**SEE REFERENCE LITERATURE**

# Functional Analysis

Introduction of functions that sys must perform

* ADS functions
* ACS functions
* GNC functions

Difference between probe and orbiter

* Probe is limited to EDL only
* Orbiter primarily for on-station life

# Requirements

* Summary of requirements from baseline
* Update TBDs here
* Indicate if new requirements are added/ discovered
  + Maneuver rates
  + Slew maneuvers

# Calculations and model

**Functional results**:

* Note: Actions based on heritage (MSL/ phoenix for entry, MRO for orbiter)
* GNC process [Elements…]
  + sense data with IMU,
  + create estimation
  + transmit to earth
  + receive ephemeris data
* ACS process
  + Use stored momentum to passively counter torques
  + Use additional momentum for maneuvers
  + Periodic momentum desaturation
  + Thrusters for high-rate maneuvers/ desaturation

**Design process/results**:

* Process
  + Name key steps of this design phase (discussed later)
    - Requirements (described in previous section)
      * Control modes result
    - ACS Type
    - Disturbance Torques
      * Parametric python model
    - Hardware Selection
      * Parametric python model
    - Budgets
      * Parametric python model
  + Steps for later design phases
    - Control logic
    - Refined inputs
* ACS Type (3-axis stable, RWs)
  + Trade-off
  + List driving requirements
  + See design log
  + See SMAD trade-off tables
  + Summarize results
* Disturbance Torques:
  + Rough parametric MOI model (brief description
  + List/justify external torques considered
  + List/justify internal torques considered
  + Summarize results
* Hardware selection:
  + Cyclic vs Secular
  + Based on heritage for undetermined requirements
    - IMU
    - Sensors
    - Data processing
  + Summarize results
* Budget summary
  + Final results
* Model Limitations:
  + LOD that of SMAD/ Elements (first order sizing)
  + Limited knowledge of required maneuvers and s/c geometry
  + Based on worst-case scenarios

# Risk

Consequences:

* Power loss
* Communication failure
* Mission failure

Mitigation:

* Based on heritage standard practices
* Critical components at least once redundant
* All critical maneuvers can be performed with both reaction wheels and thrusters
* Reaction wheels greater than minimum to use off-the-shelf components
* Flight proven hardware:
  + MIMU
  + RW
  + Star Trackers
* Sizing based on worst-case conditions

# V&V

* All functions verified independently
* Validated with FireSat mission design described in SMAD
  + Different input parameters
  + Output identical

# Compliance matrix

Table of requirements that are met

# Recommendations

Refinement of model:

* Better geometry data when available
* Larger hardware selection
* More specific requirements
  + Sensor accuracy -- > better sensor selection
  + Jitter + Settling Time -> exact thruster design
* Control Law definition