**Orbit Propagator & IGRF Model**

Time

Orbit Propagator J2

Earth Rotation

ECIF to ECEF

Sun Position ECI

IGRF 10th Order

Satellite Position ECI

Eclipse

Time

Photodiode Measurement SBRF

Photodiodie Model

MTM Measurement SBRF

Gyro Measurement SBRF

True Satellite Attitude ECI to SBRF

MTM Model

Gyro Model

True Satellite Angular Rate SBRF

**Sensors Emulation**

True Satellite Angular Rate SBRF

Gyro Model

MTM Model

True Satellite Attitude ECI to SBRF

Gyro Measurement SBRF

MTM Measurement SBRF

Eclipse

Previous Control Torque SBRF

IGRF 9th Order

Satellite Position ECI

Sun Position ECI

Kalman Filtration

*Initialization: outside eclipse, ControlTorque = 0, use raw sensor data and QUEST algorithm*

**State Estimation**

Sun Pointing Spin Controller

Estimated Satellite Attitude ECI to SBRF

Estimated Satellite Angular Rate SBRF

Inertia

Commanded Satellite Angular Rate SBRF

Sun Position ECI

MagneTorquers Emulation

Control Torque SBRF

MTM Measurement SBRF

On/Off Frequency

Magnetic Moment SBRF

**Control**

Update True Satellite Angular Rate SBRF

Inertia

True Satellite Attitude ECI to SBRF

True Satellite Angular Rate SBRF

RK4 Integration

Update Time

Update True Satellite Attitude ECI to SBRF

Gravity Gradient Disturbance

Magnetic Disturbance

Atmospheric Disturbance

Solar Radiation Disturbance

Disturbance Torques

**Satellite Dynamics & Kinematics**