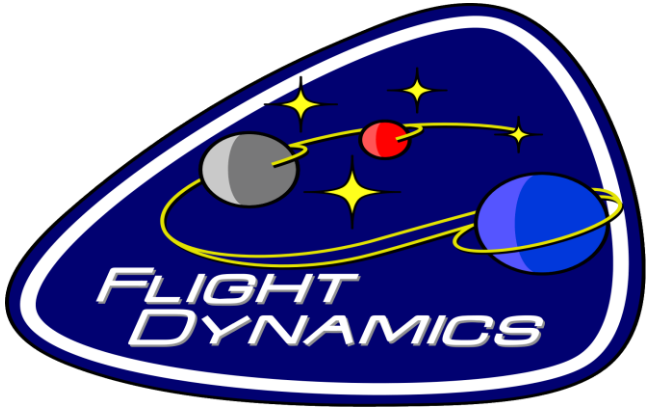






ISS Trajectory Operations

POIWG 56

TOPO/Grant Farrokh (Leidos, IMOC III)

Approved for Public Release
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Agenda

- Trajectory Products Overview
- Products Accuracy
- Altitude Strategy
- Cygnus/Dragon Reboost
- Conjunction Concern Levels



Products

- Planning Products
  - TOPO-01 – 2 year planning ephemeris and ancillary data
    - Updated twice per year
  - TOPO-02 – Increment-length planning ephemeris and ancillary data
    - Updated weekly
  - TOPO-52 – 8-week “Short Term Plan” ephemeris and ancillary data
    - Updated weekly
- Real-time Products
  - 15-day TOPO Console ephemeris and ancillary data
    - Updated 3 times per week (Monday, Wednesday, and Friday)
- As-Flown
  - Best Estimated Trajectory (BET)
    - Weekly estimation of as-flown trajectory
    - Longer ephemeris and ancillary products available upon request

Products Accuracy

- Many factors affect the overall accuracy of trajectory products.
  - Orbital Perturbations, changes in VV schedules, reboost delta-V adjustments, and atmospheric drag.
  - 8-week Short Term Plan (TOPO-52) ephemeris stated accuracy is +/- 6 minutes acquisition time after 4 weeks
    - Short Term Plan will be redelivered if this accuracy cannot be met due to realtime events (DAMs, flight plan changes, etc.)
  - 15-day TOPO Console ephemeris is updated 3 times per week
    - Updated more frequently after significant trajectory events
- Solar maximum has made atmospheric drag more dynamic and generally more difficult to predict.
  - TOPO realtime products remain within accuracy limits, but have become less accurate with increasing atmospheric activity.

Altitude Strategy

- Current signed ISS altitude strategy is to maintain an operational altitude range between 405 and 425km.
  - Updated March 2025
  - Allows more operational flexibility during solar maximum where the previous strategy (416 ± 2 km) was difficult to maintain with monthly reboosts.
  - Time spent between 418-420 km will be minimized to reduce time spent in a phase repeat orbit.
- Reboosts are typically scheduled to be once per month.
- Reboost magnitudes are selected to maintain Russian Visiting Vehicle launch/landing targets.
  - Temporary exceedances to the altitude strategy are sometimes needed to maintain the Russian VV plan.
  - Debris avoidance maneuvers are selected to clear conjunction risk and may result in exceedance to the altitude strategy.

Cygnus/Dragon Reboost

- Cygnus reboost was successfully demonstrated on several Cygnus missions starting with NG-17.
  - Cygnus will not be utilized for debris avoidance maneuvers
  - ISS attitude for Cygnus reboosts 180, 90, 0 LVLH
    - The thrusters on Cygnus will be pointed through the CG of ISS as much as possible
- Dragon to provide reboost capability with SpaceX-33
  - SpX-31 successfully demonstrated reboost capability with the capsule thrusters.
  - SpX-33 Dragon to use a trunk-mounted kit for reboost capability.
  - ISS attitude for SpX-33 Dragon reboosts is -XVV

Conjunction Concern Levels

- Conjunction concern levels are at TOPO discretion and depend on the specifics of the conjunction and proximity to VV ops and/or other dynamic events.
- **High Concern:** "The team should be focused on this conjunction event."
  - Current Pc is yellow/red/black, PDAM planning has been kicked off, and/or trending indicates Pc will remain at actionable levels
- **Medium Concern:** "The team should be aware of this conjunction event."
  - Current Pc is yellow/red/black <36 hours to TCA, preliminary PDAM planning by TOPO is in work, and/or trending indicates Pc may stay at or reach actionable levels
- **Low Concern:** "The team does not need to focus on this conjunction event."
  - Green Pc with stability in the updates or current Pc is yellow/red/black with >36 hours to TCA with the potential to go green

Questions?

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