NASA/JAXA DTN DRTS TIM

NASA DTN Overview
MSFC Roles & Responsibilities for ISS DTN
MSFC Approach & Plans for DRTS Testing

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Marshall Space Flight Center
Alabama, USA
Objectives: NASA Space DTN Project

1. Mature DTN via ISS testing and use results to automate ISS Payload and Core operations (AES)
2. Continue Core Protocol development (SCaN)
3. Increase automation of current and upcoming point-to-point LEO and deep space mission operations
4. Lay DTN foundation for future internetworked space operations

- Provide secure, accountable end-end data transfer with multiple Qualities of Service
- Facilitate networked sensor webs
- Enhance international interoperability
- Reduce Mission Operations costs
- Enable repurposing of spacecraft for future DTN relay support
- Mission Support Networks
The Project will be managed and executed jointly by the SCaN Technology Program and by the Advanced Exploration Systems office (AES) at NASA-HQ:

SCaN’s role in FY13 will be to continue to support the protocol development and international standardization aspects of the DTN suite for NASA:

- SCaN will fund the DTN Core Team activities
- CCSDS Blue Books: ‘LTP for CCSDS’; ‘BP for CCSDS’ – the core DTN protocols - are nearly complete
- Solar System Internetworking Architecture document is complete
- Key elements of the full DTN suite (routing, network management, security, key management, etc.) required to operate a space network are in early stages of development and their development will be funded by SCaN
- DTN Project Focus in FY13 is Network Management and Security
- Draft CCSDS Green Book on ‘Network Management Concept of Operations’ in work

AES will take over the ISS test, demonstration and infusion activities for Human Space Flight:

- All DTN flight test and demonstrations using the ISS or Human Space Flight Systems
- MSFC will gradually assume responsibility for interfacing with payload customers and conducting flight development and demonstration activities
  - The University of Colorado will be retained in a consulting role during and after this transition.
New NASA DTN Project Management Structure:
Jointly Managed by SCAaN and AES

AES: oversees all NASA DTN flight test and demonstration activities conducted on the ISS:
• NASA formal Point of Contact:
  Richard McGinnis, NASA-HQ

SCaN: oversees all NASA DTN protocol engineering, development and validation activities, including international standardization:
• NASA formal Point of Contact:
  John Rush, NASA-HQ

Ed Birrane/APL
Kevin Gifford/CU
Phil Paulsen/GRC
Dave Leucht/GSFC
Jay Wyatt/JPL
Adam Schlesinger/JSC
Mike Kearney/MSFC

AES Sponsor: Rich McGinnis
SCaN Sponsor: John Rush

DTN Project Development Manager: Adrian Hooke
DTN Project Execution Manager: Jay Wyatt
DTN Chief Engineer: Keith Scott
JAXA/NASA Project Relationships

JAXA

Consolidated Space Tracking and Data Acquisition

- Provide JAXA TKSC DTN node
- Lead Test Planning
- DRTS Planning
- Lead and conduct DTN Ground Testing by:
  - operating DTN node at TKSC
  - providing and operating DRTS links
  - Lead writing of Test Report

JAXA/NASA Technical Understanding

NASA-HQ

NASA Space DTN Project: AES and ScaN

NASA Space DTN Testing Lead - Marshall Space Flight Center (MSFC)

JAXA/NASA Technical Framework

JAXA-NASA DTN Ground Test - Project Plan

- Provide NASA TKSC DTN node
- Support Test Planning
- Support DTN Ground Testing by:
  - operating NASA DTN node at TKSC

DTN Test Plan

DTN Test Report
MSFC DRTS Testing Approach

Jeff Lippincott
MSFC Mission Operations Lab
General Approach & Plans

• **Work Prior to NASA/JAXA Meeting in November 2012**
  - Installed IOS 3.0.2.
    - Worked through Tutorials.
    - Modifying tutorial and example configuration files to implement single and multi-node configurations for learning purposes.
    - Working with DTN Apps: bping, bpcp, bpchat, cfdptest, and bss.
  - Reviewed Previous Test Plan provided by JAXA.

• **Work After NASA/JAXA Meeting in November 2012**
  - Assist JAXA with test plan development by participating in the iterative update/review process.
  - Perform any tasks necessary to procure and configure the computers to host NASA DTN Nodes.
  - Develop the NASA DTN nodes at NASA/MSFC facility and conduct both NASA-internal testing in a lab environment and external (NASA<->JAXA) ground testing.
    - NASA would like to invite JAXA to participate in the informal external ground tests identified. (Details on following page).
  - Configure the NASA DTN nodes at NASA/MSFC in preparation for tests in partnership with JAXA at MSFC in April 2013.
  - Configure the NASA DTN nodes at NASA/MSFC for Ground Testing and conduct tests in partnership with JAXA over the Internet.
  - Bring NASA DTN nodes to Tsukuba for conducting the DRTS space-link testing of DTN data protocols in partnership with JAXA, work with JAXA to install and configure the NASA DTN nodes at JAXA for Ground Testing over DRTS with DSS, conduct tests in partnership with JAXA, and bring the NASA DTN Nodes back to NASA after the test.
  - Evaluate the DTN testing result in partnership with JAXA.
JAXA-NASA DRTS Test Schedule

**JAXA status**
- JAXA preparation including test configuration development and internal testing
- JAXA internal testing for Ground testing
- JAXA internal testing for DRTS/DSS testing

**NASA status**
- Inputs from TReK
- NASA preparation including DTN node development

**Joint activities**
- MSFC visit to TKSC
- Joint demo @MSFC
- Informal ground testing (MSFC proposal)
- Ground testing
- DRTS/DSS testing @TKSC

**Budget planning**
- Budget planning for JFY2013
- Budget planning for USFY2013

**Note.** End of DRTS mission life is foreseen in Mar. 2015 because of the remaining DRTS’s fuel quantity.

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We are here now!!

**Ground testing (Phase-2) & DRTS/DSS testing**
- CCSDS Tech. WG@US
- CCSDS Tech. WG@Europe

**ISS/DRTS flight testing**

**Timeline**
- 2013: Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec
- 2014: Jan, Feb, Mar
# NASA Proposed Informal Internet Ground Test Concept - Summary

<table>
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<tr>
<th>Test Purpose</th>
<th>Informal Ground Test #1</th>
<th>Informal Ground Test #2</th>
<th>Informal Ground Test #3</th>
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<td><strong>Test Purpose</strong></td>
<td>Connectivity Test (Ping)</td>
<td>Streaming Configuration Test</td>
<td>CGR Configuration Test</td>
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<td><strong>DTN node</strong></td>
<td>NASA: one ground node JAXA: one ground node</td>
<td>NASA: one ground node JAXA: one ground node</td>
<td>NASA: multiple ground nodes JAXA: multiple ground nodes</td>
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<tr>
<td><strong>Protocols</strong></td>
<td>CDFP/BP/LTP</td>
<td>BP/LTP</td>
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<tr>
<td><strong>DTN Routing</strong></td>
<td>None</td>
<td>None</td>
<td>CGR</td>
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<td><strong>DTN App.</strong></td>
<td>bping, bpchat cfdptest, bpcp</td>
<td>bssrecv, bssStreamingApp</td>
<td>bping, bpcp,bpchat, cfdptest, bssrecv, bssStreamingApp</td>
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- NASA plans to perform the informal ground tests identified above prior to the joint Demo scheduled in Spring 2013.
- All of the tests are planned to be disruption free.
- The purpose of the tests is to incrementally build confidence in test configurations and DTN Node functionality.
- NASA will develop and provide a Test Configuration prior to each test.
- NASA would like to invite JAXA to participate in these tests. Participation would help to reduce risk for future test activities.
- All Tests would be conducted during the following time on the dates identified: JAXA 8:00 a.m.– 10:00 a.m./NASA 6:00 p.m.– 8:00 p.m.
- In the Proposed Date row, the “Plan” is the date the test configuration would be available, and the “Test” is the date the test would be conducted.
## Test Concept

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<td>Large file transfer</td>
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<td><strong>Joint demo</strong></td>
<td><strong>Spring 2013@MSFC</strong></td>
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<td>Conducted with CU-Boulder</td>
<td>To confirm connection and basic DTN functions before commencing formal testing.</td>
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<td>Apr. &amp; Aug. 2011</td>
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<td><strong>Ground testing</strong></td>
<td><strong>Phase-2, June 2013</strong></td>
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<td>Phase-1</td>
<td>To confirm DTN functions simulating S/C operation scenarios</td>
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<td><strong>DRTS/DSS testing</strong></td>
<td><strong>August 2013@TKSC</strong></td>
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<tr>
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<td><strong>August 2013@ TKSC</strong></td>
<td>To confirm DTN functions under real DRTS space-link environment and DRTS operation scenarios</td>
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<td><strong>ISS/DRTS flight testing</strong></td>
<td><strong>After JEM/ICS recovery</strong></td>
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<tr>
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<td>To confirm DTN functions connecting NASA DTN node onboard ISS with JAXA node@TKSC through DRTS space-link.</td>
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