III REPORT OF COORDINATION CENTERS
5. DORIS

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OVERVIEW

DORIS was developed for precise orbit determination and precise positioning on Earth.

Following the inclusion of DORIS as a new technique in IERS, six groups have been participating as Analysis Centers: CNES/SOD, GRGS, and IGN in France, UT/CSR in the USA, DUT in the Netherlands and MCC in Russia. The first four groups have submitted regular results to IERS either for polar motion determination or for tracking stations coordinates and velocities. Other groups are still developing their processing capabilities. Two IERS Data Centers have been providing the scientific community with DORIS measurements for several years: NASA/CDDIS and IGN/LAREG.

In 1999, following the recent IERS reorganization, it has been decided at the IAG General Assembly (Birmingham, UK, August 1999) to create a DORIS Pilot Experiment. Such a Pilot Experiment would give time to all groups to coordinate and improve their operationability in order to create on the long term and International DORIS Service (IDS). In the future, this scientific service would structure the DORIS community in order to provide scientific products for a broad range of potential users, starting by the IERS itself. This is done as common activity of the IERS and the IAG/CSTG (Commission of the International Association of Geodesy for the Coordination of Space Technique). This is very similar to what is done for GPS by the IGS, or for VLBI by the IVS or for SLR and LLR for the ILRS.

THE INTERNATIONAL DORIS PILOT EXPERIMENT

For the DORIS Pilot Experiment an international Call for Participation has been issued in September 1999. A steering Committee has been set up and is composed of the following individuals:

Gilles TAVERNIER	CNES	Chairperson
Kristine LARSON	University of Colorado	Stations Selection Group chairperson
Carey NOLL	NASA/CDDIS	Data Flow coordinator
John RIES	University of Texas CSR	Data and Products formats Working Group chairperson
Laurent SOUDARIN	CLS	
Pascal WILLIS	IGN LAREG	DORIS representative and Coordinating Center to IERS

CNES, CLS and IGN perform the operational tasks of the Central Bureau. A specific Web site has been created presenting the Pilot Experiment organization, the proposals, the members of the different groups, the DORIS Mails, the Site logs, a lot of new information on the DORIS system and also links to all DORIS groups Web sites: http://ids.cls.fr

The DORIS Days, organised by CNES in partnership with the IGN, CLS and GRGS, and with the sponsorship of the INSU, the IERS and the SCTG, were held in Toulouse on May 2 and 3, 2000. About 130 people, representing various contributors and users of the DORIS system attended them: the host agencies (stations), the Data and Analysis Centres, the project partners and the scientific community.

This second version of the DORIS Days was in particular devoted to a review of the start-up of the Doris Pilot Experiment and of presenting the technological changes which have been made to the system (Jason, Envisat and SPOT5 missions, 3rd generation beacons). Two workshops gave the opportunity to discuss on:
- the organization of the Experiment and the interaction between scientific research and services
- the DORIS system and performances evolutions as planned as well as needed by the users

The Data and Products formats Working Group chaired by John RIES (Jean-Paul BERTHIAS, Werner GURTNER, Carey NOLL, Jean-Jacques VALETTE and Pascal WILLIS) is analyzing possible formats for:

- DORIS measurements : either raw or preprocessed, taking future dual channel second generation receivers into account
- High accuracy satellite ephemeris
- Three-dimensional coordinates and velocities of stations
- Earth rotation parameters
- Time-varying geocenter coordinates
- Static and time varying coefficients of the Earth's gravity field
- Surface meteorology, troposphere and ionosphere information

The activity of the group in 2000 was mainly related to measurements and the two first products.

Two Data Centers archive and distribute DORIS measurements and ancillary data. They will also archive and distribute products as soon as they are available, with the help of Carey NOLL (Data Flow coordinator):

NASA GSFC / CDDIS	USA	Carey Noll
IGN / LAREG	France	Pascal Willis

There are eleven candidate Analysis Centers willing to process DORIS measurements:

AUSLIG	Australia	Ramesh Govind
CNES	France	Jean-Paul Berthias
CSR the Univ. of Texas	USA	John Ries
ESA ESOC Darmstadt	Germany	John Dow
Geod. Observ. Pecny	Czech Rep.	Jan Kostelecky
IAA St Petersbourg	Russia	George Krasinsky
IGN LAREG	France	Pascal Willis
INASAN Moscow	Russia	Suriya Tatevian
LEGOS / CLS	France	Jean-François Crétaux
Royal Observ. of Belgium	Belgium	René Warnant
University of Newcastle	UK	Phil Moore

The Stations Selection Group chaired by Kristine LARSON includes scientists involved in various applications such as geodesy, geophysics, altimeter calibration, tide gauges, ITRF collocation and a representative of the DORIS Stations Installation and Maintenance Service (IGN/SIMB): Eric CALAIS, Chuck DE METS, Herve FAGARD, Ramesh GOVIND, Bruce HAINES, Frank LEMOINE, Seth STEIN, Simon WILLIAMS.

Existing station were candidates to IDS:

Orbitography Network CNES/IGN - France	Hervé Fagard
Yarragadee, Mount Stromlo AUSLIG - Australia	Ramesh Govind
Badary, IAA - Russia	Zinovy Malkin
Kauai, Fairbanks NASA GSFC - USA	John Bosworth
Metsahovi, Finnish Geodetic Institute - Finland	Matti Paunonen
Syowa, National Institute of Polar Research – Japan	Kazuo Shibuya

The group defined site criteria taking DORIS site constraints into account and prepared a Station Response Form to be sent to candidate sites:

Cape York, Burnie and Lambert (Antartica), AUSLIG - Australia	Ramesh Govind
Dome C, Antartica	Christian Vincent
Grasse, Ajaccio - France	Pierre Exertier
Gavdos TU Crete - Greece	Stelios Mertikas
Herstmonceux - UK	Phil Moore
India	Vinod Gaur
Iran	Faramarz Nilforoushan
Irkutsk VS NIIFTRI - Russia	Vjacheslav Zalutsky
Geodetic Observatory Pecny - Czech Republic	Jan Kostelecky
San Fernando - Spain	Jose Martin Davila
Svetloe, Zelenchukskaya , IAA - Russia	Zinovy Malkin
Terra Nova Bay - Italy/Antartica	Alessandro Capra
Warsaw University of Technology - Poland	Janusz Sledzinski
Wetzel, TIGO (Chile), o'Higgins (Antartica) - Germany	Wolfgang Schlueter
Wousi, New Hebrides	Stéphane Calmant

The proposals are going to be analyzed for a first selection.

Complete information about the activities of the Stations Selection Group are available on its web page which can be fond on the IDS web site or directly at the following address: http://phys-geophys.colorado.edu/~kristine/doris.html

DORIS NETWORK

As in the past years, the DORIS network has been very stable (see figure 1). The installation and maintenance activities are realized by the IGN/SIMB.

Figure 1. The DORIS Network

In order to reach new accuracy goals for JASON 1 and ENVISAT, it was decided to improve the long-term stability of the antennas when necessary. This network renovation action started in 2000 with the stations of Cibinong, Djibouti, Hartebeesthoek and Metsahovi. Two new stations were installed in Greenbelt, replacing Ottawa (antenna on a concrete pillar instead of a high building) and in Futuna (antenna on an iron tube + concrete), replacing Wallis. Several new local ties with other geodetic techniques were realized and transmitted to the IERS Central Bureau.

It was also decided to develop third generation beacons to improve DORIS system accuracy and capacity, with possible frequency shift avoiding jamming by nearby stations, higher transmitted power, a modulated 2 GHz channel and possible remote control through a telephone line or an Argos terminal.

Sites logs have been created by the SIMB for all DORIS sites and are available at the IGN Web site (http://www.ign.fr). This includes information concerning the changes in the DORIS ground equipment (antenna, beacon...) and also precise local ties with other precise space technique of the IERS.

DORIS CONTROL CENTER

SSALTO, the new DORIS and altimetry multimission Control Center is operational since December 2000. Thanks to its links with the Control Centers of the different satellites fitted out with a DORIS receiver, it is able to collect DORIS measurements, preprocess and send them to the DORIS Data Centers as well as ancillary data such as maneuvers, attitude, meteorological data.

SSALTO also produces preliminary and precise orbits, which will be sent to the Data Centers as soon as a format is adopted. The AVISO component will ensure archiving.

DORIS SATELLITE CONSTELLATION

DORIS data from four satellites are currently available in the two Data Centers and used by the Analysis groups: SPOT 2 (launched in 1990), TOPEX/POSEIDON (launched in 1992), SPOT 3 (1993-1996) and SPOT 4 (launched in 1998).

Three new satellites will be launched in the near future, carrying an improved second generation DORIS receiver: JASON 1, ENVISAT and SPOT 5. Other missions are already decided, such as CRYOSAT (ESA) or Pleïade (SPOT follow-on). The new DORIS receivers will have a dual channel capability, allowing multiple stations positioning in the same area, an improved accuracy and a real autonomy thanks to DIODE navigator: self start, self programming and real time on-board orbit determination.

Furthermore, in its proposal CNES has offered such receivers for possible new missions outside France. The number of available DORIS satellites is still a limiting factor in the accuracy of the DORIS results for IERS (stations positions and velocities), polar motion. It is then very important to increase the present number of satellites.