



WFIRST GEO VS L2 OVERVIEW



Examination of L2 Orbit Trade



- The WFIRST baseline concept specifies an inclined 28.5 degree geosynchronous orbit
 - Continuous space-to-ground data link simplifies data acquisition and flight operations; advantageous if extended operations desired
- Recently the WFIRST Study Office has been asked to consider the design impacts of an SE-L2 orbit
 - The focus of this work is to determine what design parameters might be impacted by this orbit change
 - The goal of this top-level assessment is to determine any significant changes and to inform future, more detailed trade studies of possible WFIRST L2 design changes
 - Assume top-level WFIRST mission assumptions and parameters are similar to the baseline GEO concept (mission concept/design, ops concept, servicing, etc)



Top-Level Trade Assessment- Science



- Science and Observing Strategy
 - Need science team to weigh in on impacts (if any) to the baseline science observing strategy (ie, GEO orbit science vs. L2, future external occulters, revisit timeliness, etc)



Top-Level Trade Assessment-Observatory



- Mechanical/Thermal
 - Baseline mechanical design supports L2 Option
 - Increased propellant needed to allow observatory to travel from L2 to an Earth-Moon Lagrange point for on-orbit servicing, if required (see Servicing)
 - If servicing at the Earth-Moon Lagrange point is planned, additional propellant may require some increase in structure mass
 - Reduced WFI detector shielding anticipated due to lower radiation environment
 - Baseline thermal design expected to support L2 Option with minor modifications
 - Will re-evaluate thermal design to determine any design changes
 - Re-examine WFI FPU thermal design to determine if a cryocooler is still needed in WFI design
 - A large radiator is required for a passive design, which has servicing implications



Top-Level Trade Assessment-Observatory (cont)



- Flight Comm/Data System
 - L2 comm ops concept moves from “bent pipe” downlink to a “store and downlink” approach with multiple science data downlink contacts
 - Addition of onboard science data recorder to store large amounts of science data between ground contacts
 - Trade study to optimize onboard RF system with science data volume and ops concept; with goal of optimizing maximum science DL with L2 link restrictions
 - RF link can provide 300+ Mbps (depending on design trade), but DSN design limitations may limit to 150 Mbps
- Ground Comm system
 - Move from dedicated WFIRST ground station to use of DSN for Ka-band downlink
 - Need to assess DSN data rate and availability restrictions; possible DSN infrastructure upgrades may be needed for data rates greater than 150 Mbps



Top-Level Trade Assessment-Observatory (cont)



- Launch Vehicle
 - L2 Option allows exploration of Atlas V in addition to Delta IV and Falcon Heavy
 - Need to assess any increased structure/mass needed to accommodate other possible L2 options (propellant, additional structure, etc)
- On-Orbit Servicing
 - On-orbit servicing design essentially unchanged from GEO option
 - Need to work with satellite servicing reps to define servicing location and concept (at L2 vs. an intermediate point such as an Earth-Moon Lagrange point)
 - Additional propellant needed for transit from L2 to service location
 - Going to a passive thermal design for the wide field instrument has servicing implications



Future Work



- Flight dynamics study
 - L2 flight dynamics study to assess delta-V for orbit insertion, stationkeeping, and travel to/from servicing location
- Wide Field Instrument data rate vs Ka-Comm downlink
 - Optimize WFI detector readout performance versus instrument data rate
 - Assess detector data integration and compression options and their impact on the science data rate vs L2 link restrictions and any DSN operation restrictions and capabilities
- Examine DSN capabilities/limitations and explore possible upgrade options
- Revise cost estimate for L2 configuration