

Antenna Control System (ACS)

A new software solution for controlling LEO DB Antennas

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The Problem: Operating one or more LEO Direct Broadcast Antennas

- I. SSEC owns and operates 6 (soon to be 7) CPI/Orbital X/L-band LEO DB antennas, with all except one (Madison) in remote locations (Guam, Hawaii, California, Florida, Puerto Rico). Historically we have used the CPI/Orbital EOS-FES to control our antennas.
- II. Monitoring, troubleshooting, and fixing problems at remote antenna sites is time consuming: we need a rock-solid antenna control system that is easy to configure, operate, monitor, and troubleshoot (e.g., system configuration file in text format).
- III. We need to be able to add new satellites to the control system without vendor support.
- IV. We need flexible pass scheduling that can be updated on the fly (e.g., coordinated scheduling for multiple antenna sites).
- V. We need a software solution that is portable to current Linux distributions (RHEL, Rocky, Alma, Ubuntu, etc.).

The Solution: Antenna Control System (ACS)

1. Compiled and statically linked executable code (written in Go) designed to be executed as a service (e.g., systemd).
2. Runs on a modest Linux server (4-core Intel Xeon 3.3 GHz, 16 GB RAM, 512 GB SSD, Rocky Linux 9.7).
3. Single human-readable configuration (TOML format) file is designed to be edited by the end user (e.g. to add a new satellite).
4. Supports CPI/Orbital Systems AEHP/ACU-1) and AEBP/ACU-2 pedestals (ACU-3 support will be added) and D300 demodulators.
5. Satellite overpass scheduling is loosely coupled to ACS (you can use your own scheduling algorithm; just create a JSON schedule).
6. CADU decoding is handled by RT-STPS or SSEC-developed decoder “Dexter” (user can configure CADU decoder per satellite).
7. Pushes decoded Level 0 data via SFTP to a separate processing server via user-defined script (user can change/replace at will).
8. User-defined “trigger scripts” can be run at the end of each pass (user can change/replace at will).
9. Running at Madison WI antenna site since Dec 2025 and supports aqua, aws, fengyun-3d, fengyun-3e, gcom-w1, hops, metop-b, metop-c, metop-sga1, noaa-20, noaa-21, oceansat-3, saral, snpp (will be deployed to other SSEC antenna sites by end of 2026).

Antenna Control System (ACS) Configuration File Snippet

```
# ACS pedestal and demodulator settings

[pedestal]
type = "CPI_ACU1"
connection = {type="tcp", host="192.168.124.190", port=10001, timeout_secs=5}
feed_type = "CPI_EOS"

[demodulators.d300]
type = "CPI_D300"
mgmt = {
  type = "ssh",
  user = "oscp",
  host = "192.168.124.173",
  port = 22,
  private_key_path = "/home/acs/.ssh/id_rsa_eosfes",
}
data = {type="tcp", host="192.168.124.174", port=3490}

# ACS scheduler settings

[scheduler]
schedule_file = "${ACS_HOME}/schedules/schedule.json"
min_pass_duration_secs = 120
prepass_secs = 30
postpass_secs = 5
min_elevation_deg = 5

# ACS decoder configurations

[decoders.rt-stps]
command = "${ACS_HOME}/scripts/rtstps_decoder.sh"
env = ["RTSTPS_HOME=${ACS_HOME}/decoders/rt-stps"]

[decoders.dexter]
command = "${ACS_HOME}/scripts/dexter_decoder.sh"
env = ["DEXTER_HOME=${ACS_HOME}/decoders/dexter", "RDR_AGGREGATE=true"]

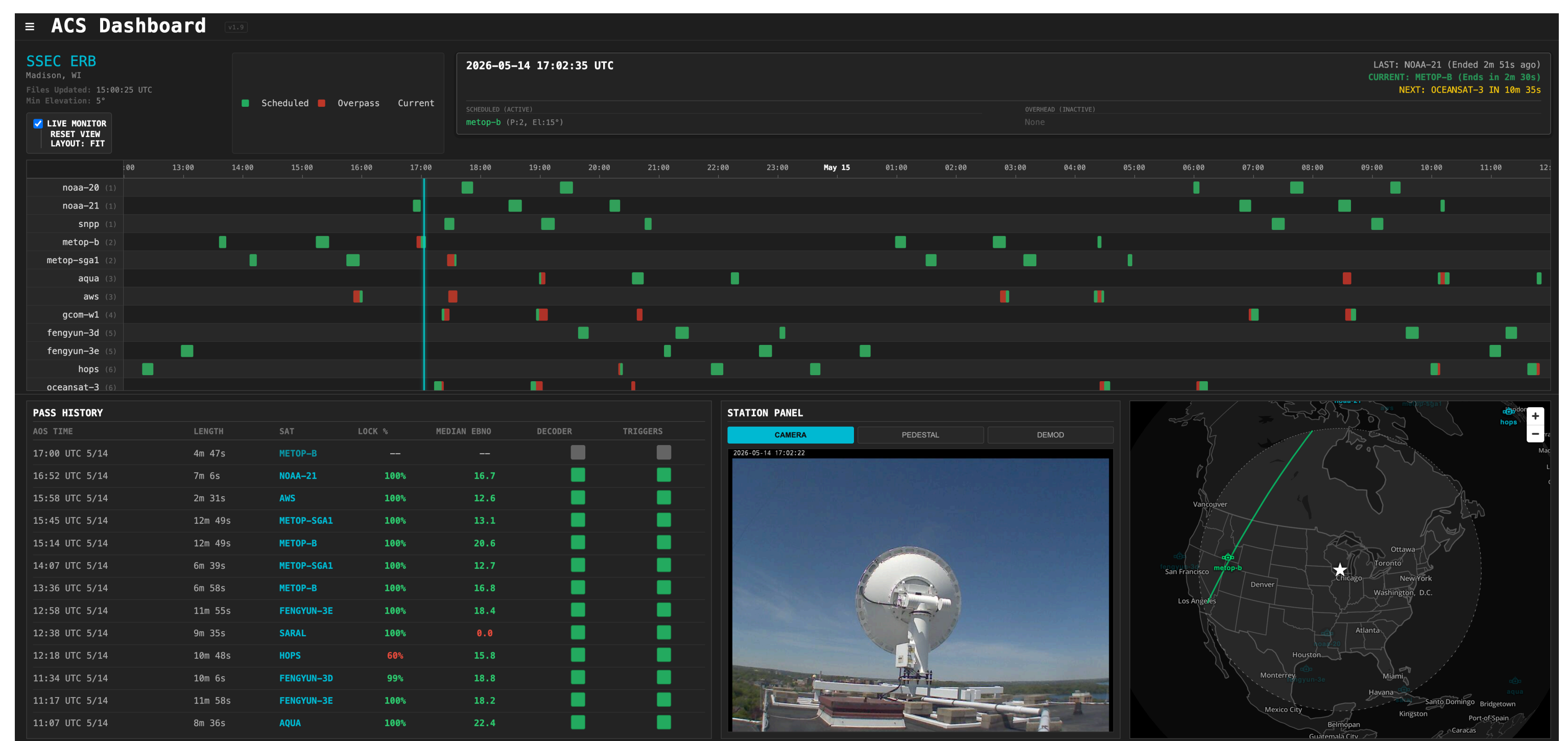
# ACS satellite configurations

[satellites.noaa-21]
norad_catalog_id = 54234
tracking_enabled = true
tracking_priority = 1
save_raw_file = false
decoder = "rt-stps"
triggers = ["persist_outputs", "upload_dbps", "create_pass_plot"]
demodulator = "d300"
demodulator_config = {mode="JPSS2", frequency=7812.0, downconverter_offset=7092.0}
feed_config = {feed_frequency=7812.0}

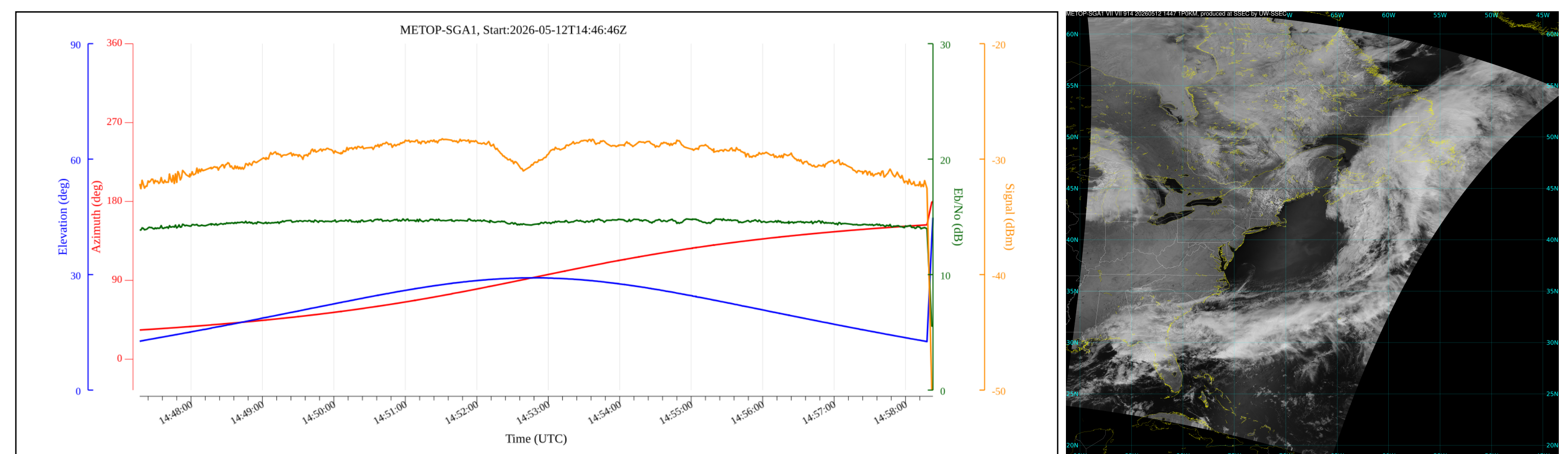
[satellites.metop-sga1]
norad_catalog_id = 65159
tracking_enabled = true
tracking_priority = 2
save_raw_file = true
decoder = "dexter"
triggers = ["persist_outputs", "upload_dbps", "create_pass_plot"]
demodulator = "d300"
demodulator_config = {mode="METOP_SGA1", frequency=7825.0, downconverter_offset=7105.0}
feed_config = {feed_frequency=7825.0}
```

SSEC added the configuration for Metop-SGA1 in December 2025
(uses D300 “METOP_SG” mode supplied by CPI/Orbital)

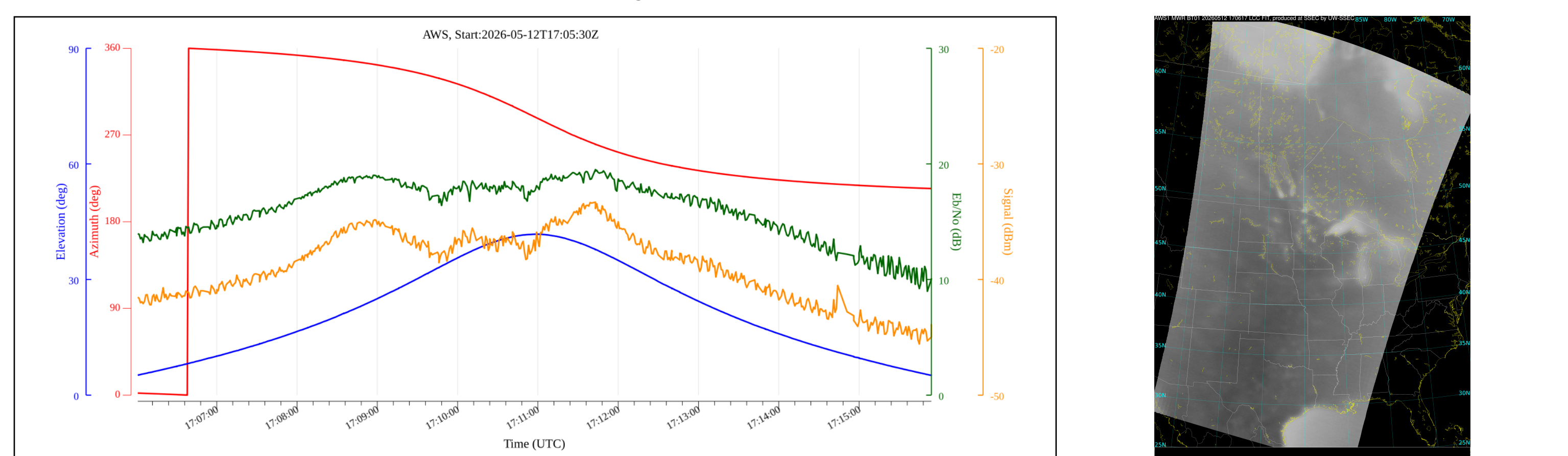
ACS Monitoring Dashboard (runs in browser)



Metop-SGA1 received by ACS and processed at SSEC



AWS received by ACS and processed at SSEC



ACS Innovations in Development

- Customized antenna scheduling to support coordinated reception priorities across 2 or more geographically separated antenna sites.
- Enabling ultra low latency reception for multiple satellites and sensors (e.g., JPSS, Metop-SG, FY-3) from multiple antenna sites.
- Providing ultra low latency ATMS, CrIS, VIIRS, and OMPS RDR granules.
- Support for other demodulators (e.g., HRD-200B, LRD-200B) and for software defined radio hardware.