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

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- CCS Purpose and Goals
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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.

**Constellation Visualization Tool**

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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

- 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