

Maritime version of ESA/CNES mobile Ariane station

P. ROCHETTE¹, C. HABIERRE², H. CAZANAVE²

1: CNES Toulouse 2 : IN-SNEC Aquitaine

Abstract : A mobile station was already available for Ariane 5 telemetry reception. For future missions requiring reception from ocean, such as ATV launch, it was decided to modify this mobile station in order to install it aboard a ship. This paper describes the implementation and the qualification of this maritime configuration.

Keywords : telemetry station, launcher, maritime.

Full Paper

1. Ariane 5 telemetry station functions

Each Ariane 5 Telemetry Station performs following functions :

- Acquire and receive in S band (2200 MHz-2300 MHz) Ariane 5 launcher telemetry,
- Record TM data on magnetic media,
- Transfer in real time "quick-look" extracted telemetry (CVI) to Kourou (French Guyana) for immediate visualization,
- Transfer off-line telemetry (CVD) to Toulouse for storage and extended treatment.

2. New Ariane missions

For some future Ariane missions, as for example ATV launch, it is required to position a station in North Atlantic Ocean.

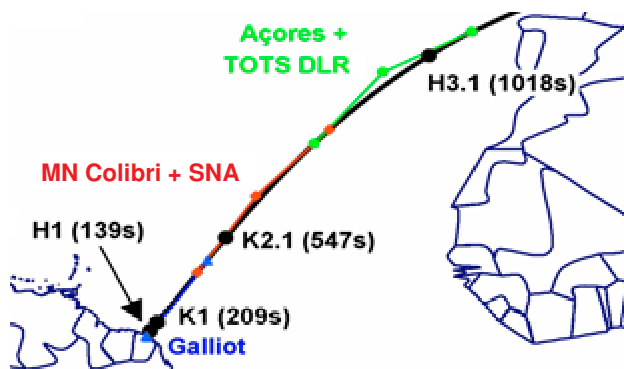


Fig 1- ATV Launch trajectory

This was the starting point for developing this maritime version of ESA/CNES mobile Ariane station.

3. Station Description

Ariane 5 Telemetry Mobile Station in "maritime" version, includes 3 main components listed hereafter :

- A 30 feet technical shelter, lying on a 40 feet "flat" mounting device,
- A "Stella 35" antenna with 4m reflector installed on a stabilized platform, being itself fixed on a 20 feet "flat" mounting device,
- a new power supply shelter of 20 feet, with 2 Inmarsat B maritime terminals implemented on its top.

4. Required modifications for maritime version

From terrestrial use previous design, some modifications were required to guarantee correct working aboard a ship. This task has been assigned to IN-SNEC Aquitaine.

- The antenna has been installed on a stabilized platform compensating for ship attitude variations in roll, pitch and heading, and thus allowing to use antenna as it were on ground.

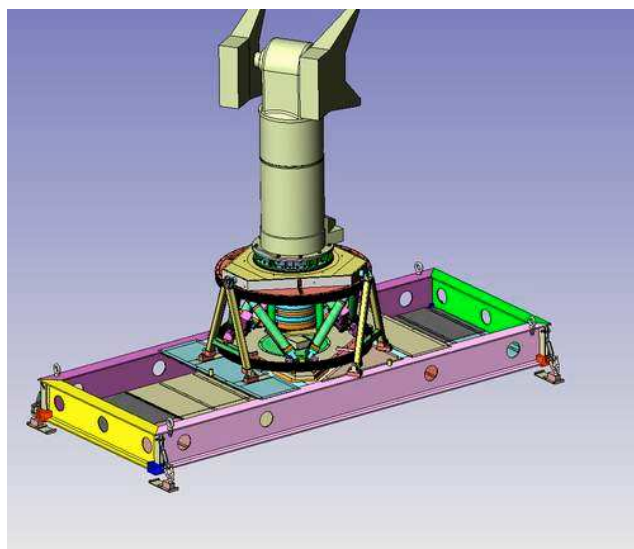


Figure 2- Antenna on platform

- All elements have been protected to withstand maritime severe conditions. Bonnets around interface panels, and an airlock for access to the technical shelter have been implemented.

- Inmarsat B terminals needed for direct links with Kourou and Toulouse have been changed from terrestrial model to maritime model.
- designation process has been improved by taking into account real GPS data of mobile station.

5. Stabilized platform design

This device is based on "hexapod" concept. This concept, including 6 jacks, has previously been used for antenna application, but in the present case it is designed for a limited motion around zenith. Servocontrol loop is performed using attitude informations from an Inertial Measurements Unit, resulting in horizontality maintain, and North heading (via an azimuth axis on top).

For improved security and reliability, a second IMU can take over the nominal one in case of failure.



Fig 3- Hexapod view

Ship attitudes specifications

The platform has been specified considering the following ship attitudes in roll and pitch.

Axis	Nominal Conditions	Degraded Conditions
Roll	7,4°	11,8°
Pitch	2,7°	4,3°

Nota : short term heading variations amplitudes are lower than 2°.

6. Factory Testing

The stabilized platform has been tested in factory on a "sea simulator".

This simulator balances (periodic movements) the object under test and can reach either in roll or pitch 18° inclination angles. This is also the case for azimuth (heading) axis.

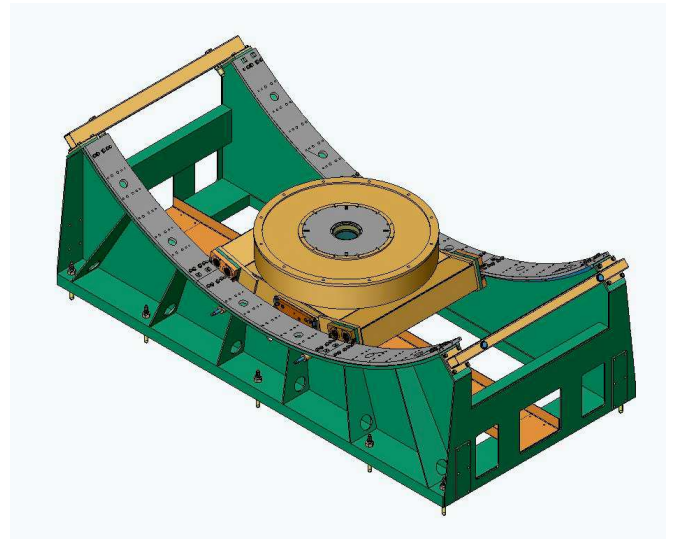


Figure 4- Sea Simulator

Tests on "sea simulator" have been performed in 2 configurations :

- with the platform alone,
- with the platform loaded by the antenna.

Only nominal conditions have been tested with the simulator, due to mechanical sollicitation limitations.

Tests were continued on ground in the final configuration, using sinusoidal pitch and roll commands in order to reach specified degraded conditions.



Fig 5- Factory final tests

7. At sea qualification tests

Following factory validation, this station has been installed in March 2005 on board MN TOUCAN ship operated by Arianespace for overall testing under real sea conditions. These tests took place during a 6 days loop travel beginning at Le Havre harbour.



Figure 6- Station installation aboard MN TOUCAN

During this trip following tests were realized :

- Ship Interface verification (mainly power supply)
- Stabilization tests under 12° roll
- North heading check
- Sun tracking
- SPOT satellite tracking in automatic or designate mode to qualify acquisition function.
- Classical telemetry tests in interface with CSG using Inmarsat telecommunications.
- Test of ship positioning procedure including heading constraint (to insure maximum visibility) at a given H0.

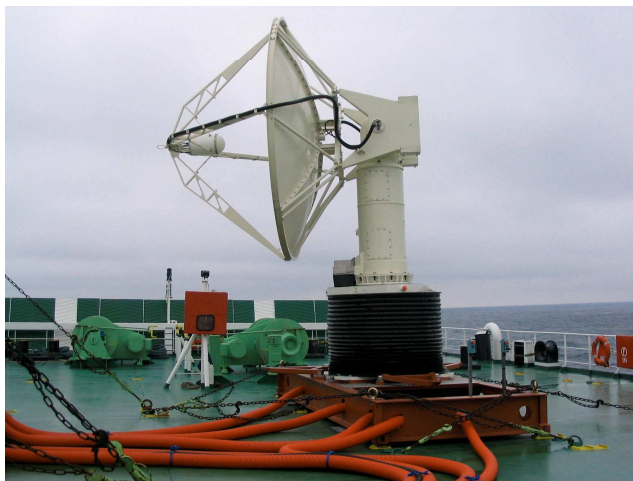


Figure 7- Satellite acquisition aboard MN TOUCAN

Main results are :

- Reception and tracking is operational from 2° elevation above horizon.
- Stabilization accuracy is 0,1° in horizontality and 0,2° in North heading in 12° roll conditions.

- With 2 Inmarsat terminals, this modified station can perfectly takes its part in the Ariane telemetry station network.
- For a given position at H0, the ship can achieve a good heading stability with a speed of 6 knots. Positionning accuracy is better than 1 nautical mile.

8. Operational use for next Ariane launch

This maritime station shall be used for the first time in operational conditions during next Ariane ECA launch scheduled in June, to improve data reception between Natal and Ascension permanent stations. Foreseen position is around 5°N, 24°W requiring about 9 days of navigation from Le Havre.

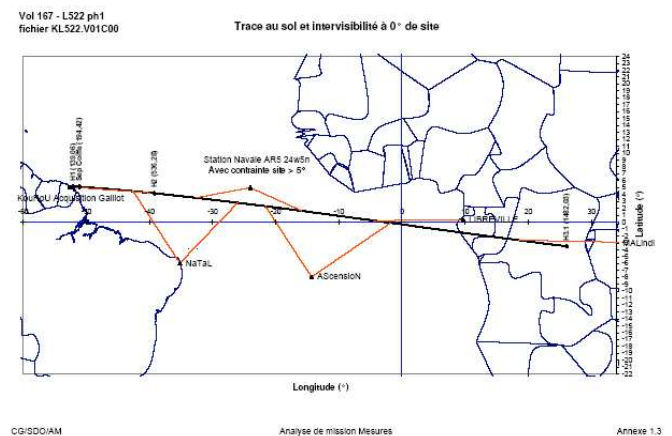


Figure 8- Position of SNA for L522

9. Conclusion

This maritime version of the Ariane mobile station has been qualified for Ariane tracking from a ship and can now be used when required for specific launch missions. First operational use is scheduled for end of June.

10. Acknowledgment

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11. Glossary

ATV- Automated Transfer Vehicule

DLA- Direction des lanceurs

ECA- Etage supérieur Cryogénique Ariane

ESA- European Space Agency

CNES- Centre National d'Etudes Spatiales

CSG- Centre Spatial Guyanais

CVI- Contrôle Visuel Immédiat

CVD-Contrôle Visuel Différé

IMU- Inertial Measurements Unit

SNA- Station Navalisée Ariane

TM-Telemetry