The IAG and Planning the IGS

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Outline

- Background: Related IAG Activities (Fast forward!)
- Background: Other Supporting Events (Fast forward!)
- Motivation for the IGS
- Planning: Sequence of Events

IAG Activities

- 1971 Moscow, XVth IUGG General Assembly (G.A.): IAG Section 2 "Satellite Techniques"

- 1979 Canberra, XVIIth IUGG G.A.: **CSTG** (IAG/COSPAR Joint Commission on International Coordination of Space Techniques for Geodesy and Geodynamics), 1979 -2003

  MERIT Working Group– IAG/IAU (Monitoring of Earth Rotation and Inter-comparison of Techniques of Observation and Analysis), 1980-87

  Result: The IERS (International Earth Rotation Service), 1988.

  ADOS (African Doppler Survey), 1981-86


15°W
0°
15°E
30°
45°
45°
30°
15°
0°
15°
30°
PORTUGAL
SPAIN
ITALY
YUGOSLAVIA
TURKEY
SYRIA
MOROCCO
ALGERIA
LIBYA
EGYPT
SAUDI ARAB
WESTERN SAHARA
SAHARA
MAURITANIA
MALI
NIGER
CHAD
SUDAN
SENEGAL
UPPER VOLTA
BENIN
NIGERIA
GUINEA
IVORY COAST
GHANA
ETHIOPIA
CENTRAL AFRICAN EMPIRE
CAMEROON
EQUATORIAL GUINEA
GABON
CONGO
UGANDA
KENYA
ZAIRE
TANZANIA
ANGOLA
ZAMBIA
ZIMBABWE
NAMIBIA
BOTSWANA
SOUTH AFRICA
Johannesburg
MADAGASCAR
MOZAMBIQUE
Gulf of Guinea
MERIDIAN OF GREENWICH
DOPPLER GEODETIC POINTS
PROPOSED
EXISTING
ON CONTROL
NOT ON CONTROL
(Nov 1987)

IAG Activities

- 1983 Hamburg, IUGG XVIIIth G.A.: IAG Section 2 renamed: "Advanced Space Technology"

  CSTG SUBCOMMISSONS:

  SCS - Standards

  DOTS - Transportable Systems -1982

  IRIS - Radio Interferometric Surveying -1983

  COTES - Establishment of a Conventional Terrestrial Reference System (Joined MERIT in 1982)

  SLRS - Satellite Laser Ranging (replaced DOTS in 1986)

- 1987 Vancouver, IUGG XIXth G.A.

  New CSTG SUBCOMMISSIONS:

  COGEOS - Campaign for Optical Observations of Geosynchronous Satellites -1985

  GPS - Global Positioning System

  CIGNET - Cooperative International GPS Network

CSTG Presidents, 2001

Ivan Mueller	1979-1984
Christoph Reigber	1984-1991
Bob Schutz	1991-1995
Gerhard Beutler	1995-1999
Hermann Drewes	1999-2003

Photo by Drewes

Supporting Events

- 1969 **WILLIAMSTOWN CONFERENCE**: "The Terrestrial Environment: Solid Earth And Ocean Physics," W.M. Kaula Ed., MIT, Cambridge, MA, 1970

- 1978 February – First GPS Satellite/Block I Development Model Launched

- 1979 **CDP - NASA Crustal Dynamics Project :** "Contribution Of Space Geodesy To Geodynamics," David E. Smith & Donald L Turcotte Eds., 3 Vol ., AGU,1993

- 1984 VLBI/GPS Collocation Experiment: Alaska-Yukon-NW Canada

- 1985 **ROCKVILLE CONFERENCE**: "Positioning with GPS-1985," Clyde Goad Ed., National Geodetic Information Center, NOAA, https://archive.org/details/positioningwithg00inte

- 1988 **CASA-UNO** - 43 GPS Receivers in Central & South America

- 1988 **ERICE CONFERENCE:** "The Interdisciplinary Role Of Space Geodesy," Ivan Mueller & Susanna Zerbini, Eds., Springer Verlag, 1989

Supporting Events: 1989

- Existing And Planned Techniques And Networks With **Global Perspective**: SLR, VLBI, QUASAT, DORIS, PRARE, CIGNET, DSN, etc.
- **International Campaigns** Addressing Regional Tectonic Problems (Mediterranean, Caribbean, South Pacific, Indonesia, Tibet Etc.)
- **Permanent Networks** (Japan, Southern California)
- **Other Disciplines** (Seismic, Geomagnetic) Develop Global Networks (IRIS/GSN, Geoscope, Intermagnet)
- **COOLFONT CONFERENCE**: Workshop On Solid Earth Science: Concept Of Fiducial Laboratories For An International Natural Science Network (FLINN): - "International Global Network Of Fiducial Stations," J.B.Minster, B.H.Hager, W.M.Prescott, R.E.Schutz, N.A.S. Press, 1991
- Edinborough IAG 125th Anniversary. Proposal for a "Global GPS Tracking System In Support of Space and Ground based GPS Programs", R.E.Neilan, W.Melbourne and G.Mader, 1989

International Association of Geodesy

125th Anniversary Meeting

Edinburgh 1989

Reception

by the

Royal Societies of London and Edinburgh and

The University of Edinburgh

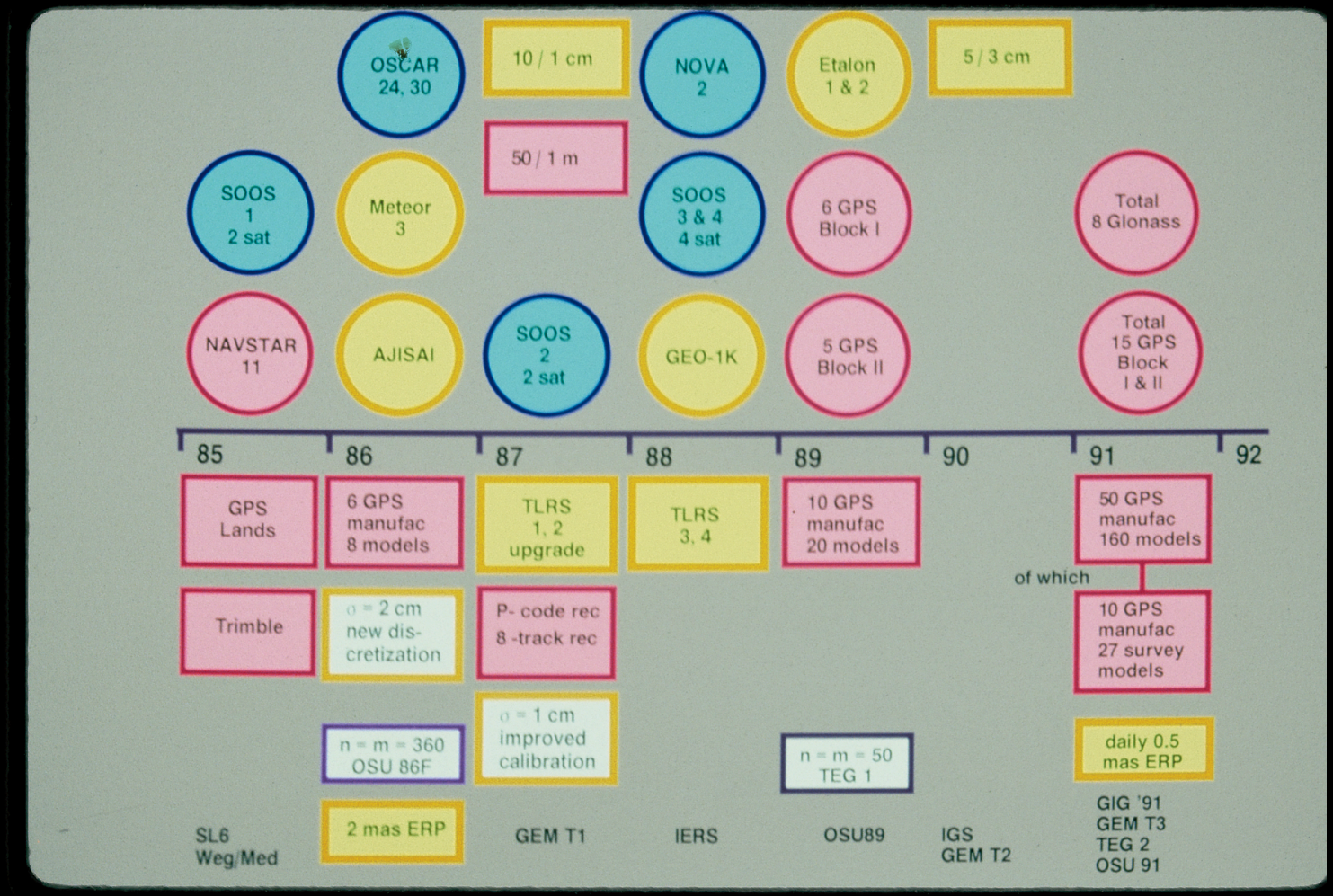
in the

The Royal Museum of Scotland

Chambers Street

Tuesday 8th August 8.15 – 9.15 pm Wine

Satellite Technology 1985-1991



Milestones in GPS Analysis

1978 **Differential positioning as VLBI** - McDoran

1979 **Doppler positioning using NAVSTAR** - Anderle

Differenced, multisatellite phase tracking for geodesy - Counselman & Shapiro

1980 **Double differencing** - Bossler, Goad & Bender

1981 **Ambiguity resolution: ambiguity function** - Counselman & Gourevitch

Milestones in GPS Analysis

1982 **Ambiguity resolution: P-code assisted -** Melbourne

Wide lane, narrow lane - Hatch

1983 **Fiducial concept -** Thornton et al.

Single, double, triple differencing - Goad & Remondi

1984 **Precise orbit determination -** King et al.

Milestones in GPS Analysis

1985 **Tropospheric mapping functions** - Lanyi

High precision geodetic software package - Gurtner et al.

Ambiguity resolution: network analysis - Bock et al.

Undifferenced phase processing - Goad

Ionospheric constraints for codeless receivers - Bender & Larden

Milestones in GPS Analysis

1985 **Kinematic surveying** - Remondi

Polar motion - Swift

Kalman filtering to reduce systematic errors - Swift

1986 **Free network solution** - Beutler

Ambiguity resolution: bootstrapping from short to long baselines - Counselman

Milestones in GPS Analysis

1986 **Kinematic positioning of moving antennas** - Hatch

1988 **Global network analysis** - Melbourne

Pseudo kinematic surveying - Remondi

Even-odd character, extra wide laning - Wübbena

1989 **Rapid-static surveying** - Blewitt

MOTIVATION

- The primary motivation in planning the IGS was the recognition that the most demanding users of the GPS satellites, the geophysical community, were purchasing receivers in large numbers and using them as more or less black boxes, using software packages which they did not completely understand, mainly for relative positioning.

MOTIVATION

- Motivation: Observations and the subsequent data analyses were not based on common standards, thus the geodynamic interpretation of the result based on repeated observations performed, sometimes by diverse groups, could not be trusted.

- Motivation: Generation of precise ephemerides for satellites together with by-products such as Earth orientation parameters and GPS clock information.

- Motivation: Future services for navigation, conventional surveying or local/regional geodynamics, although NOT planned to be part of IGS, would benefit from the existence of IGS.

Planning the IGS: Sequence of Events

- 1990.01.31 Columbus, OH

  Gerald Mader, William Melbourne, Bernard Minster, Ivan Mueller, the Four "M"-s, and Ruth Neilan prepare a proposal addressed to the IAG Executive Committee to establish a Working Group to examine the merits of an international GPS service and prepare for its eventual establishment.

- 1990.03.16 Paris, France

  The IAG Executive Committee appoints a Working Group to explore the feasibility of the establishment of a GPS service, such as accomplished by the IAG/IAU MERIT Working Group for the IERS.

The Working Group was authorized to:

1. Formulate a detailed campaign plan prior the the XX IUGG General Assembly in Vienna in August 1991 that should include:

   Reasons and merit for an IGS under IAG; Components of an IGS; Campaign Implementation and Conditions for participation

2. Organize an observational campaign in 1992 in conjunction with the International Space Year to test the feasibility of the plan.

3. Present a proposal to the IAG for the establishment of the Service.

Working Group Membership: I.Mueller (chair), C.Boucher, B.Engen, Finkelstein, G.Mader, B.Melbourne, B.Minster, C.Reigber, A.Stolz (Subsequently Joined : G.Beutler, D.Delikaraoglu, P.Fell, T.Kato, R.Neilan, R.O'Connell and Bob Schutz)

IAG Executive Committee at "Work"

MAISON DES POLYTECHNICIENS

MENU

DINER

PAVE DE TRUITE DE MER SAUCE NANTUA

GIGOT D'AGNEAU ROTI

SALADE MELEE

ASSORTIMENI DE FROMAGES

POIRE BELLE HELENE

COUPE X

SYLVANER

CHATEAU CHANTELOISEAU

CAFE

ASSOCIATION INTERNATIONALE DE GEODESIE

JEUDI 15 MARS 1990

Sequence of Events

- 1990.04.25 Paris,France: The Working Group is re-designated as "IAG Planning Committee for the IGS."

  Steering Committee: Chair – Mueller; Standards for Analysis – Melbourne; Standards for Data Acquisition and Sites – Neilan; Network Design – Minster; Data Analysis – Schutz; Central Bureau and Satellites – Fell

- 1990.09.2-5 Ottawa, Canada: Planning Committee (32 members!) meetings. Discussion for a "Call For Proposal "(CFP) to be issued in February 1991 and for its supporting documents.

- 1990.10.24 Steering Committee discussion on approaching the Department of Defense requesting clear signals.

- 1991.01.28 Press Release on IGS and the forthcoming CFP.

Sequence of Events

- 1991.02.01 CFP issued (via mailing lists of NASA/GSFC, JPL, USNO, GPS Subcommission).
- 1991.03.29 115 Letters of Intent to Participate received.
- 1991.04.01 CFP attachments (six position papers written by the Steering Committee members) mailed to those who expressed intent to participate.
- 1991.05.01 67 proposals from 40 countries received.
- 1991.06.24-25 Steering Committee evaluates the proposals, and a test campaign is planned June 21-September 22, 1992.

Sequence of Events

- 1991.06.28 Participants selected for: Acquisition Networks (~70 stations), Data Centers (8+12 regionals), Analysis Centers (10+19 regionals), Central Bureau (1).

- 1991.08.11-24 Vienna, Austria, XXth IUGG General Assembly

  IAG Symposium 102 "Permanent Satellite Tracking Networks"

  IAG Executive Committee approves the Campaign '92 proposal

  IGS Planning Committee reorganized and renamed "IGS Campaign Oversight Committee." Gerhard is ready to chair (?)

IUGG ‘91 & the IGS Planning Committee

Epilogue

"Would you tell me please which way I ought to go from here," said Alice.

"That depends on good deal on where you want to get to," said the Cat.

"I don't much care," said Alice.

"Then it doesn't matter which way you go," said the Cat.

Lewis Carroll