GOES-R Instrument Operations

Hal Bloom
GOES-R Program
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Agenda

- The GOES-R Instrument Suite
- Changes in the Last Year
- Nadir Sensor Operations
    - ABI and GLM
- Non-Nadir Sensor Operations
    - SUVI, EXIS, SEISS and MAG
- Operational Considerations

GOES-R Sensors

Advanced Baseline Imager (ABI)
- Implementation phase (2 years post-CDR)
- Contractor: ITT Corporation, Ft Wayne, IN

Solar Ultra Violet Imager (SUVI)
- Implementation phase (PDR in Fall 2008)
- Contractor: Lockheed-Martin Advanced Technology Corp, Palo Alto, CA

Extreme Ultra Violet /X-Ray Irradiance Sensor (EXIS)
- Implementation phase (PDR in Fall 2008)
- Contractor: Laboratory for Atmospheric and Space Physics, Boulder, CO

Geostationary Lightning Mapper (GLM)
- Implementation phase (PDR in Spring 2009)
- Contractor: Lockheed-Martin Advanced Technology Corp, Palo Alto, CA

Space Environmental In-Situ Suite (SEISS)
- Implementation phase (PDR in Fall 2008)
- Contractor: Assurance Technology Corporation, Carlisle, MA

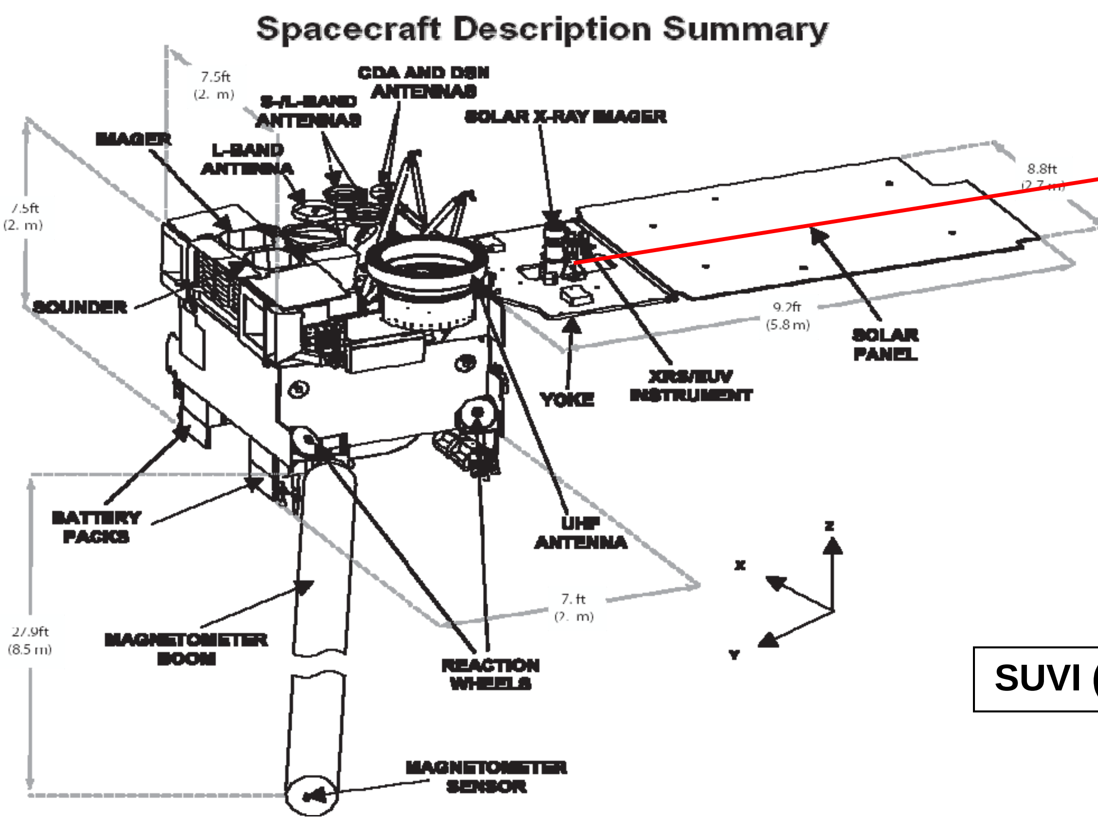
Magnetometer (MAG)
- Procured as part of spacecraft contract

Operational
Complexity

Changes in the Last Year

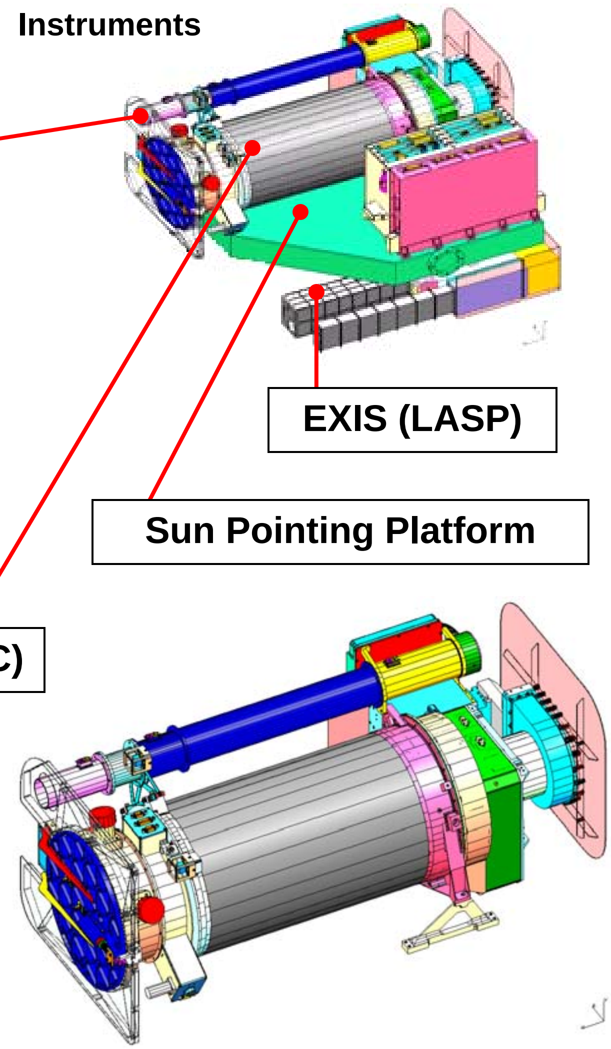
- Five Sensors are in implementation
  - Four of five Sensors are past PDR
    - GLM PDR scheduled for Spring 2009
- ABI Prototype Model integration begins this month
- Sensor interfaces remain mature
  - Defined and controlled for over two years
- Spacecraft acquisition activities continue

Non Nadir Sensor Operations: SUVI



GOES N Spacecraft -
(GOES R may have a similar Solar Panel mount configuration)

GOES R Solar Instruments



EXIS (LASP)

Sun Pointing Platform

SUVI (LM ATC)

Note: Notional sun pointing platform mounting concept shown; actual mounting TBD

Non Nadir Sensor Operations: SUVI

Nominal Operations

- Nominal operations begin immediately after end of on-orbit storage phase
- Control and health monitoring performed at SOCC
  - Data processed
  - Forcasting and Alerts at SWPC

Eclipse Operations

- Recovery from periodic eclipses of the GOES-R orbit is 4 hours, and is minimized by active thermal control of the telescope
- SUVI is capable of operating through eclipse, though the image data and Guide Telescope signals will register low levels (dark levels)

Weekly Calibrations

- A weekly set of images is taken to monitor instrument and CCD performance
- Sequence runs for a few minutes; scheduled as part of the nominal observing timeline
- Sequence provides measurements of the mechanism characteristics

Monthly Calibrations

- Guide Telescope calibration sequence
- Frequency may decrease to quarterly after the first operational year

Performance Tracking and Anomaly Resolution

- Trending of instrument performance is an integral part of mission operations
- Anomalies in subsystem operation are documented and resolved

Non Nadir Sensor Operations: SUVI

- On-board EEPROM table will hold an observing sequence set
  - Operational sequences defined by the NWS/Space Weather Prediction Center (SWPC)
  - Reconfigurable on-orbit
- During a normal “patrol” sequence, one SUVI image is anticipated each 15 seconds (TBD)
  - SUVI is capable of one image every 10 seconds
- Ground command will initiate the observing sequence which will continue indefinitely
- SUVI can transition to different sequences by:
  - Ground command
  - Spacecraft command (stored command/relative time sequence)

Non Nadir Sensor Operations

- Generally speaking, EXIS, SEISS and MAG are not operationally complex
  - Upon completion of post-launch testing and initial configurations, the instruments operate continuously once in normal operations mode
  - No special scheduling operations expected
  - No moving mechanisms during normal operations
- Limited post-launch, post-storage and periodic calibration sequences will be defined
- The in-situ instruments (SEISS and MAG) are capable of operation during storage
  - Attitude independent

Sensor Operational Considerations

- GOES-R instrument outages due to spacecraft activities such as momentum management, stationkeeping and yaw flip maneuvers will be greatly reduced from GOES-NOP
  - Cumulative time for interface outage limited to 120 minutes per year per instrument
  - Outages are limited to one outage per day with a max duration of 40 minutes
- Today's I/M and NOP series spacecraft have scheduled daily science outages due to housekeeping periods and extended outages due to maneuvers
- The GOES-R spacecraft will be able to operate autonomously within specification without ground contact for a period of 7 days

Summary

- ABI and SUVI are operationally flexible instruments
  - Timelines and sequences may be defined to meet user needs
  - All operational changes will be coordinated with the GORWG (ABI) and the SWPC (SUVI)
- SUVI, EXIS, SEISS and GLM are at the PDR phase
  - SUVI CONOPS discussions are being refined with the NWS/Space Weather Prediction Center
  - Calibration operations and impacts for all instruments are under review
- GOES-R spacecraft-to-instrument interfaces will experience fewer science data outages
  - A tremendous improvement over the current operational series (GOES-I/M and GOES-NOP)

Acknowledgments

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Backup Slides

ABI Ops Terminology

Swath(s) → Scene(s) → Timeline

Swath: sub-area collected in a single scan

- Defined by start and end coordinates; straight line, any angle

Scene: Area to be observed (e.g. CONUS)

- Ordered set of swaths; need not be contiguous

Timeline: Defines what to observe when (e.g. Mode 3)

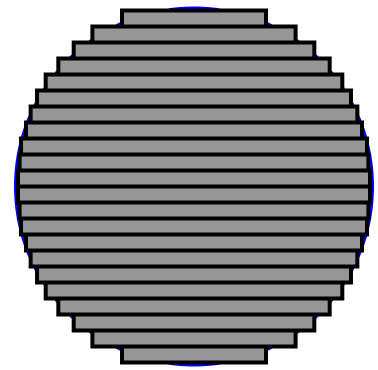
- Time sequenced set of scene swaths and durations

ABI Scene Definitions

Rectangular scenes:

- E.g. CONUS = 6 swaths, equal length, spaced uniformly North-to-South, parallel to equator

Arbitrary shapes:

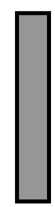


- E.g. Full Disk = 22 swaths, staggered lengths (piecewise fit to circle), spaced uniformly North-to-South, parallel to equator

Stares:

- E.g. Blackbody; same start & end coordinates

Arbitrary angles:



- E.g. NS scan for detector element uniformity checks

30 seconds

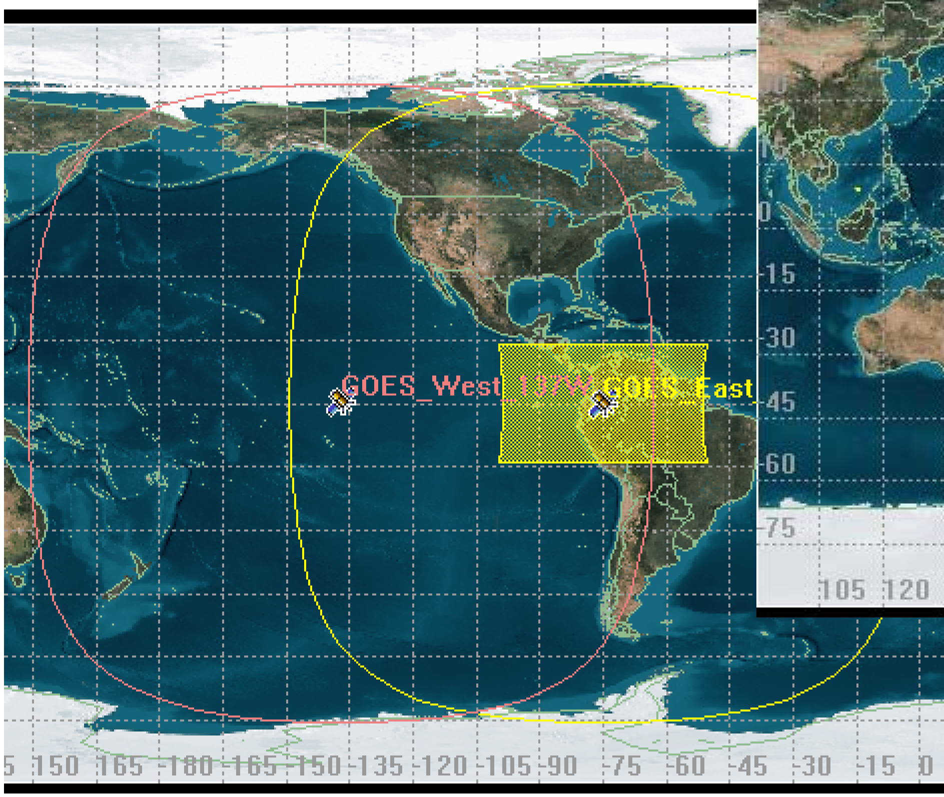
0	B	Star 1	Star 2	Meso 1-1	Meso 1-2
30	L	Full Disk Swath 1	Star 3	Meso 2-1	Meso 2-2
60	L	Full Disk Swath 2	CONUS 1-1	Meso 3-1	Meso 3-2
90	L	Full Disk Swath 3	CONUS 1-2	Meso 4-1	Meso 4-2
120	L	Full Disk Swath 4	CONUS 1-3	Meso 5-1	Meso 5-2
150	L	Full Disk Swath 5	CONUS 1-4	Meso 6-1	Meso 6-2
180	L	Full Disk Swath 6	CONUS 1-5	Meso 7-1	Meso 7-2
210	L	Full Disk Swath 7	CONUS 1-6	Meso 8-1	Meso 8-2
240	L	Full Disk Swath 8		Meso 9-1	Meso 9-2
270	L	Full Disk Swath 9	Star 4	Meso 10-1	Meso 10-2
300	L	Full Disk Swath 10	Star 5	Meso 11-1	Meso 11-2
330	L	Full Disk Swath 11	Star 6	Meso 12-1	Meso 12-2
360	L	Full Disk Swath 12	CONUS 2-1	Meso 13-1	Meso 13-2
390	L	Full Disk Swath 13	CONUS 2-2	Meso 14-1	Meso 14-2
420	L	Full Disk Swath 14	CONUS 2-3	Meso 15-1	Meso 15-2
450	L	Full Disk Swath 15	CONUS 2-4	Meso 16-1	Meso 16-2
480	L	Full Disk Swath 16	CONUS 2-5	Meso 17-1	Meso 17-2
510	L	Full Disk Swath 17	CONUS 2-6	Meso 18-1	Meso 18-2
540	L	Full Disk Swath 18		Meso 19-1	Meso 19-2
570	L	Full Disk Swath 19	Star 7	Meso 20-1	Meso 20-2
600	L	Full Disk Swath 20	Star 8	Meso 21-1	Meso 21-2
630	L L	Full Disk Swath 21	Star 9	Meso 22-1	Meso 22-2
660	L	Full Disk Swath 22	CONUS 3-1	Meso 23-1	Meso 23-2
690	L		CONUS 3-2	Meso 24-1	Meso 24-2
720	L		CONUS 3-3	Meso 25-1	Meso 25-2
750	L		CONUS 3-4	Meso 26-1	Meso 26-2
780	L		CONUS 3-5	Meso 27-1	Meso 27-2
810	L		CONUS 3-6	Meso 28-1	Meso 28-2
840	L			Meso 29-1	Meso 29-2
870	L			Meso 30-1	Meso 30-2

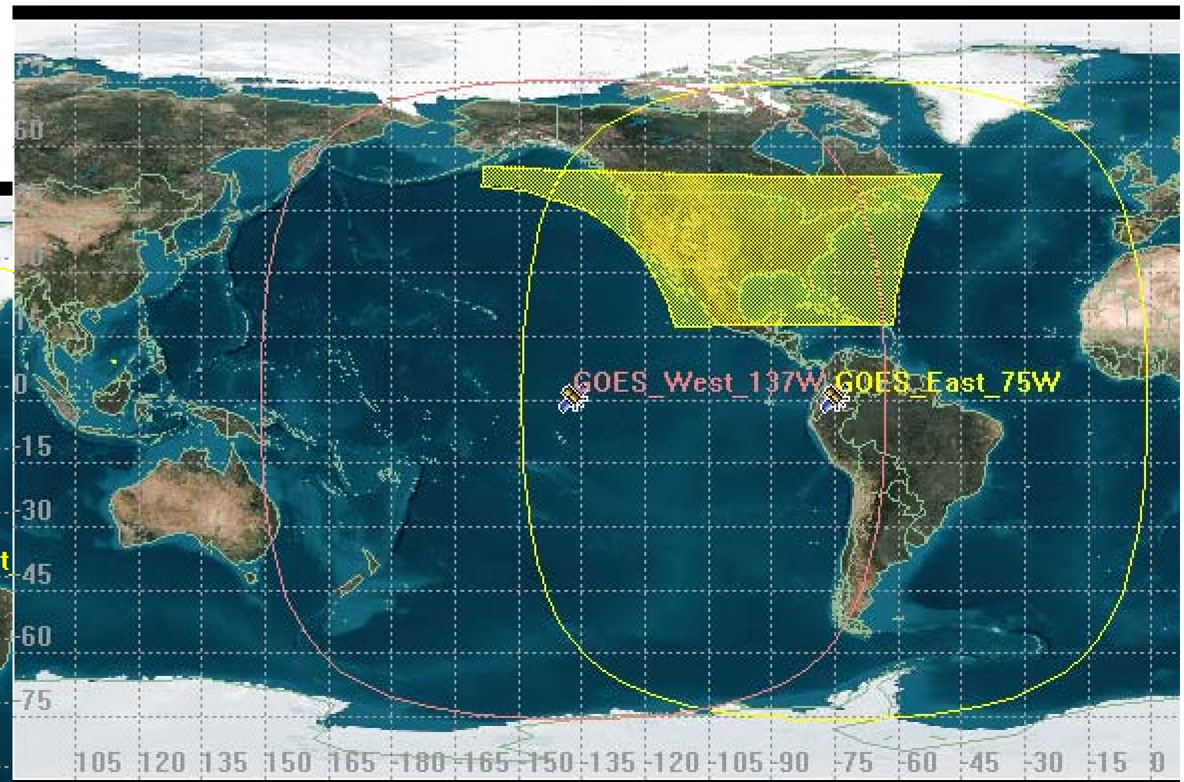
B: blackbody observation

L: space look

Single ABI GOES-East CONUS coverage

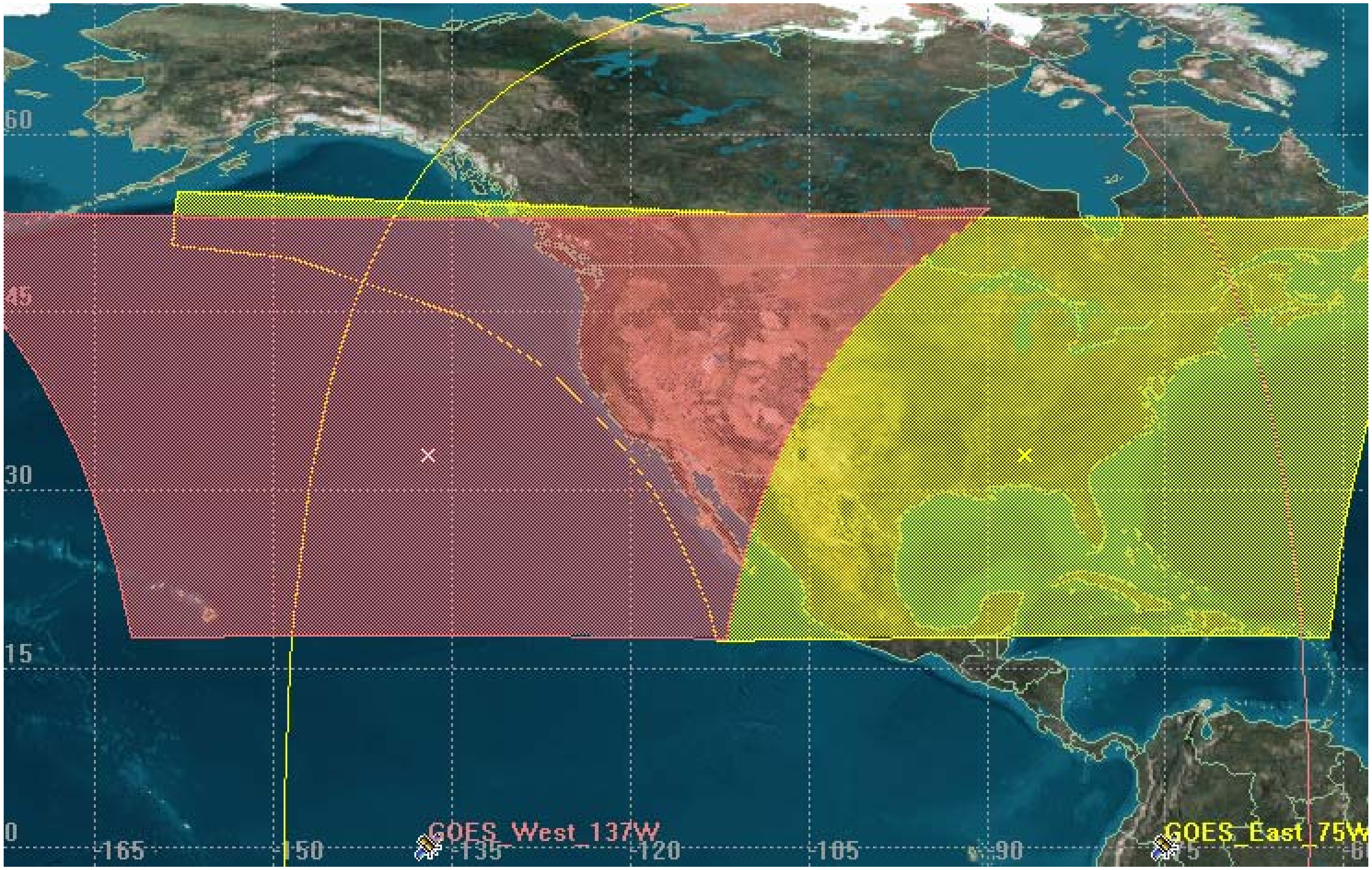
Current Mode 3 CONUS Sector (8.0215 deg x 4.8129 deg) projected up over CONUS (5000 km x 3000 km at nadir)





Note: CONUS scene sizing is under review. Interactions with the GOES-R Operational Requirements Working Group (GORWG) are underway to refine East and West scenarios.

CONUS West and CONUS East views

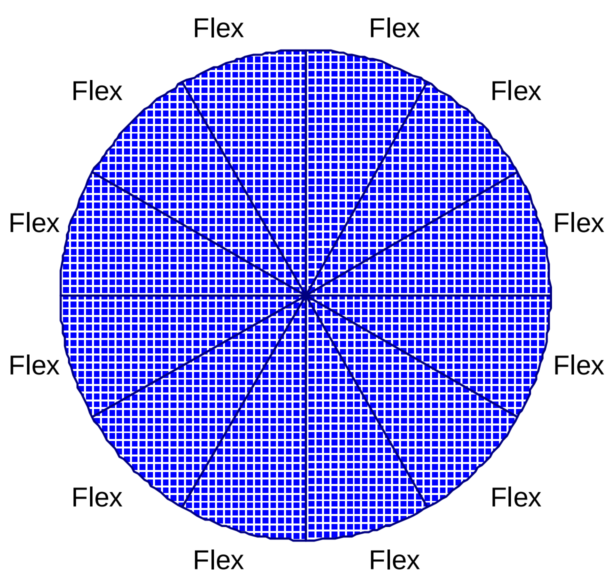


- This view utilizes current Mode 3 CONUS sizing; actual size TBD
- Today's western PACUS is ~30% larger than the Mode 3 CONUS

Possible ABI Scan Strategies

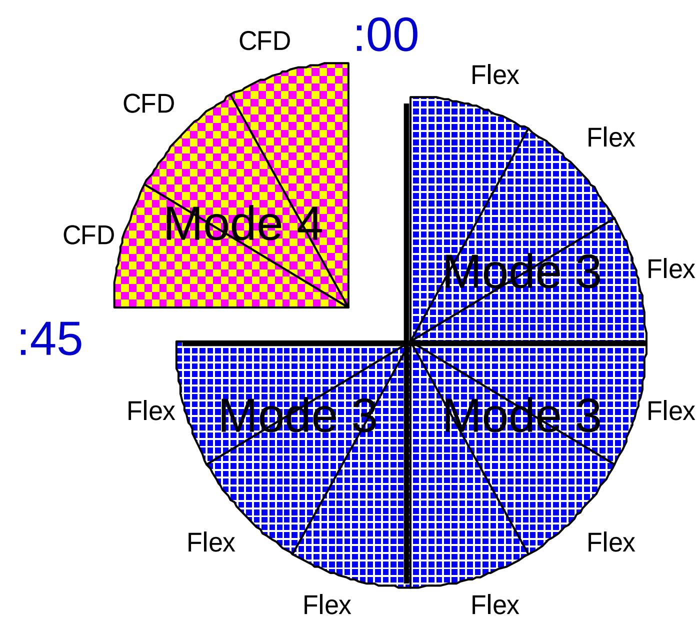
To be evaluated: What are the best combinations of scan scenes and timelines?

- Discussions will be facilitated by the GOES-R Operational Requirements Working Group (GORWG)



Mode 3
[FD+CONUS+MESO]

Full hour in severe weather situations



Combination of Mode 4 and Mode 3

Routine hourly operations mode, allows full disk winds each hour.