Automated Transfer Vehicle-4 (ATV) Mission Planning Status

09/11/12

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Agenda

- Mission Overview
- Documentation
- Mission Profile
- Space Network (SN) Support
- Eastern Range (ER) Support-Contingency
- Goddard Space Flight Center (GSFC) Support:
  - Network Integration Center (NIC)
  - Flight Dynamics Facility (FDF)
  - Communications Services Office (CSO)/NASA Integrated Services Network (NISN)
- Network Testing
- Integrated Network (IN) Staffing Plan
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- Lessons Learned
- Open Discussion
- ATV-4 IN Team
- Backup slides
  - IN Overview

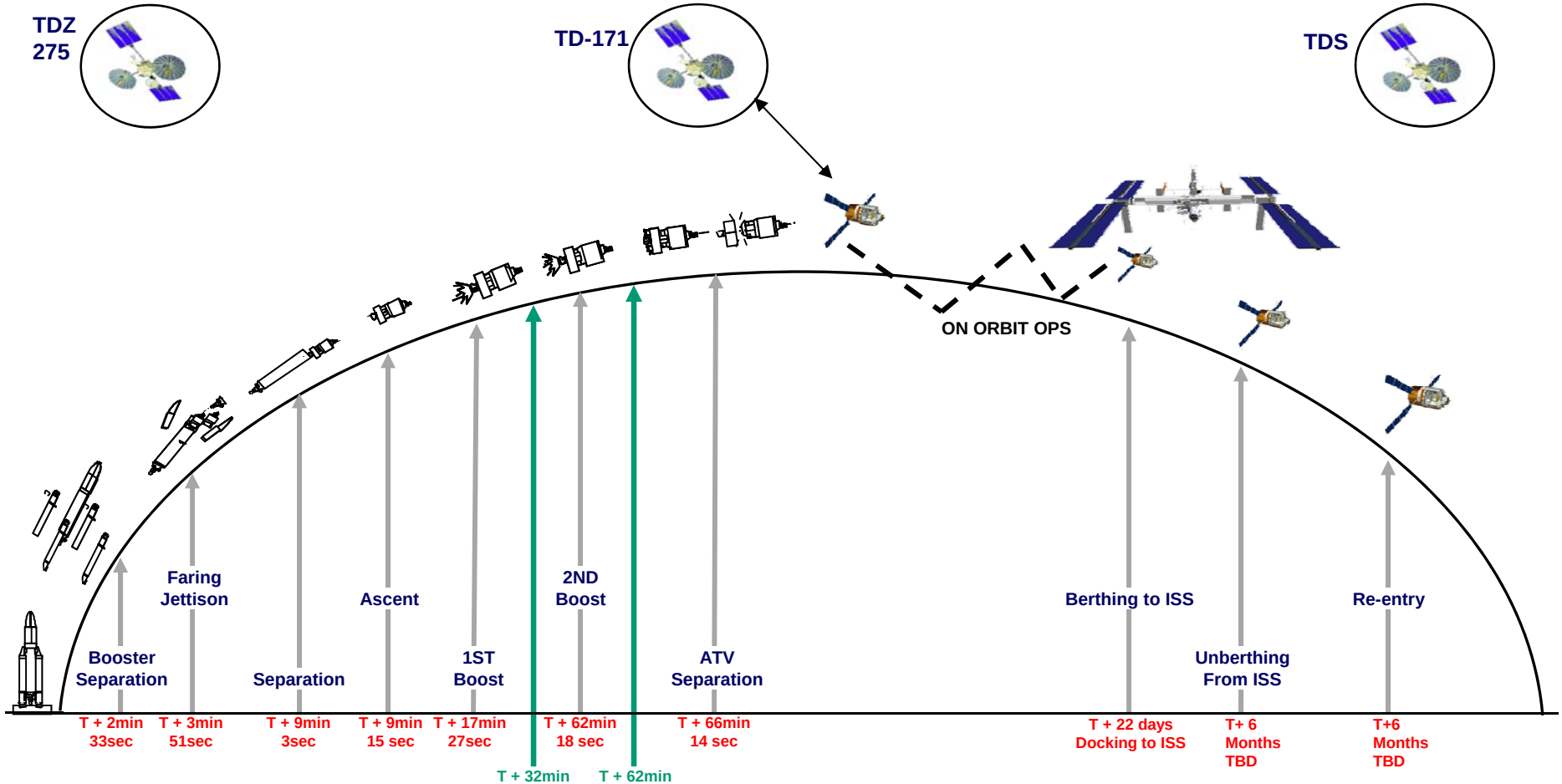
Mission Overview

- **Visiting Vehicle:** ATV-4 “Albert Einstein”
- **Launch:** 03/12/13 DOY 071 TBD GMT
- **ATV-4 Separation:** 03/12/13 DOY 071/TBD GMT
- **Launch Vehicle:** Ariane-5
- **Launch Site:** Kourou, French Guiana
- **Inclination:** 51.6°
- **Operations Site:** Toulouse, France
- **Docking Date/Time:** 03/13 DOY TBD
- **Undocking:** 08/13 DOY TBD
- **Re-entry:** 08/13 DOY TBD

Documentation

- Radio Frequency Interface Control Document (RFICD) for ATV, 450-RFICD-ATV/TDRSS dated 06/2004 DCN 002-04/2011
- 450-TNOSP-ISS, ATV Annex 06/2007 awaiting JSC comments for inclusion prior to CCB review
- Draft Launch Count will be issued 02/2013 and will need JSC inputs for minus count and plus count activities
- The IN issued Interim Support Instructions (ISIs) will be the same as was for ATV-3

Mission Profile



Data Rates
Command: 2kbps
Telemetry: SMA/MA- 8kbps
SSA- 8/64kbps

LPAs
Command: 0405
Telemetry: 0236
Command Echo: 0238

SN Support

- **Tracking and Data Relay Satellite System (TDRSS) Single Access (SA), SMA and MA services will be scheduled for pre-launch, launch, insertion, parked, docked and re-entry phases as defined in the requirements**

TDRSS Service	Mode of Operation	Telemetry Data Rate
S-band Single Access Return (SSAR)	Real-time Mode I channel Q channel Dump & Troubleshooting Mode I channel Q channel	SA 8 kbps 8 kbps 64 kbps 64 kbps
S-band Multiple Access Return (SMAR) / Multiple Access Return (MAR)	Real-time Mode I channel Q channel	MA 8 kbps 8 kbps
S-band Single Access Forward (SSAF)	Low Data Rate (LDR) Mode DG1 Mode1	SA 2 kbps
S-band Multiple Access Forward (SMAF)/Multiple Access Forward (MAF)	Command Mode DG1 Mode1	MA 2 kbps

SN Support (cont'd)

- **Launch & Early Orbit Phase (LEOP)**
  - **Continuous Multiple Access (MA)/S-band Single Access (SSA) coverage**
    - **Start of Tracking and Data Relay Satellite (TDRS) Telemetry signal (separation – 10 min) through transfer to phasing maneuvers**
  - **Tracking data coverage (coherent)**
    - **End of Solar Generation System (SGS) deployment (separation ~+35 min) for 2 orbits**
- **Routine Phasing**
  - **MAF/R continuous and SSA 20 min/orbit**
    - **SSA 20 min/orbit will be requested**
  - **Tracking data coverage (coherent)**

SN Support (cont'd)

- **Radio Frequency (RF) Performance Data Request**
  - **Procedure being defined**
- **White Sands Complex (WSC) Data Hold**
  - **Media hold request needs to be submitted prior to 50 hours**
- **Simultaneous TDRS and Artemis Support**
  - **International Space Station (ISS) Ground Controller (GC) will transmit a Ground Configuration Message Request (GCMR) to offset the forward frequency**
  - **Forward frequency offset will be documented in an ISI**
    - **Note: MA/SMA can NOT be offset**
- **Launch minus 30 day forecast scheduling telecon**
  - **WSC, Spaceflight Mission Manager (SMM), and GC discuss launch and critical period schedule**

ER Support-Contingency

- C-band Contingency Support Plan
  - ATV missions will not be routinely scheduled for C-band support
  - C-band contingency support plan is referenced in the 450-TNOSP-ISS, ATV Annex
  - An ATV-4 ISI for C-band radar contingency call-up procedures will be published prior to the mission

GSFC NIC Support

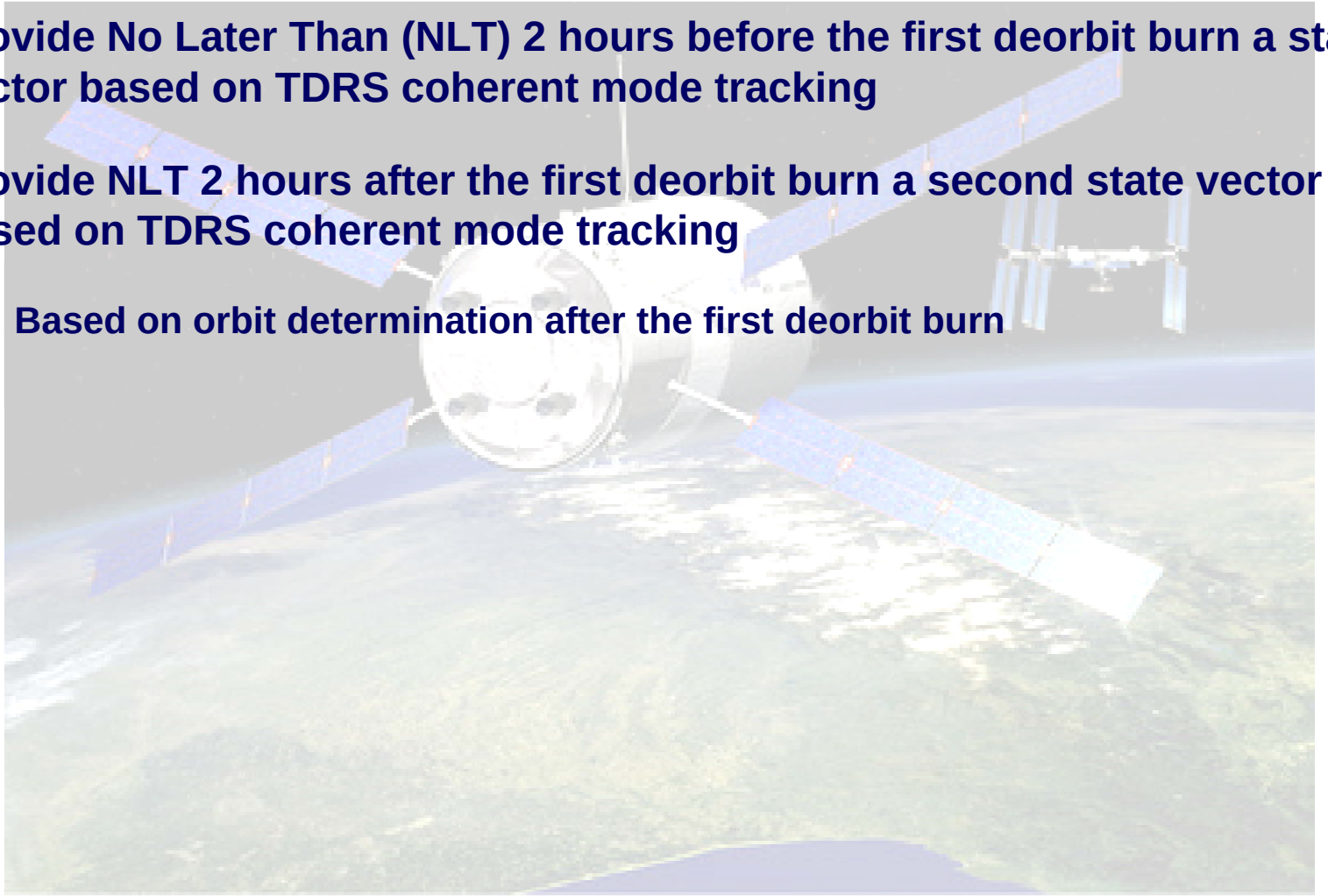
- NIC
  - Plan, conduct and support pre-mission testing
  - Interface with the IN
  - Monitor SN events during staffed timeframes for launch/on-orbit support
  - Generate ISIs as needed
  - Assist in IN fault-isolation as needed
  - Assist JSC in resolving SN Scheduling conflicts as needed
  - Conduct shift briefing for each shift
- Please “cc” smmconsole@ncc-comm.gsfc.nasa.gov for ATV-4 correspondence

GSFC FDF Support

- Provide pre-mission analysis of TDRSS coverage
- Provide orbit determination support using coherent TDRS tracking data after insertion, prior to/after maneuvers, daily during non-maneuver periods prior to docking
- Provide solution vectors to ATV-CC via JSC
- Provide acquisition data support to the SN based on ATV vectors received from ATV-CC via JSC or from FDF orbit determination solutions
- Provide TDRSS vector support to the JSC and ATV-CC
- Evaluate ATV-4 tracking data
- JSC to provide FDF with pre-mission trajectory data/vectors
- JSC to ensure coherent TDRSS tracking events are scheduled pre & post maneuver

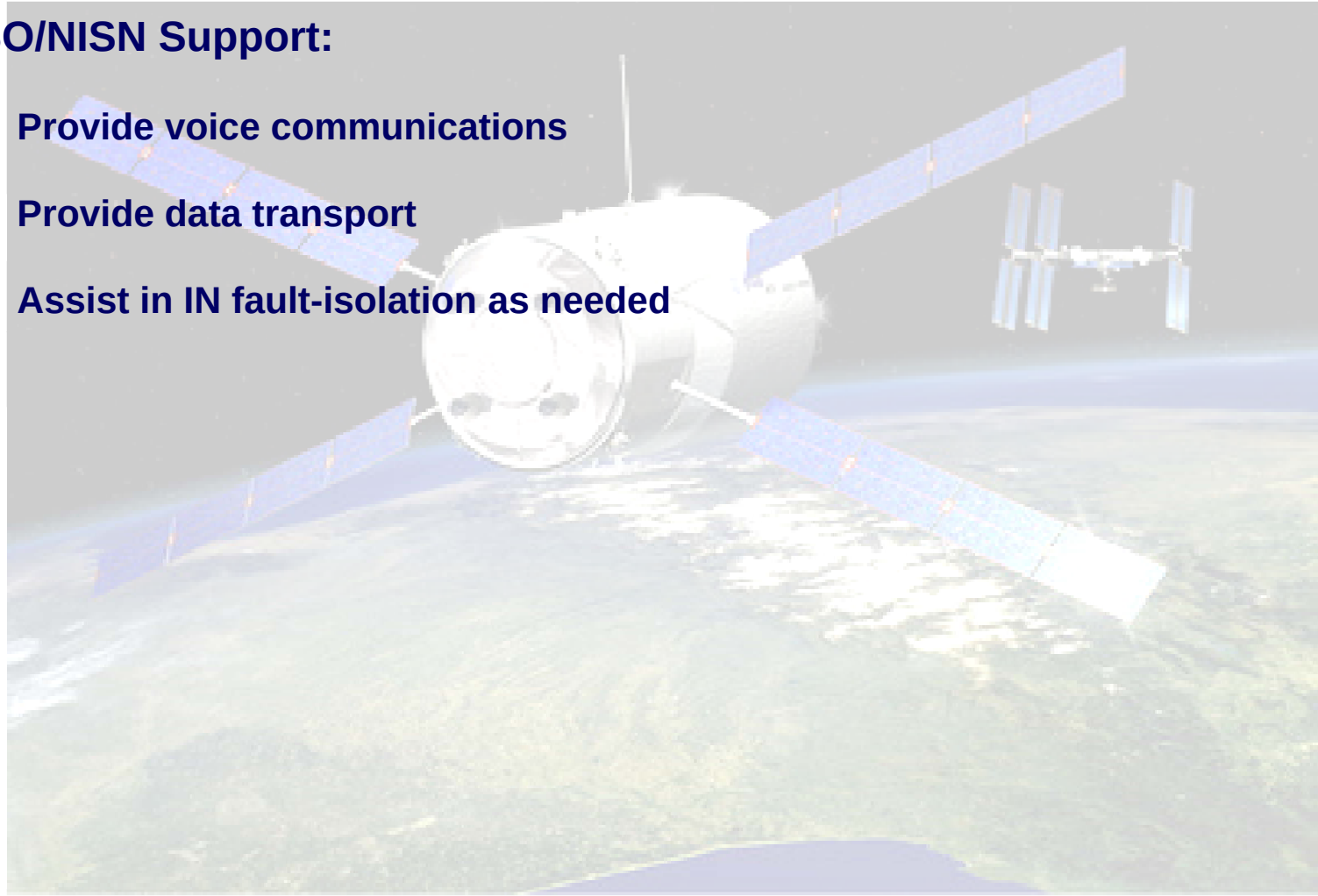
GSFC FDF Support (cont'd)

- Provide No Later Than (NLT) 2 hours before the first deorbit burn a state vector based on TDRS coherent mode tracking
- Provide NLT 2 hours after the first deorbit burn a second state vector based on TDRS coherent mode tracking
  - Based on orbit determination after the first deorbit burn



GSFC CSO/NISN Support

- **CSO/NISN Support:**
  - **Provide voice communications**
  - **Provide data transport**
  - **Assist in IN fault-isolation as needed**



Network Testing

Test	Date	Comments
SVT1 Antenna Calibration Bremen, Germany	07/16/12	Successful *
SVT1 Bremen, Germany	07/19/12	Successful *
HOSC-Backup Control Center (BCC) Checkout (c/o)	TBD	Verify the ground facilities telemetry and command dataflow functions for the TDRSS link via BCC-HOSC
SVT2 Antenna Calibration Kourou	01/2013	Preparation for SVT2 testing
SVT2 Kourou	01/2013	Final link & Encryption Validation
SN Vector Verification	03/05/13	L-7 days
WSC MRT	03/05/13	L-72 hours
L-4 c\o	03/08/13	Launch Count Down procedure will be exercised, voice checks with WSC performed and frozen
Ground Means Verification with Partners	03/09/13	L-3 days

* Created ATV test SIC 8033 which will be used whenever an ATV is in orbit and another ATV is being tested

IN Staffing Plan

- GSFC NIC and WSC Engineering Support:
  - SMM from L-9 hrs through Docking
  - WSC Engineering from L-7:30 hrs through release of LEOP (approx. T+11.5 hrs) and L-8 hrs through docking
- FDF
  - L-7:30 hrs through docking
- CSO/NISN
  - Comm Manager 24x7
  - Mission Comm Manager: L-8 hrs through release of LEOP (approx. T+ 11.5 hrs)

Open Work

- Difference in documentation for Planning Products delivery dates to the IN
  - Review operational documentation (MCC-H ATV OIP and applicable PRDs) to try and get the planning products (Trajectory and TDRSS schedule) delivery dates by L-30 days. Necessary for IN requirements
    - FDF advised L-30 to L-25 days for FDF products
    - WSC Forecast scheduling requirement is L-28 days for planning products/schedules
    - JSC recommends revising the OIP E8.2.12
    - Awaiting JSC GC response from ATV-CC
- MSFC SCD-3, 4, and 5 testing
  - Perform internal testing of the new software release 7.0 in MSFC-3, 4 and 5 with MSFC, JSC, WSC and GSFC (3 and 5 are Prime for ATV, 4 is an alternate)
  - Upon successful completion of internal testing, test with ATV-CC
  - Test dates are TBD but need to be performed before ATV-4 SVT-2 testing in mid January 2013

Open Work (cont'd)

- **Late receipt of ATV-3 1 Day Launch Slip and No Ariane 5 Second Boost Contingency TDRS schedule request files**
  - **JSC did not receive product delivery until L-2 days**
  - **NASA will have to work with ESA to change product development**
- **TDRSS events for post lift-off support be scheduled non-coherent**
  - **To preclude acquisition problem experienced during ATV-3 mission**
  - **Awaiting resolution from the June 2012 ATV-4 F2F Ground Segment Working Group (GSWG) meeting**
- **Mislabeled Insertion Vector**
  - **The Flight Dynamics Facility (FDF) received a predicted ATV vector from JSC TOPO mislabeled "Insertion"; the actual insertion vector was sent in a set of backup vectors and mislabeled "ATV TDRS Transponder On."**
  - **FDF and TOPO are working to ensure that vectors are accurately labeled in the future**

Lessons Learned

- JSC test to verify transmitting ATV TDRS Scheduling Window (TSW) and TDRS events caused an overload of the WSC system and test was performed too close to ATV-3 launch
  - A Schedule Request (SR) and Briefing Message to be provided for any testing utilizing WSC equipment and personnel
- WSC voice circuits not configured as expected for ATV-3 Launch support
  - A Network L-1 (or as close to launch as possible) Voice check will be scheduled
  - Test will be documented in Briefing Message (BM). Voice circuits will be frozen at the conclusion of the test
- WSC Vector Auto-throughput disabled prior to ATV-3 undocking
  - Vector auto-throughput management was not properly documented
  - SMM will issue an Auto-throughput Management ISI

Open Discussion

ATV-4 IN Team

Team Members	Location	Role	Contact Information
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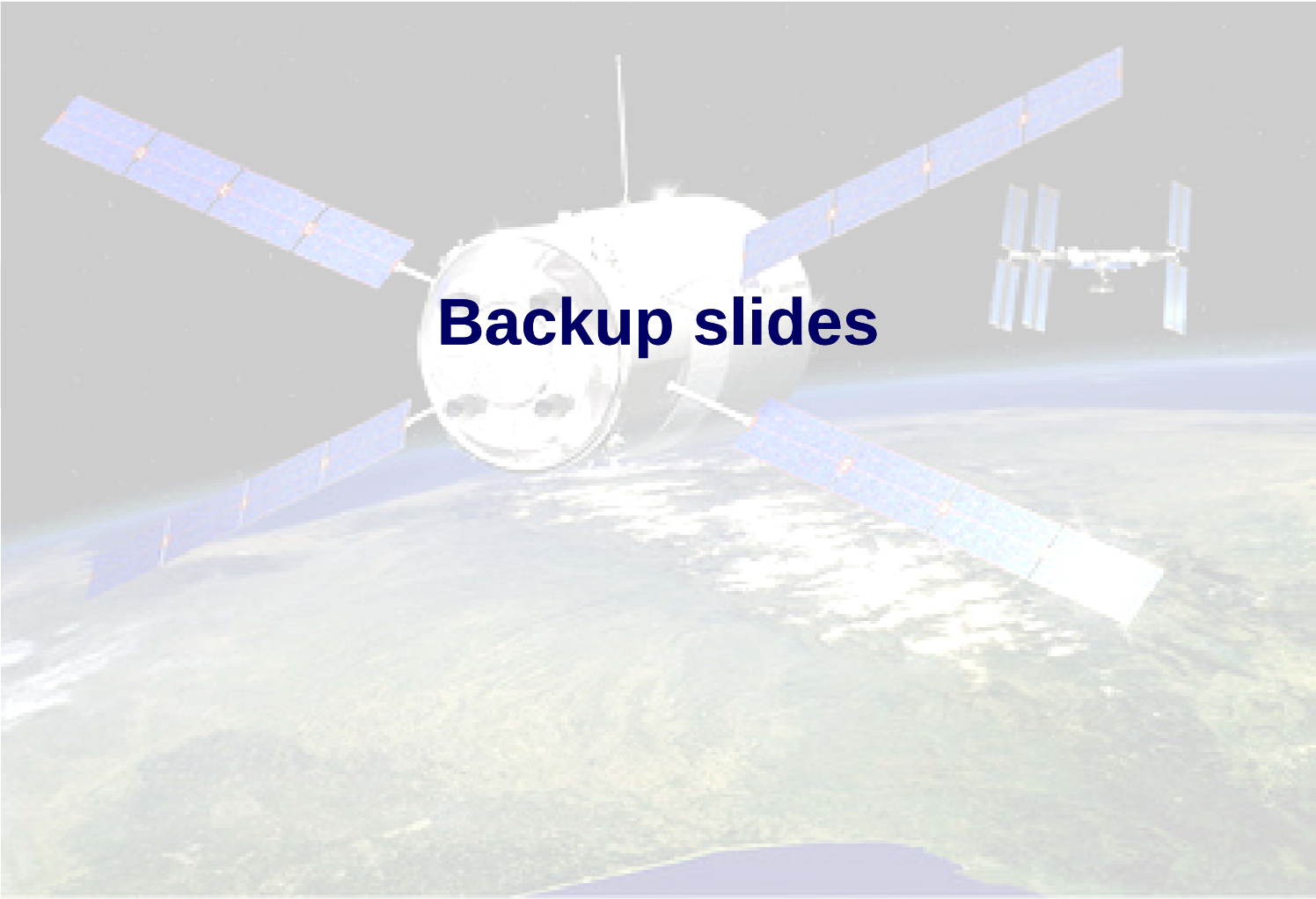
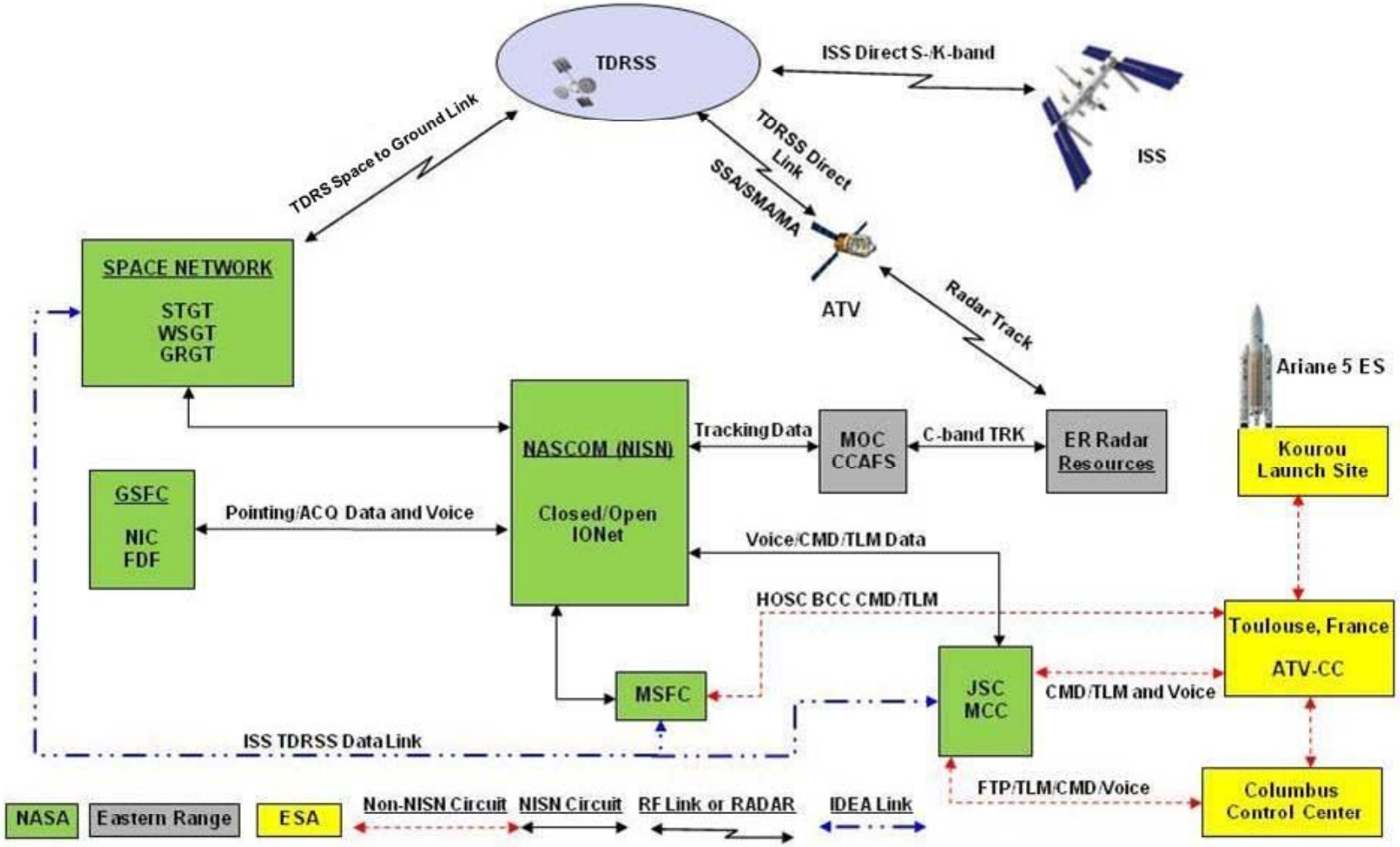


Backup slides

IN Overview


TDRSS
ISS Direct S-/K-band
ISS
TDRSS Space to Ground Link
TDRSS Direct Link
SSA/SMA/MA
ATV
Radar Track
SPACE NETWORK
STGT
WSGT
GRGT
Ariane 5 ES
NASCOM (NISN)
Closed/Open IONet
Tracking Data
MOC CCAFS
C-band TRK
ER Radar Resources
Kourou Launch Site
GSFC
NIC
FDF
Pointing/ACQ Data and Voice
Voice/CMD/TLM Data
HOSC BCC CMD/TLM
Toulouse, France
ATV-CC
MSFC
JSC MCC
CMD/TLM and Voice
ISS TDRSS Data Link
FTP/TLM/CMD/Voice
Columbus Control Center
NASA
Eastern Range
ESA
Non-NISN Circuit
NISN Circuit
RF Link or RADAR
IDEA Link