

DATE: March 30, 2011

SUBJECT: NSG Eccentricity Splinter Minutes

LOCATION: JSC, Regents Park III

ATTENDANCE:

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INTRODUCTION

Mr. Dan Jackson convened the March 30, 2011, Network Support Group (NSG) Tracking and Data Relay Satellite (TDRS) Eccentricity meeting to discuss impact of the TDRS onboard eccentricity on certain payload services (refer to the presentation, *Ku-band Open Loop Performance Assessment at Higher TDRS Eccentricities*).

MEETING

- A. Mr. Jackson reviewed questions for the analysis.
 1. Can the TDRSS network allow the orbits of the TDRS satellites go to a higher eccentricity of 0.0035 without impacting Open Loop operations at 150 Mbps? Analysis says no, but supports one half that number at 0.00175 to maintain 100 percent reliability for Open Loop at 150 Mbps.
 2. Can the Trajectory Operations Officers (TOPO) get some down-track accuracy relief to update their flight rule currently indicating that we can accept only 90 Km of down track error? Current response is yes. The original Flight Rule was written with Open Loop in mind and the current standard operating mode is autotrack. The Flight Rule will be rewritten to address the error budget.
 3. Can the present system errors support Open Loop operations at a return link data rate of 300 Mbps? The response is that you can get some successful passes. Operating at 300 Mbps, there is a drop in the return link signal level. Currently, while studying TDRS 171 tracking for the report, the system will keep the Ku-band boresight within 0.4 degrees of TDRS 100 percent of the time.
 4. What is Communication and Tracking Officers (CATO) mitigation plan for bandwidth management should Ku-band autotrack fail and we are forced to use Open Loop to support higher data rates? CATO will develop a protocol for choosing a lower data rate based on system pointing performance at the time that Open Loop execution is mandated. CATO will ask the team to attempt to improve the system's pointing performance.
- B. Mr. Jackson stated that the briefing recommends not increasing TDRS eccentricity at all beyond current values. TDRS 171 current analytical value is 0.0023552, and the analysis shows that this is very near the maximum that can be tolerated.
- C. Mr. Jackson reviewed the geometry and definitions. The BER was based on what the link was built for. At -54 dBm, hits occur. Marshall Space Flight Center (MSFC) is very sensitive to data hits. The link margin equation was standard. Mitigation steps for Open Loop operations may include dropping the return link data rate to 200- or 250-Mbps.
- D. Mr. Jackson reviewed the TDRS eccentricity and International Space Station (ISS) downrange error. He reviewed the eccentricity history for the past year and the resulting pointing error
- E. Mr. Jackson reviewed the system error budget. The Ku-band pointing system and attitude control system are separate and their accuracy performance figures must be added. Approximately 308 Km down range error is acceptable.
- F. Mr. Jackson reviewed Ku-band versus the rest of the system performance. There is good agreement between the theoretical and practical.

- G. Mr. Jackson provided the following summary.
1. Currently, TDRS 171's eccentricity represents as much error as we can accept and still assure 100 percent reliability for Ku-band Open Loop at 150 Mbps.
 2. If the Program truly expects Ku-band Open Loop to support a return link data rate of 300 Mbps, then we cannot increase TDRS eccentricity and we should pursue capping TDRS eccentricity at 0.00175.
 3. TOPO can write their flight rule predominantly addressing autotrack performance and addressing Open Loop as a contingency.
 4. CATO will develop a bandwidth determination plan to mitigate the remote possibility that only Open Loop operations are available to support data rates greater than 150 Mbps.
- H. Mr. Jackson stated that he will finalize the report and hopes to issue the final at the end of April.
- I. Mr. Jim Bangerter stated that the Space Network (SN) has not yet seen the data. This data needs to be provided to the SN. TDRS 3 needs to be considered as the spacecraft which could be reactivated (depending on battery life of TDRS-4). Ms. Michelle Bullard stated that they have vectors on each spacecraft. Mr. Jackson stated that they will look at TDRS 3. The current study is ISS-centric.
- J. In the future, the eccentricity will be modeled on board the ISS. This will eliminate the current issues. This will occur in the 2012 time frame. It was noted that the program plans to go to 300 Mbps in the 2012 time frame.
- K. Ms. Bullard stated that nominal operations are in the autotrack mode and Open Loop is for contingency. The change to modeling onboard will probably follow the nominal software track for implementation. There is also the possible mitigation of stepping down from 300 Mbps incrementally. That is a mitigation with operationally tradeoffs.
- L. Mr. Bangerter stated that the current SN position seems to be that the SN will hold at the current numbers. The SN is waiting on this data. Mr. Jim Bangerter accepted an action item to meet with Mr. Mike Bielucki/ WSC to discuss the results of the Eccentricity study and report the SN TDRSS eccentricity decision (action item 033011-Eccen-01).
- M. Mr. Bangerter noted that the 25-Mbps forward link was not part of the study. Ms. Bullard stated that adding the forward link will make issues worse.

ACTION ITEM REVIEW

The following action item was assigned at the March 29, 2011, TDRS eccentricity splinter meeting.

AI No.	Assignee	Action	Response	Status
033011-Eccen-01	Jim Bangerter/ GSFC/NASA/ HSF ND	Meet with Mr. Mike Bielucki/ WSC to discuss the results of the Eccentricity study and report the SN TDRSS eccentricity decision.		Open

(Original Approved By)
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