

ITU Seminar for Americas Region

Overview on Data Collection systems: case of low orbiting satellites

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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.

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TIROS-N

First ARGOS DCP launched in 1978: TIROS N satellite

Expanding human knowledge USA15C

Viking missions to Mars

RCA's fourth generation meteorological spacecraft

that will provide greatly improved data for world-wide weather forecasting and perform oceanographic and hydrological services

SENSOR COMPLEMENT

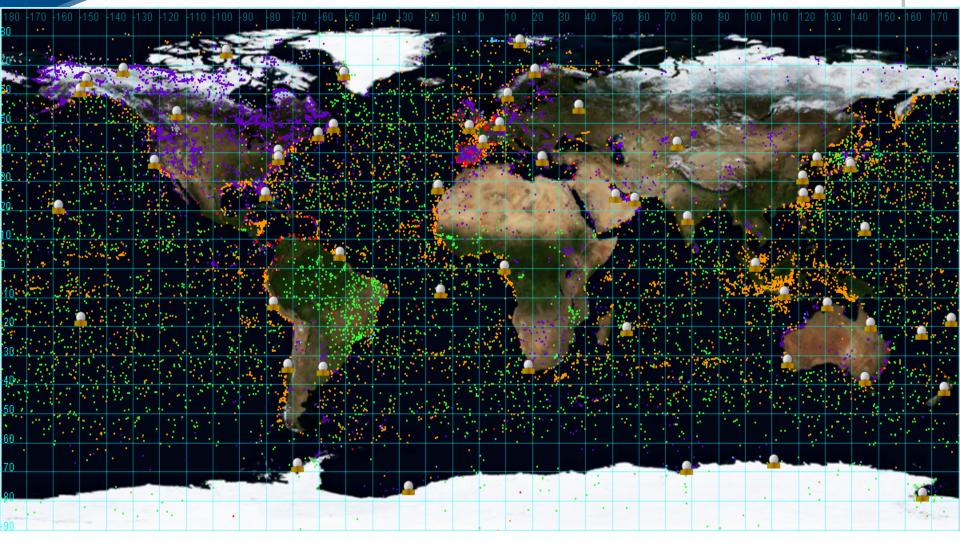
- Advanced Very High Resolution Radiometer
- Stratopheric Sounding Unit
 - Microwave Sounding Unit
 - High Resolution Infrared Sounder
 - Data Collection System
 - Space Environment Monitor TIROS-N Launched Friday October 13, 1978 — 7:23 a.m. E.D.T.
 - T. NASA, Goddard Space Flight Center NOAA, U.S. Department of Commerce RCA Astro-Electronics

RCA Government Systems Division

TIROS-N Launched Friday October 13, 1978 – 7:23 a.m. E.D.T. Near Circular Polar Orbit 543 miles by 537 miles

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Distribution of the ARGOS platforms



Jean PLA Michel SARTHOU

CNES 21/09/ 2012, MANTA

Ecuador, ITU Seminar for Americas Region

DCP for LEO satellites

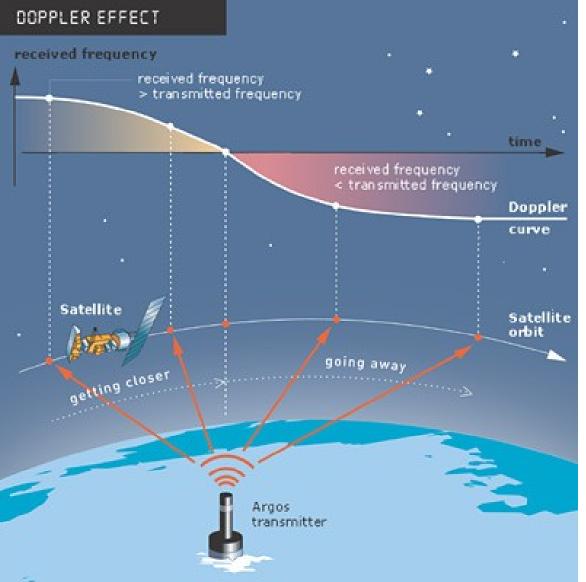
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Doppler effect (same like a train in a station)

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.

Location technique: Doppler effect



Doppler location principle(¹/₂**)**

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

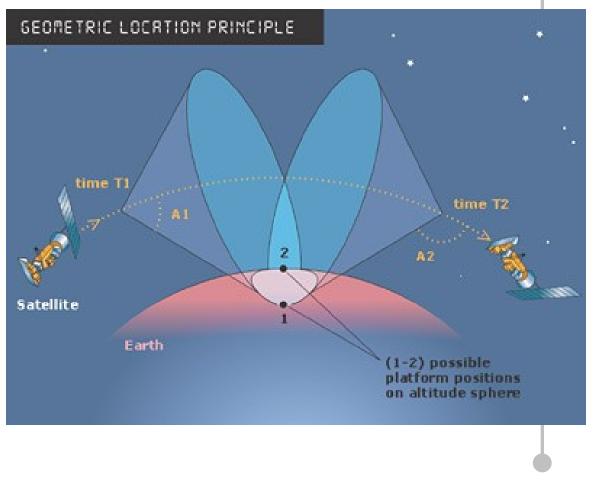
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Existence of two possible positions of the platform that give exactly the same frequency measurements on board the satellite:

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

the <u>mirror ("virtual")</u> 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



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21/09/ 2012, MANTA

ANIMAL TRACKING: ANOTHER APPLICATION FOR ARGOS



DCP for LEO satellites

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BIRD TRACKING: VERY SMALL BEACONS



Beacon of 22 grams for bird tracking

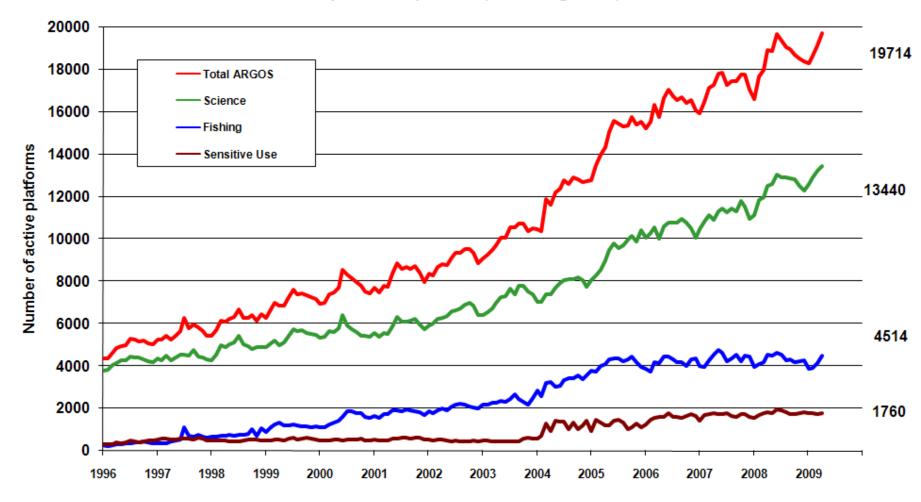


5 grams: the smallest beacon

OVERVIEW OF THE APPLICATIONS

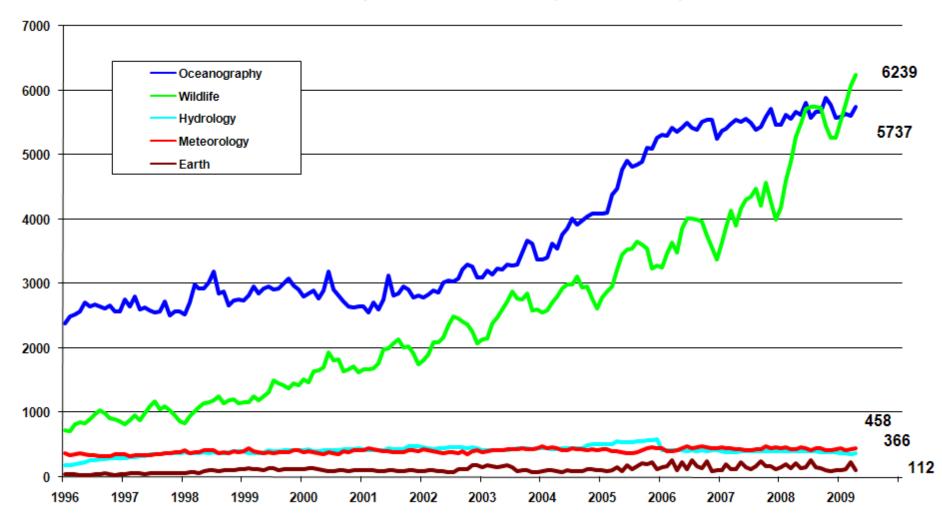
Active platforms per use (including tests)

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Active platforms in Science (without tests)





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

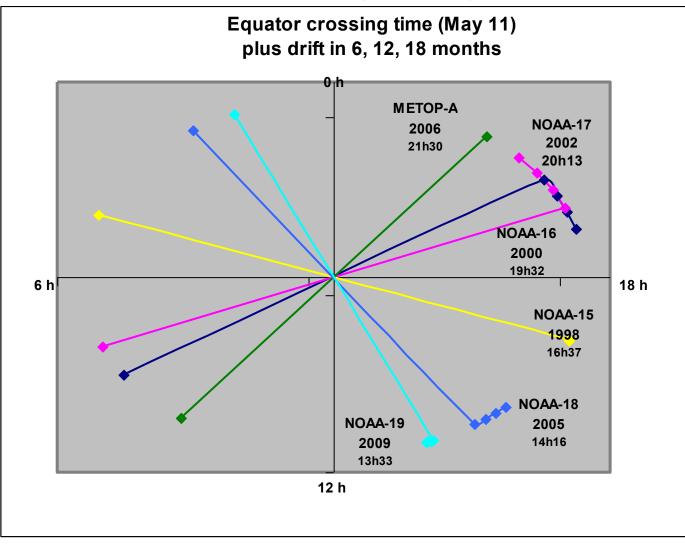
Earth Exploration between 401 and 401.7 MHz: many channels dedicated to low power applications(< 500 mWatt)

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

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CURRENT SATELLITE CONSTELLATION:

Polar orbiting sun synchronous satellites



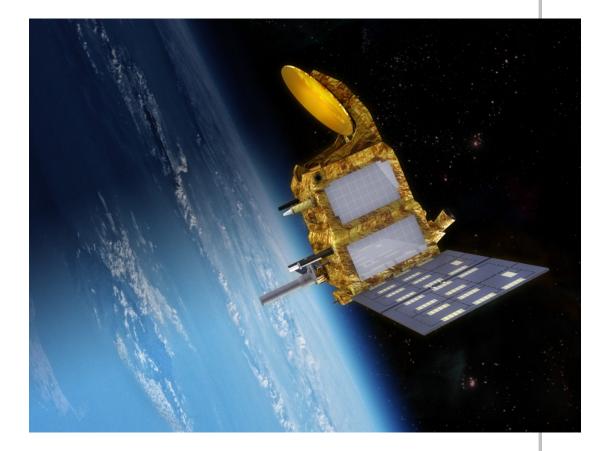
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2012: an important year for ARGOS

2 ARGOS-3 instruments are launched this year:

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- Metop-B 19 th September 2012 from Baïkonour with Soyuz
- SARAL to be launced in October 2012 from India with PSLV





ANY QUESTION?