SUMMARY OF EOS FLIGHT DYNAMICS ANALYSIS

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From a flight dynamics perspective, the Earth Observing System (EOS) spacecraft present a number of challenges to mission designers. The Flight Dynamics Support Branch of NASA GSFC has examined a number of these challenges, including managing the EOS constellation, disposing of the spacecraft at the end-of-life (EOL), and achieving the appropriate mission orbit given launch vehicle and ascent propulsion constraints.

The EOS program consists of a number of spacecraft including EOS-AM, an ascending node spacecraft, EOS-PM, a descending node spacecraft, the EOS Chemistry mission (EOS-CHEM), the EOS Altimetry Laser (EOS-LALT), and the EOS-Altimetry Radar (EOS-RALT). The orbit characteristics of these missions are presented in Table 1 below. In order to assure that downlinking data from each spacecraft will be possible without interference between any two spacecraft, a careful examination of the relationships between each spacecraft and how to maintain the spacecraft in a configuration which would minimize these communications problems must be made. The FDSB has performed various analyses to determine whether the spacecraft will be in a position to interfere with each other, how the orbit dynamics will change the relative positioning of the spacecraft over their lifetimes, and how maintenance maneuvers could be performed, if needed, to minimize communications problems.

Prompted by an activity at NASA HQ to set guidelines for spacecraft regarding their end-of-life dispositions, much analysis has also been performed to determine the spacecraft lifetime of EOS-AM1 under various conditions, and to make suggestions regarding the spacecraft disposal. In performing this analysis, some general trends have been observed in lifetime calculations. The paper will present the EOS-AM1 lifetime results, comment on general reentry conclusions, and discuss how these analyses reflect on the HQ NMI.

Placing the EOS spacecraft into their respective mission orbits involves some intricate maneuver planning to assure that all mission orbit requirements are met, given the initial conditions supplied by the launch vehicle at injection. The FDSB has developed an ascent scenario to meet the mission requirements. This paper presents results of the ascent analysis.

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Table 1: EOS Mission Characteristics

	EOS-AM	EOS-PM	EOS-CHEM	EOS-ALT/Laser	EOS-ALT/Radar
Mean Altitude	705 km	705 km	705 km	705 or 462 km	1336 km
Inclination	98.2	98.2	98.2	94	66
Repeat Cycle	16 days	16 days	16 days	183 days	10 days
MLT	10:30 am (desc) ± 15 min	1:30 pm (asc) ± 15 min	1:45 pm (asc) ± 15 min	N/A	N/A
Gndtrk control	± 20 km	TBD	TBD	± 800 m	± 800 m
Ground track Reference grid	WRS or previous repeat cycle track	TBD	TBD	previous repeat cycle track	TBD
Sun-Synchronous?	Y	Y	Y	N	N
Frozen?	Y	Y	Y	Y	TBD
Navigation	TONS	TONS or GN	TONS or GN	GPS	DORIS
Constraints	inc maneuvers must be performed during eclipse			No maneuvers over poles	
Other	No inc maneuvers planned	No inc maneuvers recommended	No inc maneuvers recommended	Correlate observations with MODIS w/in 10 min	
ELV	ATLAS	TBD	TBD	Delta-Lite	TBD
Launch Date	June 30, 1998	Dec. 1, 2000	Dec. 1, 2002	May 1, 2004	Dec. 1, 2003

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