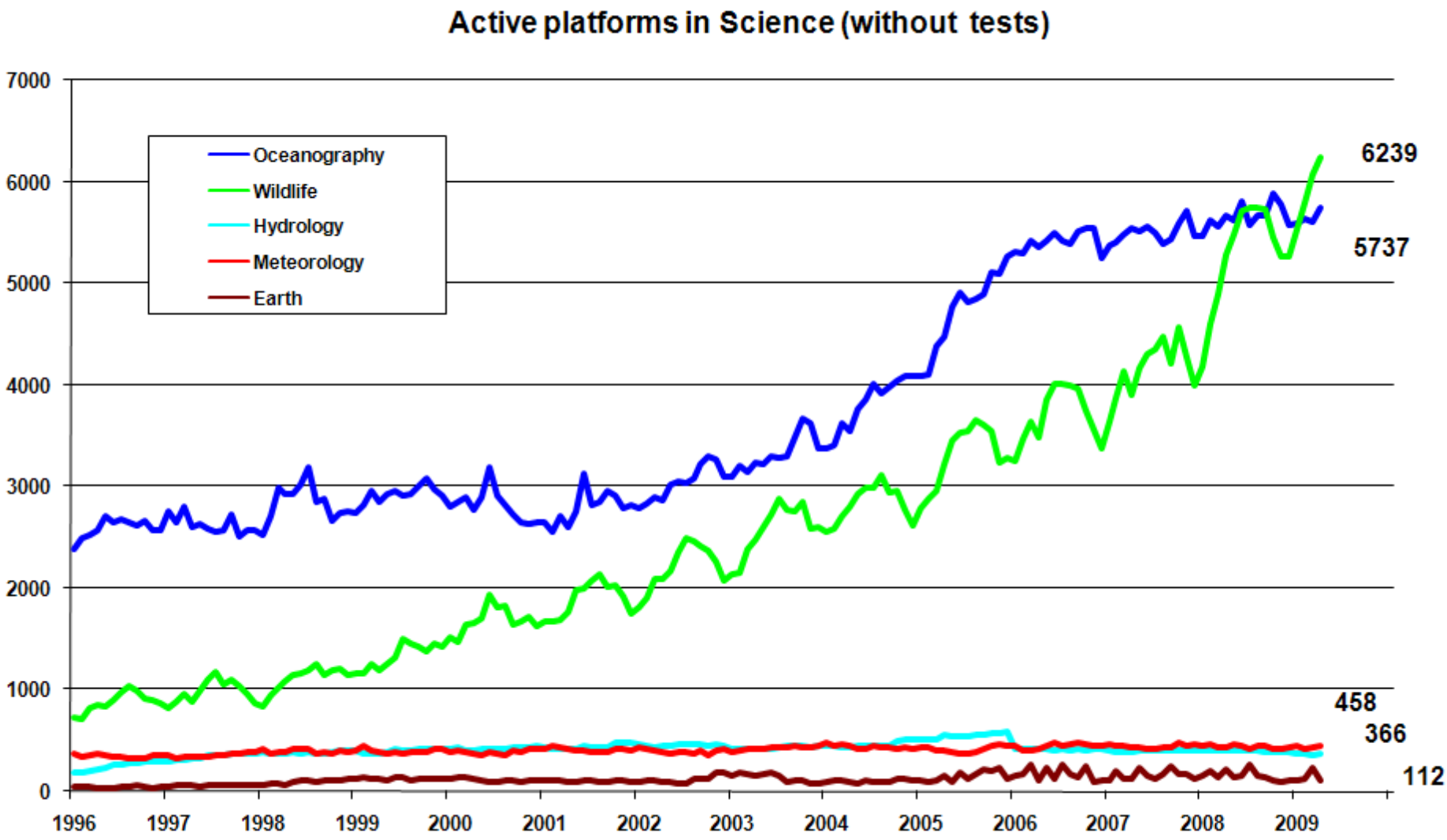
Beacon of 22 grams for bird tracking

5 grams: the smallest beacon

OVERVIEW OF THE APPLICATIONS



SCIENTIFIC APPLICATIONS



ARGOS System

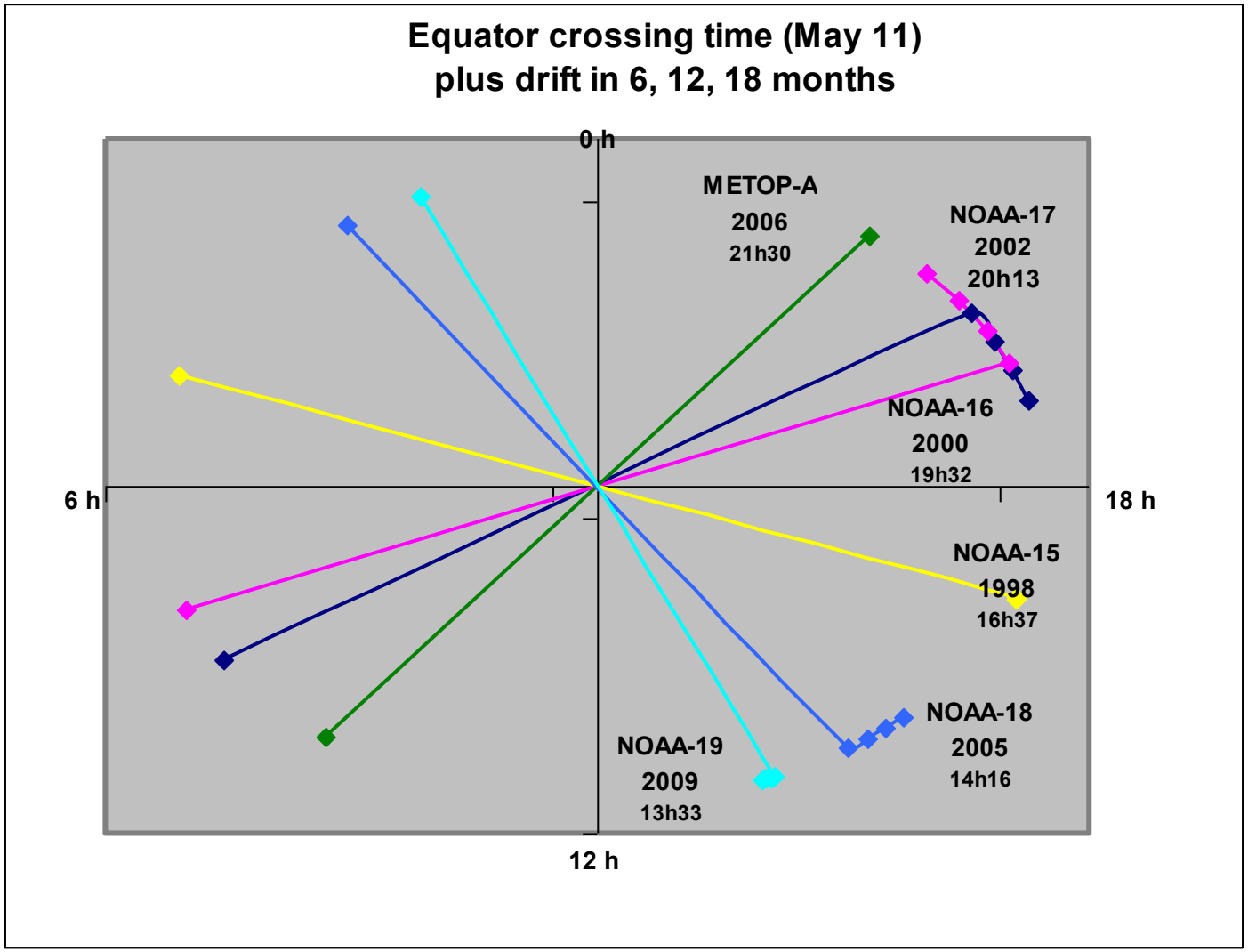
Current system: ARGOS3 in operation within 110 kHz bandwidth: 401.58-401.7 MHz under the Earth Exploration Satellite Service (Earth-to-Space)

Future system: ARGOS4, 40000 platforms are expected to be deployed

Earth Exploration between 401 and 401.7 MHz: many channels dedicated to low power applications(< 500 mWatt)

Usage of new frequency band: 399.9 to 400.05 MHz, Mobile Satellite Service (Earth-to-Space) for other types of applications: maritime, security, defense, non-environment applications

CURRENT SATELLITE CONSTELLATION: Polar orbiting sun synchronous satellites

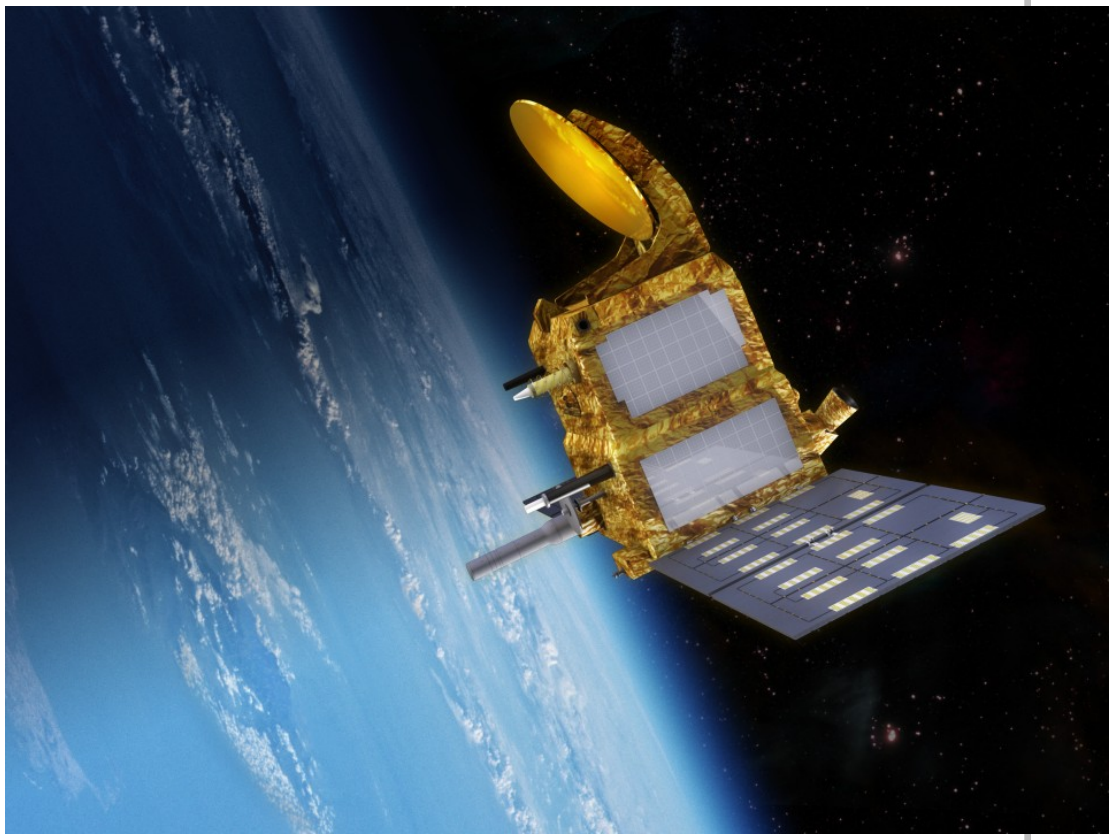


2012: an important year for ARGOS

2 ARGOS-3 instruments are launched this year:

Metop-B 19 th September 2012 from Baïkonour with Soyuz

SARAL to be launced in October 2012 from India with PSLV



ANY QUESTION?