IADC

INTER-AGENCY SPACE DEBRIS COORDINATION COMMITTEE (IADC)

ACTIVITIES AND VIEWS ON REDUCING SPACE DEBRIS FROM LAUNCH VEHICLES

Presented to:

38th Session of the
Scientific and Technical Subcommittee
Committee on the Peaceful Uses of Outer Space
United Nations

OBJECTIVES AND ORGANIZATION OF THE IADC

- **IADC is a technical organization, operating by consensus and governed by Terms of Reference**

- **Objectives**

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

- **Functionally divided into a Steering Group and four Working Groups: Measurements, Environment and Data Base, Protection, and Mitigation**

  - **Each member must be represented in Steering Group and Working Group 4, Mitigation**

EVOLUTION OF THE IADC

- **Formed in 1993 by national space agencies of US, Russia, and Japan and by ESA**

- **Eleventh member (National Space Agency of Ukraine) accepted in February 2000. Current members include space agencies of**

China	Germany	Japan	United Kingdom
ESA	India	Russia	United States
France	Italy	Ukraine	

- **Canadian Space Agency attended most recent IADC meeting as an observer**

SELECTED IADC ACTIVITIES AND ACCOMPLISHMENTS

- **Established Risk Object Reentry communications network**
  - **Exercises conducted each year**
- **Developed consensus GEO satellite disposal recommendation**
- **Share common database of historical space missions**
- **Compare national risk assessment, hypervelocity impact, and satellite reentry models**
- **Perform LEO and GEO debris observation campaigns**
- **Working to develop set of orbital debris mitigation standards**
- **Establishing IADC Internet site for public and member use**

CURRENT IADC ACTION ITEMS

Number	Title	Assignment
14.7	Develop a Catalog of Debris Mitigation Practices	WG 4
16.1	LEO End of Life Disposition	WGs 2&4
17.1	IADC Beam Park Experiment 2000	WG 1
17.2	IADC Space Debris Mitigation Standards	WG 4
18.1	International Space Debris Measurement Campaigns in GEO	WG 1
18.2	GTO-MEO-Molniya Upper Stage Disposal	WG 4
18.3	Entry Criteria and Procedures	WG 4
18.4	Small Satellites	WG 4

HIGHLIGHTS OF THE 18th MEETING OF THE IADC

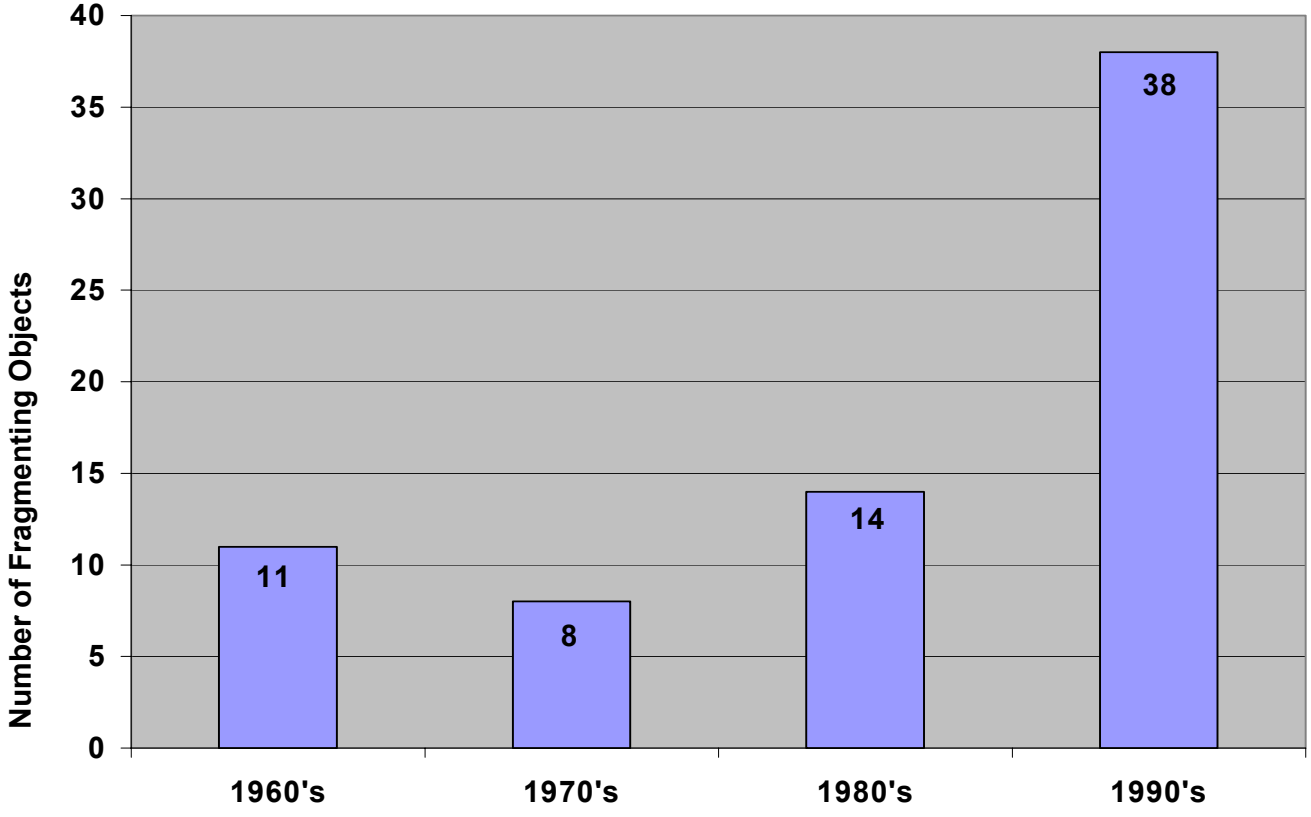
- Held at the US Air Force Academy in Colorado Springs, Colorado, USA, 13-16 June 2000
- Tour conducted of the US Space Control Center in Cheyenne Mountain
- First meeting with new member NSAU and observer CSA
- Results of third Risk Object Reentry exercise reviewed
- China provided information on passivation of Long March-4 launch vehicle
- Russia proposed study of special issues associated with small (mini, micro, and nano) satellites
- US summarized Compton Gamma Ray Observatory controlled reentry procedure
- Japan proposed new IADC documentation system
- Germany demonstrated prototype IADC Internet site
- France proposed to initiate a new study on the risks due to reentry of space vehicles

NEED FOR LAUNCH VEHICLE PASSIVATION

- **Historically, more than one-third of all known fragmentations in Earth orbit have involved non-passivated upper stages or their components**
  - **~30% of all cataloged objects in orbit in 2000 were debris created by non-passivated upper stages or their components**
- **Launch vehicles of many nations and organizations have been affected**
- **Fragmentations apparently have been caused by both cryogenic and non-cryogenic propellants, as well as by pressurized gases**
- **Upper stage fragmentations have occurred within hours of launch or as long as 25 years after launch**

BREAKUPS OF LAUNCH VEHICLE UPPER STAGES AND COMPONENTS

- During the period 1957-1999 a total of 71 upper stages or their components fragmented in Earth orbit, excluding reentry breakups
- 80% of these fragmentations involved objects which had operated successfully but had been abandoned without passivation



ELEMENTS OF LAUNCH VEHICLE PASSIVATION

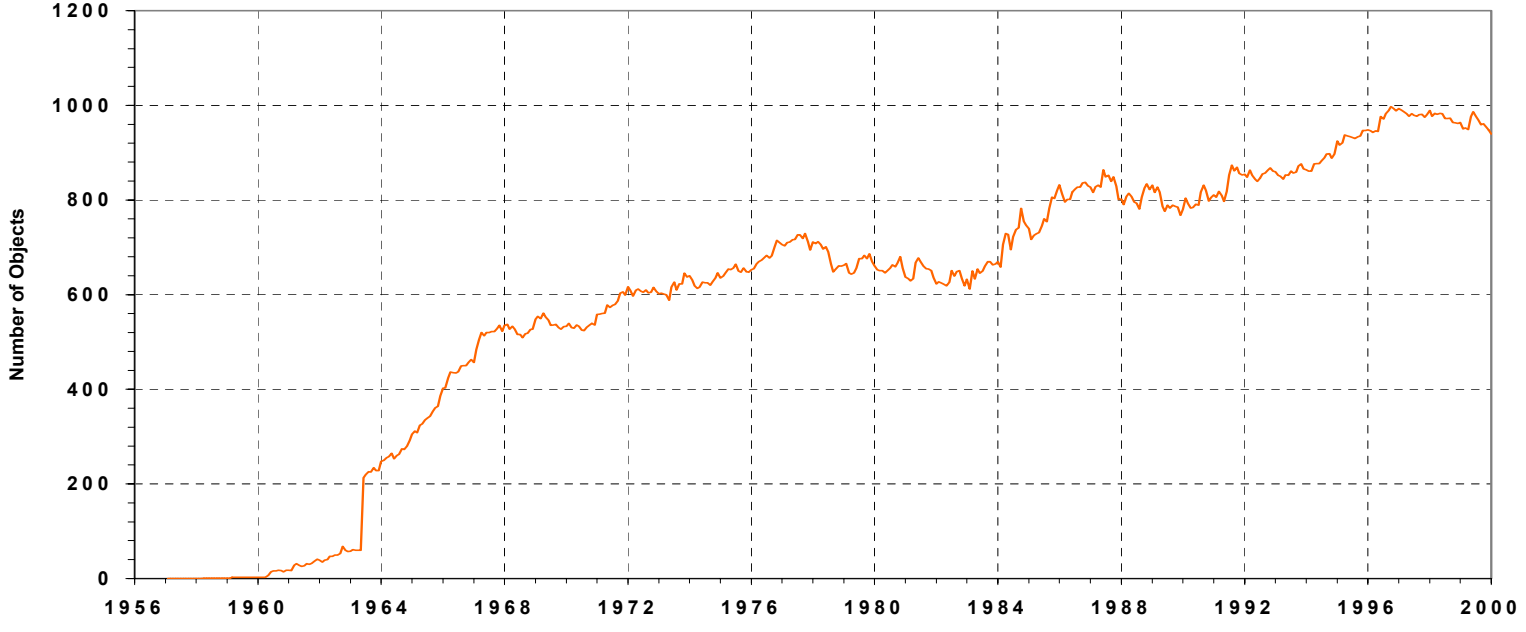
- All propellants (fuel and oxidizer) should be expended from both the primary propulsion system and attitude control system
  - Normally by depletion burns or venting
- All pressurization fluids should be released
- Batteries should be allowed to discharge
- Rotational energy in gyros or similar devices should be dissipated
- Explosive devices of range safety protection systems should be deactivated permanently

MISSION-RELATED DEBRIS

- Mission-related debris are objects ejected by spacecraft and upper stages, usually by design, during deployment or operation, e.g., lanyards, sensor covers, and engine caps
- Not all mission-related debris can be easily eliminated
- Some mission-related debris may decay from orbit within a short period and not pose a long-term environmental hazard
- Many objects which historically were released into orbit can be retained by the launch vehicle or spacecraft with the use of hinges, tethers, bolt catchers, or new designs

GROWTH OF MISSION-RELATED DEBRIS

- **In recent years the net growth of mission-related debris in Earth orbit has moderated and now accounts for only 11% of the cataloged objects**
  - **However, many mission-related debris are too small to be cataloged**



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SUMMARY

- The Inter-Agency Space Debris Coordination Committee welcomed its eleventh member, the National Space Agency of Ukraine, in 2000
- The IADC fosters a better understanding of space debris environment characterization, modeling, protection, and mitigation techniques
- Upper stage passivation and the reduction of launch vehicle mission-related debris are important to curtailing the near-term growth of space debris in Earth orbit
- The IADC is now working to develop a broader consensus set of space debris mitigation standards