

IERS Workshop on site co-location

Session 2: Site Surveys

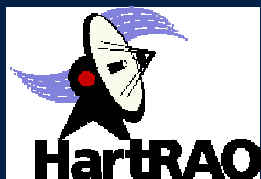
Station Hartebeeshtoeke

Valérie MICHEL

Institut Géographique National - Service de Géodésie et Nivellement
Division des Travaux Spéciaux
2-4 avenue Pasteur - 94165 Saint Mandé - FRANCE
Tel : +33 (0) 1 43 98 80 13 - Fax: +33 (0) 1 43 98 84 50
e-mail : valerie.michel@ign.fr

HartRAO Survey

- First cooperative survey project planned under ISGN Subcommission
- July 22 through August 12, 2003
- Participating agencies
 - Hartebeesthoek Radio Astronomy Observatory
 - Institut Geographique National
 - NASA Goddard Space Flight Center
 - Surveys & Mapping, Dept. of Land Affairs

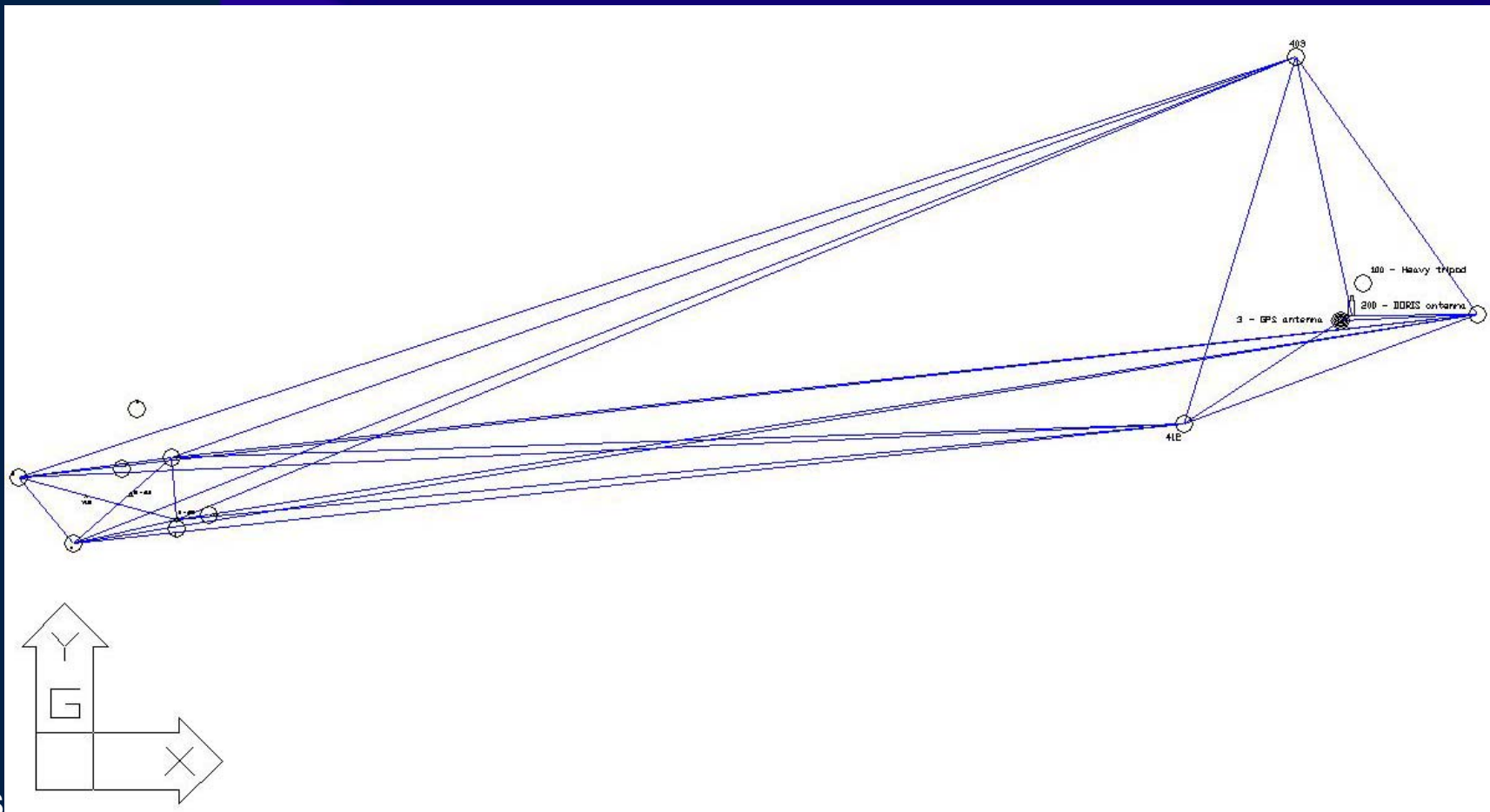


HartRAO Survey

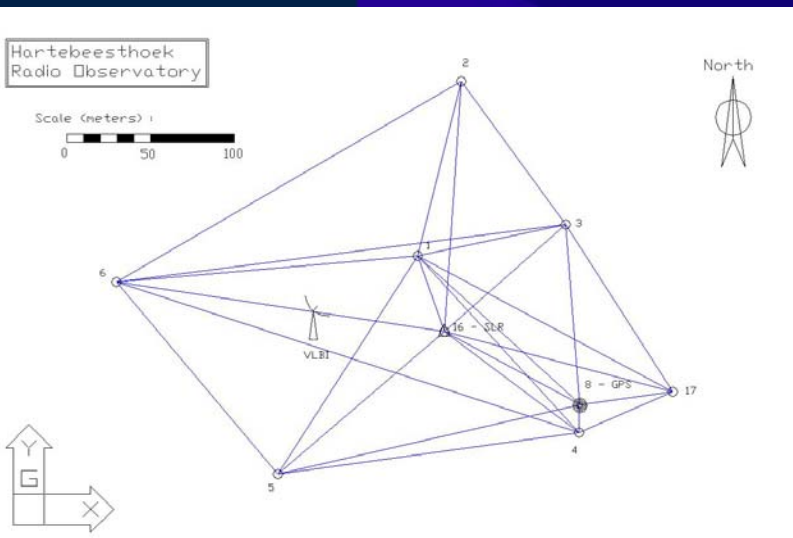
- Survey Team Members
 - Jim Long, NASA GSFC
 - Valérie Michel, IGN
 - Celine Corbière, IGN
 - Georgia Roesch, IGN
 - Sean Dane, Surveys & Mapping
- HartRAO Support
 - Ludwig Combrinck
 - Wilhelm Haupt
 - Jonathan Quick

Map of the site

- HartRAO site and SAC site



HartRAO Ground Survey Network



- Ground control network polygon consisted of 7 reinforced concrete piers
 - constructed in 2000 by HartRAO staff, except Pier 17 constructed in 2003
 - 0.5 meter diameter
 - height varies from 1.2 m to over 3 m
 - self-centering plates
 - Pier 5 on roof of main building
- Piers also used for SLR calibration targets

Typical network piers



Equipment utilized

- Leica Total Station (Tacheometer)
 - TC2002 (2) and TDA5005
 - with calibrated Leica corner cube reflectors
- Leica NA3003 electronic digital level
 - invar bar code level staffs
- Leica SR530 GPS receivers (4)
 - with choke ring antennas
- Data recorded electronically on PCMCIA cards or Module Rec
 - downloaded to laptop PC for processing



General Methods for Control Network Polygon

- Measure all directions, zenith angles, distances from each pier
 - repeat with second total station instrument
 - observe directions tangent on each side of HRAO GPS antenna
 - include station on vertical axis of SLR telescope
- Differential levels to all piers
 - include HRAO GPS antenna and SLR telescope
 - set benchmarks in base of piers
 - indirect method for tall piers

Determine SLR Reference Point

- Utilize X-Y translation stage to place target on the vertical axis of rotation
 - set up Leica total station on tripod
 - sight on trefoil target, record direction
 - rotate SLR telescope 180 degrees
 - sight on target, record
 - 1/2 difference, adjust translation stage
 - repeat until target does not move when SLR telescope rotated through 360 degrees

NASA MOBLAS-6 SLR Telescope with target



SLR Telescope Eccentricities to Mark 7501



- Utilized two methods different methods
 - agreed to less than 0.001 meter
- Set Leica total stations on tripods
 - three locations at approximately 90 degrees
- Transfer line of sight from trefoil target on vertical axis of rotation to mark 7501
 - intersection of lines of sight is on the same vertical axis



Determine VLBI Reference Point

- Hour Angle / Declination mount (HA / Dec)
 - HA fixed axis parallel with earth's rotation axis
 - axis offset needs to be determined
- Reference point defined as:
 - Perpendicular intersection of primary (HA) axis and the plane containing the secondary(Dec) axis
- Single target at apex of antenna quadripod
- Positioned by intersection method from 3 piers
 - horizontal directions and zenith angles
- Required a large number of observations because of HA / Dec mount

26-meter VLBI Antenna



Declination axis



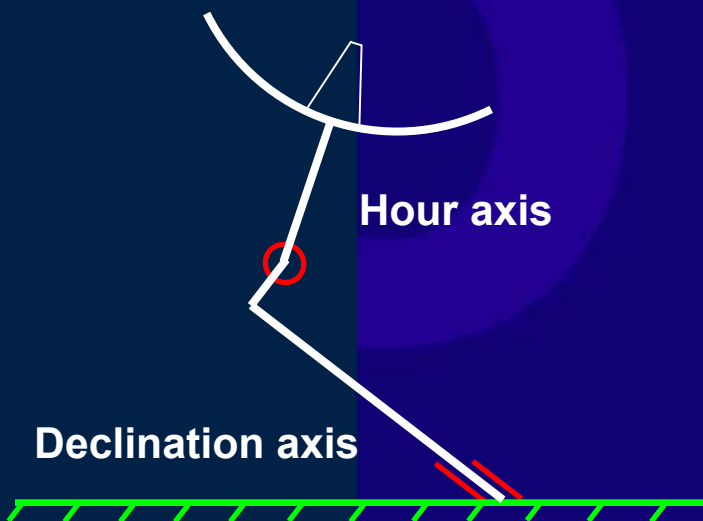
Hour axis

Declination axis

- Started with HA axis big wheel at 000 degrees
 - rotated small wheel on Dec axis to southern limit
 - rotated small wheel toward north in 10 degree increments, until northern limit
 - -85 degrees to + 48 degrees: 14 points
- Repeated with HA axis at +19 degrees west and -25 degrees east

Hour Angle Axis

- Started with Dec axis set at -25 degrees (zenith)
 - rotated HA axis to west limit
 - rotated toward east in 10 degree increments until east limit
 - +85 degrees west to -85 degrees east: 17 points
- Repeated with Dec axis set at -50 degrees



IGS Station HRAO



Tie to DORIS site

- DORIS Station HBKB and GPS Station HARB are at CSIR/SAC site approximately 3 km away
 - utilized GPS for tie between HartRAO control network and SAC control network
 - GPS observations also for orientation and geocentric coordinates
 - Ran differential levels between sites
 - temporary benchmarks at approx. 500 meters

DORIS antenna



GPS Station HARB



SAC Site

