REPORT ON INTERNATIONAL STANDARDS OKGANIZATION ACTIVITIES IN SPACE ENVIRONMENTS

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Alan Tribble holds a B.S. in Physics from the l_ University of Arkansas and a Ph.D. in Physics from the University of lows. He is a space environment effects specialist a t Rockwell International's Space Systems I Division and is currently a Principal Investigator for the NASA Space Environment Effects Program. He is the author of two bock and over one dozen technics] publications, and is an instructor for the University of Southern Californi a and t he American Institute of Aeronautics and Astronautics.

KEYWORDS

space environments and effects, rad i at ion, meteoroids, 1S0, international standards, terms and definitions, terrestrial geoid and gravitational models, space debris, simulation, contaminants.

ABSTRACT

During the last year the International Standards Organization has initiated meetings among represent a t i ves of t h e spacefaring nations to develop standardized models for space environments. Th is work is intended to facilitate the design of joint missions and the development of international markets for spacecraft components. NASA is heavily involved in this effort, and other government agencies are coming on board. T'his paper describes progress and plans for this activity. Compliance w i th these standards will be voluntary; however, in practice once these standards arc established, noncompliance could place a company at disadvantage in the international marketplace. It is vital that US industry be fully represented in these discussions, and the author encourages increased participation by US space vehicle and components manufacturing concerns.

1NTRODUCT'J ON

The international Standards Organization (ISO) was founded under the auspices of the United Nations in 1946. The purpose of the 1S0 is to promote standardization devel - opment for facilitation of international ex-

change of goods and services. The 1S0 is composed of a variety of '1'ethnical Cornmittees (l'C), Subcommittees (SC), and Working Groups (WG), that develop international standards. Compliance with 1S0 standards is completely voluntary as their intent is to enhance scientific cooperation and promote trade. ISO standards do not require individual countries to change or discard their existing specifications, rather they require individual countries to exchange information to create common definition of existing and agreed upon interfaces.

in 1993 1S0 TC20, Aircraft and Space, formed a more focused SC to deal with Space Systems and Operations, SC14. The AIAA functions as the secretariat for SC14. SC14 is in turn composed of five working groups: i) Design, Engineering and Production, ii) Interfaces, integration, and Test, iii) Operations and Ground Support, iv) Space Environments (Natural ant] Art ificial), and v) Program Management. The Space Environments working group, WG4, is chaired by Russia. The United States has four voting members on WG4, which arc appointed by the lead US aerospace technical organization, the American Institute of Aeronautics and Astronautics (AIAA).

At the current time, the four "official" US delegates are shown below. The only time this matters is when WG4 votes on a new work item. All other US activities can, and are, conducted by the organizations and individuals that arc best capable of providing input. "I'he US delegates have the obligation to share information on the ISO activities with the US space environments community and to report their findings back to the US Subcommittee Advisory Group (SCAG) before SC14 meetings.

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The immed i ate objectives on the delegation are to ensure that the best envi ronmental models are selected as international standards and to encourage improvement and further development of models where there are serious model deficiencies or where no satisfactory model exists. Eventually, these models will be applied, either in WG4 or in some other working group, to develop manufacturing standards for spacecraft components in international markets, We will require the cooperation and support of the entire US space environments community in the government, commercia I and academic sectors to be fully effective in protecting US competitive interests.

WG4 ACTIVITIES "1'0 DATE

Nagoya, Japan 12-15 Apr. 1994:

WG4 did not make its debut until the third meeting of SC14 convened by Mr. Yuri Bulgakov on behalf of the Russian Federation. This first gathering in Nagoya, Japan, a t which the US was represented solely by Dr. Ken Champion, was primarily organizational. This paper, therefore, will concentrate on the second and third WG4 meetings in Moscow and Cannes respectively. However, one significant outcome of the Nagoya meeting was the preparation of a draft set of space environment standards [1] by Dr. Champion as a strawman for review by the international community. This document was circulated among the limit cd community of experts identified at the time as interested in international space environment standards. It was instrumental in bring significant issues to the fore and

stimulating discussion on major points of concern.

Moscow, Russia, 17-21 Oct. 1994:

During the week of 17-21 Ott. 1994 the International Standards Organization (1S0) sponsored meetings in Moscow, Russia. On 18 and 19 Ott. five working groups of SC14 met in parallel at the Cosmos hotel to work issues related to specific areas of expertise. On Friday, 21 Oct. the Plenary meeting of SC14 was held at the Russian Space Agency. Dr. Guy Spitale was the sole US representative at the WG4 meetings.

Representation by country:

1 US
1 French
2 Japanese
25-30 Russian (variable)
1 1S0 representative (occasionally present)
1 Brazilian (present first day)

Summary of discussions in WG4:

The Working Group agreed upon the f 01-lowing 15 areas for standardization:

Terms and definitions.
Cosmic rays including solar cosmic rays, galactic cosmic rays, anomalous cosmic rays, albedo particles, and associated radiation transport methods.
Solar activity, solar proton events, solar emanations of various frequencies, geomagnetic indices, and solar wind.
Terrestrial geoid and gravitational models.
Terrestrial trapped radiation belts.
The magnetosphere and ionosphere.
Meteoroid environments.
Space debris.
The neutral upper atmosphere.
Optical emissions of the Earth's atmosphere.
Anthropogenic influences on the near-larth space environment.
Spacecraft interactions with the environment.
Simulation of all aspects of the space environment.
Planetary and satellite simulation (contaminants).

'I 'he group made some minor wording changes and added some subheadings in the areas of standardization. The Russians made nine specific proposals for development of standards, many of them concentrated in the radiation area, 'I'hey proposed collaboration with US investigators. Allthe proposals were approved for development.

A requirement for temporal variations within the models where appropriate was added at the suggestion of the US.

The US proposed draft standardization document [1] was withdrawn after discussion by the working group, and it was agreed that in the area of Space Environments the 1S0 should issue a complex of separat e documents in each of the a reas of standardization. These documents are to be tied together by an overarching document pointing to each of the specialized documents as appropriate standards. Only the Japanese objected to this, and it is 1 ikely that this will be an item of controversy a t future meetings.

Cannes, France, 21-28 May 94:

1 n the interim bet ween meetings seven more proposals for development of standards were circulated by the Russians and they added three more during the meetings a t Cannes. One again the US was represented only by 1 Dr. Guy Spitale.

The list of proposed work areas now stands as follows:

1 Energetic Electrons in the Near Earth Region
2 Energetic Electrons and Protons at Low Altitudes
3 Heavy Ions in the Trapped Radiation Belts
4 Anomalous Cosmic Rays

5	Galactic Cosmic Rays
6	Solar Cosmic Rays - Particle Fluences and Peak Fluxes
7	ionosphere of the Earth
8	Solar Radiation - Soft X-rays
9	Solar Radiation - Extreme and Far Ultraviolet
10	Earth Upper Atmosphere - Chemical Composition
11	Earth Upper Atmosphere - Airglow Intensity and Volume Emission Rate
12	Earth Upper Atmosphere - Diffused Radiation
13	Earth Atmosphere - Density
14	Magnetospheric Plasma - Electromagnetic Weather
15	Magnetospheric Plasma - Convection Patterns
16	Magnetospheric Plasma - Geomagnetic Field Disturbances
17	Space Systems - Vocabulary - interaction of Space Vehicles with the Environment
18	Space Systems - Space Environments - Simulation
19	Space Systems - Models and Computation Methods - Spacecraft and Aerospace Plane Motion during Re-ent ry

Representation by country:

1 us
1 UK
1 France
8 Russian Federation

'J'here was no Japanese representation because of the short notice for this meeting. Also, several important potential Russian participants in the area of ionizing radiation were unable to attend for the same rea-Soil.

Summary of Discussions in WG4:

The subcommittee secret aria t in the person of J. French of AlAA asked for priori t iz a-tion of the 19 Russian proposals and that the proposals be grouped and their number reduced. The working group chairman, Mr. Yuri Bulgakov, responded by defining three categories within which proposals were to be grouped. These three categories were labeled:

1) For immediate start
2) Defer one year
3) Reject for support

The working group members considered each proposal and voted. Although the Russian delegation dominated the group numerical y, it consistently split on the voting, and in all cases the Western delegates cast the deciding votes. The results of the voting are as follows:

Category 1: "For immediate start"

2	Energetic Electrons and Protons at Low Altitudes
5	Galactic Cosmic Rays
6	Solar Cosmic Rays - Particle Fluences and Peak Fluxes
7	Ionosphere of the Earth
8	Solar Radiation - Soft X-rays
10	Earth Upper Atmosphere - Chemical Composition
13	Earth Atmosphere - I Density
17	Space Systems - Vocabulary - Interaction of Space Vehicles with the Environment
18	Space Systems - Space Environments - Simulation
19	Space Systems - Models ant] Computation Methods - Spacecraft and Aerospace]'lane Motion during J<c-entry

Category ?: "1)efer one year"

1	Energetic Electrons in the Near Earth Region
3	Heavy Ions in the Trapped Radiation Belts
4	Anomalous Cosmic Rays
9	Solar Radiation - Extreme and Far l-Ultraviolet
11	Earth Upper Atmosphere - AirSlow Intensity and Volume Emission Rate
12	Earth Upper Atmosphere - Diffused Radiation

14 Magnetospheric Plasma - Electromagnetic Weather
15 Magnetospheric Plasma - Convection Patterns
16 Magnetospheric Plasma - Geomagnetic Field Disturbances

No items were placed in category 3.

The group did not attempt to condense the list since the prevalent feeling was felt that this must be done by the proposers themselves.

The chairman of WG4 asked for a list of US natural space environment standards. It is a simple matter for Gostandart of Russia to compile such a list since the Russian Space Agency is very formal about its standardization process. The authors are in the process of creating such a list for the US; however, there is such uncertainty in the US with regard to standards that it is not clear how much can be done.

The US suggested that work on a standard for interplanetary and near-Earth meteoroid environments is now feasible and reported that the US and Germany had been discussing the practicality of a joint effort. The US did not propose it formally as a work item since there is still some disagreement as to the direction the work should take. The working group encouraged this work.

SUMMARY OF THE CURRENT SITUATION

The emphasis in WG4 currently is on developing standardized methods of computing specific natural and induced space environments. This is useful for mission designers and project managers and is a necessary first step, but is less useful for component manufacturers. Eventually there will be an opportunity to go beyond merely standardizing environment models to establish a set of standards which would be directly in designing components for the international market. Unfortunately, there has been no direct presence of US industry at the WG4 meetings. More industry participation is essential if we are to develop standards that are going to be of use to spacecraft and component manufacturers.

The Russian Federation has significant and unique capabilities to contribute to international space efforts and a strong interest in standardization activities in the international arena as evidenced by their heavy attendance at the international meetings despite a severe shortage on travel funds. The Russians are taking the initiative in WG4 standardization activities. WG4, and it is in every one's interest that this participation be continued. All formal proposals for development of standards have come from Russia. Much of this proposed work is organized around upgrading US models or combining US and Russian models with US collaboration. The Russians seem completely open, and eager for cooperative efforts. But a stronger US response is needed.

Most US and European space environment models are published in the open literature and are, thus, in the public domain. The Russian models have not been as available but are now being offered to us via these collaborative efforts along with a large amount of data. We should take advantage of this and participate fully in these efforts and be just as open as the Russians are.

Most models - US, European and Russian - have some deficiencies that require further development before they are suitable for issuance as standards. "This requires development work (i. e., funding). The Russians place a great emphasis on standardization and seem willing to carry the load in many areas. But we shouldn't allow them to completely dominate the field. Furthermore, there are several important areas in which they seem to have no capability to propose, The proposals in work so far address only a small minority of the 15 agreed upon areas of standardization and there is a wide latitude for more work. The US is in a position to propose collaborative efforts in meteoroid environments and improved solar event models and probably in a number of

other areas to be determined, but there is no funding source for this.

in many areas (typically the areas with which the authors have the least familiarity) there are existing Russian standards. Very soon the Russian Federation will probably begin proposing these for adoption by the international community. The US needs to be in a positions to review and respond. The authors are in the process of forming a network of US reviewers to support us, but we are familiar with the community on experts in each area. If we are to adequately represent the US interest it is important that interested parties come forward to make their concerns known.

There is no central funding for Supporting WG4 activities. All funding comes from participating organizations on a voluntary basis. It is important that corporate management understand that these standards, while voluntary are standards that they are going to have to live with in order to remain competitive on the international scene. It is in their interest to fund participation - participation in the international meetings, reviewing proposed standards, and, most importantly, initiation of proposals for work and development of standards either independently or in collaboration with overseas industrial concerns and space agencies.

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