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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www.iadc-home.org

57th Session of the Scientific and Technical Subcommittee
United Nations Committee on the Peaceful Uses of Outer Space

3 to 14 February 2020

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

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

Inter-Agency Space Debris Coordination Committee

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-home.org)

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.

- JAXA hosted the meeting in Tsukuba, Japan in June 2018
- ASI hosted the last meeting in Roma, Italy in May 2019
- CNES will host the next meeting in Toulouse, France 6-10 April 2020
- DLR will host 2021 IADC annual meeting

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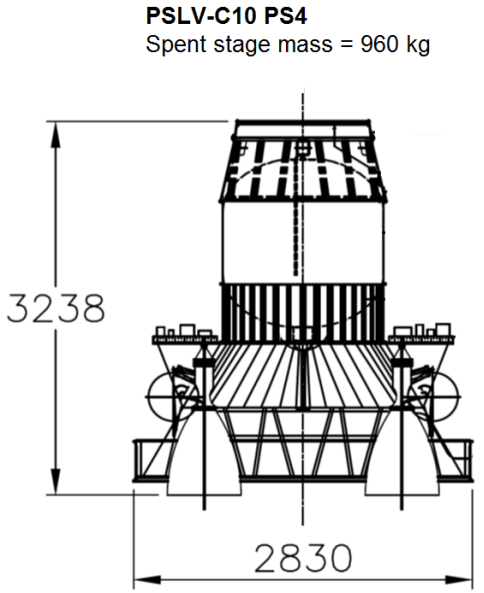
Re-entry Prediction Campaigns

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

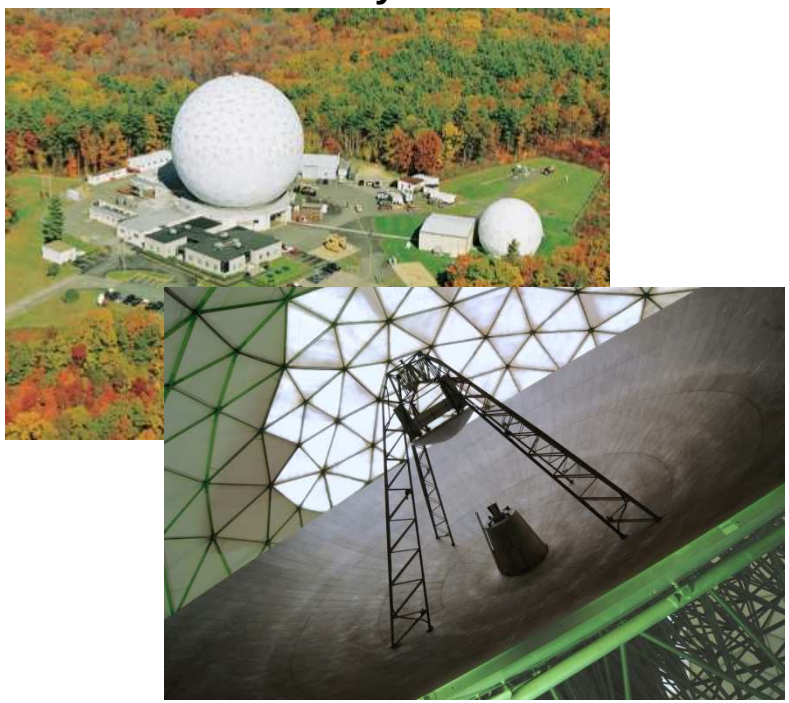
- 24 campaigns have been conducted since 1998, including the Tiangong-1 re-entry in April 2018 and Electron Second Stage in 2019
- The 2020 re-entry test campaign (PSLV fourth stage, COSPAR ID 2008-002B) has been closed since re-entry on 23 January 2020 at 08:05 UTC.



WG1: Measurements

Objective: identify, evaluate and recommend opportunities for cooperation

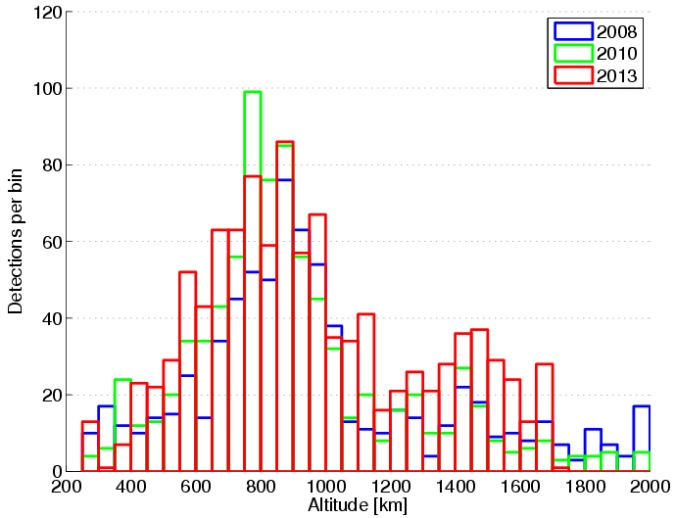
Haystack radar



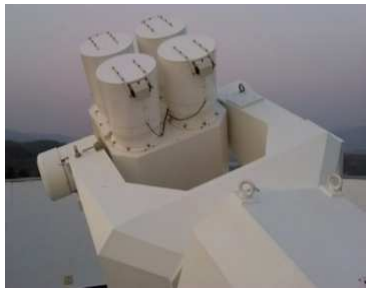
TIRA radar

24 hour LEO radar beampark campaign

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



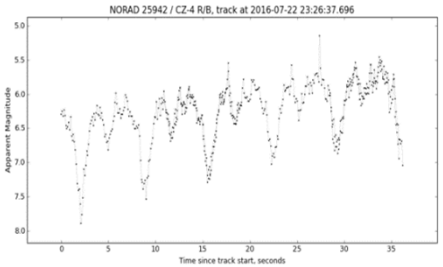
Altitude distribution of detected objects

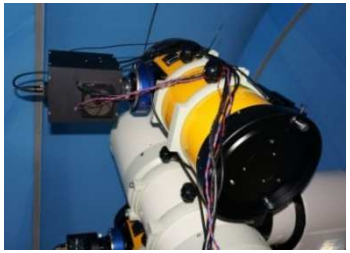



Sensors used for the lightcurve observations. CNSA(upper left), JAXA(upper right), ESA(bottom left) and Roscosmos(bottom right)

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 revealed, further analysis is needed





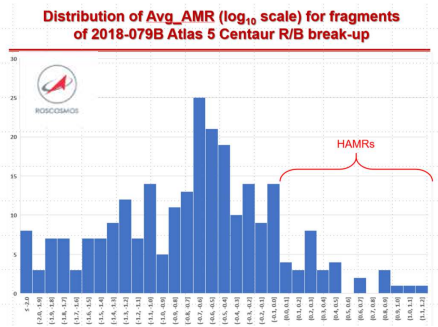
LEO survey observations using large CMOS

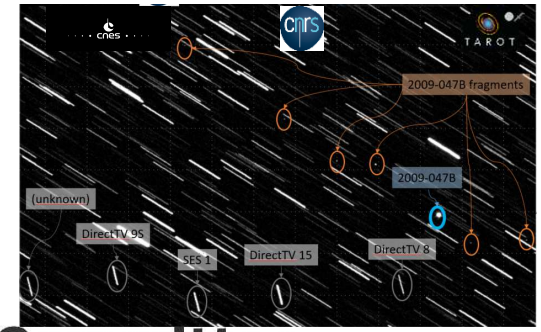
Information exchange of current status of each delegation

- 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

Fragmentations

- Exchange about observations and method used
- Characterisation of several fragmentations





WG2: Environment and Database

Studies to assess the effects of space debris on space sustainability :

- Delaying the implementation of Post Mission Disposal and Active Debris Removal
  - Establish risk thresholds that define when environmental impacts become dangerous,
  - Enable foresight & identification of appropriate actions to reduce the risk
- Deploying large constellations at very low altitude (e.g. ~500 km)
  - Evaluate the effect of constellations at very low altitudes
  - Identify how variables correlate with observed effects & to understand feedback / interactions induced by different deployment options

Studies to assess the status of the space debris environment

- Review existing environmental indices
- Define an index or a set of indices to inform the community about environmental improvement or degradation due to space debris

WG3: Protection

Documents status

- 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.
  - Version 1.0 approved by the Steering Group, ready to be uploaded to the IADC public site

- Protection Manual (IADC-04-03) version 7.0
  - Compendium of meteoroid and orbital debris risk assessment methodology
  - Edits for version 7.2 to be completed by IADC38 in 2020

WG3: Protection

Upcoming Action Items

- New Shielding Methods and Materials
  - CSA, CNSA, JAXA, ROSCOSMOS and NASA agreed to describe approach/methodology for development of advanced meteoroid and orbital debris shielding and provide examples

- Projectile Shape Effects
  - Orbital debris environment definitions continue to improve
  - Implications to spacecraft shield performance from non-spherical projectiles needs additional investigation
  - Common research plan defined with tasks including simulations, testing and equations updates divided amongst agencies
  - Draft report planned by IADC 40 (2022)

WG4 : Mitigation

During 2019 ROMA annual meeting a consensus was reached on a revised version (the third one) of the **IADC Space Debris Mitigation Guidelines** and the accompanying **Support Document**, in order to provide numerical figures and rationale for several key points such as:

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

Large Constellations:

- The **IADC Statement on Large Constellations of Satellites in LEO** including first recommendations is under revision
- Based on study scenarios agreed with, and analysed by, WG2, and on a wide literature review, a draft report for the action item “Potential Additional Mitigation Measures to Address the Proliferation of Small Satellites and Large Constellations” has been internally issued for review during the first trimester of 2020

Disposal Strategies in MEO:

- Following a request by the International GNSS Coordination Group (ICG), IADC is carrying out a technical assessment of the consequences of the disposal options
- A draft report has been internally issued for review during the first trimester of 2020

Upcoming in Toulouse

- **To engage a permanent action at IADC level to publish an environment report regularly on the current situation and evolution of the space environment (debris population increase and criticality).**

- To agree on AI to define environmental indexing scope

- To provide ICG with initial findings on MEO disposal in 2020. In 2021 ICG is provided with recommendations based on benefits and risks analyses

- To update IADC Statement on Large Constellation of Satellites in Low Earth Orbit (2017)

Conclusions

- IADC is the internationally recognized technical/scientific authority on space debris.
- IADC participates in and contributes to the UN space debris activities via the Scientific and Technical Subcommittee (STSC) of the Committee on the Peaceful Uses of Outer Space (COPUOS).
- 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 new web site hosted by KARI: http://www.iadc-home.org/**