International Earth Science Constellation
Mission Operations Working Group
June 12 – 14, 2018
Constellation Visualization Tool and Constellation Coordination
System Status

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Agenda

- Constellation Visualization Tool
- CCS Purpose and Goals
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- CCS Future
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Constellation Visualization Tool

- The Constellation Visualization Tool (CVT) has completed the authorization process and is now available to request from the NASA software catalog!
  - https://software.nasa.gov/software/GSC-17917-1
- Available to US persons and foreign national partners.
- Supports remote, local, and demo modes.
- To display morning constellation, afternoon constellation, and partner satellites, contact the Constellation Coordination System (CCS) support team to be provided with directory details.
  - To display a subset, CCS subscriptions to a non-CCS secure file transfer protocol (SFTP) server will be required.
Mean Local Time (MLT)

The Morning and Afternoon Constellations fly in frozen, sun-synchronous orbits.

The Afternoon Constellation ascends across the equator at roughly 13:30 local time on each orbit.

Sun-synchronous orbits are designed so that each crossing of the equator occurs at the same mean local time (MLT).

Flying constellations in sun-synchronous orbits minimizes the global variations in altitude and allows the science instruments on the spacecraft to observe the same points on the earth at regular intervals and at a consistent sun angle.

2017-02-01
01:25:45 UTC Paused
CCS Purpose and Goals

• System for coordinating and monitoring Constellation safety of the Earth Sciences Constellation (ESC) missions and is a central source of data sharing and operational planning.
  – Primary tool for monitoring the Constellation configurations.
  – Enables information exchange among/between domestic and international partner ESC missions, including access to nominal predicted mission ephemerides.
  – Transfer critical product data between the Mission Operation Centers (MOCs), Conjunction Assessment Risk Analysis (CARA), and other authorized mission users.
  – Mission Analysis tools and automated health and safety monitoring.
    • Automated constellation safety warning notifications.
    • Graphical visualization of orbital data.

• The latest release, CCS 2018.1, was deployed to operations on 11 April 2018.
• Addition of an ephemeris comparison utility for comparing ephemeris files and reporting of over 15 user-selected, comparison parameters including beta angle, argument of perigee, and ground track error rate.

• Automated ephemeris selection for pre-defined, mission-specific definitive and predicted product rules, based on the user selected mission and analysis span.

• Added default predictive and definitive rule selectors to the mission definitions.

• Space-Track provided states to Consultative Committee for Space Data Systems (CCSDS) orbit ephemeris message (OEM) ephemerides are now 10 weeks long.
Provided the radial, in-track and cross-track (RIC) components at the time of closest approach (TCA) to the header of the Close Approach results file.

Modified the custom mission entry field in tools to provide instant feedback of invalid entries to the user.

When a user is locked out after three unsuccessful login attempts they will now receive a notification email.

CCSDS OEM ephemerides correctly span a leap second.
Coordinated Science

• Below is a current list of CCS manual analyses. Some of these analyses will be demonstrated on how they may be used for coordinated science.

• Ad Hoc Analysis
  – Text report of a variety of orbit parameters.

• Argument of Latitude
  – Visualize the latitude of one or more missions at a specific epoch.

• Close Approach Analysis
  – Close approach situation is encountered across any pair of missions.

• Control Box and Phasing Analysis
  – Visualize a mission relative to its mission-defined Control Box over a specific time period.

• Mean Local Time at the Nodes
  – Visualize the mean local time of the Ascending and/or Descending Node for a mission.
Coordinated Science

• Phase Margin Analysis
  – Time separation between two spacecraft at their orbit intersections based on their descending node crossing times.

• Phasing at the Poles
  – Analyze the phasing and radial separation between two missions at their orbit intersections.

• Satellite Situational Awareness
  – Visualize the orbits of one or more missions.

• Single Orbit Altitude Versus Latitude
  – Analyze the altitude versus latitude relationship between any two spacecraft over a single orbit.
Demo

Demo Time!
• CCS 2018.2 is currently in development, and is scheduled for deployment in August 2018.

• Add plot images to the Control Box violation and Close Approach email notifications.

• Update Control Box analysis to include:
  – Add header information to display the number of maneuvers contained in an ephemeris file.
  – Account for trend arc discontinuities when determining violations.
  – Implement “once around” violation detection to better predict when a spacecraft will re-enter from the other side.

• Modify tools to run asynchronously to allow the user the ability to start an analysis and return to it later without having to wait on the page.

• General updates and fixes to improve user experience.
Feedback

- What ideas or suggestions do you have?
- What are the capabilities you find most useful currently?
- What would make CCS more useful to you?
- Would additional training and/or outreach be beneficial to you?
Feedback

• Thank you for your continued support!

• For all CCS communications please contact:

  ccs-support@lists.hq.nasa.gov