Advanced Satellite Ground System for the New Generation of Meteorological Satellites

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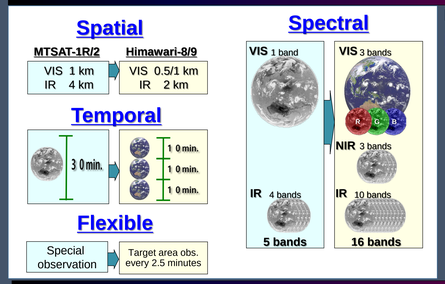
BACKGROUND and INTRODUCTION

With the emergence of Himawari-8, GOES-R, and Geokompsat-2A and FY-4 going operational in the near future the user community is faced with the huge volume of data which put a strain on the current ground system infrastructure. Since the declaration as the east operational satellite, GOES-16 has transmitted more data in the first six months of operation than all previous GOES weather satellites combined.

The order of magnitude increase in sensor capability in terms of number of spectral channels, pixel resolution, and frequency of observation demand powerful and robust processing computers. In addition, users are and will have to deal with a large number of level-2 and higher products that need to be handled and digested in order to utilize these products efficiently and effectively in order to better serve the public. Enterprise Electronics Corporation, a giant in the weather radar business now offers satellite data reception and processing systems that are most advanced among its kind in a cost effective way . The Proteus system is powerful, efficient, and user friendly to serve the new generation of satellite user community.

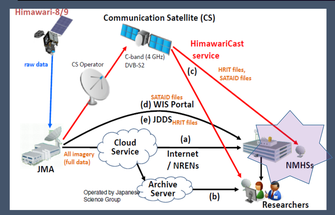
JMA's latest-generation Himawari-8 geostationary meteorological satellite began operation in July 2015, with the corresponding Himawari-9 unit entering a state of backup operation in March 2017. The Advanced Meteorological Imager (AMI) successfully launched on board the Geostationary Korea Multi-Purpose Satellite (GEO-KOMPSAT-2A) December 4, 2018. The first, GOES-R, was launched Nov. 19, 2016. Now in geostationary orbit, NOAA has re-named it to GOES-16. The second, GOES-S, was launched March 1, 2018. GOES-16 went operational on Dec. 18, 2017 followed by GOES-17 on Feb. 12, 2019..

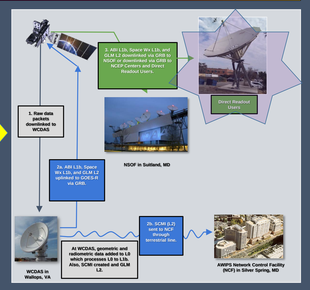
ADVANTAGE OF ABI, AHI AND AMI



Color Key:							
Not in ABI							
Different FPA							
FPM	FPA	Resolution (km)	AHI Band #	Nominal Wavelength (μm)		
				ABI	AHI	AMI
VNIR	A047	1	1	0.47	0.47	0.47
	A086	1	2	0.86	0.51	0.51
	A064	0.5	3	0.64	0.64	0.64
	A161	1	4	1.61	0.86	0.86
	A138	2	5	1.38	1.61	1.38
	A225	2	6	2.25	2.26	1.61
MWIR	A390	2	7	3.9	3.9	3.9
	A618	2	8	6.185	6.185	6.185
	A695	2	9	6.95	6.95	6.95
	A734	2	10	7.34	7.34	7.34
	A850	2	11	8.5	8.5	8.5
LWIR	A961	2	12	9.61	9.61	9.61
	A1035	2	13	10.35	10.35	10.35
	A1120	2	14	11.2	11.2	11.2
	A1230	2	15	12.3	12.3	12.3
	A1330	2	16	13.3	13.3	13.3

DATA DISSEMINATION



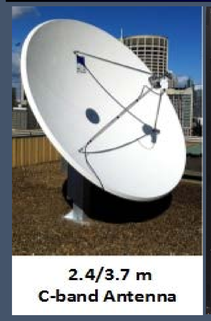


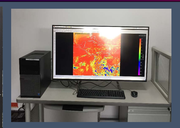
DESIGNING HIGH PERFORMANCE DIRECT BROADCAST GROUND SYSTEM

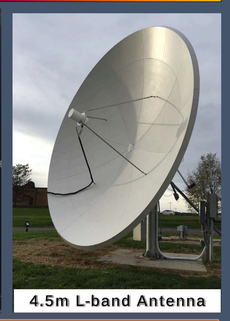
The Enterprise Electronics Corporation TeleSpace CAPELLA-GR ground station is a high performance, turnkey system that receives and processes data from the GOES-R Series of Meteorological Satellites. Likewise TeleSpace eTeleCast system is a versatile high performance, turnkey system that can be used to receive data from the HimawariCast, GeonetCast, and EumetCast downlinks. The pedestal is a rugged, precision design that manufactured to meet the challenges of L, C, or Ku band reception in all areas around the globe. The pedestal is designed for full orbital arc coverage and are readily adaptable to ground or rooftop installations, and comes equipped with a motorized antenna controller that is rack mounted.

Acquisition Workstation (AWS) for satellite reception. The AWS interfaces with the DVB-S2 based EEC100-R receiver, to receive data from the GOES-R series of satellites. The RF signal from the satellite antenna system is sent to the AWS via the provided IF cables. The AWS processes the data to level 1b. The High Speed Data Processing Workstation (DPS) will be supplied to process the data into level 1 and 2 products. The DPS receives Level 1b data from the AWS via TCP/IP. Products are then sent to the Visualization Workstations and any other authorized computers connected to the network

INTRODUCING ADVANCED SATELLITE GROUND SYSTEMS







HimawariCast System | Training | GOES-R/S Ground System

GOES FEED and RECEIVER SPECIFICATIONS

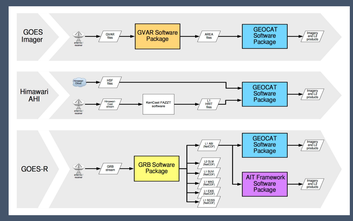
FEED SPECIFICATIONS	
Feed Structure	High Efficiency Scalar Waveguide
Center Frequency	1686.6 MHz
Polarizer	Septum Type, Dual, Left Hand and Right Hand
Polarity Isolation	> 27 dB
RF Filtering	Multi-Pole Extremely Hi Q Cavity Filter (Pre LNA)
RF Bandwidth	20 MHz Converted Bandwidth
LNA (s)	25K Noise Temp (0.4 dB Noise Figure)
Antenna Gain/Noise Temperature (G/T)	> 15.6 dB/0K
Downconverter (s) LO Frequency	1546.6 MHz
Image Rejection	> 100 dB
Output Frequency (Dual Channel)	140 MHz Dual Channel LHC and RHC
Downconverter (s) Performance	Very High TOIP +36 dBm, Low Phase Noise -93dBc/Hz @ 10 kHz
Environmental	-40 to +50 C
Status Available	LO Lock Status, Temperature, Humidity, Pressure and Voltage

EEC100-R SPECIFICATIONS	
Basic Demodulator Structure	Advanced ASIC Based Digital Demodulation, DVB-S2 Standard Compliant
GRB Modes / Decoding Supported	QPSK 9/10 Symbol Rate 8.665938 Msps / 8PSK 2/3 Symbol Rate 7.825768 Msps
FEC Supported	LDPC / BCH
GRB Coding and Modulation	CCM (Constant Coding and Modulation)
Implementation Loss	Near Shannon-Limit
Typical Eb/No for QEF Performance	4.1 dB (QPSK 9/10), 3.9dB (8PSK 2/3), QEF = PER Better than 1x10-6
Transport Stream Support	Generic Transport Stream for Space Data Packets
Matched Filtering	0.25 Roll-Off Factor
Channels Supported	Simultaneous LHCP and RHCP Reception
Input Frequency (Dual Channel)	140 MHz
Input Filtering	SAW Filter Matched to GRB Signal Bandwidth
Data / Status Interface	GB Ethernet / CADU packets via UDP
Receive Signal Strength Indicator (RSSI)	DC Voltage Output for Remote Antenna Alignment
Size	1U Rack Mount
Power	Universal 100 – 240 VAC, 47 to 63 Hz

PROTEUS BASELINE LEVEL 2 PRODUCTS

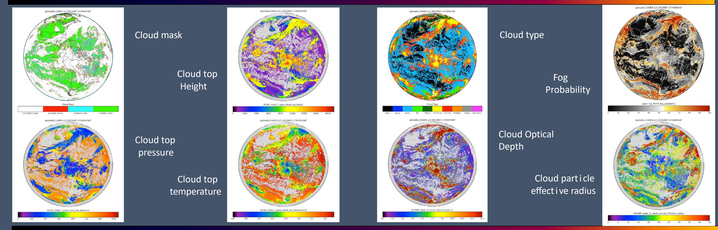
1. Cloud-top pressure;
2. Cloud-top height;
3. Cloud-top temperature;
4. Cloud type;
5. Cloud amount;
6. Sea-surface temperature;
7. Land-surface temperature;
8. Fire points;
9. Fog;
10. Dust
11. Convective Area
12. Dust and Fog;
13. Rain Rate Estimation;
14. Volcanic Ash;
15. Clear Sky Radiances;
16. RGB Products;
    - Burned Area
    - Natural Color
    - Day Convective Storm
    - Air Mass
    - Dust
    - Day Micro-Physics
    - Night Micro-Physics
    - Snow and Fog
    - Biomass Burning
    - Volcanic Ash
    - Smoke and Haze
    - Cloud Phase Detection
    - True Color with non-linear adjustment (for HSD only)

CSPP-GEO FOR LEVEL 2 PRODUCTS

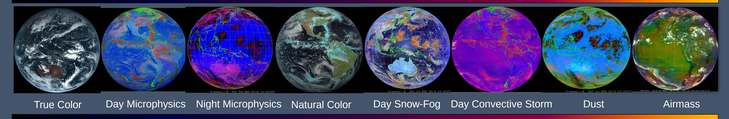


product	algorithm	maintainer
0.65 um reflectance	GEOCAT L1	GEOCAT team
3.9 um reflectance	GEOCAT L1	GEOCAT team
3.9 um brightness temperature	GEOCAT L1	GEOCAT team
6.7 um brightness temperature	GEOCAT L1	GEOCAT team
11.0 um brightness temperature	GEOCAT L1	GEOCAT team
13.3 um brightness temperature	GEOCAT L1	GEOCAT team
Cloud mask	Cloud mask	A Heidinger
Cloud phase	Cloud type	M Pavolonis
Cloud type	Cloud type	M Pavolonis
Cloud top height	Cloud height	S Wanzong
Cloud top temperature	Cloud height	S Wanzong
Cloud top pressure	Cloud height	S Wanzong
Cloud 11 um emissivity	Cloud height	S Wanzong
Cloud visible cpFcal depth	DCOMP / NCOMP	A Walther / P Heck
Cloud effecTve radius	DCOMP / NCOMP	A Walther / P Heck
Cloud liquid water path	DCOMP / NCOMP	A Walther / P Heck
Cloud ice water path	DCOMP / NCOMP	A Walther / P Heck
Probability of Marginal Visual Flight Rules (MVFR)	Fog	M Pavolonis
Probability of Instrument Flight Rules (IFR)	Fog	M Pavolonis
Probability of Low Instrument Flight Rules (LIFR)	Fog	M Pavolonis
Low cloud geometric thickness	Fog	M Pavolonis

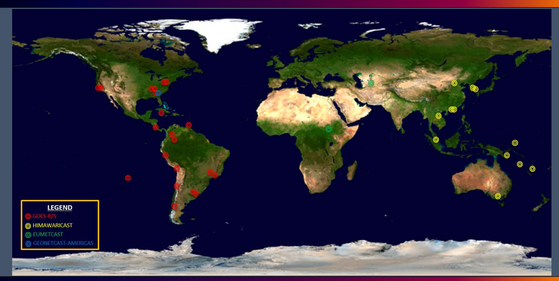
LEVEL 2 CLOUD PRODUCT SAMPLES



RGB PRODUCT SAMPLES



EEC PROVIDED GOES-R/S, HIMAWARI, EUMETCAST & GEONETCAST-AMERICAS GROUND SYSTEMS



EEC TELESPACE SATELLITE PRODUCT LINE

CAPELLA-GR™

GOES-R/S GRB MODELS: 3.7M, 4.5M, 6.5M

GOES-R/S Ground Station

Powerful Processing system to handle the dramatic increase in data over the current GOES series

42 inch display coupled with PROTEUS Satellite Data Visualization and Analysis software

ETELECAST™

HIMAWARICAST, EUMETCAST, CMA-CAST, GEONETCAST-AMERICAS MODEL: 2.4M, 3.7M

eTeleCast Ground Station

Automatic , Decryption, Decompression, Output, and Processing. Includes PROTEUS Satellite Data Visualization and Analysis software

OBERON-S™

NOAA, METOP, FY3-L MODEL: Gyro- stabilized 1.5m, 2.4m Shipboard

The Practical Solution

Shipboard polar operational environment satellite system.

Powerful Turnkey system with intuitive integrated GUI.

The choice of oceanographic research and commercial ocean going vessels around the world.

OBERON-XL/E™

NOAA, METOP, NPP, AQUA, TERRA,FY3, and JPSS XL/E MODELS: 2.4m,3.0m With or W/O Radome

The Precise Solution

Everything you want in a Polar Orbiting XL Groundstation is in EEC's new OBERON including PROTEUS Satellite Data Visualization and Analysis software

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