COLOCATIONS AND MONUMENTATION IN THE DORIS NETWORK

Hervé FAGARD (Institut Géographique National - France)
Antenna types in the DORIS permanent network

Alcatel

- 10 stations
- Deployed 1986 --> 1992
- Point identification: xxxA

Starec

- 46 stations (+ 2 IDS experiments)
- Deployed as of 1992
- Point identification: xxxB
Survey of a DORIS/Alcatel antenna

2 GHz phase centre (actual DORIS measurements)

Reference point

GPS survey using the forced centering interface
Survey of a DORIS/Starec antenna

2 GHz phase centre
(actual DORIS measurements)

Reference point

GPS survey using the forced centering interface
Colocations with other IERS techniques: how active and reliable are they?

• Many instruments collocated with DORIS are not currently operating:
  – Discontinued long-term occupation by:
    » VLBI (Richmond, Santiago)
    » SLR (e.g. Dionysos, Easter Island, Goldstone, etc.)
  – Short duration (2 days only once, to a few days per year) mobile VLBI occupations (Toulouse, Ponta Delgada, Metsähovi)

• Unreliable tie:
  – Insufficient accuracy, measured only once, sometimes many years ago
  – Very long baseline, different geological movements (e.g. Kourou)
  – Ties to be measured: Sakhalinsk, Cachoeira

--> Not all DORIS presumed colocations have the same usefulness for the current realisation of the ITRS
DORIS stations in proximity to other IERS techniques

- No colocation (17 stations + 1 IDS exp.)
- 1 other technique (21 stations)
- 2 other techniques (12 stations)
- 3 other techniques (6 stations + 1 IDS exp.)
DORIS colocations with active other techniques

- No active colocation (22 stations + 1 IDS exp.)
- 1 other technique (21 stations)
- 2 other techniques (11 stations)
- 3 other techniques (2 stations + 1 IDS exp.)
### Number of colocations: theoretical vs active

<table>
<thead>
<tr>
<th>Method</th>
<th>Theoretical</th>
<th>Active &amp; surveyed</th>
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<tbody>
<tr>
<td>DORIS +...</td>
<td></td>
<td></td>
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<tr>
<td>GPS</td>
<td>38</td>
<td>34</td>
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<tr>
<td>SLR</td>
<td>12 + 1 IDS exp.</td>
<td>7 + 1 IDS exp.</td>
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<tr>
<td>VLBI</td>
<td>13 + 1 IDS exp.</td>
<td>8 + 1 IDS exp.</td>
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</table>
• 31 DORIS stations, out of the 56 making up the current permanent network, have multiple antenna positions (following antenna change or relocation):
  – Two different antenna positions at 20 sites
  – Three different antenna positions at 10 sites

• All ties between different antenna positions on the same site have been measured accurately, except:
  – AMSA-AMSB (approximate connection planned, AMSA no longer exists)
  – HBKA-HBLA (antenna moved by host agency, no direct survey)
  – HELA-HELB (antenna change by host agency, no survey)
  – KERA-KERB (dubious KERA antenna height)
  – GOLA-GOMA (no direct connection)
DORIS « internal » colocations (2)

- 2 DORIS antenna positions
- 3 DORIS antenna positions
The overall antenna stability depends on the stability of:

- **The mounting structure:**
  - Metal tower (guyed or not)
  - Steel pole
  - Metal interface
- **The monument on which this structure is installed:**
  - Concrete pillar or block (founded or not on the underlying bedrock)
  - Building
- **The geological structure on which the monument is located**
Antenna support: 1st generation (→1992)

- Stability requirement: a few cm
  (expected DORIS positioning accuracy = 10 cm)
- Guyed metal tower: guy-wires not always placed so as to guarantee a long term antenna stability
- Alcatel antennas:
  - Phase center position known to within ± 5 mm
  - Difficult to survey and center
  - No accurate verticality adjustment
  - Catches the wind
- Measured eccentricities after more than 10 years:
  1 to 5 cm
Antenna support: 2nd generation (1993 —> 1999)

- Stability requirement: 1 cm over 10 years (Achieved DORIS positioning accuracy = 2 to 3 cm)
- Starec antennas available:
  - Phase center position known to within ± 1 mm
  - Easy to accurately survey and center
  - Resist high winds
- Improved guying and verticality adjustment:
  - 3 guy-wires at 120°, whose tension is adjusted to reach a mm level centering
  - The supporting plate can be leveled so as to adjust the antenna verticality to within ± 1 mm
- Excellent short term rigidity and stability, but long term stability still dependent on the guy-wires
Antenna support: 3rd generation (as of 2000)

- Stability requirement: a few mm over 10 years (DORIS positioning accuracy approaching 1 cm)

- Antenna supports:
  - Forced centering plate on a concrete monument
  - Metal mounting structures not requiring guy-wires

- Monuments:
  - Prefer ground installation rather than buildings
  - Concrete structure deeply anchored into the ground (design depends on ground nature)
  - Buildings: low elevation, antenna on a load-bearing wall
Examples of DORIS pillar designs

Bedrock at or near ground level

No bedrock, but hard soil

Soft soil

Solid bedrock

2 cm diameter rebars

Excavated, then backfilled & compacted

High-strength reinforced concrete

17 cm diameter steel casing

1 m

0,5 m

2 m

0,5 m

7 m
Network renovation progress: estimated antennas stability

Number of stations


Poor  Dubious  Good  Excellent

H. Fagard (IGN-F)