Dear Bart, Sebastiaan, and Pap,

Although the precise process and methods will be described in detail in the final report, I would like to use this short presentation to outline the general method used to design the Attitude and Orbital Control System (AOCS).

A first-order sizing of the AOCS used a design process consisted of six distinct steps: requirements determination, attitude control method selection, geometry model, quantification of disturbance torques, hardware selection, and budget updates. Illustrated in the figure on the following page, the orange blocks are the primary steps, the blue blocks represent the sub-categories, and the result or final calculation to be made is highlighted in green. The results of these calculations are summarized in the table below.

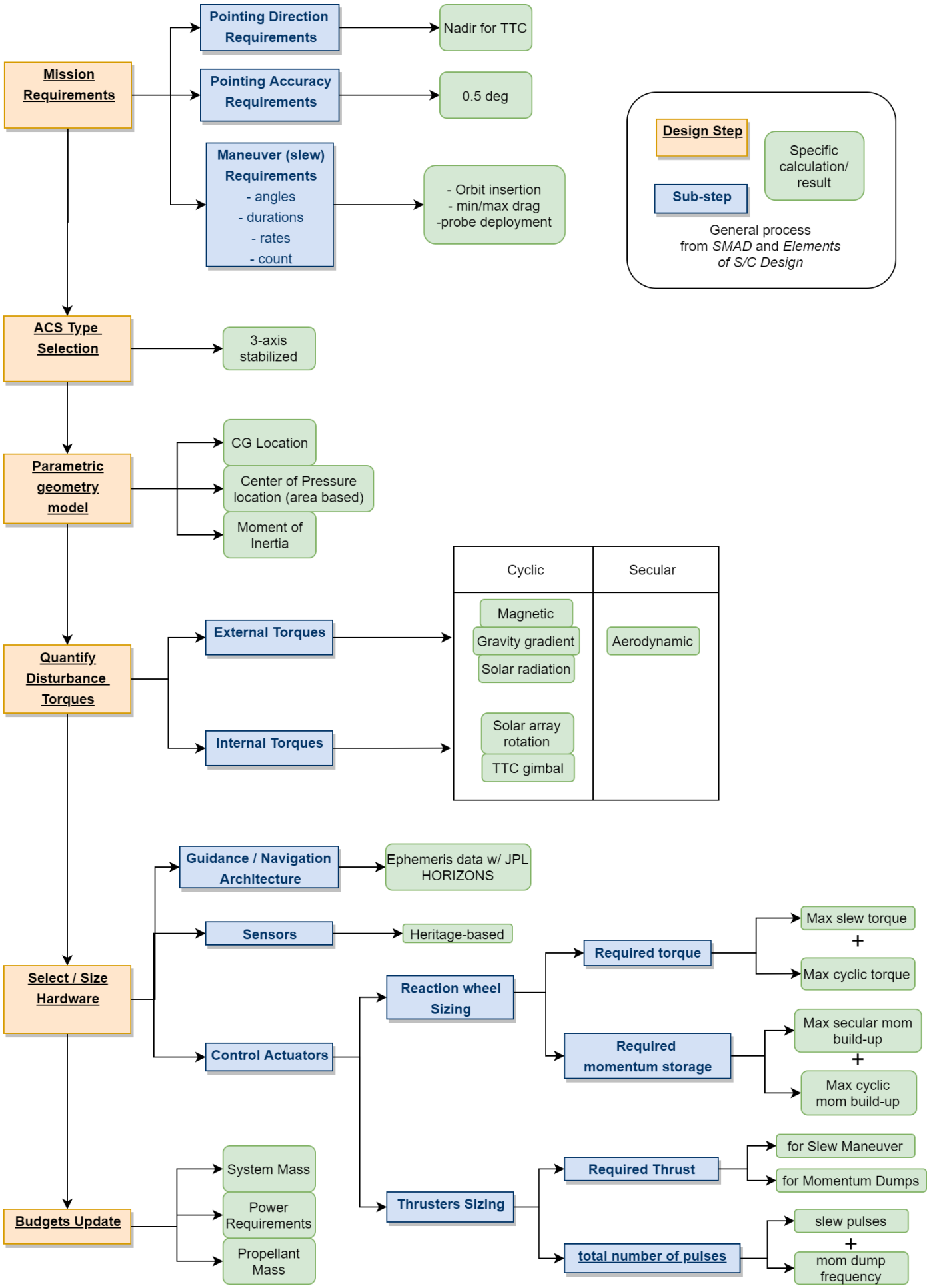
Due to many uncertainties in the overall design of the spacecraft, such as the geometric properties of the orbiter and probe, maneuver requirements, or operations requirements, many input variables were estimated using combination of heritage data and rough sizing. Additionally, worst-case scenarios were used for all sizing computations. For example: the lowest altitude during aerobraking was used for quantifying the aerodynamic disturbance torques, and the total required torque and momentum calculations consider situations where the actuation of the solar arrays and antennas coincides with the peak external disturbance torques. Naturally, the mission can be planned to prevent these occurrences, but this provides an upper estimate of the performance requirements.

The diagram below speaks a thousand words, and shows all the major steps of the design process. I will give a brief overview during the meeting to add clarification if necessary. I'm looking forward to your feedback on Thursday, please let me know if you have questions or concerns.

Kind regards,

Luigi

Parameter	Value	Units
Magnetic Disturbance Torque	0	N m
Solar Disturbance Torque	1.235E-05	N m
Gravity Gradient Torque	3.079E-13	N m
Aerodynamic Disturbance Torque	2.373E-12	N m
Mom storage per orbit	0.032	N m s
RW torque slew	0.001	N m
Max internal dist torque	0.103	N m
Max internal dist momentum	12.323	N m
Force thrust slew	0.005	N
Secular momentum buildup	5.526E-11	N m s
Thrust momentum dump	3.684E-11	N
Thruster pulses	2768.000	-
Propellant mass	0.010	kg
Hardware: RW	Honeywell HR12	
Hardware: IMU	Honeywell MIMU	
Hardware: Star Sensor	A-STR	


Mission Requirements
Pointing Direction Requirements
Nadir for TTC
Pointing Accuracy Requirements
0.5 deg
Maneuver (slew) Requirements
- angles
- durations
- rates
- count
- Orbit insertion
- min/max drag
-probe deployment
Design Step
Specific calculation/ result
Sub-step
General process from SMAD and Elements of S/C Design
ACS Type Selection
3-axis stabilized
Parametric geometry model
CG Location
Center of Pressure location (area based)
Moment of Inertia
Quantify Disturbance Torques
External Torques
Internal Torques
Cyclic
Secular
Magnetic
Gravity gradient
Solar radiation
Aerodynamic
Solar array rotation
TTC gimbal
Select / Size Hardware
Guidance / Navigation Architecture
Ephemeris data w/ JPL HORIZONS
Sensors
Heritage-based
Control Actuators
Reaction wheel Sizing
Required torque
Max slew torque
+
Max cyclic torque
Required momentum storage
Max secular mom build-up
+
Max cyclic mom build-up
Budgets Update
System Mass
Power Requirements
Propellant Mass
Thrusters Sizing
Required Thrust
for Slew Maneuver
for Momentum Dumps
total number of pulses
slew pulses
+
mom dump frequency