



# IDS ACTIVITIES AND PUBLICATIONS

## SINCE PARIS 2013 WORKSHOP

Jérôme SAUNIER, IGN  
IDS Network Representative

# FEW REMINDERS

## ■ DORIS NETWORK SPECIFICITIES

- A global network managed by a unique entity: exclusively maintained by CNES/IGN
- Centralized control of the network deployment
- Homogeneous distribution
- 70% of the DORIS stations co-located with at least one other IERS technique

## ■ ORGANIZATION

- CNES in charge of on-board segment and responsible for ground segment instruments: development, monitoring, maintenance
- IGN in charge of the network deployment and evolution, maintenance and surveys
- CNES/IGN Working Groups: Network Evolution, System Performance...
- IDS supports geodetic and geophysical research activities through DORIS data and products
- IDS works in close collaboration with CNES and IGN to improve the contribution to ITRF

# IDS ACTIVITIES SINCE MAY 2013

## ■ ITRF2013 CONTRIBUTION

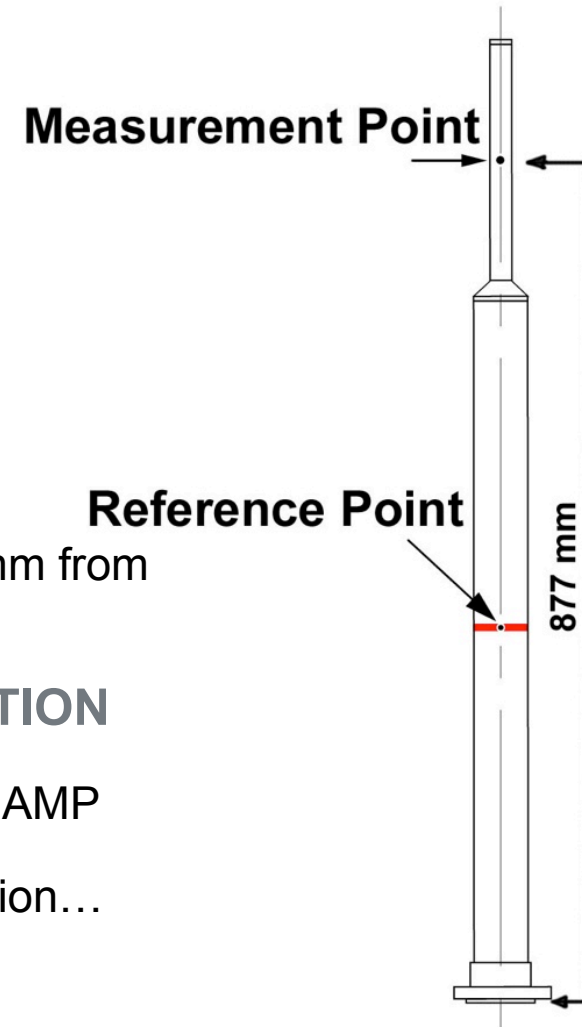
- 6 Analysis Centers contributors
- 21 years of data collected, 12 DORIS missions
- Better precision and continuity

## ■ REQUEST FOR DESIGNING A NEW GROUND ANTENNA MODEL

- IDS letter to CNES on August 5<sup>th</sup>, 2013
- CNES reply on November 20<sup>th</sup>: not foreseen in the 4G beacon specification, but improvements can be made to the current antenna:
  - Work with the manufacturer: improving the manufacturing process
  - Work with IGN: thinking on devices facilitating the survey
  - Work at CNES: consolidating the phase corrections to be applied
- CNES-IGN working group: dedicated meeting on December, 2013

# THE GROUND ANTENNA

- STAREC MODEL: HELICAL ANTENNA TYPE
- THE ENTIRE NETWORK USES THIS ANTENNA
- ANTENNA REFERENCE POINT (ARP):
  - Intersection of the antenna axis and the red ring
- ACTUAL MEASUREMENT POINT (AMP):
  - 2GHz phase center: located on the antenna axis, 877 mm from the antenna base
- THE AMP POSITION IS DEFINED W.R.T. ARP POSITION
  - In theory: Up Eccentricity of 487 mm between ARP and AMP
  - Possible manufacturing defect: misalignment, imperfection...
  - Possible installing defect: verticality



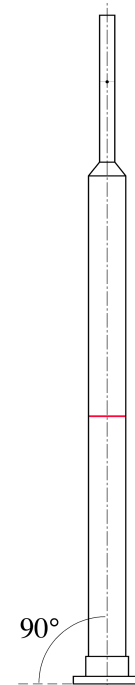
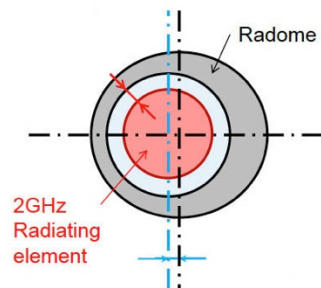
# ERROR SOURCES

## ■ MANUFACTURING

1. Variability of the 2GHz phase center position w.r.t. antenna flange => vertical error
2. Centering of the 2GHz phase center w.r.t. radome => horizontal error
3. Alignment ARP/AMP w.r.t. antenna axis => horizontal error
4. Perpendicularity of the antenna flange w.r.t. antenna axis => cured by installation

## ■ SURVEY

1. Antenna verticality adjustment => horizontal error
2. Local tie survey (ARP positioning) => horizontal and vertical error



# WORKING GROUP CNES/IGN

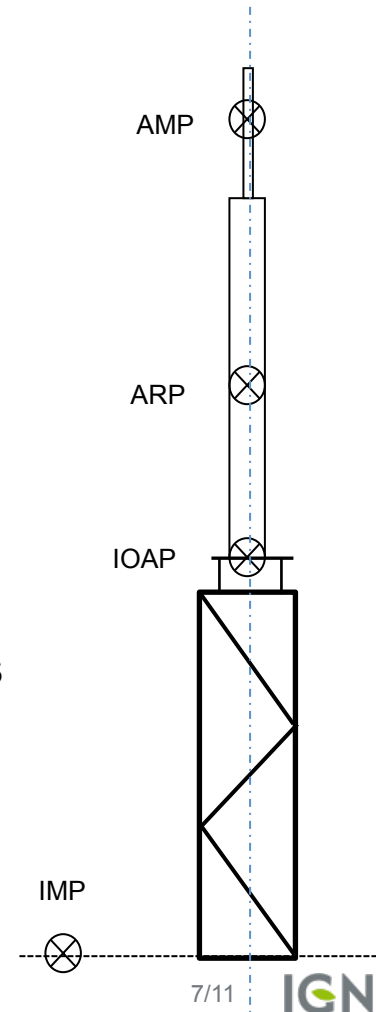
- NEW ANTENNA DEVELOPMENT: OPTION NOT RETAINED
- MAKING IMPROVEMENTS TO THE CURRENT ANTENNA
  - Antenna characterization undertaken by CNES
  - Better control of the reproducibility of the antennas manufacturing
  - Thinking on devices facilitating the survey
  - Defining the characteristic points of the antenna
- STAREC TYPE B => STAREC TYPE C
  - From serial number SN 172
  - Consolidated specifications :
    - Position of the 2GHz phase center w.r.t. antenna body
    - Perpendicularity antenna base/antenna axis
    - Alignment of the connector on the antenna axis
  - Allows new method of ARP position determination



# ANTENNA POINTS DEFINITIONS\*

- **AMP: ACTUAL MEASUREMENT POINT**
  - 2 GHz phase center
- **ARP: ANTENNA REFERENCE POINT**
  - Intersection of the antenna axis and the red ring
- **IOAP: INSTRUMENT OPTICAL ACCESS POINT**
  - Intersection of the antenna axis and the flange
  - Can be surveyed directly (optically)
- **IMP: INSTRUMENT MONUMENT POINT**
  - Witness mark under the antenna = geodetic print of DORIS
  - In most cases, on the ground close to the antenna vertical axis
  - Essential to measure successive antenna positions
  - Measured using surveying techniques

\* *Inspired by the Space Geodetic Project (NASA) nomenclature*



# VECTORS

- IF THE ANTENNA REQUIREMENTS ARE MET (MANUFACTURING + INSTALLING) :
- WE CAN DETERMINE THE ARP POSITION USING THESE VECTORS:

- **IMP > IOAP**

- Determined by optical surveys

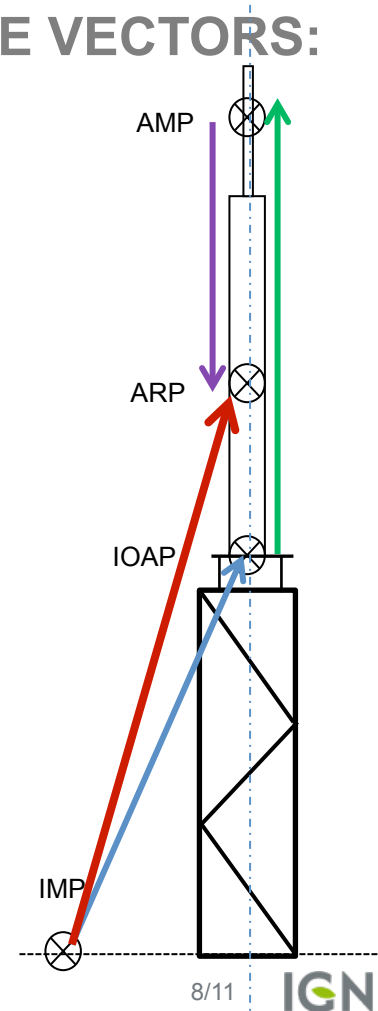
- **IOAP > AMP**

- Up Eccentricity of 877mm

- **AMP > ARP**

- Up Eccentricity of -487mm

$$\text{IMP} > \text{ARP} = \text{IMP} > \text{IOAP} + \text{IOAP} > \text{AMP} + \text{AMP} > \text{ARP}$$





# ERROR BUDGET

- The work with the manufacturer helped to consolidate the antenna specifications and draw up an error budget
- The topometric measurement uncertainties remain unchanged but the survey is simplified

Error Type	Error Source	Direction	Error Value	
Manufacturing	2GHz PC centering / radome	Horizontal	± 1 mm	± 2 mm
Manufacturing	Alignment ARP/AMP / axis	Horizontal	± 1 mm	
Manufacturing	2GHz PC position / flange	Vertical	± 1 mm	± 3 mm
Characterization	2GHz PC position and associated phase law	Vertical	± 2 mm	
Survey	Verticality adjustment	Horizontal	± 1 mm	± 2 mm
Survey	Local tie survey	Horizontal	± 1 mm	
Survey	Local tie survey	Vertical	± 1 mm	± 1 mm

**NB**: this error budget is relating to future installations (antenna type C)

# IDS PUBLICATIONS

## ■ IN PRESS:

- Willis, P.; Lemoine, F.G.; Moreaux, G.; Soudarin, L.; Ferrage, P.; Ries, J.; Otten, M.; Saunier, J.; Noll, C.; Biancale, R.; Luzum, B. **The International DORIS Service (IDS), Recent developments in preparation for ITRF2013**, IAG SYMPOSIA SERIES, 143
- Willis, P.; Zelensky, N.P.; Ries, J.; Soudarin, L.; Cerri, L.; Moreaux, G.; Lemoine, F.G.; Otten, M.; Argus, D.F.; Heflin, M.B. **DPOD2008, a DORIS-oriented Terrestrial Reference Frame for Precise Orbit Determination**, IAG SYMPOSIA SERIES, 143

## ■ IDS WORKSHOP, KONSTANZ, 27-28 OCTOBER 2014

- **Doris STAREC ground antennas characterization and impact on localization.** Cédric Tourain (CNES), Guilhem Moreaux (CLS), Albert Auriol (CNES)
- **Ground Antenna Position: Initiating an Error Budget.** Jérôme Saunier (IGN), Cédric Tourain (CNES), Albert Auriol (CNES)
- **RF Compatibility tests of DORIS Simulator with VLBI Broadband Antenna at GGAO.** Lawrence Hilliard (NASA), Cedric Tourain (CNES), Brian Corey (Haystack Observatory), Christopher Beaudoin (Haystack Observatory), Jérôme Saunier (IGN), William Petrachenko (National Research Council)
- **Overview of the network monumentation (poster).** Jérôme Saunier (IGN)

# CO-LOCATION SURVEY REPORTS

## ■ DORIS CNES/IGN DIRECTING BOARD DECISION (23/01/2012):

- Favorable context with REGINA to carry out high precision local tie surveys

## ■ IGN CO-LOCATION SURVEY REPORTS AVAILABLE ONLINE:

[http://itrf.ign.fr/local\\_surveys.php](http://itrf.ign.fr/local_surveys.php) (link available on IDS website: “Documents” > Stations > Local surveys)

- GRASSE, August 2013
- LE LAMENTIN, July 2013
- JIUFENG, October 2012
- PAPEETE, July 2011
- RIKITEA, July 2011
- DIONYSOS, May 2011
- KOUROU, February 2011
- ROTHERA, February 2011

## ■ UPCOMING CO-LOCATION SURVEY REPORTS (DORIS + REGINA):

- FUTUNA, April 2012
- KERGUÉLEN, April 2012
- METSAHOVI, June 2012
- MAHE, December 2012
- AREQUIPA, January 2013
- CACHOIERA, March 2013
- RIO GRANDE, June 2013
- ST JOHN’S, July 2013
- YELLOWKNIFE, July 2013
- DJIBOUTI, December 2013
- TOULOUSE, February 2014
- HARTEBEEESTHOEK, March 2014
- PONTA DELGADA, September 2014