National Aeronautics and Space Administration

ODM use at JSC-MCC

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Exploration Vehicles GN&C

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Retirement of Legacy Systems

- JSC NASA utilized NASCOM 4800-bit block format serial data transmissions for exchange of Inter-Center Vectors throughout the support of the Space Shuttle program

- With the retirement of Shuttle, the JSC legacy front-end equipment and interfaces were decommissioned.

- Modernization Project was initiated at JSC, in conjunction with Goddard Flight Dynamics Facility (and other Centers JSC interfaces with), to determine the best path forward

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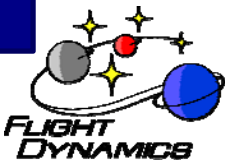
Modernization Project Implementations

- Modernization team determined the Centers should retire the NASCOM formats and move towards an XML exchange of CCSDS messages

- Simultaneously with the inter-center data transmission upgrade, the JSC Flight Dynamics group retired the Shuttle Trajectory software

- FreeFlyer COTS product was implemented as the replacement
  – The "FreeFlyer Ephemeris file" is at the heart of JSC trajectory functions
  – Vehicle characteristics are required fields within this file
    - COLUMN_LABELS = "Epoch","X","Y","Z","VX","VY","VZ","Mass","Cd","DragArea","DragKFactor","EpochTAI"
  – Other in-house and partner state vector and ephemeris file formats also have required vehicle characteristics fields.

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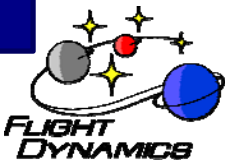
JSC-FDF ICDs Driven by Software Design

- JSC Trajectory s/w drove the JSC-FDF ODM ICD to include the addition of the vehicle parameter values into the exchange

- Goddard FDF has also developed operational s/w that can use the vehicle parameters from the exchange messages they receive from JSC-MCC
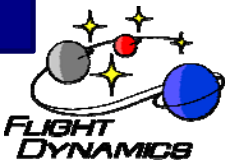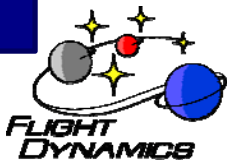
Characteristics as Comments

- Development team determined the best design to transfer the vehicle parameters was to include them within the OEM as COMMENTS in the DATA section of the XML

  - Mass
    - `<COMMENT>MASS=MMM.M</COMMENT>`

  - Drag/Solar Area
    - `<COMMENT>DRAG_AREA=AAA.A</COMMENT>`
    - `<COMMENT>SOLAR_RAD_AREA=AAA.A</COMMENT>`

  - Drag/Solar Coeff
    - `<COMMENT>DRAG_COEFF=C.D</COMMENT>`
    - `<COMMENT>SOLAR_RAD_COEFF=C.D</COMMENT>`
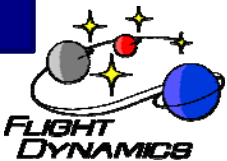
Operational Use

- First exchanges of OPMs and OEMs between JSC-MCC and GSFC-FDF planned for the Exploration Flight Test-1 (EFT-1) launching 12/4/14

- Sustained exchanges of OPMs and OEMs between JSC-MCC, GSFC-FDF, Commercial and International partners planned for the International Space Station operations beginning 3/15