

GEO CubeSat Operating Guidelines to Help the SSA Community

Small Sat Conference - Virtual

Authors

Christopher Tamanini
Keith Morris

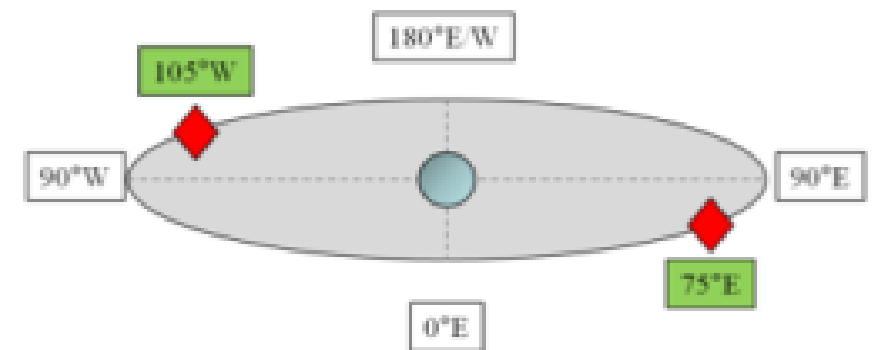
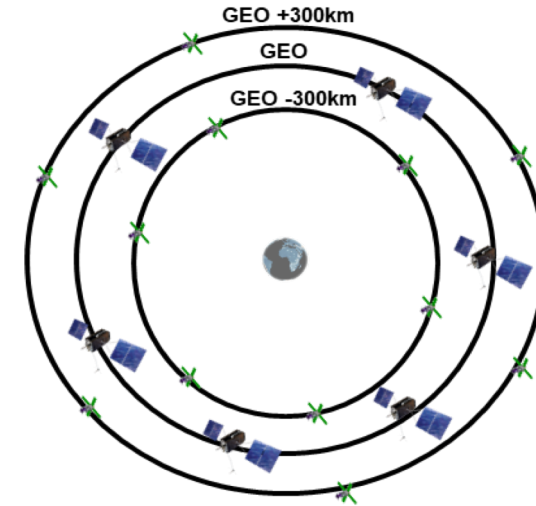


Context

- Space Situational Awareness is difficult to obtain and maintain
 - This difficulty is magnified in GEO, given the GEO belt's distance from earth
- Proliferation is the next fad
 - CubeSat's have proliferated from LEO (2003) to GEO (2020+)
- Technology advancements can be applied to solve this problem
 - More advanced SSA sensors
- Can we, the SSA community, think about the problem in a different way?
 - Combination of sensors and standards
- Is there a more efficient solution?
 - A potential solution is to create CubeSat Operating Guidelines for the GEO belt

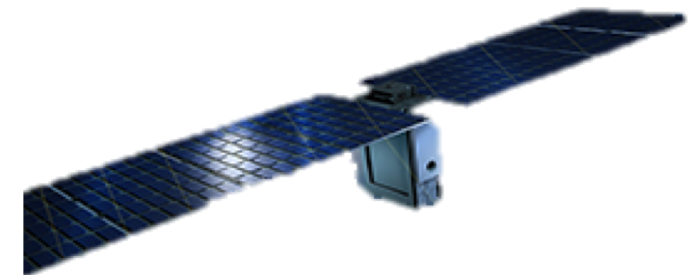
Example Operating Guidelines

- 1) Operate -300km to +300km of the GEO belt
 - Station keeping is required for GEO spacecraft
 - Reduces strain on the SSN - CubeSats would not require the same level of observation in this orbit
- 2) Operate with single fault tolerance to disposal
 - Some missions require station keeping over a prescribed point on the earth
 - If utilizing CubeSats, it is imperative to require single fault tolerance to disposal
- 3) Operate at Geopotential Wells (if applicable)
 - Wells offer stationary orbital regimes for CubeSat missions
 - If CubeSats stationed in wells fail, they remain there indefinitely



Example Operating Guidelines

- 4) Considerations for CubeSat constellations
 - A minimum distance between nodes of the formation
 - Where in the GEO belt these constellations can be operated (i.e. not near crowded GEO slots)
- 5) Provide position/velocity data to SSA community
 - CubeSat operators could be required to provide the SSN with position and velocity data acquired through system operation
 - Provide position and velocity data recorded before/after the maneuver
- 6) Include laser retro reflectors
 - Operators could be required to house a small, directable retro reflector on the CubeSat exterior
- 7) Provide unique signal for each GEO CubeSat
 - CubeSats sometimes have difficulty distinguishing between downlinks when they are in close proximity



Implementation

- Gain recognition from a space oriented international governing body, who could facilitate discussion between industry, operators, and SSA community members
 - Responsible for enforcing Operating Guidelines
- Alternatively, establish a new governing body focused on SSA
 - Can utilize other organizations as inspiration:
 - International Telecommunications Union (ITU)
 - Enables members by having one set of common standards for the industry
 - U.N.'s Committee on the Peaceful Uses of Outer Space (COPUOS)
 - Emphasizes coordination and agreement between member countries AND commercial space operators
 - Consortium for Execution of Rendezvous and Servicing Operations (CONFERS)
 - Publishes notational operating procedures/standards for RPO and OOS
 - CubeSat manufacturers can also use this international governing body to establish design standards
 - Important to establish a way to create/edit these guidelines to respond to new industry trends

LOCKHEED MARTIN

