1. ORBIT
   1. Not Walker because we need sun synchronous (for homogeneous lighting conditions).
   2. RAAN evenly spaced because of coverage considerations.
   3. Mean Anomaly (off-line): Compute response time for different MA configurations. Fix h, nsats and nplanes: {2planesx2sats, 2planesx3sats, 2planesx4sats, 3x2, 4x2} Fixe mean anomalies of plane 1 (evenly spaced) and vary mean anomalies of the other planes (still evenly spaced).
   4. Nsats/plane and nplanes:
      1. Plot system cost vs Time to 100% Coverage. Change {h, nsats/plane, Nplanes, Npixels, Max off-axis pointing}. System cost = Nplanes\*Cost\_per\_launch + Nsats\*cost\_per\_sat (learning curve). Cost\_per\_sat = cost\_optic (h,off\_axis angle, Npixels) , cost\_power(mass\_power(off-axis angle,Npixels)) ,cost\_ADCS (h, Off-axis angle).
      2. Plot system cost vs Mean Response time (optics). Change {h, nsats/plane, Nplanes, Npixels, Max off-axis pointing}. System cost = Nplanes\*Cost\_per\_launch + Nsats\*cost\_per\_sat (learning curve). Cost\_per\_sat = cost\_optic (h,off\_axis angle, Npixels) , cost\_power(mass\_power(off-axis angle,Npixels)) ,cost\_ADCS (h, Off-axis angle).
      3. Plot system cost vs Number of Images per day. Change {h, nsats/plane, Nplanes, Npixels, Max off-axis pointing}. System cost = Nplanes\*Cost\_per\_launch + Nsats\*cost\_per\_sat (learning curve). Cost\_per\_sat = cost\_optic (h,off\_axis angle, Npixels) , cost\_power(mass\_power(off-axis angle,Npixels)) ,cost\_ADCS (h, Off-axis angle).
      4. Pick the best point given a target cost.
2. OPTICS
   1. Areal density: Important parameter to set and justify; not changed in the integrated model; (relate cost to areal density; look at theses). Also it is easier
   2. Linear vs 2D array (off-line): Qualitative discussion about trade-off between ADCS requirements, cost and coverage. Try to figure out pointing requirements for each one.
   3. Aperture: Driven by 1m ground resolution requirements; computed by optics module; function of height, slant range (off-axis pointing), wavelength
   4. Spectral content: 3 bands + Ir to be able to do color imaging + see through the clouds.
   5. Focal length: Set by model, function of pixel size, GSD (0.5m), altitude, off-axis angle).
   6. FOV: Set by model.
   7. SW: Set by model.
   8. p: Input to the model. Qualitative discussion on size vs sensitivity.
   9. N: Set by 1e.
   10. S/N and integration time (offline study).
3. ADCS
   1. Control type: Passive-Momentum bias-3 axis.
   2. Actuators: Type of actuators are decided a priori (qualitative). Off-line analysis: compute amount of fuel for thrusters, try to compare cost and complexity. Need: Slew rate, Altitude. Cyclic disturbances.
   3. Sensors: Qualitative.
   4. Control accuracy: Estimate from dynamic model with Kalman filter (settling time)… ?
   5. Actuators sizing: integrated model. Inputs: slewing rate, altitude (disturbances). Outputs are reaction wheels’ momentum storage and torque authority and mass and power on a second step. For magnetic torquers, input = altitude; output = D (magnetic moment) and that gives you mass and power. Slewing rate can be chosen in two different ways:
      1. Max eta in say P/k (k = 2,3, …)
      2. Being able to slew the max angle, take a picture and send it to the GS in the worst case pass for a in theater ground station scenario.
4. COMM
   1. Antenna diameter (satellite): Uplink RF budget assuming ground station known.
   2. Downlink data rate: Be able to send data volume in time.
   3. Emitted power : Downlink equation assuming given Rb.
5. GROUND SEGMENT

We base our approach in using existing ground stations’ infrastructure. And also consider a special case with 1 mobile ground station that can be moved in theater.

* 1. NGS
     1. N=1 fix + 1mobile
     2. N>1 (show improvement in response time)
  2. DGS: Mobile Ground Station 🡺 Calculate diameter in order to limit image transmission time to some value.
  3. Location : Run stk\_example to find optimum location for the fix ground station.
  4. Fix/mobile or both: show some of the tradeffs in terms of costs. 🡺 Greenland.

1. POWER
   1. Power sources: solar arrays, fuel cells, primary and secondary batteries, RTGs. Choice: qualitative.
   2. Power storage: Show some numbers on max eclipse time.
   3. Sizing: Solar arrays, batteries, wires. Inputs: Power requirements for every subsystem. Outputs: mass and power.
   4. Duty cycle??
2. MASS
   1. Add up all the masses and do a table with the components.
3. LAUNCH COST
   1. Trade-off between number of satellites per plane and launch cost. Off-line analysis benchmarking literature review (with response time).
4. PROPULSION
   1. Do we really need one? You need propulsion if you use single launch for multiple satellites in order to achieve your operational orbit.
   2. Advantages: Station-keeping, launch failure, more responsive (flexibilities).achieving orbit phasing (if multiple satellites per launch). End of live maneuvering.
   3. Disadvantages: mass (a lot of propellant mass), cost, complexity, slosh, interference with payload.
5. OBDH
   1. Off-line analysis: Take smallest and biggest images and calculate necessary computing power. If the differences are small we do not need to integrate this into the whole model.