From: Stephen Horan [shoran@gauss.nmsu.edu]
Sent: Thursday, December 09, 2004 12:59 PM
To: John Kennedy
Subject: RE: Status of STA file No.: 0695-EX-ST-2004

Mr. Kennedy,
I have tried to address these questions as clearly as I can from here. If more detail is needed, I will need to contact the people back home where the construction details are kept.
Thank you.

Steve Horan

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Will there be any surviving components, in addition to the other elements of the casualty risk assessment PN?

The satellites are designed as a unit without any form of shrouds, covers, or other deployable device coming from the satellite proper. The satellites do not have any form of propulsion so the atmospheric re-entry is uncontrolled. The total satellite weight is approximately 30 lbs. The electronic components inside the satellite are housed in containment boxes made of 6061-T6 aluminum (I believe either ¼ or 1/8 in thick aluminum walls). The largest of these units has a mass of a few kilograms. The satellite bus structure is also made of 6061-T6 aluminum in the form of an isogrid structure, which is an open lattice structure. We do not have a re-entry model for the satellites. Since the structure is relatively small, the probability of actually hitting a person will be small as well.

Note: this project was vetted through the NASA safety process at an earlier date when the launch vehicle was to be a shuttle. At that time, NASA's concern was for shuttle re-contact hazards. NASA did not bring up re-entry debris as a safety issue that they were concerned with. Additionally, the Air Force has also reviewed this mission at several times. Re-entry concerns were not raised during these reviews either.

The satellites are mated to the launch vehicle via an attachment plate that is GFE to us because it was designed, manufactured, and is controlled by the Air Force. This attachment plate will provide the push-off via springs. There is a docking collar, which comes in two pieces, to attach the satellites to this plate. One-half of the docking collar is permanently bolted to each satellite and one half is permanently bolted to the attachment plate. The docking collars are made of interlocking mechanisms held in place via a tension cord. When the cord is cut, the tension is released, the mechanisms disengage, and the springs push the satellites away. To the best of my knowledge, there is no associated debris with this mechanism like there would be with explosive bolts and similar technology.

Quoting John Kennedy <John.Kennedy@fcc.gov>:

> Mr. Horan,
>
> Please address the question below [please reference attached public
> notice (PN)]:

> Will there be any surviving components, in addition to the other
> elements of the casualty risk assessment PN?
>
> John W. Kennedy
> Federal Communications Commission
> Office of Engineering and Technology
> Experimental Licensing Branch
> (202) 418-2484
>
>
>
> *** Non-Public: For Internal Use Only ***
>
> -----Original Message-----
> From: Stephen Horan [mailto:shoran@gauss.nmsu.edu]
> Sent: Wednesday, December 08, 2004 7:18 AM
> To: John Kennedy
> Cc: shoran@nmsu.edu
> Subject: Status of STA file No.: 0695-ex-st-2004; Confirm. No.: EL902100
>
>
> Mr. Kennedy,
> I checked the STA status site this morning and saw that this
> application was still listed as "pending." My sponsors in the Air
> Force are expressing concern to me because the launch is scheduled for
> Friday afternoon. If there
> are any other questions that need to be answered to move this process
> along,
> please contact me. Could you please let me know as soon as a resolution
> of
> the application is arrived at?
> Thank you for your assistance with this process and I hope that the
> application can be granted by launch time on Friday.
>
> Stephen Horan
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> If need be, I can be contacted on my cell phone at 505-621-6056
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# PUBLIC NOTICE

**Federal Communications Commission**
**445 12th St., S.W.**
**Washington, D.C. 20554**

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DA 04-1724
Report No. SPB-208
June 16, 2004

**International Bureau Satellite Division Information**

Orbital Debris Mitigation:
Clarification of 47 C.F.R. Sections 25.143(b), 25.145(c)(3), 25.146(i)(4) and 25.217(d)
Regarding Casualty Risk Assessment for Satellite Atmospheric Re-entry

Sections 25.143(b), 25.145(c)(3), 25.146(i)(4) and 25.217(d) of the Commission's Rules require applicants requesting certain satellite authorizations to submit a narrative statement describing the design and operational strategies, if any, that they will use to mitigate orbital debris. These rules specifically require applicants to submit a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the spacecraft.[1]

To date, the assessments submitted for those cases in which disposal of a spacecraft by atmospheric re-entry is contemplated have generally been inadequate to permit completion of Commission consideration. Consequently, in this Public Notice, we clarify the minimum information that must be submitted to the Commission to satisfy this requirement. All casualty risk assessments must include the following information:

1. A statement as to whether the atmospheric re-entry of the satellite will be controlled or uncontrolled.

2. For controlled re-entry, the projected geographic region of the debris field of the surviving components/fragments, if any, and any measures taken to forewarn people who are likely to be in the geographic region during the time period of the re-entry.

3. For uncontrolled re-entry:

    a. An estimate of the number of components/fragments, and their estimated dimensions and mass, likely to survive to the Earth's surface.
    b. An estimate of the probability of human casualty resulting from surviving components/fragments of the satellite.[2]

[1] The Commission has proposed to consolidate these "service-by-service" requirements into a single rule applicable to all space stations. *See* Mitigation of Orbital Debris, *Notice of Proposed Rulemaking*, 17 FCC Rcd 5586, 5607 (2002). This Public Notice is intended to provide guidance for applicants under any Commission rule requiring submission of a casualty risk assessment.

[2] One method for making this estimate is to derive the total casualty area for the reentry, and from that figure derive the probability of casualty. The total casualty area can be defined as the sum of the casualty areas for each

c. A full description of the assumptions and parameters used in developing the estimates.

In the event the information on the satellite design characteristics, satellite components and satellite ground track during re-entry are not yet known, the applicant must provide the above required information based on assumptions and parameters of a "worst-case" scenario.

In preparing such exhibits, applicants may find guidance in the U.S. Government Orbital Debris Mitigation Standard Practices[3] and in a related Safety Standard developed by the National Aeronautics and Space Administration.[4] Further, the software tools at the NASA website may prove useful in completing the debris mitigation statements, including the casualty risk assessment. [5]

Applicants with space station applications pending before the Commission must provide this information on or before **July 19, 2004**, if the applicant plans or is contemplating post-mission disposal by atmospheric re-entry. Failure to do so shall result in the dismissal of the application as incomplete.

Applicants filing new space station applications must also provide this information as part of their application, if the applicant plans or is contemplating post-mission disposal by atmospheric re-entry. Failure to do so shall result in the dismissal of the application as incomplete.

For further information contact Sankar Persaud of the Satellite Engineering Branch, Satellite Division, International Bureau, at (202) 418-2441 or email: Sankar.Persaud@fcc.gov.

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component/fragment, where the casualty area of each component/fragment is the squared sum of the square root of the cross-sectional area of a person and the square root of the cross-sectional area of the surviving component/fragment of the satellite, i.e., $[(\text{Cross-sectional Area of a Person})^{1/2} + (\text{Cross-sectional Area of Fragment surviving re-entry})^{1/2}]^2$, summed for all surviving components/fragments. The probability of casualty may then be calculated, as follows: Probability of Casualty = $1-(1-P_0)^N$ where $P_0$ = [Average Casualty Area x Average Population Density, (people per $m^2$) that may potentially be struck by the surviving components/fragments of the satellite]; N is the number of surviving components/fragments. The average casualty area is defined as the total casualty area divided by N, the number of surviving components/fragments. One source for information regarding population density for different geographic regions of the Earth is available at: http://sedac.ciesin.columbia.edu/plue/gpw/index.html?main.html&2.

[3] http://www.orbitaldebris.jsc.nasa.gov/library/USG_OD_Standard_Practices.pdf.

[4] National Aeronautics and Space Administration Safety Standard 1740.14. http://orbitaldebris.jsc.nasa.gov/library/NSS1740_14/nss1740_14-1995.pdf.

[5] http://www.orbitaldebris.jsc.nasa.gov/reentry/reentry.html