



Update on ARGOS & IRIDIUM Systems and Services

Solène ROUTABOUL

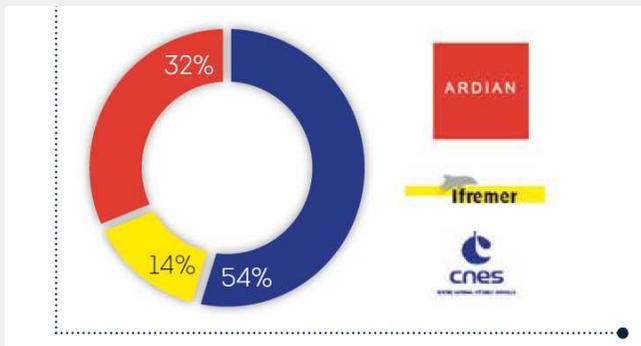
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<http://www.cls-telemetry.com/>



What is CLS ?

srouabout@groupcls.com



CLS is a **subsidiary of the French Space Agency (CNES)**, and was created in 1986.

- ✓ **Unique provider of the Argos services**
- ✓ **Iridium services provider** dedicated to ocean platforms
- ✓ **Satellite Altimetry World Expert**

With 2 global coverage LEO satellite systems and 3 processing centers operational 24/7, CLS is the **privileged partner of ocean in-situ programs**



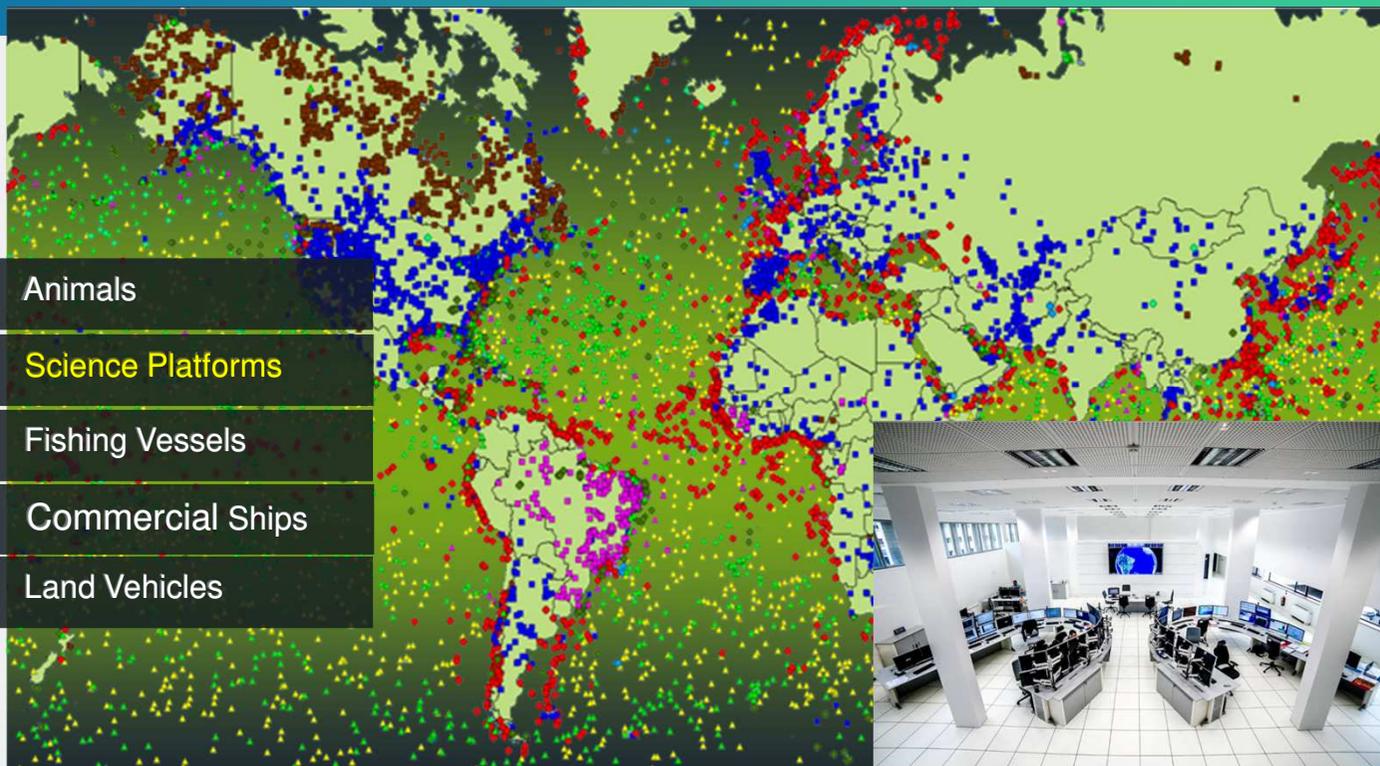
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100 000+ Platforms Tracked each day

sroutabout@groupcls.com



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Ocean Instruments that use CLS satellite services

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5000+ Ocean Platforms



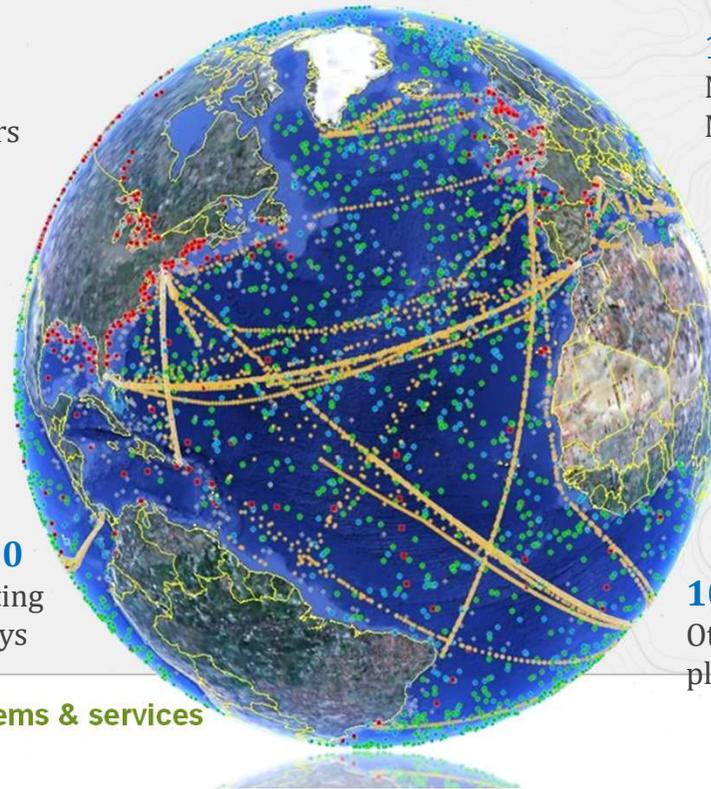
200
Glider



2500
Profiling
Floats



1200
Drifting
Buoys



1000
Met. / Ocean
Moored Buoys



200
Ice Buoys



100+
Other
platforms

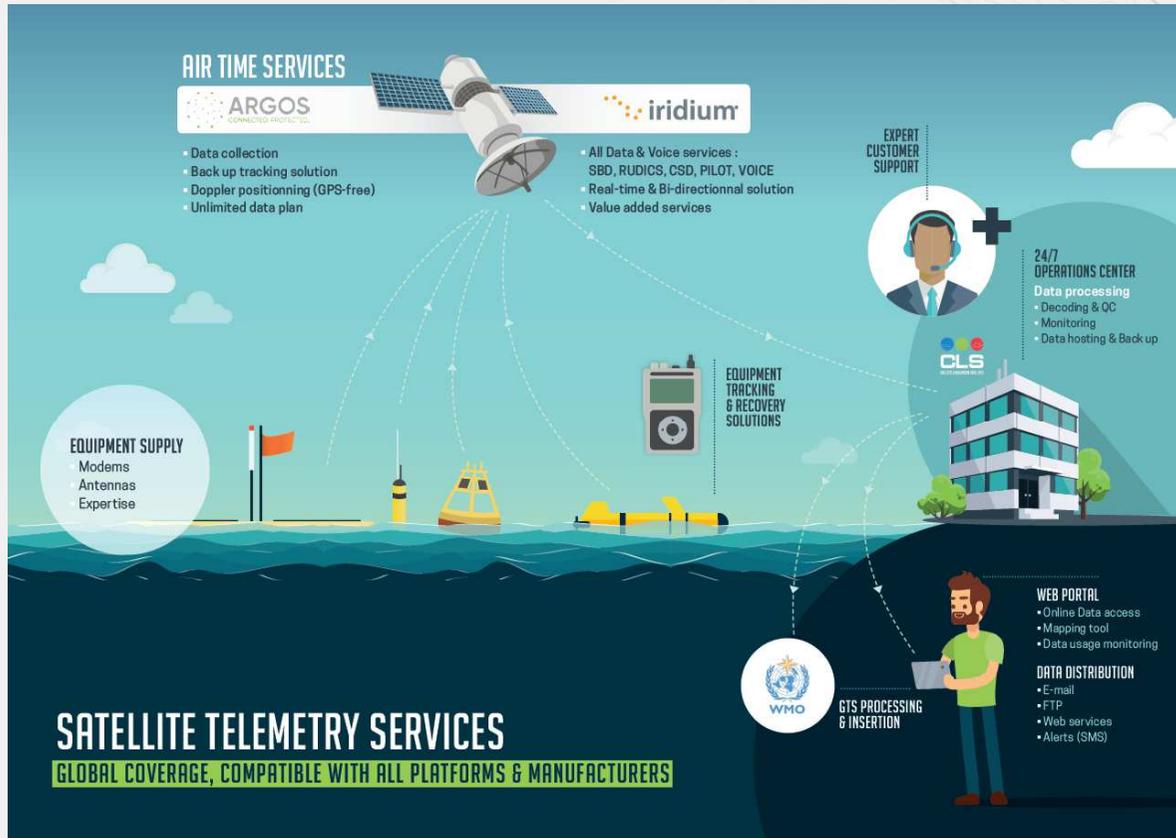


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TELEMETRY SERVICES FOR OCEAN & MET PLATFORMS : OVERVIEW



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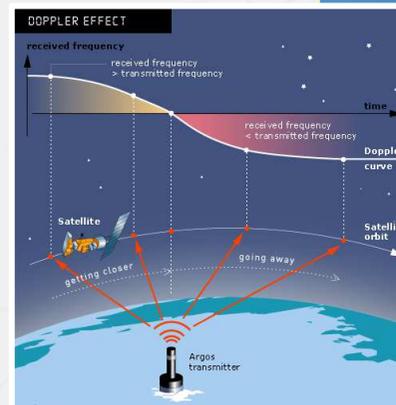
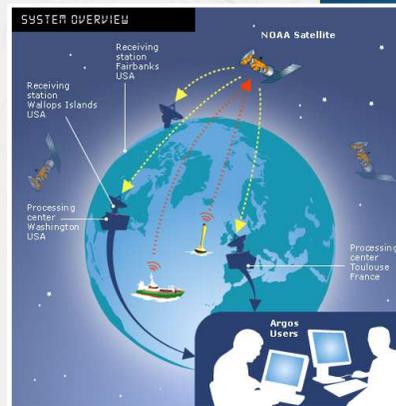


ARGOS
CONNECTED. PROTECTED.

> **Current System Status**

The current System

- ✓ **Currently 7 operational satellites**
- ✓ **LEO: 850 km, Polar**
- ✓ **GLOBAL coverage**
- ✓ **Satellite Pass Duration: up to ~10-12 min**
- ✓ **Frequency band: 401.650 MHz +/- 30 KHz**
- ✓ **Transmission power from 0.1 to 2W**
- ✓ **DOPPLER Positioning**



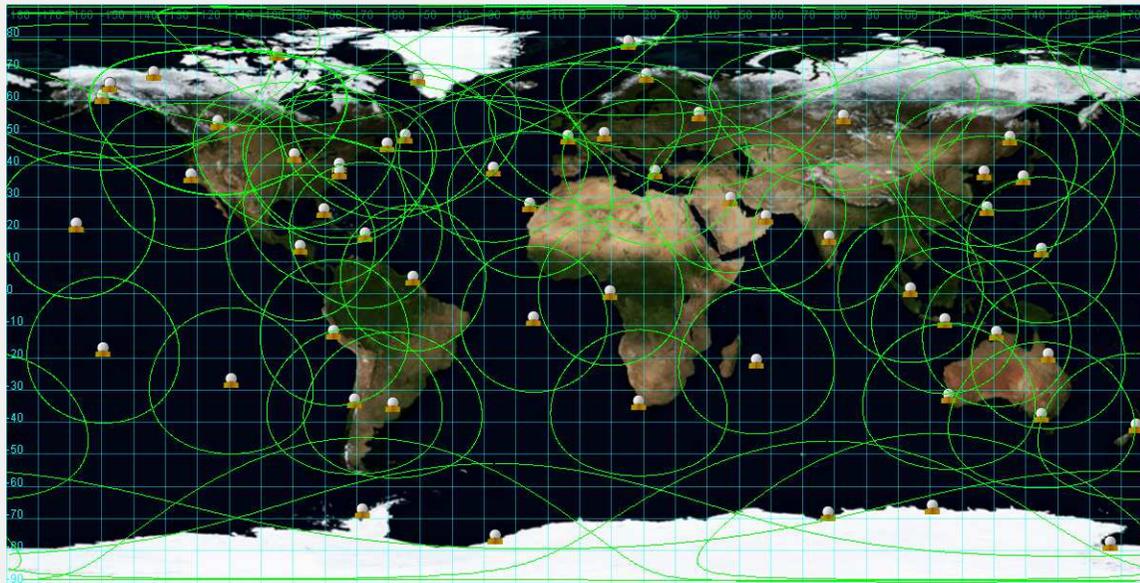
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The ARGOS Antenna Network

- ✓ A network of 7 **Global** stations and 65 **Regional** real-time stations
- ✓ Data collection in real time is possible for Argos platforms **within satellite and antennas visibility** at the same time



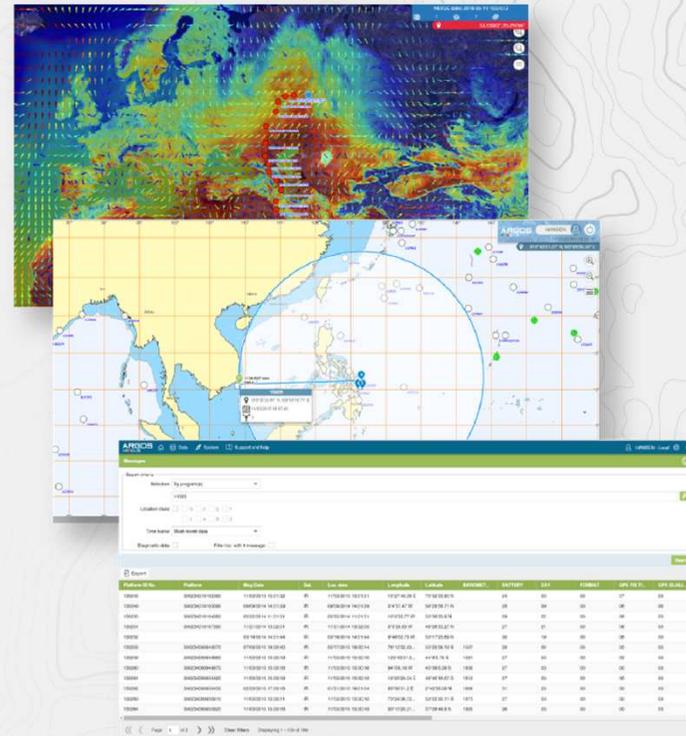
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Portfolio of ARGOS Services

Basic ARGOS Service :

- Data collection & positioning
- Data decoding & GTS encoding
- Customer Support
- Access to **ARGOSWEB**, a single secured web site to:
 - View all positions on a map
 - Download all available data
 - Export Google Earth files
 - Manage users settings



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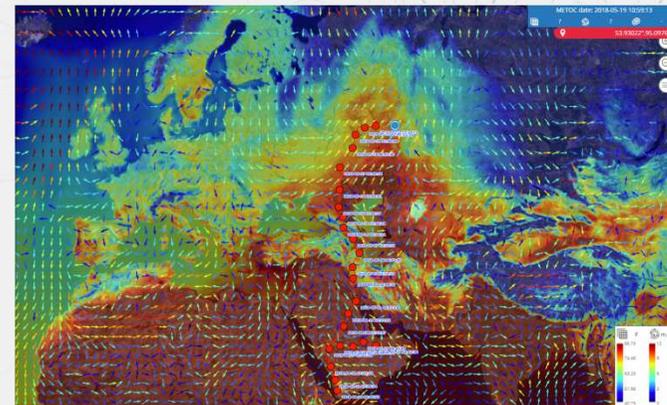
Portfolio of ARGOS Services

ARGOS Added-Value Services :

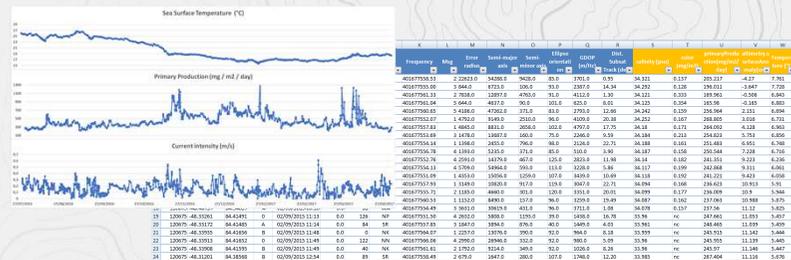
- Data distribution Services (email, FTP, etc.)
- Track & Loc
- Post processing Services (Kalman smoother, etc.)
- Monitoring Services

	Backup Tracking		Geofencing		Sensor Alert
	Transmission Monitoring		Underwater Beacon Monitoring		Moored Buoy Monitoring

Plot your ARGOS tracks with METOC Data :



Extract Data along an ARGOS track



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ARGOS
CONNECTED. PROTECTED.

> The Future of the system

ARGOS LEGACY : A SECURED FUTURE



COMPLETED in 2019: A new satellite with an Argos payload has been launched successfully and is operational (Feb, 2019) : METOP-C



December 2019: CNES is launching the Argos ANGELS project (Argos NEO Generic Economic Light Satellites) with the launch of the 1st Argos CubeSat in 2019



Mid. 2020 : New generation of satellite instrument Argos-4 will be launched in 2020 by ISRO on OceanSat-3



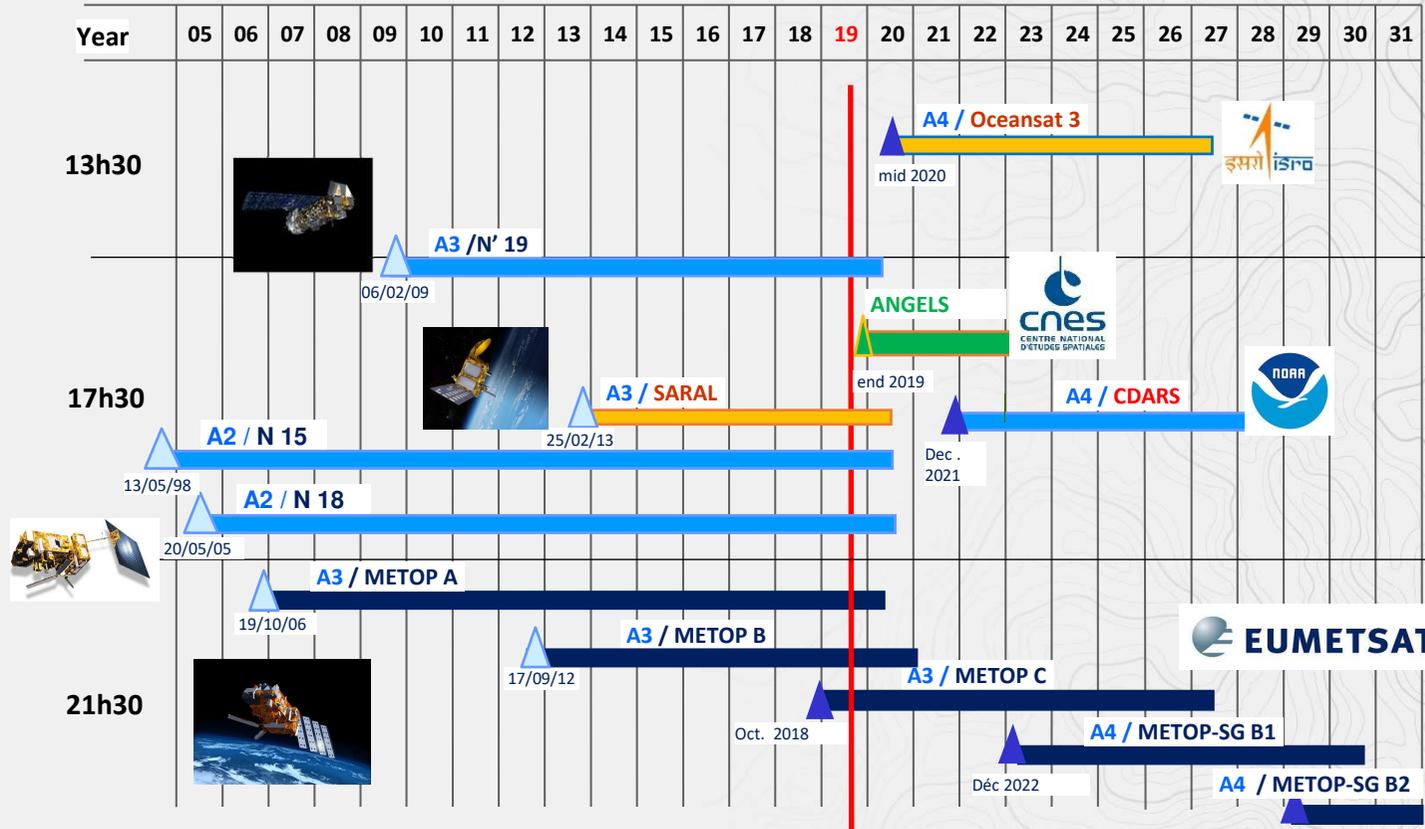
End 2021 : NOAA, will launch an Argos-4 instrument on CDARS



Now, until 2036 : EUMETSAT committed to Argos until 2036



ARGOS LEGACY : A SECURED FUTURE



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ARGOS 4 : SYSTEM IMPROVEMENTS

Improved performance for very low power transmitters

Objective: to decrease the transmitter output power : **down to 100 mWatt**

Improved high data rate performance (1200- 4800 bps)

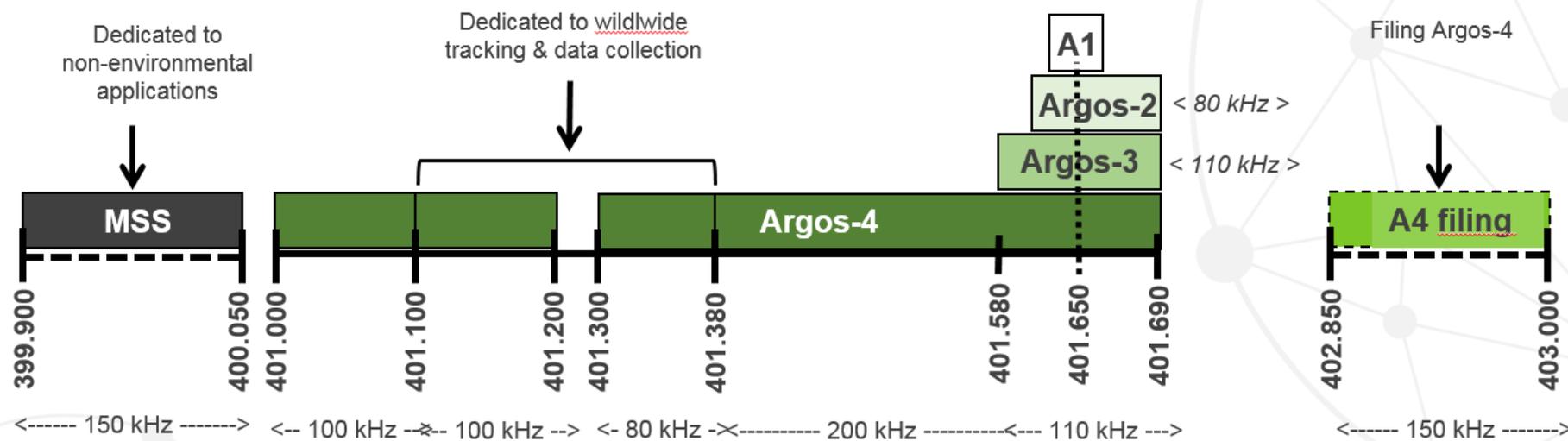
- ✓ **4 dB improvement**, automatic switch between medium and high data rates
- ✓ New downlink, compatible with international frequency regulation

Increased system capacity

- ✓ More than 50 000 beacons will be processed (20 000 today), better performance regarding detection
- ✓ 40 processing unit (instead of 12 with Argos-3)
- ✓ High increase of frequency bandwidth (600 kHz instead of 110 kHz on Argos-3)

ARGOS-4 FREQUENCY BANDS

Argos dedicated frequency bands



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> The **ARGOS** REVOLUTION **has started...**

A NEW ARGOS SYSTEM IS BORN



GIVES BIRTH TO A COMPANY DEDICATED TO THE NEXT ARGOS SYSTEM



With Kinéis, ARGOS becomes IoT Everywhere



25
NANOSATELLITES
INTEGRATED PROPULSION



25
GROUND STATIONS



3
STRATEGIC
PARTNERS



2021
PUT INTO ORBIT



2022
OPERATIONAL SYTEM

ARGOS 2022 : A system with multiplied capacities



TOTAL CONTINUITY OF SERVICE WITH THE ARGOS SYSTEM

- Total compatibility between Argos generations



INCREASING REVISIT TIME

- 10 to 15 minutes in average
- Less than 20 minutes everywhere



CAPACITY TO TRANSMIT MORE DATA

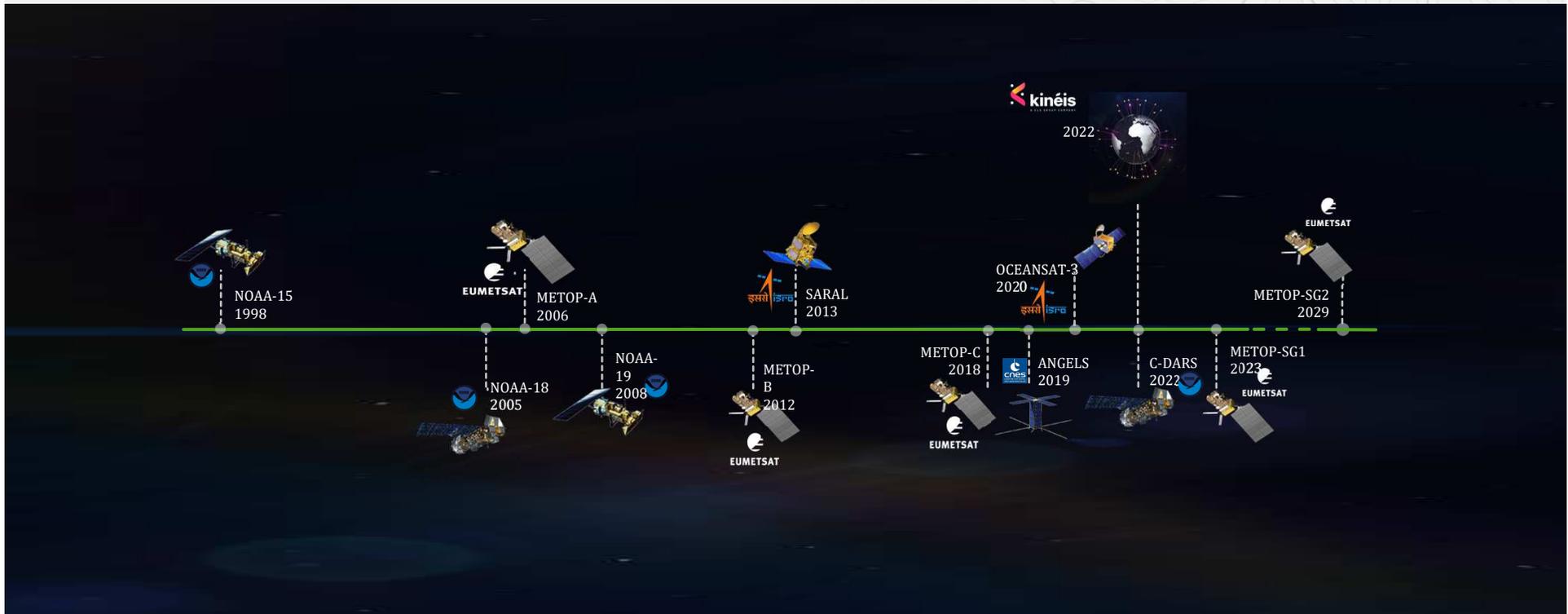
- More satellite passes
- More possibilities to send data in high data rate



TWO WAYS GUARANTEED

- A constellation fully equipped to communicate with transmitters

ARGOS 2022 : an Unparalleled private-institutionnal constellation



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New Kinéis/ARGOS Hardware available !

>> Small, cheap, and highly capable



R2 Chipset (= RF core):

- current price (R2) : 50€
- 2021 price (mass production of R3) < 10€

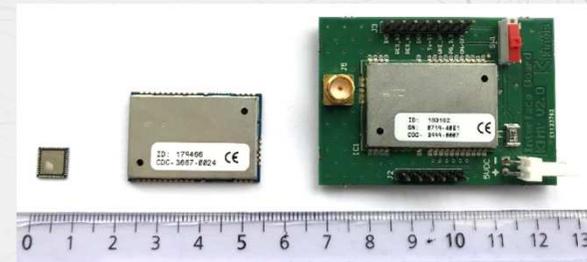


Modules (= modem with integrated chipset) :

- current price (KIM-1) : 50€
- 2021 price (mass production of KIM-3) < 15€



Interface dev. Boards : board for KIM modules with connectors (around 200€)



With the rise of Kinéis, ARGOS JTA pricing will decrease !

- Kinéis is an official subsidiary of CLS, CNES & private investors, created to reinforce the ARGOS system & ensure its continuity. Kinéis will launch 25 nanosatellites end of 2021
- CLS remains the exclusive provider of ARGOS services & VAS for scientific applications

JTA is a mechanism that annually sets the price of the ARGOS service for scientific users, based on a **cost recovery mechanism**.

If the cost of running the system is shared with other groups of users, **the price of the service for JTA users will decrease...and it will be the case** : Kinéis will also sell connectivity to new users (outside of JTA) : logistics, safety at sea, adventure, smart farming, etc., being a reference for space IOT applications.

**Therefore, with Kinéis, the price of the ARGOS service for scientific applications will go down!
We expect it to be divided by 2 in 2024.**

Hardware Update : a new Goniometer is soon ready



CLS RXG-134
GONIOMETER

Improvements on the RXG-134 :

- A3 & A4 VLD modulations compatibility
- A4 frequency band compatibility
- New close-range mode
- Extended embedded memory for messages & favorite platforms (64 vs 16)
- Better performances with increased antenna sensitivity
- Narrowband mode : focus on the relevant frequency
- Faster display

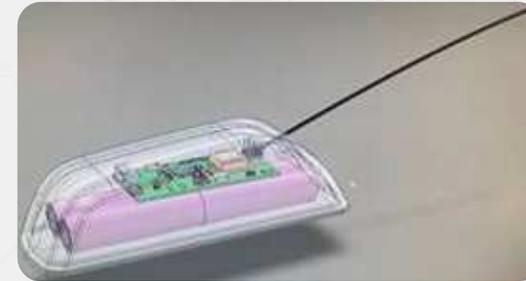
>> Expected availability : early 2020

ARGOS INTERGATION IN GLIDERS



Future external CLS ARGOS transmitter: a **generic** and **low-cost** tracker

- ✓ **Generic** (usable for different use cases)
- ✓ **Low-cost** (< 500€)
- ✓ **Waterproof** : 1200 m
- ✓ **Surface detection** (to save battery power)
- ✓ **GPS**
- ✓ **Small size**: ~13.5cm x 3.5cm
- ✓ **Easy and convenient to use** → configurable by **Bluetooth**
- ✓ a **rechargeable** and **non-rechargeable** version (by induction) → *future versions*
- ✓ **satellite passage forecasts** → *future versions*
- ✓ **Availability** : mid-2020 for first prototypes
- ✓ **Goniometer compatible**





 **iridium**[®]
Everywhere

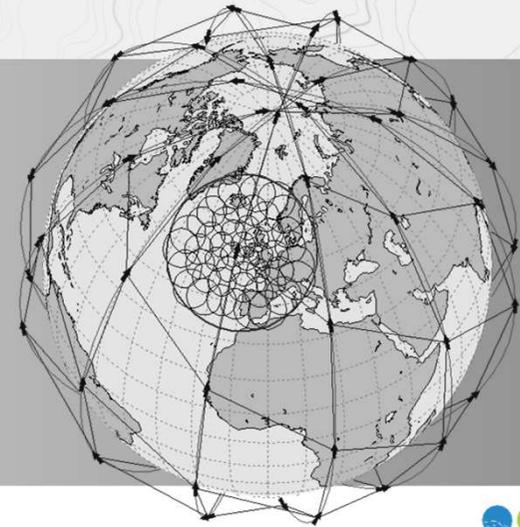
The current IRIDIUM System



Global mobile satellite communications system,
with **voice and data solutions**

66 satellites : world's largest commercial satellite constellation

- **6 polar orbital planes** with **11 satellites** per plane
- Low Earth Orbit (LEO) = **780 km altitude**
- Each satellite completely circles the earth once **every 100 minutes**
- Each satellite travels from horizon to horizon **in 10 minutes**
- The Iridium satellite system uses a frequency band **in L band** (1616 - 1626.5 MHz)



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EXAMPLE OF PLATFORMS USING IRIDIUM

OCEANOGRAPHIC



Drifting buoys



Moored buoys



Gliders



Profiling floats (ARGO)



AUV & USV

METEOROLOGICAL



Land Stations



Ice beacons



Weather balloons

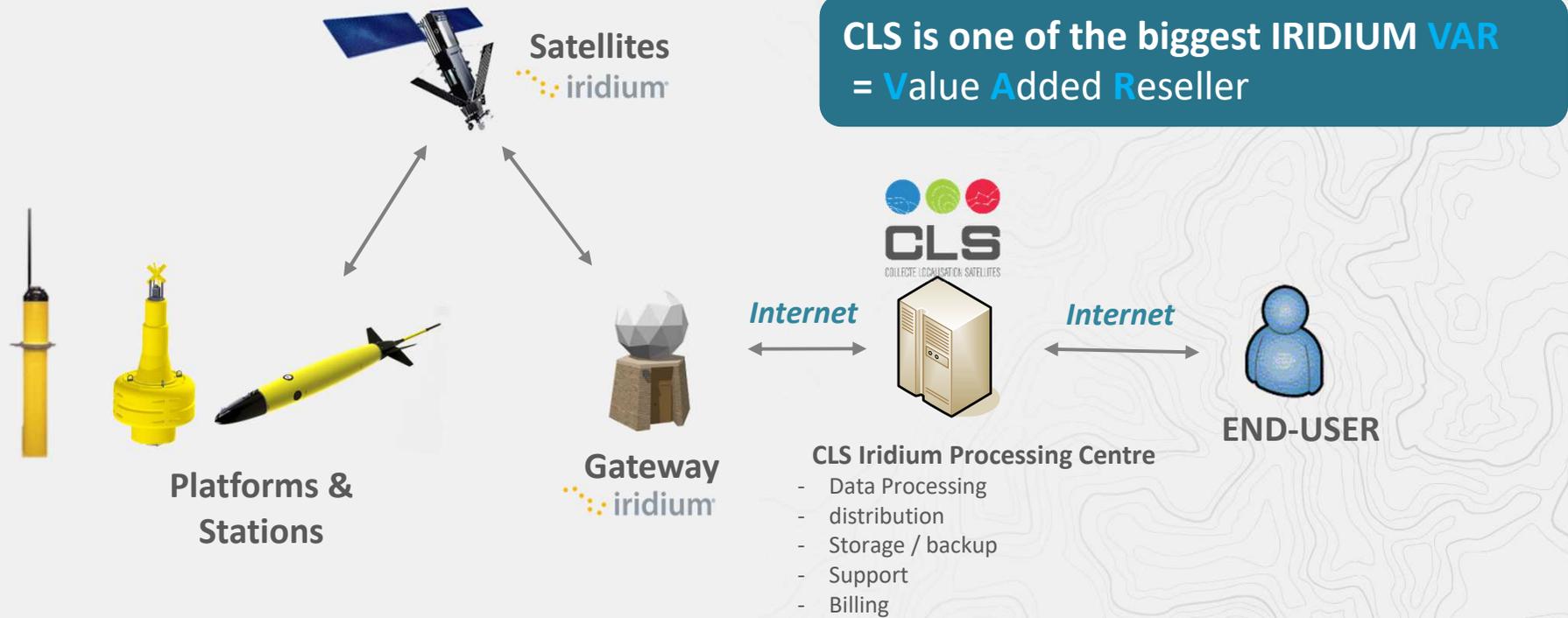


Moored stations

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IRIDIUM at CLS: SBD, RUDICS, CSD, Voice, Go, etc.



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IRIDIUM SBD Value-Added Services

- ✓ Compatible with all manufacturers & platforms
- ✓ Data processing
- ✓ Data distribution (email, FTP, etc)
- ✓ **GTS Processing & insertion**
- ✓ Data & positions display (web portal)
- ✓ Customized alerts (geofencing, sensor value) sent by email / SMS
- ✓ Automatic data archiving & back-up

The screenshot displays the ARGOS web portal interface. On the left, there is a search filter sidebar with options for 'Data to load', 'Load criteria', 'Last days Archiving', 'Load' (days/hours), 'Selection of platforms', '0 Selected platforms', '14 available datasets', and 'Filter loc with 1 message'. The main area features a world map with numerous green circular markers representing satellite locations. Below the map, there is a 'Messages' section with search criteria (Selector: By program), a location class (11325), and a time frame (Most recent data). At the bottom, an 'Export' table lists satellite data:

Platform ID No.	Platform	Msg Date	Sat	Loc. date	Longitude	Latitude	BARCODE
130048	300234010162380	11/03/2015 15:01:50	IR	11/03/2015 15:01:31	19°57'40.30 E	79°52'33.85 N	
130049	300234010163390	09/09/2014 14:01:20	IR	09/09/2014 14:01:20	0°457'47 W	58°28'56.71 N	
130050	300234010164380	05/22/2014 11:01:31	IR	05/22/2014 11:01:31	10°235.77 W	03°56'35.0 N	
130051	300234010167390	11/21/2014 13:02:01	IR	11/21/2014 13:02:00	0°5'28.65 W	48°38'53.27 N	
130052		03/19/2014 14:01:44	IR	03/19/2014 14:01:44	0°46'52.79 W	33°17'35.89 N	
130058	300234000348070	07/09/2015 19:00:40	IR	07/12/2015 18:00:14	78°12'30.85...	89°52'36.19 S	1507
130059	300234000349090	11/03/2015 15:00:19	IR	11/03/2015 15:00:18	125°40'21.3...	44°03'39.8 S	1501
130060	300234000348070	11/03/2015 15:00:16	IR	11/03/2015 15:00:16	84°05.18 W	48°59'30.30 S	1506
130061	300234000349040	11/03/2015 15:00:19	IR	11/03/2015 15:00:18	10°38'20.04 E	48°45'18.07 S	1612
130062	300234000349040	02/23/2015 17:00:18	IR	01/21/2015 18:01:04	83°58'31.2 E	8°42'56.08 N	1608
130063	300234000349010	11/03/2015 15:00:11	IR	11/03/2015 15:00:10	73°24'36.72...	53°22'30.11 S	1675
130064	300234000349020	11/03/2015 15:00:18	IR	11/03/2015 15:00:18	08°10'20.21...	37°28'49.6 S	1605

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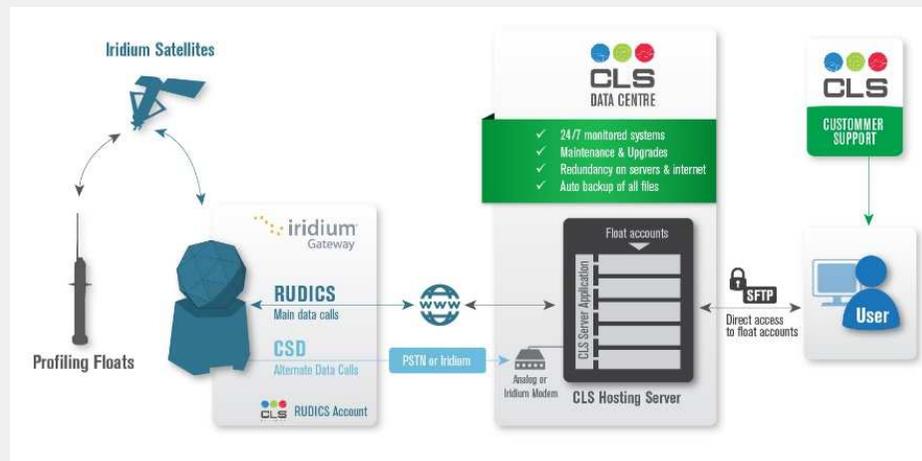


CLS Hosting service for ARGO floats



Allows all users to easily and securely manage their communication with their ARGO floats, via separate FTP accounts.

CLS hosting is based on servers that are operational and monitored 24/7.



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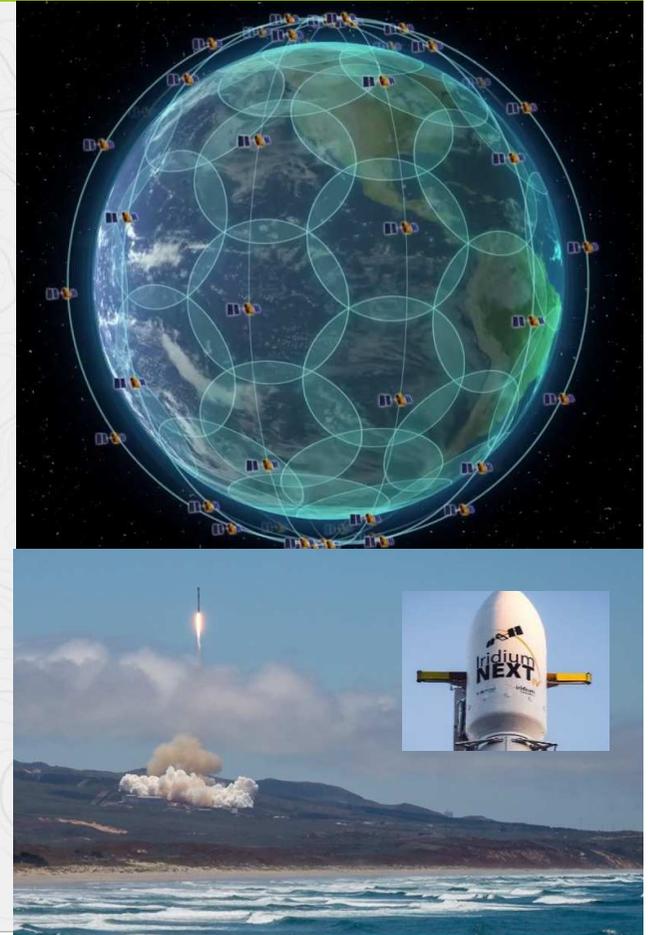
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Iridium NEXT : launches just completed !

- ▶ \$3 B Project for 81 satellites
 - 8 successful launches from Jan 2016 to Jan 2019
 - 66 new operational satellites + 9 in-orbit spares & 6 ground spares
- ▶ Same 66-satellite LEO architecture
 - ▶ 6 orbital planes, 11 sat./ orbit,
 - ▶ LEO : 780 km alt.
- ▶ New commercial Gateway scheduled for 2020
- ▶ New range of services: Iridium Certus



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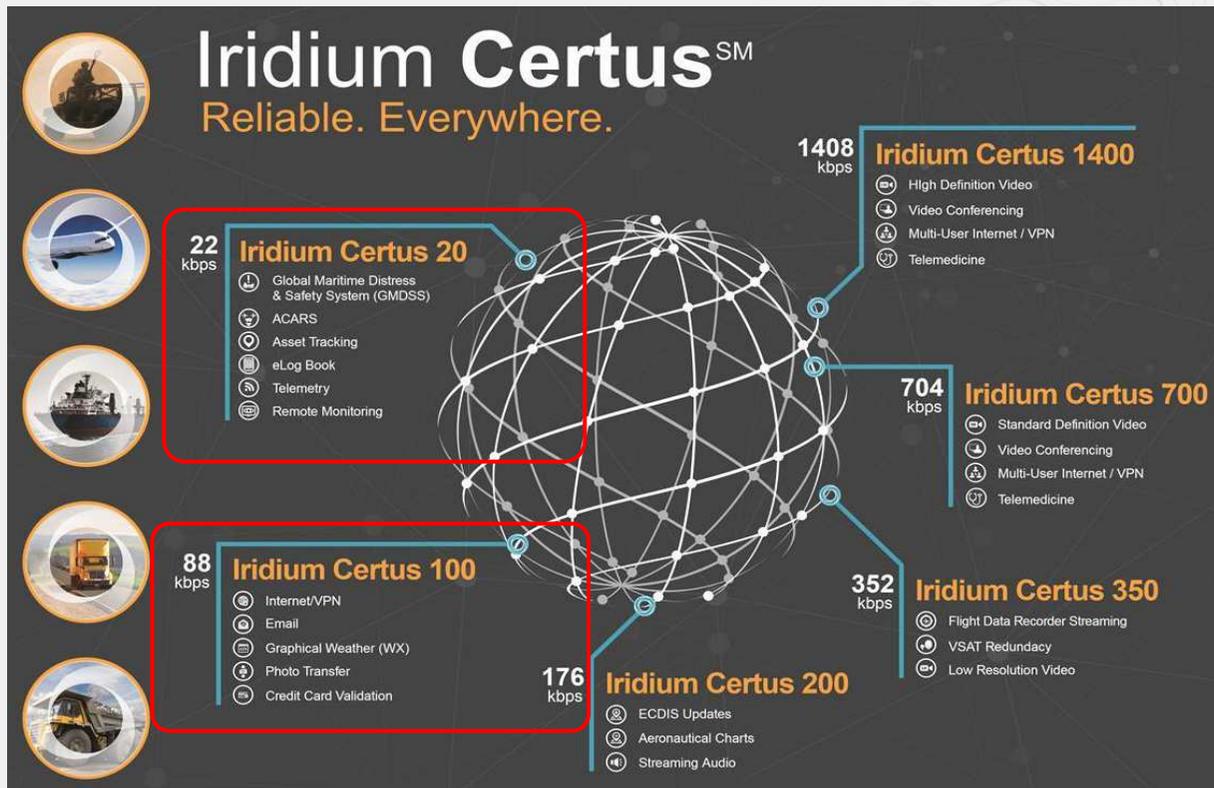
Iridium NEXT : New services

Range of new services : CERTUS

- based on new wave forms : x4 capacity, x10 throughput !
 - High Quality voice (4.8 kbps)
 - IP Streaming, **broadband IP Data (up to 1.4 Mbps)**
 - Backwards compatibility : SBD, Iridium Burst, PTT, CSD/RUDICS still possible
- ▶ Certus 350 commercial service available, Certus 700 **full availability in 2020.**



Iridium NEXT new services: Certus



2 Services relevant for most autonomous ocean platforms: Certus 20 and 100 (small modems, low power, small antenna)

Iridium Certus modems update

- ▶ SBD, RUDICS : **maintained on Iridium NEXT, no new module scheduled for now** (9602, 9603, 9523)
- ▶ **9810 modem**: ready, for Certus 350 & 700, available and integrated in Thales & Cobham terminals (big ones, for Maritime communications)
- ▶ **9770 modem**: **being finalized**, available S2 2020. **Data sheet already available (ask us)!**
 - Hybrid service : **22 kbps MO/88 kbps MT**
 - voice, streaming, SBD.
 - invoicing based on volume
 - Internal PA, passive antenna.
- ▶ Future roadmap:
 - **9730**: for Cetus 20 : **22 kbps MO/MT** integrated PA (like 9602), data only (IP and SBD)
 - Modem SFX 100 (??): **88 kbps MO/MT**, external PA, IP data, 2 voice lines, 56 kbps streaming, SBD



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ARGOS vs IRIDIUM

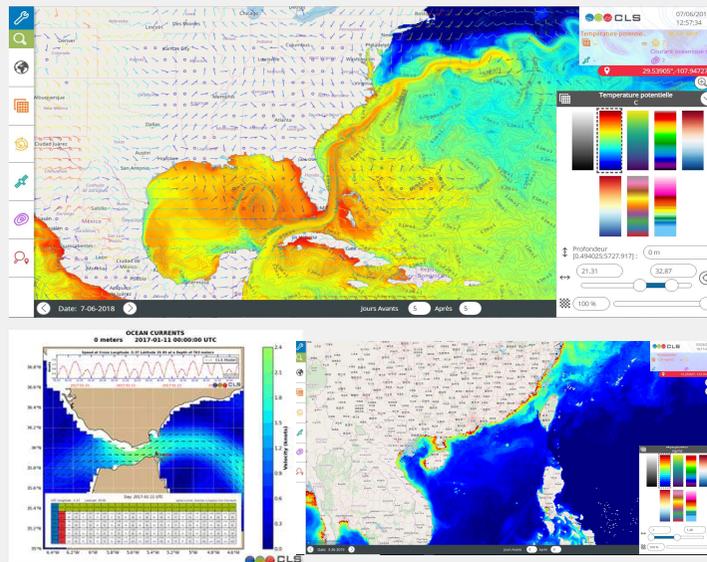
	IRIDIUM	ARGOS
Type of system	Commercial	International collaboration between space agencies - 2022 : mix public/private (Kinéis)
Ground infrastructure	3 antennas (Tempe, DoD, Russia)	65 antennas
Satellites	66 satellites	6 satellite today ; 2022 : > 30
Coverage	Global	Global
Delay	Real time	Currently : ~1h - 2022 : 10-15mn max
Pricing	Per volume If not in use : fees apply	Per day (unlimited use for fixed price) ; Price will decrease soon - If not in use : no charge
Bi-directionality	YES	Today : partially (A-3) - 2022 : YES
Volumes	SBD : 0,34 to 1,9 KB / message RUDICS : 2,4kbps	0,5 KB / message (ARGOS high data rate)
Power consumption	> 1W	Down to 0.1 W
Basic Service from CLS includes	Raw data, customer support	Raw data, customer support, data processing, webportal, data archiving, ARGOS positioning, data delivery, GTS, custom alerts, geofencing.

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Data services « One Stop Shop »



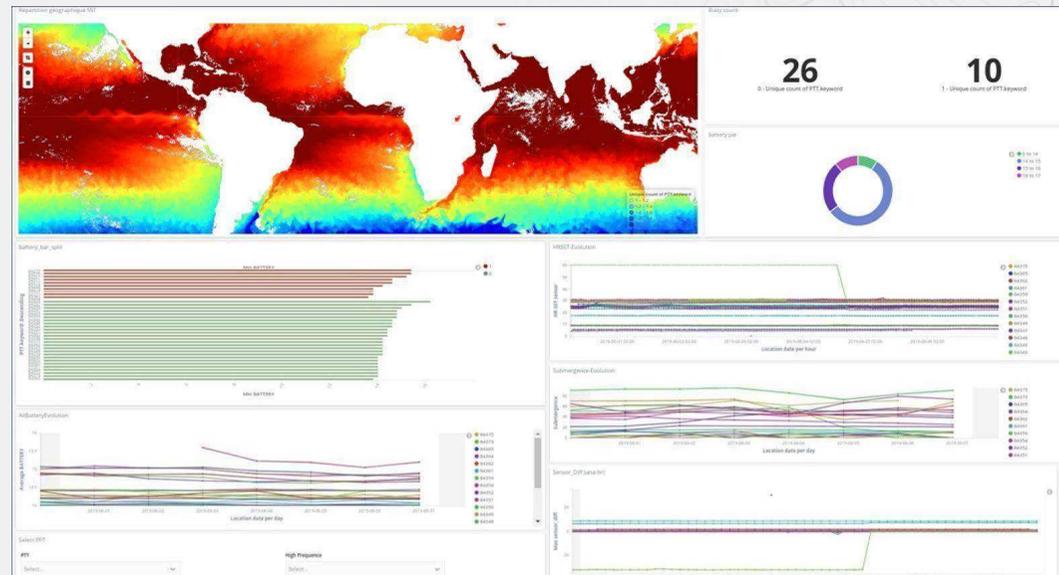
A lot of valuable data

- ✓ SST
 - ✓ Chorophyll
 - ✓ Phythoplanktön
 - ✓ Ocean current
 - ✓ Ocean salinity
 - ✓ Ice coverage
 - ✓ ...
- Various distribution media:
- ✓ Bulletin
 - ✓ Webservices
 - ✓ Viewer
 - ✓ Custom offer (hardware, data, software)

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CLS Value-added services - « Seechart » an integrated monitoring tool



Manage a fleet of all the platforms simultaneously

- ✓ Visualize the **location**
- ✓ Visualize the **metadata of the platform**
- ✓ Visualize **sensor data**
- ✓ Monitor the **vital parameters** (i.e battery status etc)
- ✓ **Satellite data** such as SST (maps and trends) can be included → track interesting features & check that the sensors are behaving properly

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Questions ?

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