

IISL - ECSL SYMPOSIUM - 18 March 1996

ESA Activities

Status and Organisation of the Inter-Agency Space Debris Co-ordination Committee

(IADC)

Presented by G. Lafferranderie (ESA Legal Advisor)

ESA and its Member States have been actively addressing the space debris issue for several years, a matter by definition subject of an international cooperation (facilities, expertise within the spirit of the Outer Space Treaty). I would like to summarise the main actions undertaken by ESA in close cooperation with Member States and their national agencies in order to reach a better understanding of the issue. These actions will at a later stage lead hopefully to a common policy which will be the starting point for regulations at international level.

1) **The genesis and development within ESA (involvement of national space agencies)**

In 1986 the Director general of ESA decided to create a **Space Debris Working Group**, composed by ESA staff and experts from ESA member States, the objective of which was to assess the various aspects of space debris.

Based on the report of this working group, the ESA Council adopted in **1989** a **Resolution on space debris** (entitled "Resolution of the Agency vis a vis the space debris issue", see Annex I) and approved a document entitled "**ESA Activities for space debris**" where the Agency objectives in the field of space debris were formulated.

These objectives are the following:

- to minimise the creation of space debris to ensure free access to space and reduce the risk for manned and unmanned space flight;
- to reduce the risk on ground due to re-entry of space objects;
- to reduce the risk for the geostationary satellites;
- to acquire through its own facilities and in cooperation with the other space agencies the data on space debris which are necessary to assess the extent of the problem and its consequences;
- to study the legal aspects of space debris;

(on this last point I have to say that it has not been yet addressed)

A two phase implementation plan was foreseen, initially where **Phase 1** - Analysis and preparation - (=13,5 MAU) covered the period **1989-92**, and **Phase 2** (=15-20 MAU) - Implementation and operations - the period **1993-95 mainly oriented towards international cooperation**. **A Phase 3**, has now been added covering the period 1996-1998 which will address the Low-Earth Orbit (LEO) region and the consequences of multi-satellite constellations (such as the Global Positioning System [GPS] or Iridium project). The international cooperation both on a European and world wide level will remain an essential element.

A crucial element of the Space Debris Plan is the **Space Debris Research Programme** whose general objectives include:

- to gain a better understanding of the space debris problem,
- to assess the level of risk for its own programmes
- to identify ways and methods to mitigate the space debris problem,
- to support the establishment of an overall ESA policy on space debris.

Two groups were created for the guidance and coordination of the Agency's activities in compliance with the formulated objectives: the **ESA Space Debris Advisory Group (SDAG)** with experts from member States representing the major entities in Europe with experience in space debris matters and the internal **Space Debris Coordination and Technical Analysis Group**.

I should here underline that the SDAG has a special coordination role with respect to space debris matters not only with national space Agencies of member states but also at international level with other space agencies (European and non-European like NASA).

It is interesting to note in this context that the progress in international cooperation was demonstrated at the occasion of the **salyut-7/Kosmos 1686 reentry**, where our European Space Operation Centre acted as the central hub for the data exchange between several space organisations and also subsequently organised an **international workshop on that matter in April 1991**. The same applied at the occasion of the uncontrolled reentry of the equipment module of the Chinese spacecraft in October

1993, as well as at the occasion of the very recent (on 12 March 1996) uncontrolled reentry of a Chinese satellite, where ESOC provided forecasts to ESA's Member States on time and location of the reentry based on the data from European facilities, US Space Command and Russia.

I should maybe also mention that ESA and NASA entered into an exchange of letters in 1992 (see Annex III) concerning the space debris issue and ESA has regularly been organising ad hoc **Space Debris Coordination Meetings** with the Japanese and American space agencies which were the predecessors of the IADC.

Particular emphasis on the **First European Space Debris Conference which was held in Darmstadt at the initiative of ESA from 5-7 April 1993**. This conference which was a considerable success gathered 251 experts from 17 countries. Its aim was to provide:

- a forum for the presentation of results from research on space debris;
- to assist in defining future directions of research;
- to identify methods of debris control, reduction and protection;
- and to discuss international implications and policy issues.

At this occasion a major step in the international cooperation was reached when the **first multilateral meeting** with representatives of NASA, the Russian Space Agency (RKA), Japan and ESA agreed to establish an **Inter-Agency Space Debris Coordination Committee (IADC)** (terms of reference in Annex II). It is envisaged to hold the second European Space Debris Conference in 1997.

I would briefly like to indicate which were the major achievements of ESA regarding the space debris issue:

- The Agency has established the DISCOS data base for space objects for its own use and entities in the Member States; it supplies information on the currently catalogued objects and is a basis for risk assessments.

- Debris preventive measures, such as venting of Ariane upper stage in synchronous orbit since flight 59 (in September 1993) and re-orbiting of geostationary spacecraft into a graveyard orbit above the GEO (the recent examples are GEOS-2 [+ 260 km, 1984], OTS-2 [+318 km, 1991], METEOSAT 2 [+334 km, 1991], ECS-2 [+ 335 km, 1993], OLYMPUS (- 213 km, 1993), METEOSAT 3+4 (1995), have been implemented;

- Finally generic work on protective measures for manned vehicles has been carried out (shield testing and hypervelocity impact tests) at several facilities within the Member States. In the shielding area research activities have focused on the selection of optimum materials and the design of shields with minimum mass for given safety and damage tolerance;

ESA contributed to a comprehensive report¹ on space debris of the U.S. National Academy of Sciences. It offers clear recommendations for research on the space debris population, for methods to improve the protection of spacecraft, and on

¹ Orbital Debris. A Technical Assessment. *National Academy Press* 1995

methods to reduce the creation of debris.

2) **The IADC**

a) Form

The IADC constitute a very unique forum devoted to consultations at international level on orbital debris without creating any specific legal commitment for its Members and has therefore no legal personality.

b) Membership

This Committee has today increased the number of its Members and is now composed by eight members which are ESA, Japan, NASA, the Russian Space Agency (RKA), the Chinese Space Administration (CNSA), the French Centre National d'Etudes Spatiales (CNES), the UK Defense Research Agency (DRA) and the Indian Space Research Organisation (ISRO).

c) Purpose

IADC offers a forum for discussion and coordination of technical space debris issues and will soon hold its 14th meeting in Darmstadt, Germany. Such meetings are being held at intervals of about 8-10 months preferably coinciding with other international meetings. Location of meetings are rotating among Members as appropriate and the host of each meeting acts as the Chair of the meeting, and is responsible for coordinating the dates, location, and agenda of the meeting, drafting and distributing the minutes of the meeting. The primary purpose of the IADC is to exchange information on space debris research activities, to facilitate opportunities for cooperation in space debris research, to review the progress of ongoing cooperative activities and to identify debris

mitigation options. It is also stated in the IADC terms of reference that any specific cooperative activities endorsed by the IADC will be implemented through arrangements negotiated between Member organisations. Members exchange data resulting from national orbital debris programs as appropriate. Data and information exchanged through the IADC are normally to be exchanged without restrictions as to use or disclosure. In the event that technical data is exchanged which is considered to be proprietary, and for which protection is desired, the data is marked with a notice indicating the use and disclosure restrictions, and the recipient agrees to abide by the terms of such notices.

d) Structure

IADC comprises a Steering Group composed by representatives of the Members and four technical working groups composed of 2-3 experts from each Member and dedicated to specific areas:

- i) measurements of the environment,
- ii) database and environment,
- iii) protection,
- iv) mitigation.

Within the framework of this cooperation the participants exchange relevant technical information and experience related to space debris and prepare common strategies to counter the space debris problem. Current activities focus on:

- a joint debris database,

- the discovery of significant new debris source in the heavily used near Earth orbital region of 700 km to 1100 km altitude which could be attributable to RORSATs²,
- improve meteoroid and debris models,
- debris mitigation in GEO transfer orbits,
- optical observations and global inventory of the geostationary ring,
- debris management practices in the geostationary ring.

e) Legal commitment

It is important to note that the IADC terms of reference document the mutual interest on the part of its Members to exchange information on orbital debris, but that they do not establish any obligation or legal requirement to do so, nor do they establish any obligation to conduct any particular cooperative activity.

3) ESA and UNO work on space debris

As you know the topic *space debris* appeared in 1994 and 1995 on the agenda of the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS). At both sessions technical presentations to the space debris issue were given by ESA. The S&T Subcommittee adopted in

² Radar Ocean Reconnaissance Satellites

1995 a multi-year work plan:

- 1996: Measurements of space debris and effects of the environment on space systems
- 1997: Modelling of the space debris environment and risk assessment
- 1998: Space debris mitigation measures (protection, prevention, removal).

Conclusion

I shall conclude by stating that for the moment the necessary flexible international cooperation tool exists which allows us to understand the technical aspects and to coordinate national activities related to space debris. It remains to discuss at an appropriate time, in addition to the existing space law treaties if new instrument would be needed and if so what would its legal form be.

Any future legal regulation on that subject should be examined by the UNCOPUOUS which will still take some time. ESA will naturally in due course, subject to a mandate given by its member States, contribute to the elaboration of such new standards from a European perspective once the technical assessments of the space debris have been completed.

- Annex 1 -

ESA/C/LXXXVII/Res. 3 (final)

europaean space agency

COUNCIL

Resolution on the Agency's policy vis-à-vis the Space Debris issue

(approved on 29 June 1989)

The Council,

CONSIDERING that the problem of space debris has become world-wide one of the major issues regarding the environmental protection of outer space and has reached a level which requires serious considerations especially for manned missions,

WELCOMING the attention already devoted to this problem by the Agency and NOTING the on-going activities and preventive measures (i.e. ESA/PB-ARIANE-(89)26),

HAVING REGARD to the report by the Chairman of the Council Working Group on Space Debris set up following the invitation it made at its December 1986 meeting (ESA/C(89)44),

CONSIDERING that any action, such as elaboration of norms, will require careful assessment and coordination, in particular among all space-faring nations,

ESA/C/LXXXVII/Res. 3 (final)

- I. ENDORSES the recommendations expressed by the Space Debris Working Group;
- II. AGREES to the Agency's objectives and implementation strategy as contained in document ESA/C(89)24, rev. 1, i.e. in particular to obtain a better knowledge and understanding of critical issues, to reduce to the maximum possible extent the production of space debris and to promote exchange of information and cooperation with other space operators;
- III. SUPPORTS the setting up, under the Director General's authority, of the necessary management structure to cope with all space debris aspects and of a space debris Advisory Group with outside experts;
- IV. INVITES the Member States to continue seeking a common position, using IRAC, with regard to space debris matters at international level, in particular vis-à-vis the United Nations;
- V. INVITES the Director General to make proposals within the annual budgets for implementing the approved objectives.

- Annex 2 -

IADC Terms of Reference
(draft update)

Revised March 10 1995

Terms of Reference for the Inter-Agency Space Debris Coordination Committee

This document constitutes the Terms of Reference (ToR) for the Inter-Agency Space Debris Coordination Committee (IADC) and establishes the basic principles related to its function.

The Terms of Reference of the Inter-Agency Space Debris Coordination Committee have been agreed at the 10-th IADC meeting at TSNIIMASH, Kaliningrad, October 25-26, 1993, and have been updated at the 12-th IADC meeting at NASA Johnson Space Center, Houston, March 8-10, 1995.

1. Purpose

The primary purpose of the IADC is to exchange information on space debris research activities between member space agencies, to facilitate opportunities for cooperation in space debris research, to review the progress of ongoing cooperative activities and to identify debris mitigation options.

2. Rationale

The members share a number of common interests in space debris research which may be developed into a variety of cooperative research activities. Such ventures are likely to increase in frequency and scope in the future. It is highly desirable to exchange information on current research activities so as to identify future cooperative activities. Therefore, the IADC is established to identify, plan, and assist in the implementation of joint cooperative activities that are of mutual interest and benefit.

3. Scope

The IADC will

- a. review all ongoing cooperative space debris research activities between member organizations;
- b. recommend new opportunities for cooperation;
- c. serve as the primary means for exchanging information and plans concerning orbital debris research activities;
- d. identify and evaluate options for debris mitigation.

Any specific cooperative activities endorsed by the IADC will be implemented through arrangements negotiated between member organizations.

Members should exchange data resulting from national orbital debris programs as appropriate. Data and information exchanged through the IADC will normally be exchanged without restrictions as to use or disclosure. In the event that technical data is exchanged which is considered to be proprietary, and for which protection is desired, the data shall be marked with a notice indicating the use and disclosure restrictions, and the recipient agrees to abide by the terms of such notices.

4. Membership

Members of the IADC are the European Space Agency (ESA), Japan, the National Aeronautics and Space Administration (NASA), and the Russian Space Agency (RKA); China, CNES (France), DRA (United Kingdom), ISRO (India since 27.02.1996).

New members may be included upon unanimous decision of the members of IADC.

Member delegations may include representation from other organizations or government agencies in their delegation.

More detailed criteria for membership are defined in Annex I.

5. Organizational structure

The IADC will comprise

- a Steering Committee composed of representatives of the members. The Steering Committee will include the points of contacts of the members listed in Annex II.
- four specialised Working Groups:

Working Group 1: Measurements

Working Group 2: Environment and Data Base

Working Group 3: Protection

Working Group 4: Mitigation.

Each Working Group shall be composed of 2-3 experts from each member. The terms of reference of each working group are given herein and as supplemented in Annex III. Present working group chairperson, deputy chairperson, and membership are listed in Annexes IV and V.

6. Meetings

Location of meetings of the IADC will rotate among the members of the IADC, as appropriate. The frequency and schedule of IADC meetings will be established by the Steering Committee. Meetings at intervals of about 8-10 months should be aimed for, preferably coinciding with other international meetings.

The host of each meeting will act as the chair of the meeting, and will be responsible for coordinating the dates, location, and agenda of the meeting and drafting and distributing the minutes of the meeting.

General meeting arrangements and associated meeting expenses will be borne by the host agency. Each member will be responsible for the travel and subsistence of its representatives attending the IADC.

7. Terms and Conditions

These Terms of Reference may be modified or terminated by mutual agreement of the parties. These Terms of Reference and all activities under these Terms of Reference may be terminated unilaterally by any member with three-months prior written notice. All debris cooperative activities for which separate agreements have been concluded, may continue after termination of these Terms of Reference, pursuant to the terms and conditions of those agreements.

These Terms of Reference document the mutual interest on the part of the members of IADC to exchange information on orbital debris. The Terms of Reference do not establish any obligation or legal requirement to do so, nor do they establish any obligation to conduct any particular cooperative activity.

Working Group 1

Measurements

Terms of reference

- The IADC Steering Committee has established Working Group 1 on Measurements
- The members of WG 1 are appointed by each member of the IADC.
- The Working Group nominates a chairperson and a deputy. The chairperson organizes and guides the activities of the Working Group.
- The Working Group establishes its own agenda. However, it may also receive tasks from the IADC.
- The Working Group reports through its chairperson to the IADC Steering Committee.
- Meetings of the Working Group can be attended by others when invited by a member of the IADC.

Scope and objectives

The scope of WG 1 are all measurement techniques, both functioning and currently under development, to gain information on man-made and natural objects in near-Earth space. This includes

- ground-based and space-based measurements and related techniques, e.g. radar, optical and infrared
- detectors and collectors for small-size particulates onboard space vehicles
- analysis of spacecraft surfaces exposed to the space environment.

Within the above scope the objectives of the WG are to

- review space debris research efforts in the area of measurement techniques
- identify, evaluate and recommend new opportunities for cooperation
- serve as means for exchanging information and plans concerning research activities in the area of measurements of orbital debris.

Required inputs

- Reports on research activities in member organizations with regard to measurements.

Expected outputs

- Identification, definition and review of cooperative research activities.

Working Group 2

Environment and Data Base

Terms of reference

- The IADC Steering Committee has established Working Group 2 on Environment and Data Base.
- The members of WG 2 are appointed by each member of the IADC.
- The Working Group nominates a chairperson and a deputy. The chairperson organizes and guides the activities of the Working Group.
- The Working Group establishes its own agenda. However, it may also receive tasks from the IADC.
- The Working Group reports through its chairperson to the IADC Steering Committee.
- Meetings of the Working Group can be attended by others when invited by a member of the IADC.

Scope and objectives

The scope of Working Group 2 is the characterization and modelling of meteoroid and debris around the Earth and storage and access of the data by electronic means. This includes

- meteoroid and debris models describing the spatial distribution and other characteristics, e.g. flux, size, albedo.
- short- and long-term evolution
- related mathematical methods
- collision prediction and risk assessment
- uncontrolled reentry
- establishment of joint data base for debris and meteoroids
- development of models which characterize explosions or collisions in space.

Within the above scope the objectives of the WG are to

- review research efforts in environment modeling and related data base
- identify, evaluate and recommend new opportunities for cooperation
- serve as means for exchanging information and plans concerning research activities in the area of environment modelling and related data base.

Required inputs

- Reports on research activities in member organizations with regard to environment modelling and related data bases.

Expected outputs

- Identification, definition and review of cooperative research activities.
- Concepts for extended and comprehensive data bases.

Working Group 3

Protection

Terms of reference

- The IADC Steering Committee has established Working Group 3 on Protection.
- The members of WG 3 are appointed by each member of the IADC.
- The Working Group nominates a chairperson and a deputy. The chairperson organizes and guides the activities of the Working Group.
- The Working Group establishes its own agenda. However, it may also receive tasks from the IADC.
- The Working Group reports through its chairperson to the IADC Steering Committee.
- Meetings of the Working Group can be attended by others when invited by a member of the IADC.

Scope and objectives

The scope of the activities of WG 3 comprises design and technology of shielding against meteoroids and space debris and the associated test methods.

Within the above scope the objectives of the WG are to:

- establish a common data base of world-wide test facilities
- optimize the shield design, its performance and test methods, including the use of computer codes
- coordinate test procedures for computer code validation
- establish a data base on impact test results
- develop and update shield design and test planning for improvement of crew safety and satellite/station system integrity
- study space vehicle fragmentation events including dynamics of structure at their impact with space debris and secondary debris
- coordinate test procedures for impact testing on pressurized structures
- study the feasibility of common shield designs, testing planning and test procedures
- review research efforts on hypervelocity testing and shielding
- identify, evaluate and recommend new opportunities for cooperation
- serve as means for exchanging information concerning actual on-orbit impacts and shielding design performance
- serve as means for exchanging information and plans concerning research activities in the area of protection.

Required inputs

The working group requires the following inputs:

- Design and performance data on current shield concepts.
- Description and capabilities of test methods.
- Description and capabilities of computer codes.
- Information on planned activities in the area of shield design, shield testing and establishing and upgrading of test facilities.

Expected outputs

The expected outputs are as follows:

- Data base on testing and shielding.
- Detailed acquaintance with existing shield design, performance and test facilities.
- Proposed shield design and test activities for improvement of crew safety and satellite/station system integrity.
- Proposal for implementing the proposed concepts.

Working Group 4

Mitigation

Terms of Reference

- The IADC Steering Committee has established Working Group 4 on Mitigation.
- The members of WG 4 are appointed by each member of the IADC.
- The Working Group nominates a chairperson and a deputy. The chairperson organizes and guides the activities of the Working Group.
- The Working Group establishes its own agenda. However, it may also receive tasks from the IADC.
- The Working Group reports through its chairperson to the IADC Steering Committee.
- Meetings of the Working Group can be attended by others when invited by a member of the IADC.

Scope and objectives

The scope of Working Group 4 is the study of all measures to reduce or avoid the creation of space debris or reduce the hazards created by space debris. This includes

- identification of space debris sources
- design and operations of space system to avoid or reduce the creation of space debris
- removal of man-made objects
- measures to prevent the creation of space debris
- measures to reduce the collision hazard
- guidelines for debris mitigation.

Within the above scope the objectives of the WG are to

- review space debris research efforts in the area of mitigation
- identify, evaluate and recommend new opportunities for cooperation
- serve as means for exchanging information and plans concerning research activities in the area of mitigation.

Required inputs

- Debris mitigation measures of member organizations.

Expected outputs

- Evaluation of debris mitigation measures.
- Handbook/guidelines for debris mitigation.

Annex I

Criteria for Membership in IADC

1. Scope

The purpose of the "Criteria for Membership in IADC" is to expand on Article 4 of the ToR of IADC, and to provide a more detailed and precise description of the criteria for membership in IADC.

Membership in IADC is addressed in Article 4 of the ToR.

2. Preamble

In the interest of efficiency the number of members of the IADC should be of a manageable size and, therefore, limited to appropriate nations and organizations consistent with the aims and objectives agreed in the ToR of the IADC. Where appropriate greater concentration in regional grouping should be aimed for.

IADC members complete necessary coordination (Intra-agency, Inter-agency, etc.) prior to IADC meetings.

3. Criteria for membership

- a. Members are countries or national or international space organisations which are carrying out space activities, through either manufacturing, launching and operating spacecraft or manufacturing and launching rockets.

A member should be actively undertaking space debris research activities and contribute to an increased understanding of space debris issues.

A member may represent one or several countries.

- b. A country is represented in IADC by itself or by one space organization. The delegation of any IADC member may, however, be comprised of delegates from other space organizations or other selected agencies of that country or of other countries.
- c. International consortia sponsoring major satellite programmes (e.g. INTELSAT, INMARSAT, etc.) or relevant specialized agencies of the UN (e.g. International Telecommunication Union) may be invited to participate in IADC meetings when specific issues of interest are discussed.

ANNEX II

Contact Points of IADC Members

ESA: Dr. W. Flury, ESOC, Robert-Bosch-Str. 5, 64293 Darmstadt
Germany

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NASA: Mr. G. Levin, NASA HQ, Washington D.C. 20546, USA

Fax +1 202 358 2885
Tel +1 202 358 4478
glevin@osfms1.hq.nasa.gov

RKA: Mr. Y. Levitsky, RKA, Schepkina Str. 42, Moscow 129 857,
Russia

Fax +7 095 251 8702
Tel +7 095 971 9315

Annex III

Format of the IADC Meetings and Procedures for the Working Groups

A Format of IADC Meetings

1. The host agency or country will act as secretary and prepare the minutes of the meeting for the approval of the Chair.

2. The agenda will be prepared by the Chair and provided to all the participants not less than three weeks prior to the meeting. The agenda will identify topics and speakers and time allocations for presentation. Not less than one third of the time should be allocated to discussion and plans.

3. The Chair will be responsible for reporting the groups activity to the plenary session; he may ask members of the group to make parts of the report.

4. The general plan for future meetings should be for four full days. The pattern of such a meeting would be:

Day 1	AM Plenary PM Working Groups
Day 2	AM Working Groups PM Working Groups
Day 3	AM Working Groups PM Working Groups
Day 4	AM Plenary - Working Groups Report Executive session of Plenary: <ul style="list-style-type: none">o Draft minutes with summaryo Recommendationso List of action items PM - Review of proposals of cooperative projects between Steering Committee and Working Groups <ul style="list-style-type: none">- Tours of suitable facilities- Closing session.

The objective is to provide enough time for meaningful discussion and the accomplishment of real work.

5. Establish a "rule" that all presentations have word charts and figures, as appropriate to summarize the remarks. In addition the speaker should provide three copies to the secretary.

B Procedures for the Working Groups

1. Elect a Chairperson to serve a term of two consecutive meetings and a Deputy who will succeed as Chairperson for the following term. A new Deputy will be elected for the following term, etc.

2. Normally a presentation should not last more than 15 minutes.

3. Discussion should define the most immediately important topics for the Working Group and who will prepare material for the next meeting to address those topics. Assign the appropriate actions to make the presentations for the next meeting.

4. The Working Groups are expected to pursue agreed upon activities by fax, e-mail and other correspondence and communication between meetings to perform agreed upon tasks.

5. Working Groups are not expected to have meetings outside of the context of the general meeting. The objective of the plan is to reduce the total number of meetings.

6. The basic function of each Working Group is to define mutually agreed upon work so that each participant can better understand the issues and the state of understanding so as to advise his authorities as to appropriate policy and action.

Annex IV

Chairpersons and Deputies of Working Groups

Status: March 11 1995

	Chairperson	Deputy
WG1 Measurement	Tadashi Takano The Institute of Space and Astronautical Science 3-1-1 Yoshinodai, Sagamihara Kanawage 229, Japan Tel +81 427 51 2911 Fax +81 427 59 4251	Prof. A.I. Nazarenko Russian Academy of Sciences, Center for Program Studies 84/32 Profsoyuznaya ul. Moscow 117810, Russia Tel +7 095 429 5400 Fax +7 095 420 2275
WG2 Environment & Data base	Heiner Klinkrad ESOC PO Box 406 64276 Darmstadt Germany Tel +49 6151 90 2295 Fax +49 6151 90 2625 HKLINKRA@ESOC	Robert C. Reynolds Lockheed 2400 NASA Road 1 C102, Houston TX 77085-3799 USA Tel +1 713 333 7071 Fax +1 713 333 7791 BOBR@SN.DNET.NASA.GOV
WG3 Protection	Viktor N. Dolgikh TSNIIMASH 4, Pionerskaya st. 141070 Kaliningrad Moscow region, Russia Tel +7 095 516 3043 Fax +7 095 274 0025	Jeanne Lee Crews NASA Johnson Space Center Mail Code SN3 Houston, TX 77058 USA Tel +1 713 483 5308 Fax +1 713 483 5276 CREWS@SN.DNET.NASA.GOV
WG4 Mitigation	Akira Takano Office of Research and Development System Engineering Department Tsukuba Space Center NASDA 2-1-1 Sengen Tsukubashi Ibaraki 305, Japan Tel +81 298 52 2239 Fax +81 298 52 2247	Walter G. Naumann ESA HQ 8-10, rue Mario-Nikis 75738 Paris Cedex 15 France Tel +33 1 5369 7350 Fax +33 1 5369 7678 WNAUMANN@ESA

Table 2. Chairperson and Deputy of Working Groups

Annex V

Membership in Working Groups of the IADC

Status: March 10 1995

	ESA	JAPAN	NASA	RKA
WG 1 Measurements	Jehn Schwehm	Arimoto (CRL) Takano (ISAS) Sato (Kyoto University)	Stansbery Vilas	Kuriksha Yurasov Shargorodsky
WG 2 Environment & Database	Drolshagen Klinkrad	Kibe (NAL) Kato (NASDA)	Potter Kessler	Veniaminov Khutorovsky Potchukaev
WG 3 Protection	Lambert Heusmann	Shirai (NASDA/MHI) Sato (NASDA)	Crews Christiansen	Dolgikh Ulanov
WG 4 Mitigation	Soons Naumann Flury	Yasaka (Kyushu University) Takano (NASDA)	Loftus Levin	Chekalin Moiseev Yakovlev

Table 1. Composition of Working Groups

- Annex 3 -

Correspondence with NASA




europaean space agency
agence spatiale européenne

CAB/INT/KB/MTL/5144

Mr. Peter G. Smith
Director International Relations
NASA H.Q.
Washington, D.C. 20546

U.S.A.

Paris, 15 JUL 1992


Dear Mr. Smith,

1. ESA and NASA agree to regularly hold coordination meetings on all debris aspects of mutual interest, in particular the knowledge of the terrestrial particulate environment, risk analysis of space projects, and prevention and protection. This cooperation includes exchange of research results.
2. ESA and NASA agree to continue cooperation in the studies of debris impacts on LDEF. ESA has provided LDEF thermal blanket material to NASA and results of their analyses. NASA will provide to ESA the results of their thermal blanket material analysis.

8-10 rue Mario-Nikis 75738 Paris Cedex 15 - ☎ (33.1) 42 73 76 54
Télécopieur (33.1) 42 73 75 60 - Télex ESA 202746 - Télégr. Spaceurop Paris

3. Cooperation will also continue on the analysis of IRAS data. For its part, ESA will continue to conduct analyses of the IRAS data, establish a database of debris sightings, and make the results of the analysis available to NASA.
4. ESA and NASA agree to exchange information involving orbital elements of satellites and space objects. For its part, NASA will provide electronic transmission of the Two-Line-Element (TLE) updates to ESA/ESOC. For its part, ESA will provide NASA access to ESA's DISCOS database, which contains among other elements, the TLE's and the Royal Aerospace Establishment's (RAE) Table of Earth Satellites. ESA may grant full access to DISCOS for users within the ESA establishments. For external users within the ESA Member States, full access to the DISCOS TLE requires the prior agreement of NASA. Annex 1 lists the current users with full access to the TLE data in DISCOS. In addition, any user of the DISCOS database may gain access to a limited number of TLE of space objects (on the order of 20). ESA is free to publish, in hard copy format, any data or information derived from the TLE catalog.
5. ESA and NASA also agree to continue the exchange of information and results concerning hypervelocity impact results. Efforts will be made to continue the standardization process for testing and reporting results, and developing a shared database of information.
6. ESA and NASA also agree to continue exchange of information on debris minimization through space vehicle design and operation.
7. Other areas of interest which will be studied by ESA and NASA are:
 - . optical and radar observation of space debris
 - . modelling of the space debris environment of the Earth including long-term evolution
 - . break up modelling
 - . risk analysis
 - . meteoroid and debris protection of manned and unmanned vehicles
 - . re-entry of space objects (trajectory calculation, break up modelling)
 - . geostationary orbit (re-orbiting, collocation)
 - . debris mitigation.
8. It is the intent of ESA and NASA that the data exchanged by them be exchanged without restrictions as to use or disclosure. In the event either side finds it necessary to exchange technical data that are either export-controlled or considered by the furnishing side to be proprietary, and

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for which protection is desired, the furnishing side shall mark the technical data with a notice indicating the use and disclosure restrictions and the receiving side agrees to abide by the terms of the notice.

Release of public information regarding this cooperation may be made by each side for its own portion of the envisaged activities as desired and, insofar as participation of the other is involved, after suitable consultation.

Nothing in this exchange of letters shall be construed as granting or implying any rights to, or interests in, patents or inventions of the Parties or their contractors or subcontractors.

Nothing in this exchange of letters shall compel or authorize the disclosure of privileged or proprietary information, national security information, or information the disclosure of which is prohibited by applicable law.

Nothing in this exchange of letters authorizes the export of any item in violation of applicable laws and regulations; and both sides, upon timely coordination, shall use their best efforts to arrange for free customs clearance of items necessary to carry out this cooperation.

9. No exchange of funds is provided under this cooperation and it is understood that participation by either NASA or ESA is contingent upon availability of funding appropriations required to support their respective responsibilities. Neither side nor its contractors, subcontractors, experimenters, or any other participant(s) in these cooperative efforts shall hold the other liable for any injury, death, loss or damage which arises out of this cooperation. Further, these arrangements shall not be considered as creating any right or benefit, enforceable at law or in equity, by any person or entity against either side, its contractors, subcontractors, experimenters, or other participants in the cooperative effort.

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4. Formulation of an International Position Paper on Orbital Debris by the IAA Ad Hoc Space Debris Group - 42nd Congress of the International Astronautical Federation - October 5-11, 1991 - Montreal, Canada