4.9.4 Antenna Infrastructure (CCR 1803)

The GOES-R Antenna System is part of the comprehensive GOES-R GS and is a subsystem of the Mission Management Element. The terminology of "Antenna System" includes all components across all three sites required to receive or transmit RF signals to/from the satellites through the Intermediate Frequency Distribution System (IFDS) interface demarcation point with the GS. (CCR 1803)

Within the GOES-R Antenna System, the term "antenna station" designates a single reflector/pedestal assembly together with all associated transmit and receive equipment (normally located within or in close proximity to the antenna pedestal) required to establish an uplink/downlink communication path with a single satellite. It also includes all local monitor and control equipment required for a single antenna station. There are three new GOES-R system antenna stations located at WCDAS and at the CBU. (CCR 1803, CCR 3019A, CCR 3584)

Preliminary plans are to operate the GOES-R ground system similarly to the previous GOES-I/M and GOES-N/P mission support concept. (CCR 1803, CCR 3584)

The new GOES-R system antenna stations located at WCDAS is designed for full operation in sustained winds corresponding to a Category 2 hurricane (up to 110 mph) to enhance their robustness and give NOAA wider options to plan contingency scenarios. The "hurricane" rating at WCDAS is also necessary because the new GOES-R system antennas must also be capable of supporting GOES-N/P, which is required to operate from WCDAS under high wind conditions. (CCR 1803, CCR 3584)

During normal operations, the GOES-R system antennas and associated equipment at both WCDAS and CBU are monitored and controlled from the WCDAS operations room, with backup monitoring by operators at NSOF via remote GOES-R system Antenna Monitor, Control, and Test subsystem (GAMCATS) workstations. The capability exists to assume primary monitor and control from NSOF for contingencies (e.g. during a transition to CBU operations if WCDAS becomes unavailable). (CCR 1803, CCR 3019A, CCR 3584)

The CBU is primarily used in a continuity of operations mode, and is capable of rapid fail-over ("hot-swap"). The CBU is not normally used to actively swap primary command and control and/or GRB processing functions in an autonomous or semi-autonomous mode during conditions such as rain-fade events, but the CBU is designed to support this concept. The CBU may be used to cover scheduled or predicted periods of interference with normal operations, such as seasonal solar RF interference periods and preventative maintenance activities. (CCR 1803, CCR 3019A, CCR 3584) image is also generated within five minutes and mesoscale images can be generated every 30 seconds. (CCR 3584)

Mode 3 mesoscale tasking is analogous to the legacy GOES 13-15 series imager Rapid Scan Operation (RSO) mode (but with frames sizes closer to the super-rapid scan schedule). While it is possible to design a system for automated direct tasking of mesoscale frames by users, control of the ABI Mode 3 is similar to the legacy RSO scheme, where the Senior Duty Meteorologist vets mesoscale requests from local NWS field service offices. However, efficiency and automation of the Mode 3 tasking process is increased over the legacy GOES level. Similarly, though the capability may eventually evolve to dynamically task ABI mesoscale scans via a closed-loop automated system (e.g. using image analysis to identify severe storm regions for ABI mesoscale scans), this advancement would be implemented only after considerable study and validation.(CCR 3584)

Regardless of which possible scan mode switching to optimize mesoscale data collection under particular conditions, the normal synoptic cadence of 5 min CONUS and 15 min full disk images is maintained. (CCR 3019A, CCR 3584)

Mode 6 ten-minute full disk images allows NOAA to match the full-disk scanning cadence of our international partners enabling nearly global advanced imager coverage every ten minutes. Ten-minute full disk imagery is critical to our National Weather Service Weather Forecast Offices, National Centers, and the Volcanic Ash Advisory Centers in monitoring hazardous weather conditions and providing additional information in observationally limited areas like over the oceans or in the mountains. The faster temporal cadence also improves aviation safety. (CCR 3584)

Integral parts of each scan mode are space and blackbody calibrations needed to meet radiometric performance requirements. These calibrations are included in the allocated time for each. All instruments operate concurrently and continuously with minimal downtime for housekeeping operations. The ABI exploits the "Operate-through" capability of the spacecraft bus for continuous imaging within specification during housekeeping activities and possibly orbit maneuvers. (CCR 3584)

No special "keep-out-zone" commanding is required for Sun or Moon avoidance in normal operations. The ABI is capable of scanning across the Earth limb with the Sun present in the FOV at the normal scan rate without damage, but onboard software will prevent direct Sun impingement during normal imaging operations with minimal loss of image data. Solar and lunar exclusion zones for star looks and space-look calibrations are automatically computed by the ABI flight software using onboard spacecraft ephemeris data. (CCR 3584)

5.10.2 GLM

The concept for the GLM is to perform much of the raw data processing on the ground, resulting in a raw data downlink rate of approximately 7.5 Mbps. On-orbit operational requirements are very limited for the GLM. Detector navigation is performed on the ground using spacecraft bus attitude solutions. No routine on-orbit calibration will be required. A large amount of the raw data processing is done to discriminate between true lightning events detector stimulation produced by charged particles, surface glint, or electronic noise-induced events. The flash false alarm probability will be less than 5% after processing. (CCR 3019A, CCR 3584)

Some operational characteristics of the GLM are:

- Continuous operation through eclipse periods
- Withstands sun in the field-of-view indefinitely without damage
- Autonomous background imaging (intensity of every detector element) once every 2.5 minutes, or upon ground command

GLM data reported for each lightning event includes geolocation of the event to 5 km accuracy, intensity of the detected event, and time of the event to an accuracy of 500 microseconds. (CCR 3584)

5.10.3 Space Weather and Solar Imaging

The SUVI, EXIS, SEISS, and MAG/GMAG operate and transmit data during eclipses and stationkeeping maneuvers. Each operates independently of the other instruments on the spacecraft bus. When operational, all instruments will be observing simultaneously and do not invoke different observing modes. It is possible that the SEISS and MAG/GMAG instruments may be operational during on-orbit storage to collect space environmental data from the storage location. This function will depend on the storage mode attitude control mode and the downlink antenna geometry. For CCOR (GOES-U only), no images will be taken during total solar eclipse periods. To compensate for the data gap, an increased number of images will be taken just before and after the eclipse period. (CCR 3584)

SEISS, SUVI, and EXIS calibrations vary by instrument. The solar-pointing instruments require periodic (no more than 4 times per year) off-pointing from the Sun by up to 15 deg to measure background. Sequential orthogonal slews across the solar disk (cruciform slews) will also be required for the SUVI and EXIS instruments, but these activities may be combined into a unified operation for the Sun-pointing platform suite and are required no more than 4 times per year. Initial on-orbit calibration of the magnetometer instrument offset bias (instrument plus spacecraft) may require successive large-angle (multi-rev) spacecraft rotation maneuvers. The magnetometer offset determination is a one-time calibration maneuver involving large angle attitude slews performed during the spacecraft post-launch test period in the vicinity of local noon. (CCR 3584)

CCOR (GOES-U) operational scenarios are yet to be developed, save for the infrequent solar off-pointing calibration maneuvers; the instrument should require minimal operational resources. (CCR 3584)

5.11 SCHEDULING / MISSION PLANNING

All routine and special operations commanding of the spacecraft and instruments will be performed using the scheduling (mission planning) process. In general, the daily payload schedule is routine and is much repeatable from day-to-day. This routine schedule may be planned at least 30 days in advance. Long term changes requiring a change in the whole structure of a routine daily schedule (i.e. changing the size of a standard frame or setting up a specific research imaging sequence) will require at least thirty days' notice. Limited short-term schedule changes can be made within an hour in response to anomalies or rapidly changing conditions. Scheduling will generate all orbit event predictions for the Mission Management function, including instrument or attitude sensor interference periods, acquisition data for MM and user antenna pointing, solar and lunar eclipses, and solar RFI. (CCR 3584)