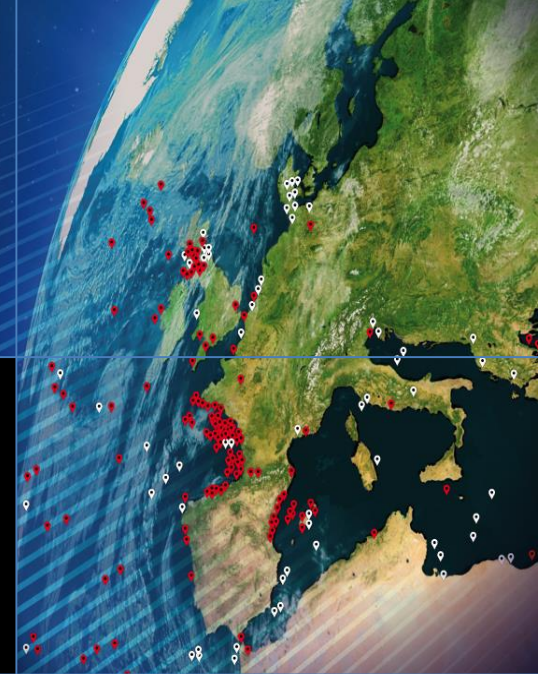


Satellite Telemetry Services for ARGO floats



Solène Routaboul

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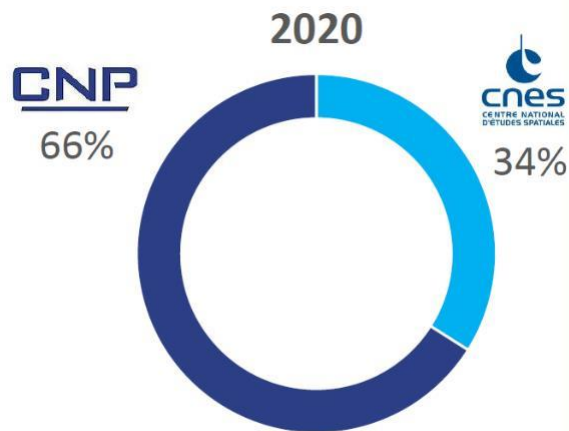
<http://www.cls-telemetry.com>



ARGOS
CONNECTED. PROTECTED.

 **iridium**[®]

COMPANY PROFILE



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

- ✓ **Unique operator of the Argos system**
- ✓ **Iridium services provider** dedicated to ocean platforms

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



24/7 OPERATIONALITY

Receiving, processing, monitoring, distributing and archiving data from satellites



CLS Systems are
MONITORED 24/7





ARGOS

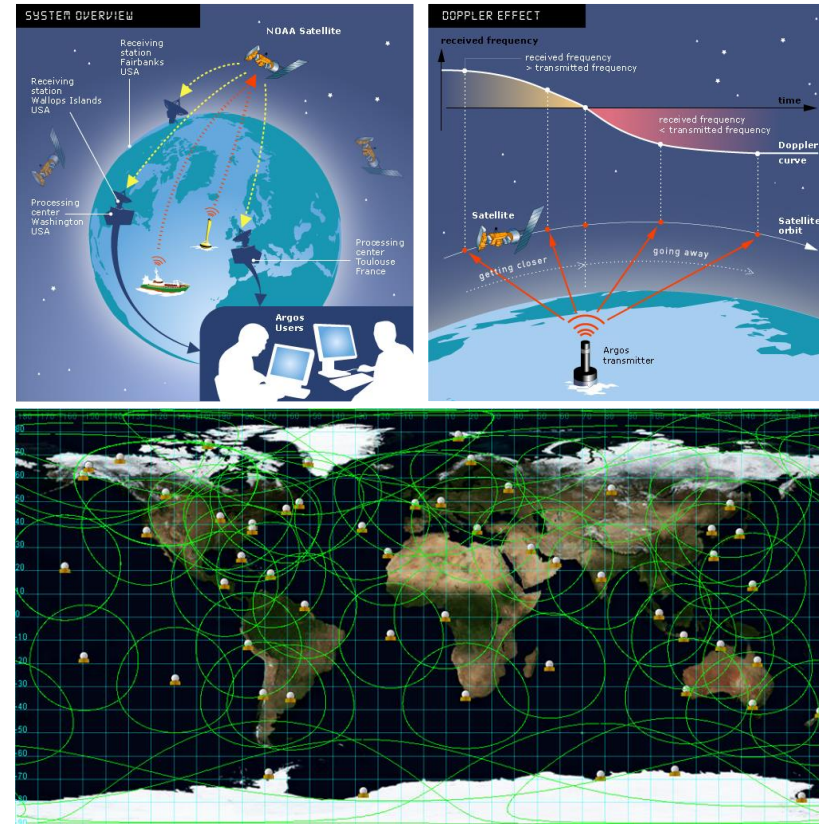
CONNECTED. PROTECTED.

“Argos is a global, non profit satellite-based data collection and positioning system, dedicated to studying and protecting the earth’s environment.”

Argos is operated by CLS, and governed through a partnership between NOAA, NASA, CNES, ISRO and EUMETSAT.

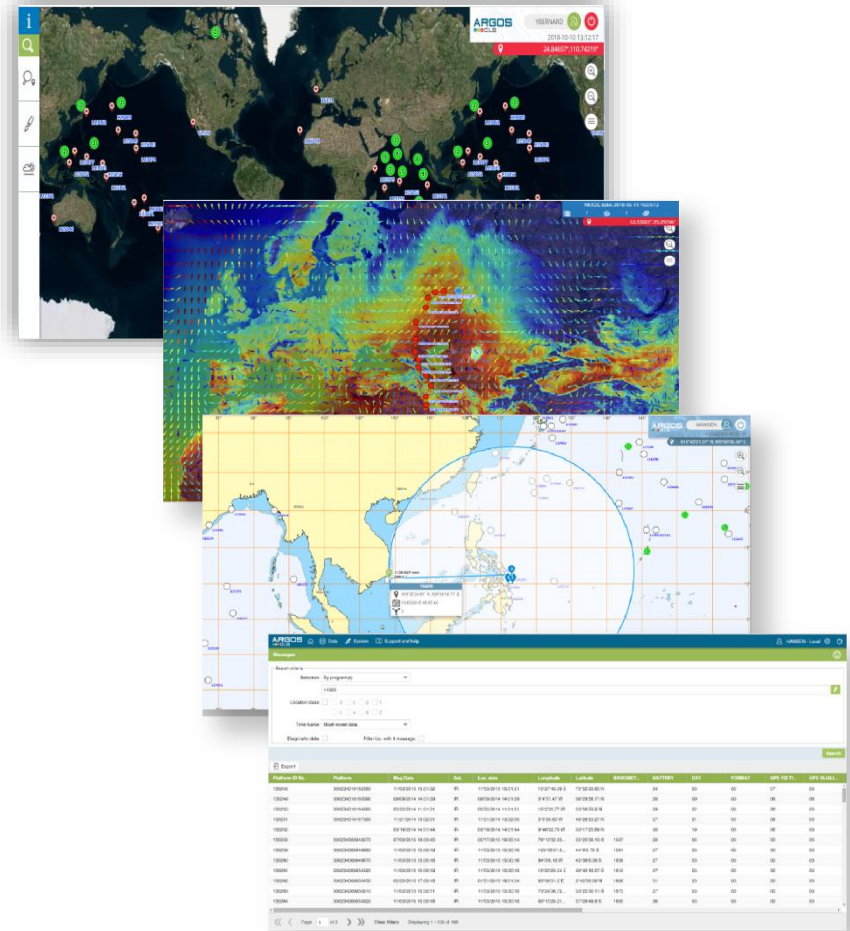
ARGOS, THE CURRENT SYSTEM

- ✓ **Currently 7 operational satellites :**
 - *From 3 Kbytes to 5 Kbytes of data can be transmitted through Argos every day
- ✓ **GLOBAL** coverage system:
 - *Global Coverage thanks to polar orbits (LEO)
 - *7 Global & 65 Regional real-time stations
- ✓ **Low transmission power :**
 - *<1W (long lifetime autonomy)
- ✓ Satellite Pass Duration: up to ~10-12 min
- ✓ **DOPPLER Positioning**
 - *GPS free positioning system
 - *Accuracy up to **250 m**
 - *For more accuracy GPS could be added



Portfolio of ARGOS Services

- 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



THE FUTURE OF ARGOS





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



Completed in Dec. 2019 : CNES launched the Argos ANGELS project (Argos NEO Generic Economic Light Satellites) with the launch of the 1st Argos CubeSat in 2019



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



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



Now, until 2036 : EUMETSAT committed to Argos until 2036



➤ Improved performance for very low power transmitters

- Objective : to decrease the transmitter output power : **down to 100 mWatt**
- Objective : after the “2 grams” beacon in 2015, the “1 gram” beacon in 2020 !

➤ Increased system capacity

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

➤ To introduce a new “non-environmental frequency band” in order to deploy many more new applications





> The ARGOS REVOLUTION has started...

With Kinéis, ARGOS becomes IoT Everywhere



25

NANOSATELLITES
INTEGRATED PROPULSION



25

GROUND STATIONS



3

STRATEGIC
PARTNERS



kinéis

A CLS GROUP COMPANY



2021

PUT INTO ORBIT



2022

OPERATIONAL SYTEM



ARGOS & IRIDIUM Satellite Communications
ARVOR-PROVOR technical Workshop 2020



ARGOS 2022: A system with multiplied capacities



TOTAL CONTINUITY OF SERVICE WITH THE ARGOS SYSTEM

-
Total compatibility between Argos generations



DECREASING 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

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€

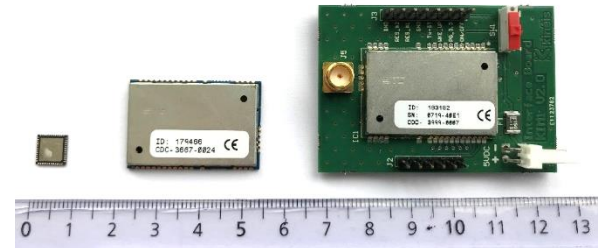


Modules (= modem with integrated chipset) :

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



Interface dev. Boards : board for KIM modules with connectors (less -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.

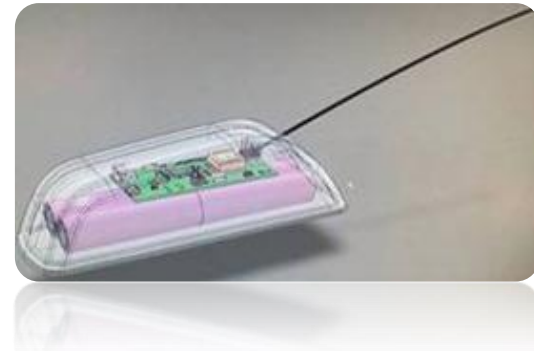
Therefore, with Kinéis, the price of the ARGOS service for scientific applications will go down!

We expect it to be divided by 2 in 2024.



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 + ARGOS positioning
- ✓ Small size: ~13.5cm x 3.5cm
- ✓ Easy and convenient to use → configurable by Bluetooth
- ✓ a rechargeable version (by induction) → *future versions*
- ✓ satellite passage forecasts → *future versions*
- ✓ Availability : mid-2020 for first prototypes
- ✓ Goniometer compatible





FOR BACKUP TRACKING



- ✓ Highly sensitive **direction finder** designed for field recovery
- ✓ Gives the direction to find an Argos platform
- ✓ Gives an indication of the signal power of the Argos transmitter
- ✓ Internal compass
- ✓ Decodes GPS positions transmitted by the platform (if any)
- ✓ More than 100km reception in good conditions
- ✓ Waterproof and portable (one operator)
- ✓ Autonomy > 50h

CLS **RXG-134** GONIOMETER

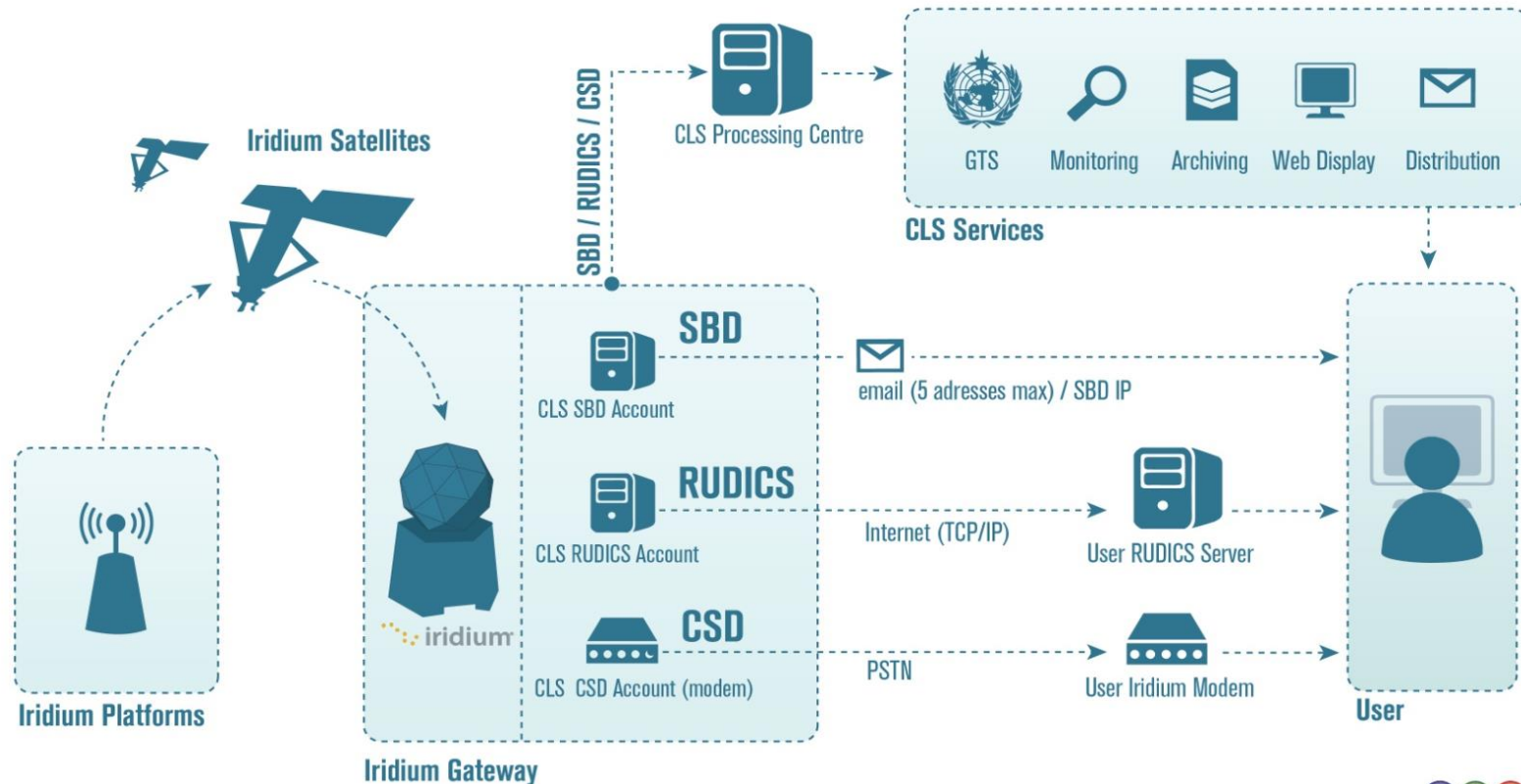


THE IRIDIUM SYSTEM



THE IRIIDIUM SERVICES FOR OCEAN PLATFORMS

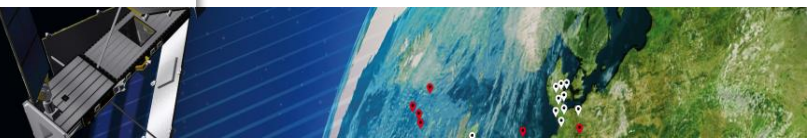
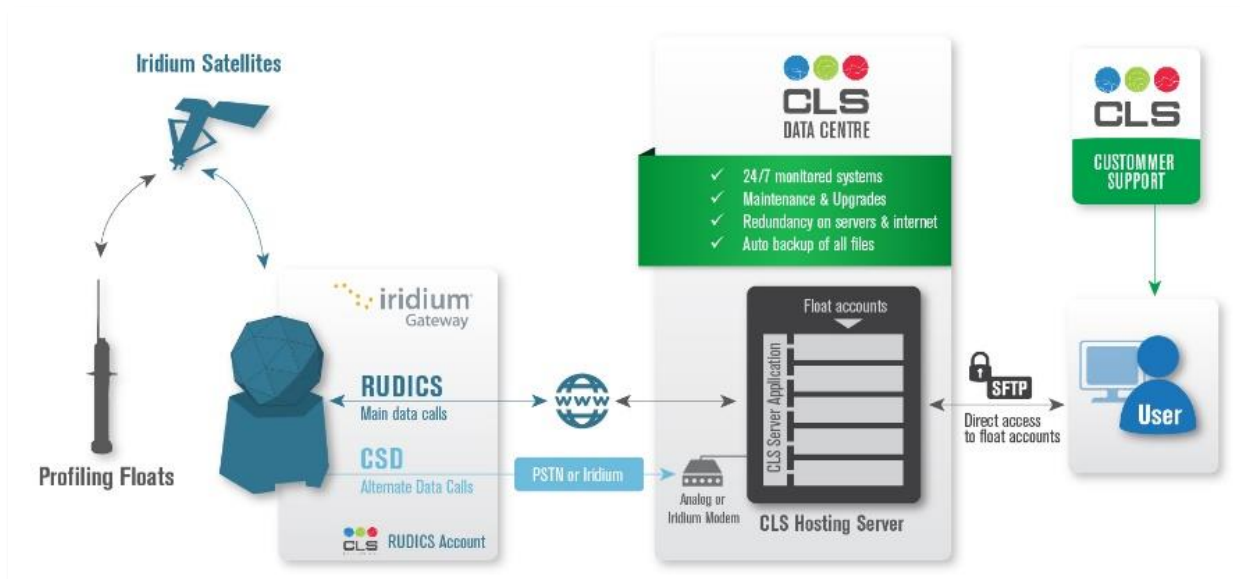
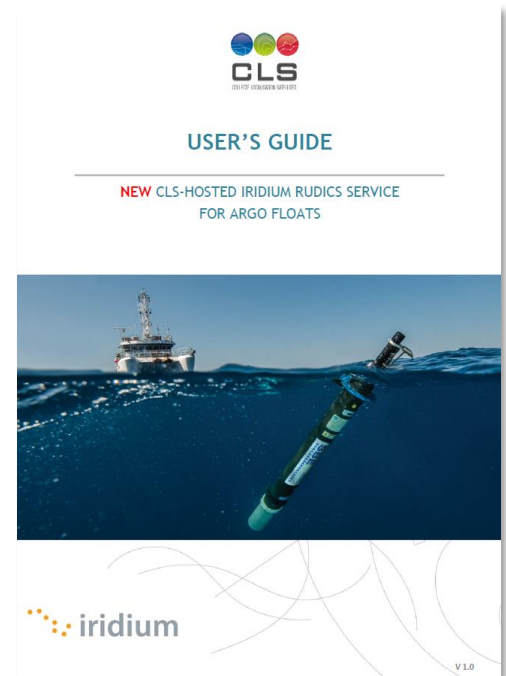
Out of the 7 Iridium data communication solutions, **only 3** are relevant to ocean platforms : **SBD, RUDICS and CSD**



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.



Online real-time data consumption : for all services (SBD, RUDIC, CSD, etc.)

MYDATA
CLS APPLICATIONS CLS Group worldwide tracking and environmental monitoring by satellite

Time Zone : GMT+1.0

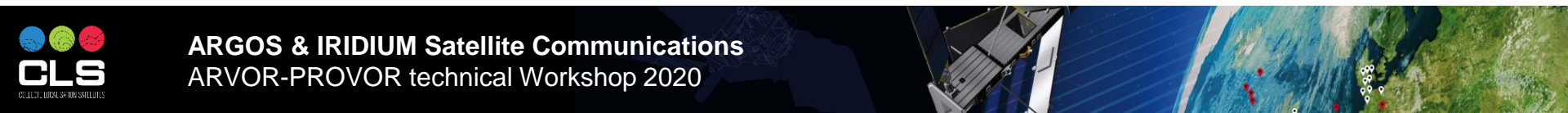
Reports - Detailed calls

Time Frame: Since (days / hours) 182 / 0

Report type: Detailed

Call date	tid	Bytes	Seconds	Service	Type	Supplementary ...	ICCID Number	IMEI	Called number
2016/07/21 15:37:02	8988169234001...	60	60	CSD RUDICS	DATA		8988169234001...	901032340128955	0033603757350
2016/07/21 15:35:03	8988169234001...	60	60	CSD RUDICS	DATA		8988169234001...	901032340128952	0033603757350
2016/11/08 11:28:21	8988169234001...	20	20	CSD RUDICS	DATA		8988169234001...	901032340128952	0033681357829
2016/11/08 11:25:19	8988169234001...	60	60	CSD RUDICS	DATA		8988169234001...	901032340128952	0033695174965
2016/08/01 17:22:02	8988169234001...	1680	1680	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 15:28:11	8988169234001...	760	760	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 14:13:03	8988169234001...	3500	3500	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 17:53:48	8988169234001...	320	320	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 14:12:16	8988169234001...	20	20	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 14:10:09	8988169234001...	80	80	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 10:48:19	8988169234001...	360	360	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 10:46:35	8988169234001...	100	100	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 07:47:01	8988169234001...	840	840	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 16:59:28	8988169234001...	1300	1300	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 16:31:02	8988169234001...	600	600	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 16:41:25	8988169234001...	20	20	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 16:08:06	8988169234001...	1380	1380	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/07/21 16:14:35	8988169234001...	860	860	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 16:51:18	8988169234001...	480	480	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 12:51:34	8988169234001...	100	100	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 16:43:44	8988169234001...	120	120	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 16:41:54	8988169234001...	40	40	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 16:46:58	8988169234001...	80	80	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 12:38:47	8988169234001...	140	140	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 13:22:02	8988169234001...	260	260	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 11:23:16	8988169234001...	160	160	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 13:19:01	8988169234001...	160	160	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/01 15:41:17	8988169234001...	1340	1340	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 11:17:54	8988169234001...	220	220	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 11:15:45	8988169234001...	120	120	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 11:04:43	8988169234001...	520	520	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 07:46:32	8988169234001...	20	20	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 13:08:26	8988169234001...	500	500	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959
2016/08/02 13:47:35	8988169234001...	180	180	CSD RUDICS	DATA		8988169234001...	901032340128952	00881622402959

Displaying items 1 - 100 of 122

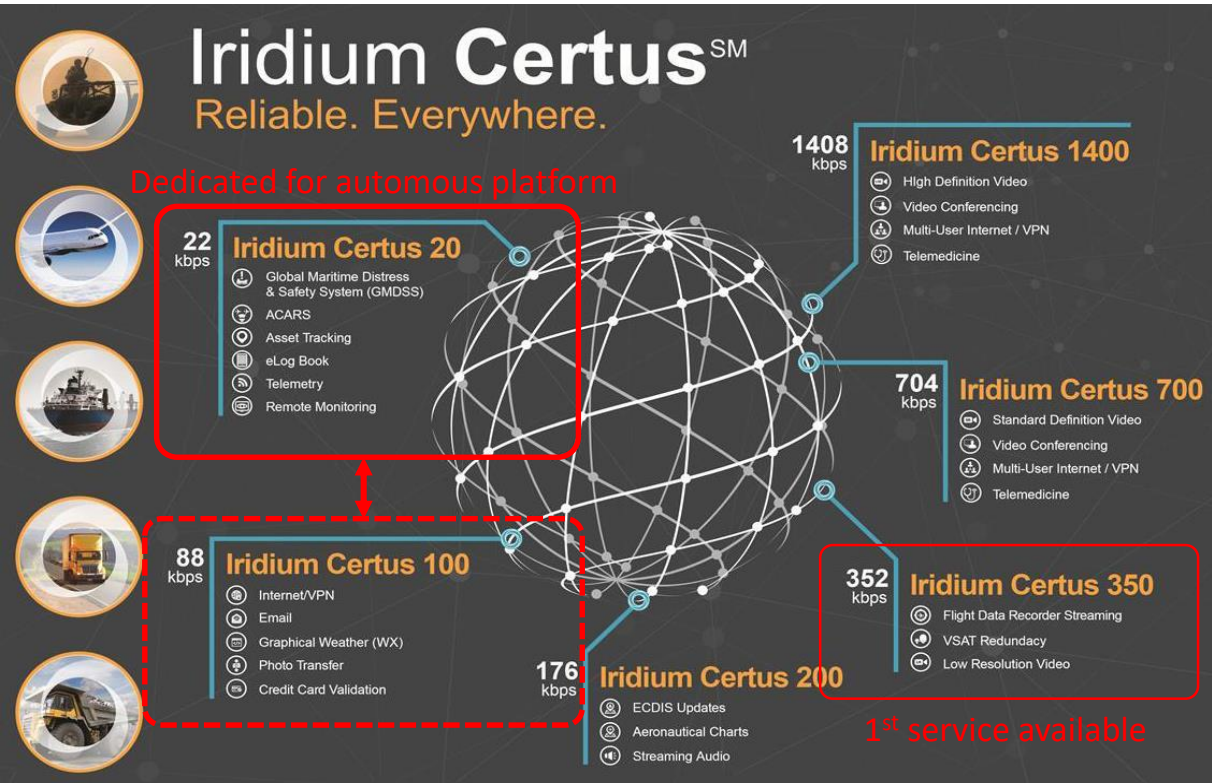




The PROJECT

- ✓ \$3 B Project for 81 satellites:
 - ✓ 66 new operational satellites
 - ✓ 9 in-orbit spares,
 - ✓ 6 ground spares
- ✓ The new constellation completely replaces the current constellation
- ✓ More bandwidth and higher speeds (new CERTUS service) up to 1.4 Mbps (vs. 134 bps) = **throughput increase of x 10**
- ✓ **Service and hardware** continuity & backwards compatibility
- ✓ The service is totally ready but not yet the hardware





- ✓ Full compatibility with existing services and terminals : SBD, CSD/RUDICS, Pilot and Voice improved (HD quality).
- ✓ **Certus 20 & Certus 100** : Service available but need to wait for first modems → 9770 modem
- ✓ 9770 modem :
 - Data speed : IP data 22 kbps MO/88 kbps MT
 - Modem with **SIM card**, basic subscription for data (**by volume**) and options for voice/SBD/streaming
 - Price : noting announced officially → \$1-\$20/MB (invoicing based on volume)
 - Modem with integrated PA, passive antenna (several designs: strand or patch, internal or external)
 - **Dimensions**: 6 x 14 x 2 cm
- **ongoing development (mech. & elect. Design)**
- Available mid-2020

Iridium Certus terminals (land)

Small form factor
Phase array antennas (no moving part)

1st service available

	Iridium Certus 100	Iridium Certus 200	Iridium Certus 350	Iridium Certus 700	Iridium Certus 1400
Above-Deck Equipment (ADE) Height & Diameter	~ 150mm	~ 50mm	~ 150mm	~ 180mm	~ 270mm
Form Factor	Electronically switched and phase steered, horizon to horizon - no moving parts				
Below-Deck Equipment (BDE) Form Factor	Standalone	Standalone	Standalone or Rack Mount	Standalone or Rack Mount	Rack Mount
Telephony Number of Voice Lines <i>Determined by partner implementation</i>	x 2	x 3	x 3	x 3	x 3
IP Data, Background <i>All best-effort, maximum speeds</i>					
Vessel Receive	88 kbps	176 kbps	352 kbps*	704 kbps	1408 kbps
Vessel Transmit	88 kbps	176 kbps	352 kbps*	352 kbps	528 kbps
IP Data, Streaming Upload / Download Rate	56 kbps	128 kbps	256 kbps	256 kbps	256 kbps
Target Markets	<ul style="list-style-type: none"> Commercial Fishing Sport Fishing Leisure Motor & Sail GMDSS** 	<ul style="list-style-type: none"> Commercial Fishing Tugs, Tows & River Craft Leisure Motor & Sail Sport Fishing GMDSS** 	<ul style="list-style-type: none"> Merchant Shipping Commercial Fishing 	<ul style="list-style-type: none"> Merchant Shipping Commercial Fishing 	<ul style="list-style-type: none"> Offshore Platforms Scientific Research

Throughput > FBB, non-symmetrical
MO/MT

date

9 CLS

*134 kbps on Iridium legacy satellites

**Pending IMO recognition



Questions?



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