Inter-Agency Space Debris Coordination Committee

The Inter-Agency Space Debris Coordination Committee (IADC)

an overview of IADC's annual activities

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on behalf of the IADC Steering Group

www.iadc-online.org

International Committee on Global Navigation Satellite Systems (ICG) Annual Meeting
Xi'ang (China
4-9 November 2018

Overview

IADC is an international forum of national and international space agencies for the worldwide technical/scientific coordination of activities related to space debris in Earth orbit issues and provides technical recommendations.

The 13 IADC member agencies are:

- ASI (Agenzia Spaziale Italiana)
- CNES (Centre National d'Etudes Spatiales)
- CNSA (China National Space Administration)
- CSA (Canadian Space Agency)
- DLR (German Aerospace Center)
- ESA (European Space Agency)
- ISRO (Indian Space Research Organisation)
- JAXA (Japan Aerospace Exploration Agency)
- KARI (Korea Aerospace Research Institute)
- NASA (National Aeronautics and Space Administration)
- ROSCOSMOS (State Space Corporation “ROSCOSMOS”)
- SSAU (State Space Agency of Ukraine)
- UKSA (United Kingdom Space Agency)

Membership

IADC members are national or international space and state organizations that carry out space activities through planning, designing, launching, or operating space objects.

IADC members should actively undertake space debris research activities and contribute to an increased understanding of space debris issues for the preservation of the orbital environment

Structure and Purposes

IADC consists of a Steering Group and four specified Working Groups (WGs) covering measurements (**WG1**), environment and database (**WG2**), protection (**WG3**), and mitigation (**WG4**).

The primary purpose of the IADC is to

- exchange information on space debris research activities between member space agencies.
- facilitate opportunities for cooperation in space debris research.
- review the progress of ongoing cooperative activities.
- identify debris mitigation options

IADC provides technical recommendations to the world space communities. It is not a regulatory organization

(IADC Terms of Reference, see http://www.iadc-online.org)

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Annual Meetings

More than 100 technical experts from member agencies participate in the annual meetings to share information, address issues, and define and conduct studies on all aspects of space debris: measurements, modeling, protection, and mitigation.

- ESA hosted the meeting in Darmstadt, Germany in 2017
- JAXA hosted the last meeting in Tsukuba, Japan in June 2018
- ASI will host the next meeting in Roma, Italy in May 2019

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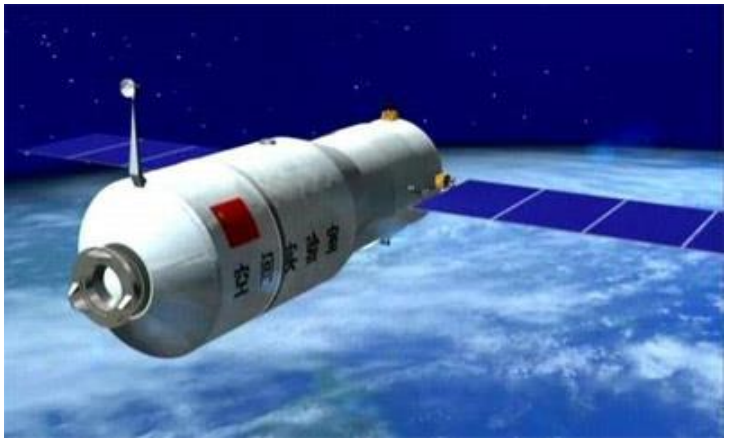
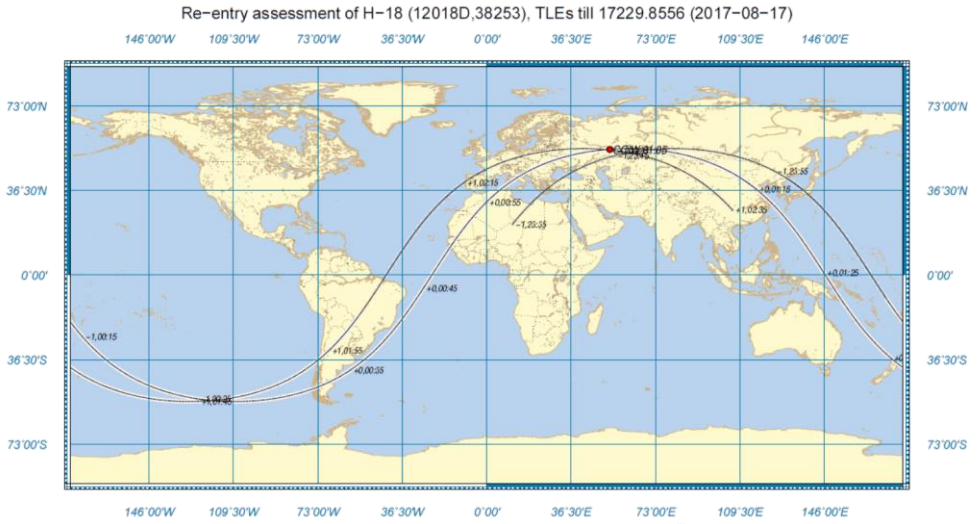
Re-entry Prediction Campaigns

To prepare for and respond to high risk re-entry events, the IADC members conduct annual object re-entry prediction campaigns for data sharing exercises and improvement of the prediction techniques.

- 22 campaigns have been conducted since 1998, including the Tiangong-1 re-entry in April 2018.





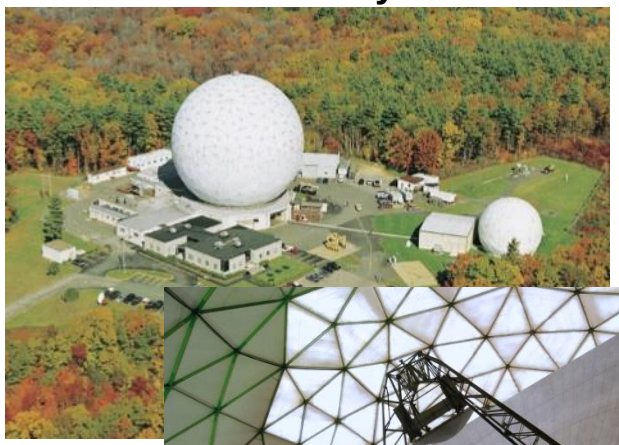
WG1: Measurements

Objective: identify, evaluate and recommend opportunities for cooperation

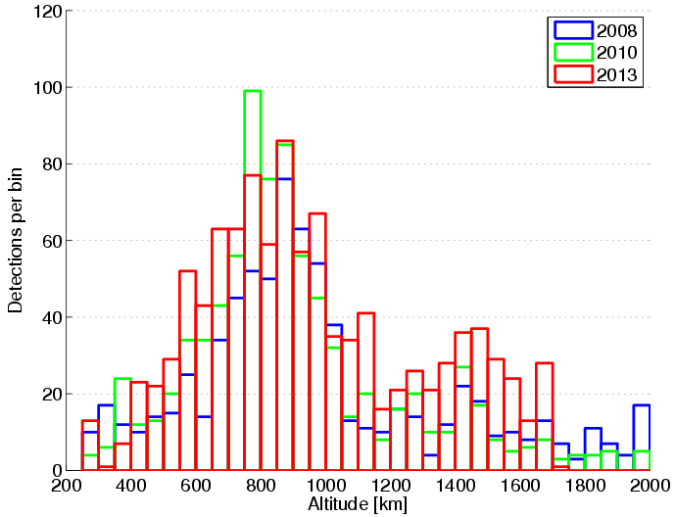
24 hour LEO radar beampark campaign

- regular 24-hour radar survey of LEO population
- snapshot of population > ~ 1 cm
- monitor evolution of population

Haystack radar



TIRA radar



Altitude distribution of detected objects

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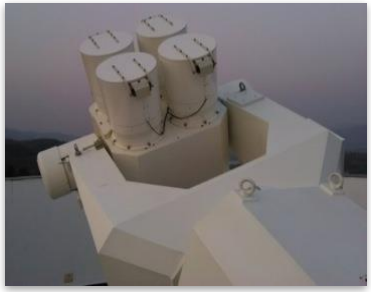
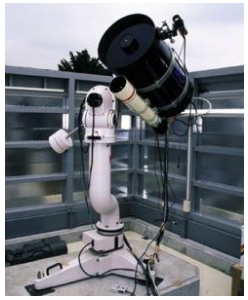
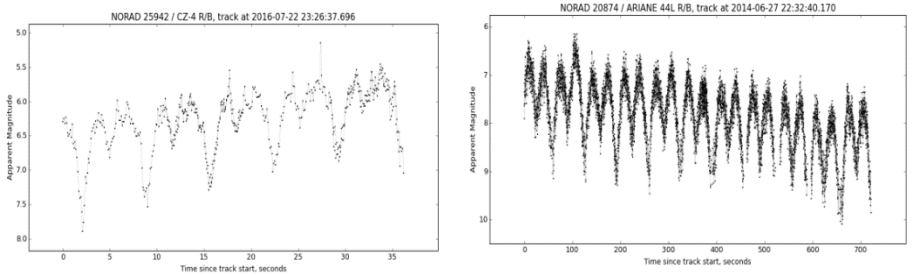
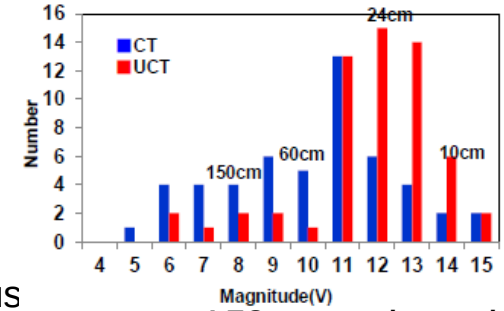



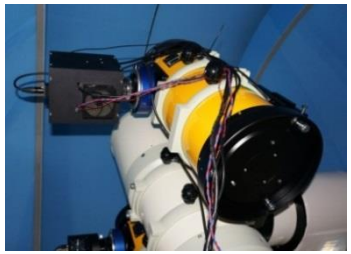
Sensors used for the lightcurve observations. CNSA(upper left), JAXA(upper right), ESA(bottom left) and Roscosmos(bottom right)

Optical lightcurves of massive LEO objects

- Objective: understand the motion of ADR targets for long duration
- Campaign observations were carried out (ESA, CNSA, NASA, JAXA,Roscosmos)
- Some insights were revealed
- Further analysis is needed



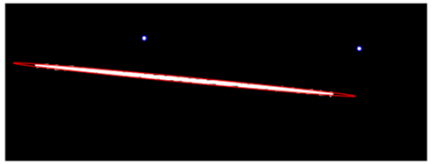
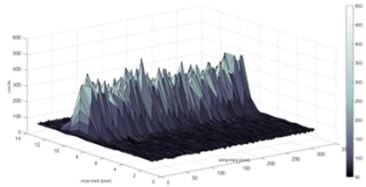




LEO survey observations using large CMOS

Information exchange of current status of each delegation

- Roscosmos started regular operation of Automated Warning System on Hazardous Situations in Outer Space(ASPOS OKP)
- JAXA carried out LEO survey test observation using the large CMOS sensor.
- ASI developed the software to extract lightcurve

New ASI software for lightcurve analysis

WG2: Environment and Database

Study to quantify the benefits of active debris removal initiated as a result of 2013 LEO stability report

Companion studies in progress to extend and clarify main study results

- Characterise the uncertainties in future environment projections from propagation, solar activity, fragmentation
- Quantify the effect of differences/unknowns in the future launch traffic such as small satellite proliferation and increases in launch rates

Consideration of space sustainability effects from deploying large constellations of satellites

WG3: Protection

- Spacecraft Component Vulnerability for Space Debris Impact
  - Unique collection of hypervelocity impact test data and numerical simulation results of space vehicle components such as batteries, cables, etc.
- Protection Manual (IADC-04-03) version 7.0
  - Compendium of meteoroid and orbital debris risk assessment methodology
- New Shielding Methods and Materials
  - approach/methodology for development of advanced meteoroid and orbital debris shielding and examples
- Projectile Shape Effects
  - Orbital debris environment definitions continue to improve
  - Implications to spacecraft shield performance from non-spherical projectiles needs additional investigation

WG4 : Mitigation

IADC Space Debris Mitigation Guidelines revisions in order to provide numerical figures and rationale for several key points such as:

- On-ground casualty expectation for re-entry events
- Maximum long-term presence tolerated in GEO region
- Probability of success for post mission disposal
- Probability of break-up during operational phase

Large Constellations:

- Potential Additional Mitigation Measures to Address the Proliferation of Small Satellites and Large Constellations
- Reached consensus on study scenarios with WG2
- IADC Statement and First Recommendations on Large Constellations of Satellites in LEO

Guidelines to aid orbit and attitude determination.

Commercial launches, attitude / orbit determination help, MEO objects etc…

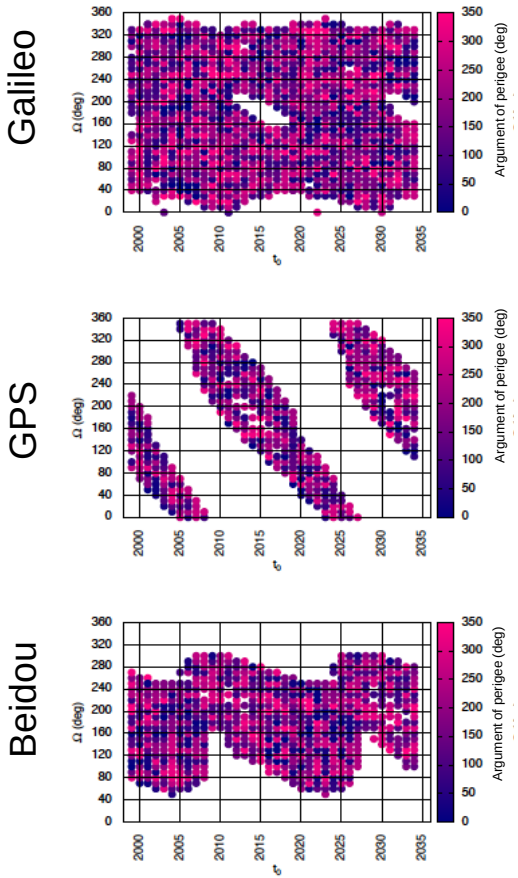
Potential IADC – ICG interaction

- MEO disposal as a growing field of study at university level and addressed by space agencies
- Investigating MEO re-orbiting and de-orbiting strategies
- Analyse long-term impact on operational MEO constellation (and other) missions

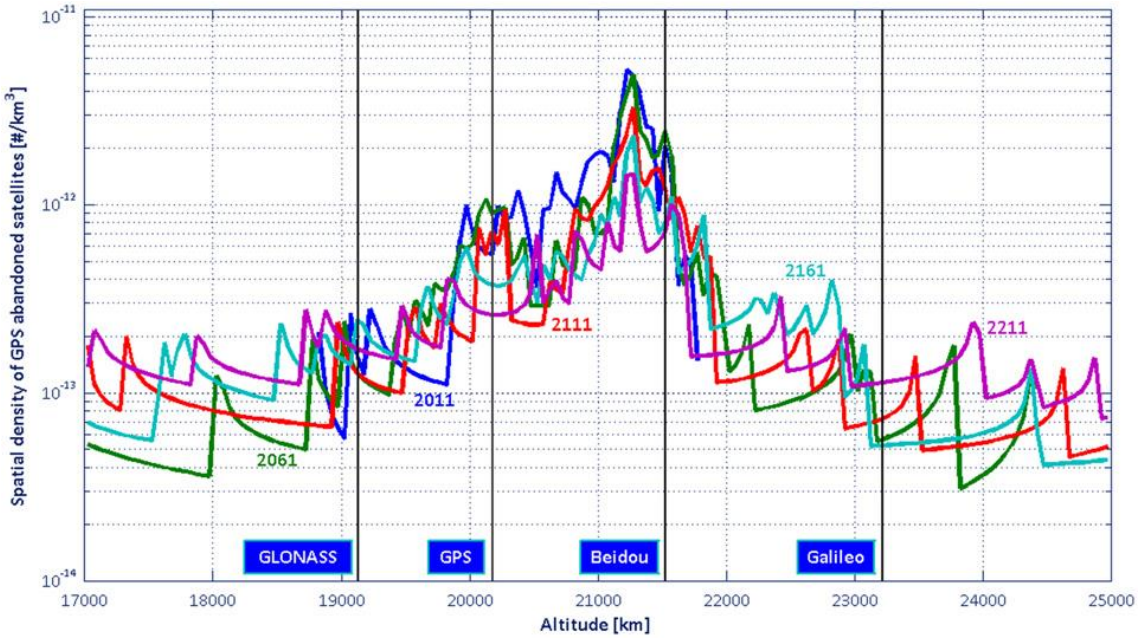
Questions/Clarifications/Reactions ⇒ IADC Steering Group – Current chairman ettore.perozzi@asi.it

Related study results by some IADC members (non-binding examples)

Required initial conditions
for a re-entry in 100-200 years



Spatial Density
extrapolation of current disposal scheme over 200 years



Conclusions

- IADC is the internationally recognized technical/scientific authority on space debris.
- IADC will continue to advance the knowledge of space debris and to develop environment management strategies to preserve the near-Earth space for future generations
- IADC could be a suitable partner to the ICG in providing consensus-based technical expertise and solutions on disposal strategies in MEO
- Upon written request by the ICG, the IADC would seek the consensus of its members for a related action item (typical duration 1-2 years) and coordinate with the ICG on the results
- IADC web site: http://www.iadc-online.org/

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