12th International Symposium on Equatorial Aeronomy

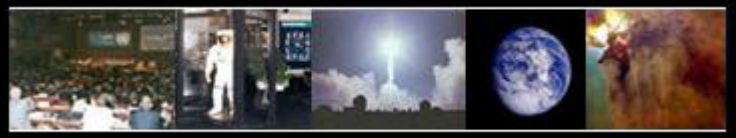
International Committee on Global Navigation Satellite Systems (ICG)

World-wide Ground-based Instrument Arrays

ICG Secretariat

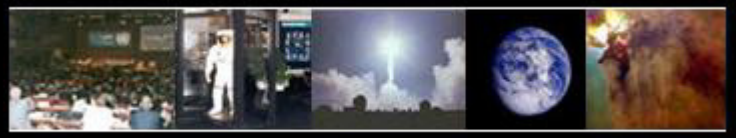
United Nations Office for Outer Space Affairs

18 – 24 May 2008
Heraklion, Crete, Greece



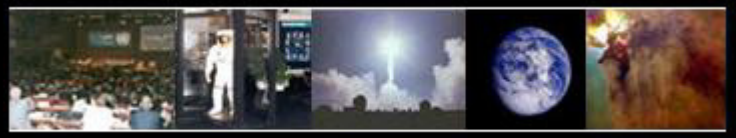
Outline of the Presentation

- **UNCOPUOS, IHY2007, IYA2009**
- **UN/ESA/NASA/JAXA Workshops**
- **IHY Instrument Arrays**
- **Coordinated Investigation Programmes**
- **International Committee on GNSS (ICG) – *a forum to discuss Global Navigation Satellite Systems to benefit people around the world***



United Nations Committee on the Peaceful Uses of Outer Space

- **UN (192 MS): UN General Assembly**
- **UNCOPUOS (69 MS): Scientific and Technical Subcommittee, Legal Subcommittee**
- **OOSA: Committee Service and Research Section, Space Applications Section**
  - **Programme of OOSA: space science, space technology, space law**
  - **Applications, education, training, research, policy making**
- **UNCOPUOS: three-year workplan 2006-2008 (extended to 2009), UN GA 60/99, 2005**



Action IHY 2007 Preparations started in 2004

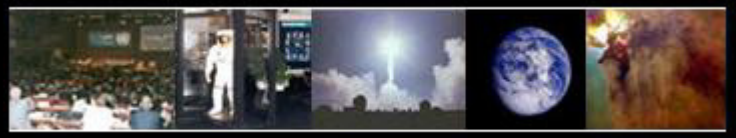
- **Session** of UNCOPUOS in 2004 called for addressing solar-terrestrial interaction: global climate, space weather, Sun-Earth-heliosphere-system

- **Workshop** on Distributed Arrays of Small Instruments, 8-9 June 2004, National Academies' Jonnson Centre, Woods Hole, Massachusetts, USA

(Report published by The National Academies Press, Washington, D.C. 2004)

- **Meeting** between NASA and UNOOSA, 19-21 October 2004, NASA Goddard Space Flight Center, Greenbelt, Maryland, USA

(Report on-line at http://ihy2007.org/observatory/observatory.shtml)



International Heliophysical Year (IHY 2007)

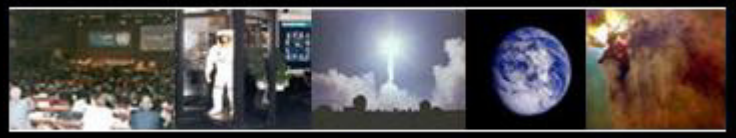
- Advancing understanding of the heliospherical processes that govern the Sun, Earth, and Heliosphere
- Demonstrating the beauty, relevance, and significance of space and Earth science to the world
- Continuing a tradition of international Collaboration on the 50th anniversary of IGY 1957

- IHY website: http://ihy2007.org/
  - International Advisory Committee, International Steering Committee, Regional Coordinators, National Coordinators, National Outreach Coordinators, IHY Secretariat

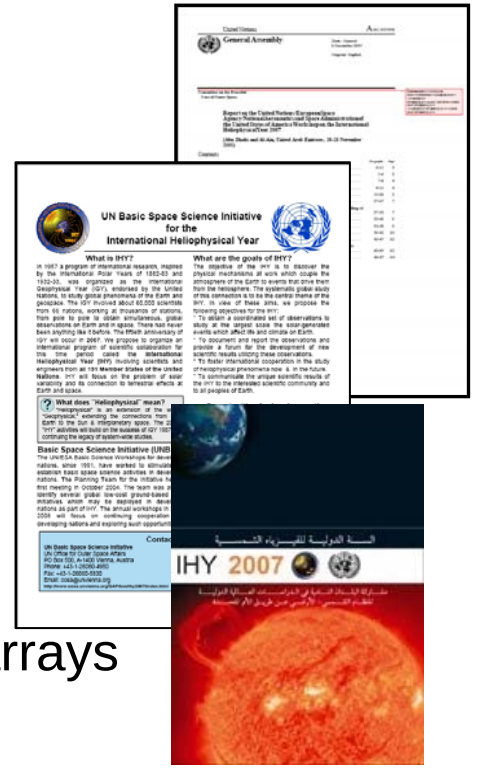
- UN/ESA/NASA/JAXA workshops: UAE 2005, India 2006, Japan 2007, Bulgaria 2008, South Korea 2009

- Regions: Africa, Asia and the Pacific, Latin America and the Caribbean, Western Asia, Europe

Office for Outer Space Affairs
United Nations Office at Vienna

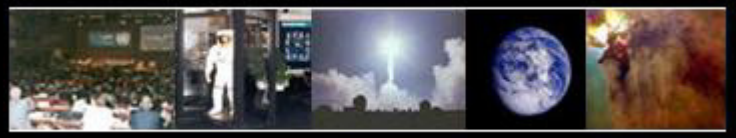


International Heliophysical Year (IHY 2007)



- **IHY Outreach**
  - **Workshop Reports (UN documents)**
  - **Flyers**
  - **Posters**
  - **Brochures**
  - **Booklets**

- **IHY Follow-up Projects**
  - **Low-cost, ground-based** world-wide instrument arrays
  - **ADS**
  - **Virtual Observatories**
  - **BSS TRIPOD → IHY TRIPOD**
  - **GNSS on board of instrument arrays ?**

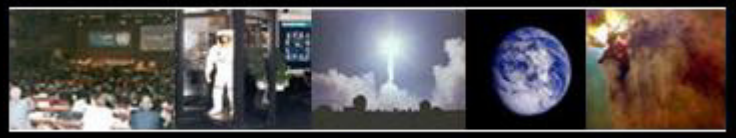


BSS TRIPOD: Telescope, Observing, Teaching

- Government of Japan
  - Japanese Cultural Grant Aid
  - 45 cm reflecting telescope
  - CCD & computer equipment
  - Building/ dome/ slide roof/ maintenance provided by local institution
  - Singapore 1987, Indonesia 1988, Thailand 1989, Sri Lanka 1995, Paraguay 1999, The Philippines 2000, Chile 2001, Mongolia?, India?

- American Association of Variable Star Observers (AAVSO)
  - Hands-on Astrophysics
  - Setting Up a Variable Star Observing Programme
  - Astronomy, mathematics, computer science

- Astrophysics for University Physics Courses



UNBSSI TRIPOD –> IHY TRIPOD

- **UBBSSI TRIPOD**
  - **Equipment: astronomical telescope**
  - **Data taking and analysis: observing programmes**
  - **Teaching: astrophysics for university physics courses**

- **IHY TRIPOD**
  - **Low-cost ground-based world-wide instrument arrays such as broad-band radio receivers (GPS TEC, scintillation, tomography, VLF)**
  - **Passive radar (Intercepted signals from non-dedicated transmitters),**
  - **Magnetospheric monitors (global, high-time-resolution magnetometers, radiometers),**
  - **Active radio (digisonde, small radar),**
  - **Optics (All-sky imagers, interferometers for neutral atmosphere dynamics),**
  - **Radiometers and neutron monitors for particle fluxes, solar monitors, enhanced real-time communications and analysis**

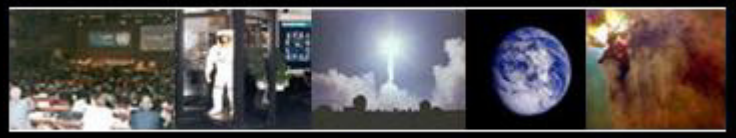
- **Coordinated Investigation Programmes** in disciplines
  - **heliosphere and cosmic rays, solar, magnetospheres, ionized atmospheres, climate, astro/heliobiology**

Low-cost ground-based world-wide instrument arrays

(A/AC.105/C.1/2008/CRP.6 of 14 February 2008 [STSC UNCOPUOS])

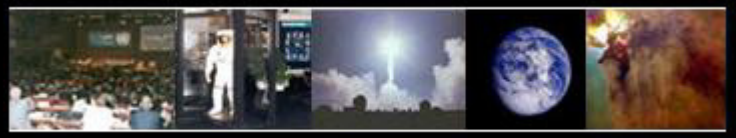
- **RENOIR (Remote Equatorial Nighttime Observatory for Ionospheric Regions, USA)**
- **SEVAN (New type of particle detectors for space weather forecasting network, Armenia)**
- **GPS (Global Positioning System in Africa, France)**
- **AMBER (African Meridian B-Field Education and Research, USA)**
- **AWESOME/SIDs (Climate And Weather of the Sun-Earth System, USA)**
- **CALLISTO (Compound Astronomical Low-cost Low-frequency Instrument for Spectroscopy and Transportable Observatory, Switzerland)**
- **MAGDAS (Magnetic Data Acquisition System, Japan)**
- **SAVNET (South Atlantic Very-low-frequency NETwork, Brazil)**

In 2008 the total number of IHY instrument arrays is 17



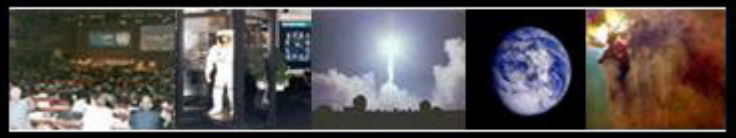
IHY TRIPOD: Instrument Array, Data, Teaching

- **Deploying inexpensive instruments around the world to make global measurements of ionospheric, magnetospheric, and heliospheric phenomena**
- **Partnership between instrument providers and instrument host nations**
- **Lead scientist/engineer provides instrumentation**
  Host institution provides manpower, facilities, and operational support
- **Data taking, sharing, analysis, publication**
- **Using data in teaching space science at university level**



IHY Coordinated Investigation Programmes (CIPs)

- **Principle mechanism for coordinating scientific activities for IHY**
- **Researcher proposes programme for coordinated use of facilities, whether space-based or ground-based instruments, observatories, models or other supporting research activities**
- **Process for CIPs has three stages: Propose, Coordinate, Review**
- **Types of activities that can be carried out as CIPs:**
  - **Programmes of observations from multiple sites and/or multiple instruments**
  - **Workshops, etc.,**
  - **Coupling models of different regions/regimes, and**
  - **Coordinated or distributed data recovery or analysis**



IHY Coordinated Investigation Programmes (CIPs) (cont.)

Instrument array / Number of CIPs

- **RENOIR: none**
- **SEVAN: 56**
- **GPS: 2**

- **AMBER: 4, 45**
- **AWESOME: 64**
- **CALLISTO: none**
- **MAGDAS: 26**
- **SAVNET: 13**

In 2008 the total number of CIPs is 71

International Heliophysical Year 2007 (IHY2007) to International Year of Astronomy 2009 (IYA 2009) UNGA 62/200 of 2007

First Meeting of the ICG, UNOV, Vienna, Austria: 2006

- **ICG Workplan**
  - Compatibility and interoperability
  - Enhancement of performance of GNSS services
  - Information dissemination (UN OOSA)
  - Interaction with international organizations, national, and regional authorities
  - Coordination among service providers
- **ICG Information Centres**
  - UN-affiliated Regional Centres will act as the ICG Information Centres

Second Meeting of the ICG, ISRO, Bangalore, India: 2007

Providers' Forum

- Within the ICG is the Providers' Forum, consisting of those countries (United States, Russian Federation, European Community, China, India, Japan) operating GNSS systems or with plans to develop one. The Forum provides a venue for coordination and cooperation to improve overall service provision

Third Meeting of the ICG: JPL, Pasadena, USA, December 2008

Fourth Meeting of the ICG: Roscosmos, Russian Federation, 2009

ICG Membership: Members, Associate Members and Observers

- 9 nations and the European Community
- 15 organizations (UN system entities, IGOs, NGOs)

ICG participation is open to all countries and entities that are either GNSS providers or users of GNSS services, and are interested and willing to actively engage in ICG activities

Promoting the use of GNSS technologies

- UN/Colombia Workshop on the applications of GNSS, 23-27 June, Medellin, Colombia
- International Workshop on GPS applications, ISEA, 18–24 May, Crete, Greece
- International Training Course on Satellite Navigation and Location Based Services, CSSTEAP, 18 June-18 July, Ahmedabad, India
- Combined AFREF, Africa Array, IHY, AMMA-GPS Meeting, 17–19 June, Johannesburg, South Africa, Session on Coordinating GPS and "Geo" instrumentation in Africa
- ICG Expert Meeting on GNSS systems and services, COSPAR, 15 July, Montreal, Canada

Office for Outer Space Affairs, United Nations Office at Vienna

Website: www.icgsecretariat.org

Email: oosa@unvienna.org