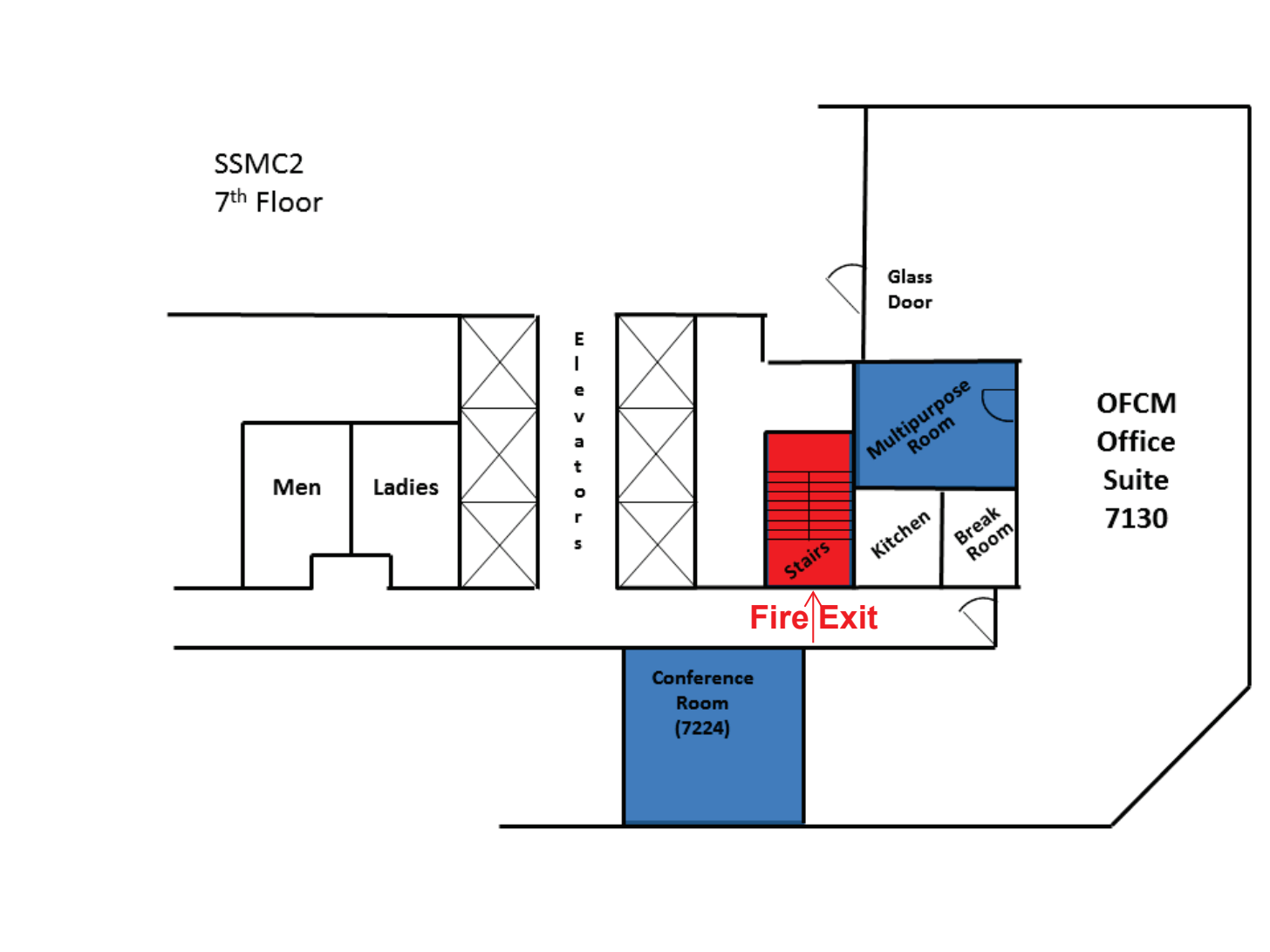
Committee on Operational Environmental Satellites

Meeting 2017-3

Sep 18, 2017

Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM)

OFCM Floor Plan



Opening Remarks

COES Co-Chairs:

- Mr. David McCarren (DOD-USN)
- Mr. Joseph Pica (NOAA-NWS)

COES Executive Secretary:

- Mr. Michael F. Bonadonna (OFCM)

Meeting is being recorded to help produce an accurate Record of Action (ROA)

Agenda

- Opening Remarks: COES Cochairs
- Action Item Review: Executive Secretary
- Indian Environmental Satellite Programs:
  Kerry Sawyer (NOAA-NESDIS)
- DoD Space–based Environmental Monitoring (SBEM) Program:
  Major Luke Rederus (HQ USAF SAF-SP)
- Committee For Operational Processing Centers (COPC):
  James Vermeulen (FNMOC)
- COES Update to ICMSSR:
  COES Cochair, Dave McCarren (USN)
- Open Discussion: COES Members.
- Action Item Review / Next Meeting: Executive Secretary
- Adjourn: The meeting is expected to end by 3:00 PM EDT.

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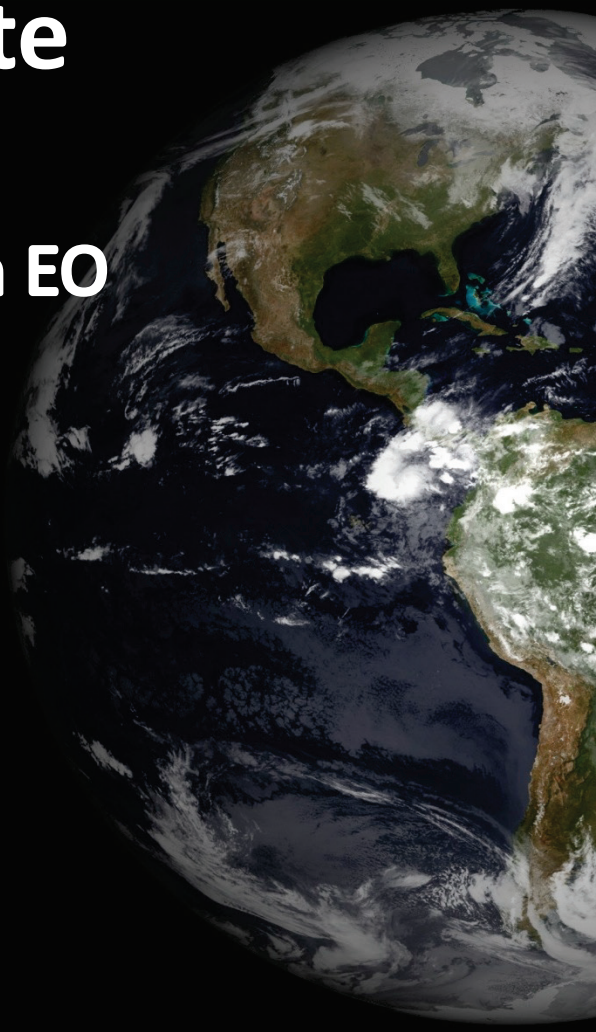
Indian Environmental Satellite Programs

SCATSAT-1, INSAT-3D/3DR and other Indian EO Missions



COES 2017-3 Meeting
18 September 2017

Overview of Collaboration

Indian Space Research Organisation (ISRO)

- Activities include cooperation in the calibration, validation, and application of ocean surface vector wind and ocean color observation data from ISRO's SCATSAT, Oceansat-2 and follow-on missions.
- **Actively engaging India in broad data sharing agreement quid pro quo utilizing NOAA's Fairbanks Command and Data Acquisition Station (FCDAS) to downlink payload data, telemetry, and tracking data and uplink commands.**
- **Agreement will allow NOAA to receive all Indian oceanographic and meteorological satellite data, including INSAT-3D and INSAT-3DR.**

India Meteorological Department (IMD)

- *Implementing Arrangement Regarding INSAT-3D Satellite Data (IA-3D) (NESDIS-IMD),* signed October 2010; technically lapsed and needs to be renewed but IMD has been reluctant to exchange letters because they feel the collaboration has not been fruitful

Exchange of Letters

भारतीय अन्तरिक्ष अनुसंधान संगठन
अन्तरिक्ष विभाग
भारत सरकार
अन्तरिक्ष भवन
न्यू बी ई एल रोड, बेंगलूर – 560 231, भारत
दूरभाष : +91-80-2341 5241 / 2217 2333
फैक्स : +91-80-2341 5328

Indian Space Research Organisation
Department of Space
Government of India
Antariksh Bhavan
New BEL Road, Bangalore - 560 231, India
Telphone: +91-80-2341 5241 / 2217 2333
Fax : +91-80-2341 5328
e-mail : chairman@isro.gov.in

आ. सी. किरण कुमार / **A. S. Kiran Kumar**
अध्यक्ष / Chairman

ISRO/IC/N 001

September 23, 2016

Dear Dr. Kathryn Sullivan,

It's my pleasure to write to you on a potential opportunity for enhancing ISRO-NOAA space cooperation which will be beneficial for the global earth observation community.

As a follow up to our successful cooperation on OCEANSAT-2 data utilization, which resulted in generation of climate quality wind vector data records, our technical teams are discussing on sharing of ISRO's SCATSAT-1 data with global scientific community. The teams have worked out the technical feasibility for using NOAA's ground station in Fairbanks for downloading the SCATSAT-1 data.

At ISRO, we are interested in expanding this cooperation to other areas including the possibilities of using NOAA ground stations at Fairbanks to provide TTC and data download support for ISRO satellites. Also, we could provide access to data from other science payloads of ISRO's oceanographic and meteorological satellites.

I request you to identify NOAA point of contact to carry forward the discussions and work towards concluding an Implementing Arrangement on this specific area of cooperation, under the "2008 ISRO-NOAA Framework Agreement". Mr. S. Arunan, Director, Earth Observations System, ISRO Headquarters (arunan@isro.gov.in) will be the point of contact from ISRO on this initiative.

I also take this opportunity to extend a warm invitation to you to visit ISRO at your convenience. We would like you to see the developments in Space science and technology, including applications in India.

With warm regards,

Yours sincerely,

आ सी किरण कुमार
(A. S. Kiran Kumar)

Dr. Kathryn Sullivan
Administrator
National Oceanic and Atmospheric Administration (NOAA)
Washington DC
USA

UNITED STATES DEPARTMENT OF COMMERCE
The Under Secretary of Commerce
for Oceans and Atmosphere
Washington, D.C. 20230

OCT 25 2016

A.S. Kiran Kumar
Chairman
Indian Space Research Organisation
Department of Space
Government of India
Antariksh Bhavan
New BEL Road
Bangalore – 560 231, India

Dear Kiran Kumar:

Congratulations to you and your team on the recent successful launch of SCATSAT-1. This mission is vitally important to the continuity of global ocean vector winds data and marks another significant contribution from the Indian Space Research Organisation (ISRO) to the international community.

ISRO and the National Oceanic and Atmospheric Administration (NOAA) have a signed Memorandum of Agreement for Cooperation in Earth Observation and Earth Sciences. This established a framework between the agencies to enable the continued cooperation and coordination of activities and programs in Earth observation, operations, and research and applications in Earth Sciences on the basis of "equality, reciprocity, and mutual benefit." I believe our joint collaborations on SCATSAT-1 will certainly enhance our space cooperation and agree this partnership will benefit the global Earth observation community.

In response to your letter, I have identified Stephen Volz, Assistant Administrator for NOAA's Satellite and Information Service, as the NOAA point of contact to continue discussions and ensure appropriate agreements are drafted for our collaborative activities. I acknowledge your request to investigate the feasibility of utilizing our Fairbanks Command and Data Acquisition Station (FCDAS) to not only downlink payload data from SCATSAT-1, but to also downlink and uplink telemetry, tracking, and commanding. There are significant steps that must be accomplished to address this request and we look forward to establishing a more robust and regular interaction to move this proposed project forward. While we investigate the feasibility of utilizing FCDAS to take the SCATSAT passes, we would like for ISRO to confirm that NOAA can receive SCATSAT data via EUMETSAT and ask that you please formally nominate NOAA to do so in a letter to EUMETSAT. I am pleased to hear that ISRO can provide access to data from other Indian oceanographic and meteorological satellites and I look forward to including this topic in future discussions.

ıe invitation to visit ISRO. While it is unlikely I will be able to travel to India
few months that I will serve as NOAA Administrator, I hope that you will
ılz when his schedule allows.

, fortunate to be a part of the calibration and validation team for SCATSAT's
CAT on Oceansat-2, and we look forward to continuing our scientific and
ıborations on SCATSAT-1 and future missions.

Sincerely,

Kathryn D. Sullivan, Ph.D.
Under Secretary of Commerce
for Oceans and Atmosphere

India's Space Program

- 92 Spacecraft Missions
- 64 Launch Missions
- 209 Foreign Satellites – 28 countries
- India has cooperative relationships with over 35 countries through international mechanisms and access to foreign satellites is necessary to complement and supplement Indian data

INDIAN EARTH OBSERVATION SATELLITES CURRENTLY IN ORBIT

LAND & WATER

RESOURCESAT-2A
LISS-3, LISS-4, AWiFS

Dec 2016

RISAT-1
C-Band SAR

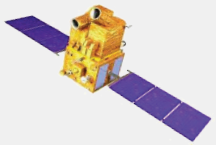
Apr 2012 to Apr 2017

HIGH RESOLUTION

CARTOSAT-2
0.8 m PAN

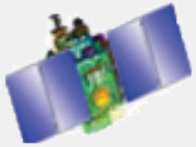
Jan 2007 – May 2012

CARTOSAT-1
2.5m PAN stereo



May 2005 – May 2010

CARTOSAT-2 Series



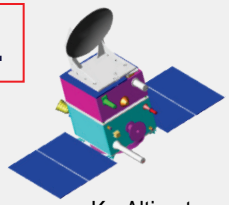
Jun 2016, Feb 2017 & Jun 2017

OCEAN

OCEANSAT-2
OCM, OSCAT, Rosa

Sep 2009 – Sep 2014

SARAL



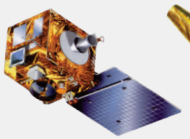
Ka-Altimeter

Feb 2013

SCATSAT-1
Ku-band Scatterometer (SCAT)

Sep 2016

WEATHER; CLIMATE

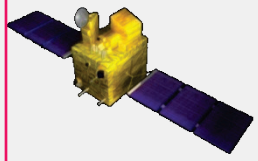


KALPANA
VHRR
2002-2012

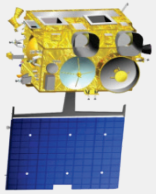
INSAT-3A
VHRR, CCD

2003-2013

MEGHA-TROPIQUES
MADRAS, SCARAB, SAPHIR, ROSA



Oct 2011

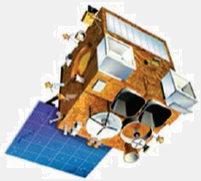


INSAT-3D
Imager, Sounder

2013-2023

INSAT-3DR
Imager, Sounder

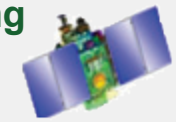
Sep 2016



Indian EO Missions - Near Future

CARTOSAT-2E

VHR Panchromatic and Multispectral Imaging



Payloads

- PAN (0.60 m, 10 km swath, 11 bit)
- Mx (2m , 10 km swath, 4 Xs, 11 bit)

Orbit : 500 km

Local time: 0930 hrs

Dec 2017

CARTOSAT-3

VHR Panchromatic, Multispectral Imaging

Payloads

- PAN (0.25 m, 16 km swath, 11 bit)
- Mx (1m , 16 km swath, 11 bit)

Orbit : 450 km

Local time: 1030 hrs

March 2018

RISAT-1A

Continuity for RISAT-1

Payloads

- C-Band SAR

Orbit : 536 km

Local time: 0600 hrs

Sept 2018

NISAR

Joint Mission with JPL/NASA

Payloads

- L & S Band SAR

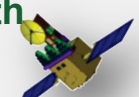
Orbit : 747 km

Local time: 0600 hrs

Nov 2020

Oceansat-3 & 3A

Continuity for OS-2 with Improvements



Payloads

- 13 band Ocean Color Monitor
- Ku-band Scatterometer
- Long Wave Infrared Bands

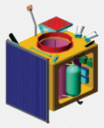
Orbit : 720 km

Local time: 1200 hrs

Dec 2018 & 2019

GISAT - 1

Geosynchronous Orbit



Payloads

- HR Mx VNIR : 50m; SWIR: 1.5 Km
- HYSI VNIR: 320m; WIR : 192m

Orbit : 36000 km

Every 30 min

Dec 2017

INSAT-3DS

Meteorological Satellite

Payloads

- 6 Channel Imager
- 19 Channel Sounder

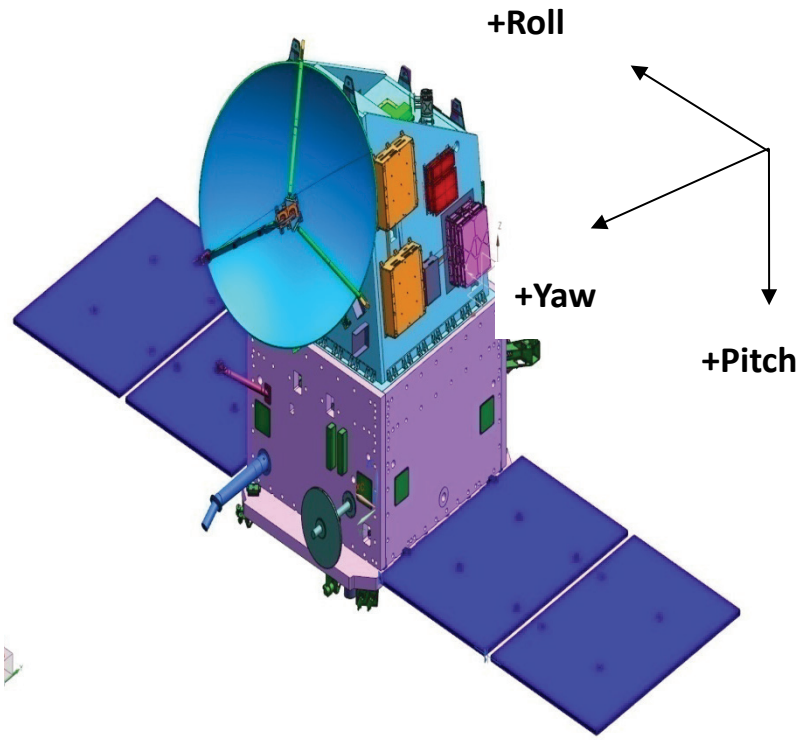
Orbit : 36000 km

Every 30 min

TBD

Resourcesat-3 & 3A; Resourcesat Sampler-3S & 3SA are in Planning Stages

SCATSAT-1



- Launched September 26, 2016
- 5 year mission design life
- Currently undergoing cal/val (ISRO-NOAA-JPL-KNMI joint activity)
  - Characterizing L1b (sigma0) and addressing corrections as necessary
  - Critically important activity with OSCAT to get products that were of sufficient quality and consistency to support real-time decision making
- Swath coverage will be comparable to QuikSCAT

Data declared operational April 2017

SCATSAT-1 Orbital Parameters

Orbit type	Non – SSPO (At Injection)	After Arresting the Drift
Number of orbits / day	14 ½	14 ½
Altitude (kms)	720	720
Semi – Major axis (kms)	7098.14	7098.14
Inclination	98.1	98.29
Local time @ Descending node Equator	Injection at 09:18 AM Drifting@ 5.5 secs /day	08:45 AM LT*
Orbit Period (min)	99.19 min	99.19 min
Path to path distance (Kms)	1382	1382
Repeat cycle / Revisit	2 days	2 days

Mission Specifications

Spacecraft Altitude	720 Km (Nominal)
Inclination	98°
Orbit	Injection at 9:20 am into Polar Non Sun-Synchronous orbit; Will be allowed to drift @8sec/day; Planned to arrest at 8:45am LT after ~1year
Frequency	13.515625 GHz
Polarization	HH for inner and VV for Outer beams
Swath	1400 Km (both HH and VV beams available) 1400-1800 km (only VV beam available)
Wind Speed Range	3-30ms/s
Wind Direction Range	0° to 360°
Wind Speed Accuracy	1.8 m/s rms or 10% whichever is higher
Wind Direction Accuracy	20^0 rms
Wind Vector Cell (grid) Size	25 Km x 25 Km Grid

Types of Products – SCATSAT-1

S.No	Level of product	Description	Format
1	Level 1B	Scan mode Sigma – 0	HDF 5
2	Level 2A	Swath grid mode sigma – 0	HDF 5
3	Level 2B	Swath grid Wind product	HDF 5
4	Level 3W	Global wind product	HDF 5
5	Level 3S	Global Sigma – 0 product	HDF 5

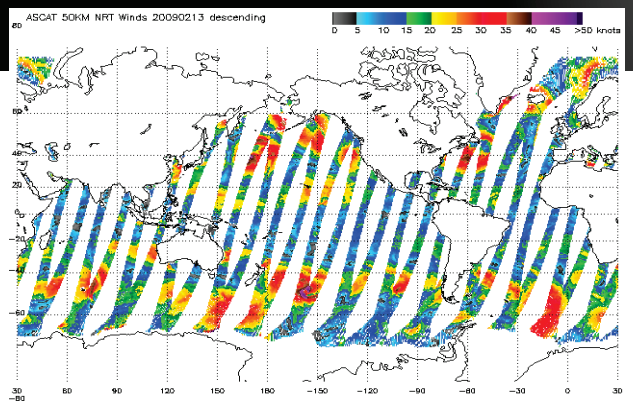
Data Products - Sizes

Product	Definition	Volume (MB)
L1B (slice BW: 9.54 KHz)	Half orbit -wise	260
Products for WVC resolution of 50 km x 50 km		
L2A	Half orbit-wise	70
L2B	Half orbit –wise	1
L3S	Day-wise	4
L3W	Day-wise	3
Products for WVC resolution of 25 km x 25 km		
L2A	Half orbit –wise	130
L2B	Half orbit -wise	4
L3S	Day-wise	16
L3W	Day-wise	12

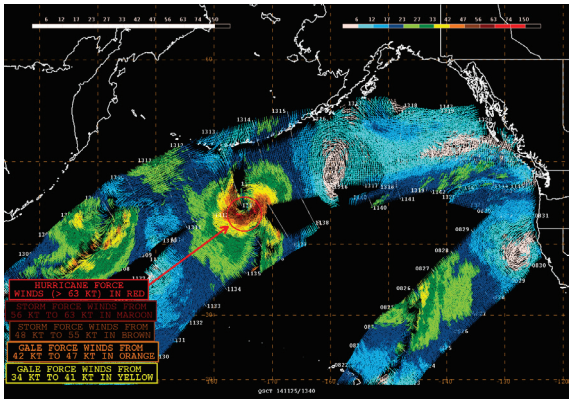
Time lines for SCATSAT-1 products with 9.54 KHz slice band width and 193 PRF

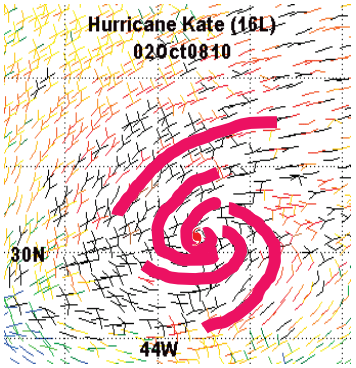
S.No	Activity	Proposed times in minutes (max)	Actual times		
			ANT	SVB minimum	SVB Maximum
1	VB/ANT/TRO to SAN data transfer	8	3	20	35
2	Level 0 processing	5	5	5	5
3	DP processing	25	8	8	8
4	Data uploading onto ftp and web servers	2	5	5	2
Total time		**40**	**21**	**38**	**50**

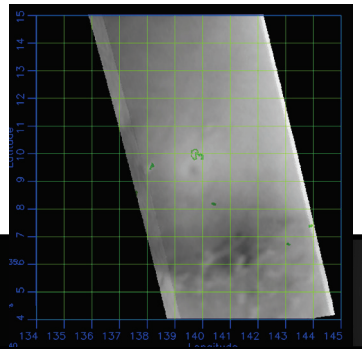
STAR Full Suite of Scatterometry Products – Planned for SCATSAT-1

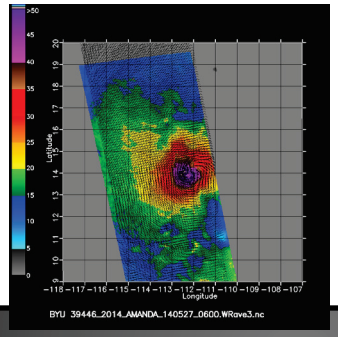


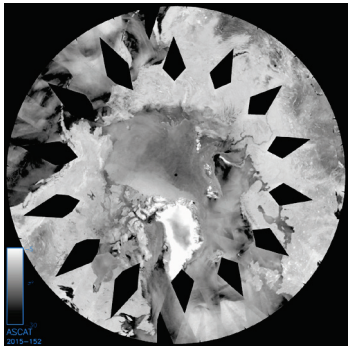
- **Low and high resolution global**
  - Scatterometer wind vectors
  - Wind vector ambiguities
- **NAWIPS and AWIPS ready** wind vector products for NWS operations
- **BUFR ready** wind vector products for Data Assimilation
- **Ultra high resolutions NRCS imagery** for
  - TC positioning
  - Oil spill detections
- **Ultra high resolution TC** wind vector product
- Scatterometer derived sea **surface pressure fields**
- **Ice products**

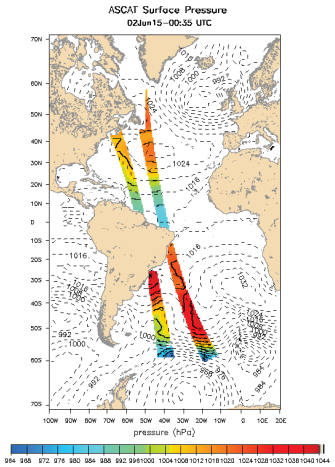








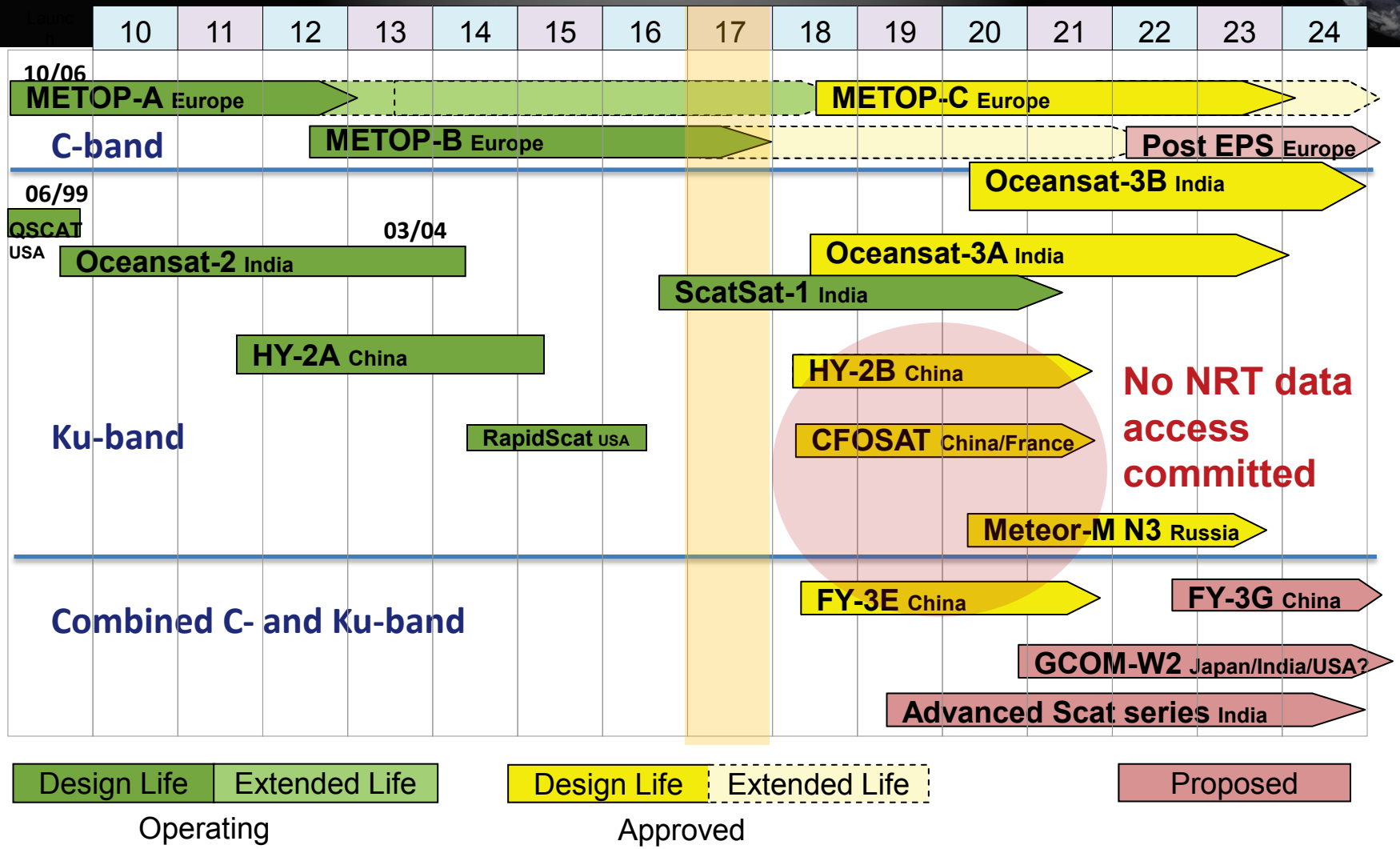




NHC's Use of Scatterometer Data

- NHC routinely uses scatterometer data for its marine and tropical cyclone operations
  - Tropical cyclone analysis (center position, intensity, 34-kt and even 50-kt wind radii in hurricanes)
  - Marine analysis, forecast, and warning applications (surface analysis, warnings for gale, storm, and hurricane-force winds) and model validation
- Data from new Indian scatterometer(s) would be valuable to NHC operations
  - Ku-band scatterometers have more sensitivity at higher wind speeds
  - Instruments would increase temporal and spatial coverage from what is currently available (ASCAT)
  - Wider swath will fill gaps that exist with ASCAT, particularly at low latitudes
- Need to have data validated and quality controlled by NESDIS STAR and delivered in NRT for display in NAWIPS/AWIPS2 to ensure full utilization in operations

CEOS Ocean Vector Surface Winds Virtual Constellation (OSVW-VC) Current status and outlook – NRT data access



Source: WMO OSCAR database and direct interactions with agencies

INSAT-3D/3DR

- Full disk scanned every 30 minutes
- It carries four payloads -
- 6 channel multi-spectral Imager
- 19 channel Sounder
- Data Relay Transponder (DRT)
- Search and Rescue Transponder
- 7-year mission life
- INSAT-3D: 82°E
- INSAT-3DR: 74°E

INSAT-3D Imager

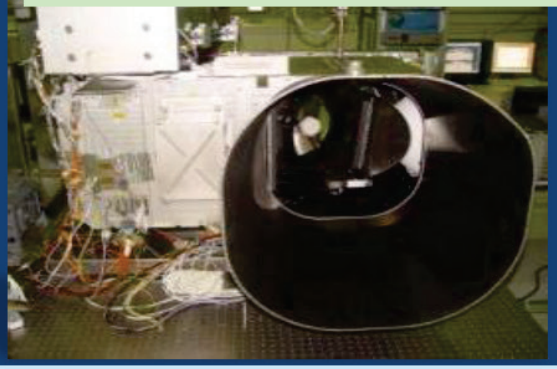
Band identifier	Spectral range (microns)	Spatial resolution (km)
VIS	0.55 – 0.75	1.0
SWIR	1.55 - 1.70	1.0
MIR	3.80 - 4.00	4.0
WV	6.50 - 7.10	8.0
TIR 1	10.3 - 11.3	4.0
TIR 2	11.5 – 12.5	4.0

INSAT-3DR Improvements:

- Imaging in Middle IR band to provide nighttime pictures of low clouds and fog
- Imaging in two Thermal IR bands for estimation of SST with better accuracy
- Higher spatial resolution in the Visible and Thermal IR bands

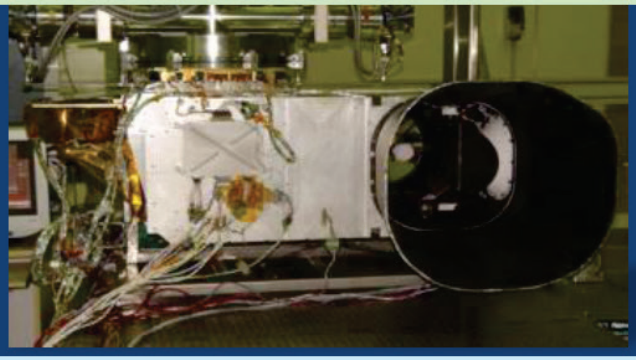
INSAT 3D Met. Payloads

Six channel Imager



- Visible to Thermal IR
- 1KM to 8KM IGFOV
- Half hourly earth coverage
- Flexible scanning modes
  - Programmable number of lines and frame repeats
- Improved Blackbody calibration scheme
- Image motion & Mirror motion compensation

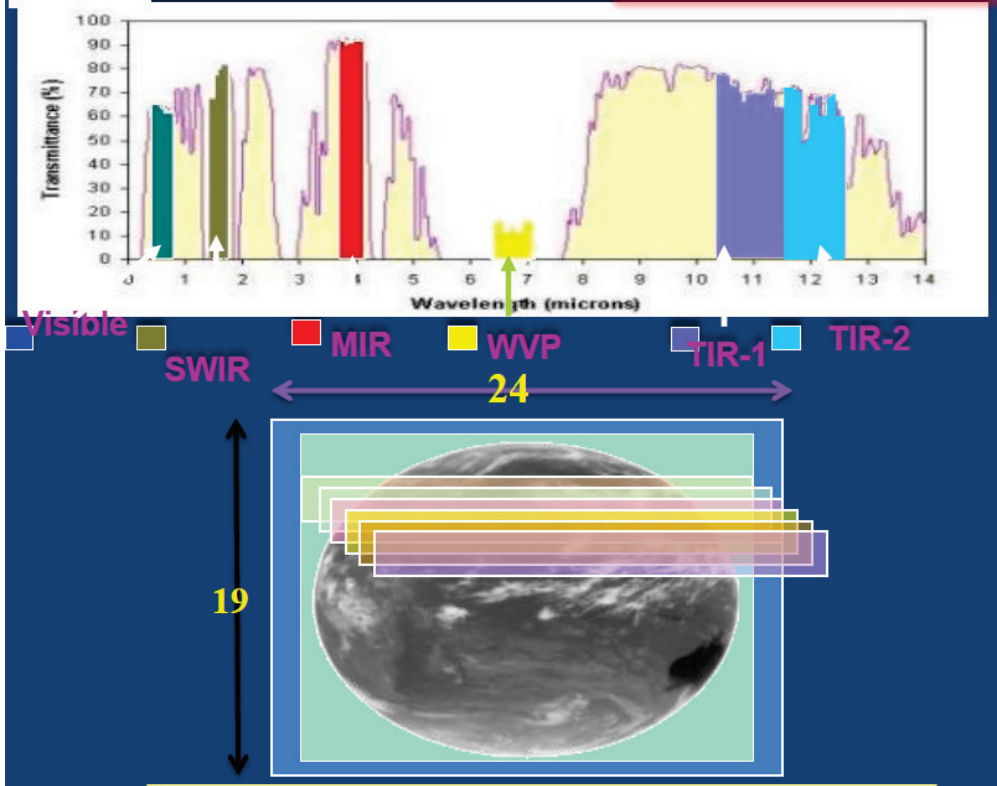
Nineteen channel Sounder



- Visible to Long Wave IR
- Fully programmable East-West and North –South Scan pattern
- Programmable dwell time for East-West scan step motion
- Automatic space view every 2 min and Blackbody view every 30min.
- 10KM IGFOV, 14bits digitization
- Image motion & Mirror motion compensation

Slide from ISRO presentation to CGMS-45

6 Channel Imager



Channel (NEΔT@300K)	Spectral Band (µm)	Spatial Resolution at Nadir (km)
VIS (SNR>150)	0.55-0.75	1 km
SWIR (SNR>150)	1.55-1.70	1 km
MIR (1.4K)	3.80-4.00	4 km
WV (1.0K@230K)	6.5-7.1	8 km
TIR-1 (0.35K)	10.3-11.3	4 km
TIR-2 (0.35K)	11.5-12.5	4 km

Scan Modes:

Normal: Full Earth Disk, 18 x18 in 24 x19 FOR (<27min)

Program: No. of Scan lines and No. of Image repeats programmable. Can be placed anywhere in FOR

Slide from ISRO presentation to CGMS-45

INSAT 3D Met. Payloads

Geo-Physical Parameters for INSAT-3D Meteorological Mission	
IMAGER, VHRR,CCD	SOUNDER
Cloud Motion Vector (CMV)	Aerosol
Water Vapour wind Vector (WVWV)	Temperature , Humidity and Ozone
Outgoing Longwave Radiation (OLR)	Geopotential Height
Quantitative Precipitation Estimation (QPE) GPI and IMSRA	Layer Precipitable water
Snow Cover	Total Precipitable Water
Upper troposphere humidity (UTH)	Lifted Index
Fog Identification (only Night time)	Wind Index
Smoke (with MODIS data)	Dry microburst Index
Fire (tested with MODIS data)	Maximum vertical theta – e differential
Sea Surface Temperature (SST)	
Normalized Differential Vegetation Index	

DERIVED

Slide from ISRO presentation to CGMS-45

INSAT-3D/3DR Products

- Level 1C image product, the rectified image data are stored in counts, radiance and brightness temperatures (albedo for the visible channel). The geostationary projection details and viewing angles are also included.
- In the Level 2B sea surface temperature product, the data values and the associated quality control flags and geolocation is stored for each pixel.
- The assessment of the file sizes for the image data is based upon live data provided by ISRO/MOSDAC. These data are in HDF5 format.

Existing INSAT-3D Data Policy

Essential Data & products (Data which will be redistributed to all users worldwide on a free and unrestricted basis)		Other data & Products	
I. Data from INSAT-3DImager			
		1.	½ hourly Imager Data
II. Products from INSAT-3D Imager			
1.	3 hourly Rain Rate	1.	½ hourly Rain Rate
2.	3 hourly Accumulated Rain	2.	½ hourly Rainfall
3.	3 hourly Atmospheric Motion Vectors	3.	½ hourly Atmospheric Motion Vectors
4.	3 hourly Cloud Motion Vectors	4.	½ hourly Visible band Wind
5.	3 hourly Water Vapour Wind	5.	½ hourly MIR Winds
6.	3 hourly Sea Surface Temperature	6.	½ hourly Water Vapour Wind
7.	3 hourly Outgoing Long wave Radiation	7.	½ hourly Sea Surface Temperature
8.	Daily Sea Surface Temperature	8.	½ hourly Outgoing Long wave Radiation
9.	Daily Accumulated Rain	9.	½ hourly Upper Tropospheric Humidity
10.	Daily Upper Tropospheric Humidity		
11.	Daily Outgoing Long wave Radiation		
III. Data and Products from INSAT-3D Sounder			
1.	Humidity & Temperature Profiles	1.	Brightness Temperature Data

Potential Users of INSAT-3D/-3DR

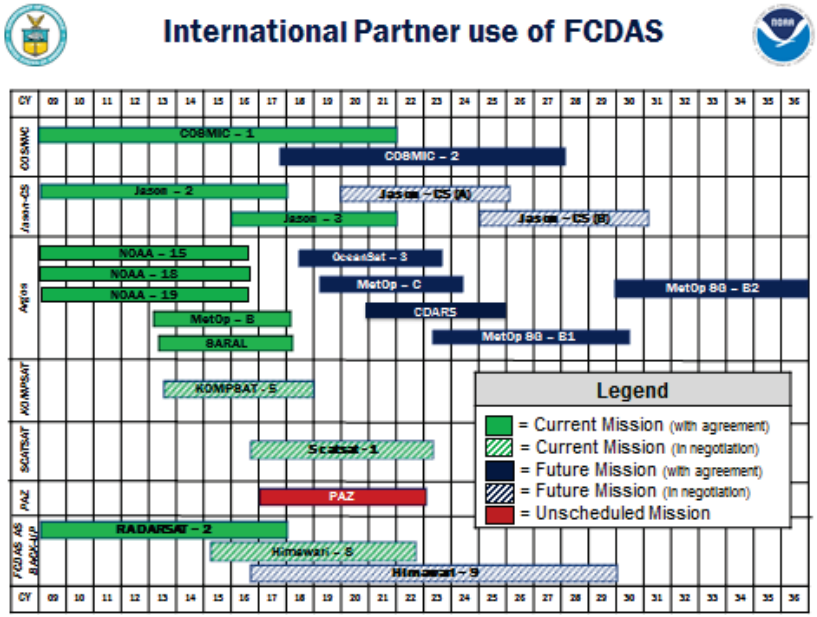
- National Weather Service (NWS)
  - NWS is enhancing its Global Forecast System (GFS) to include aerosols and the model needs input on fire emissions. Current plan is to use MODIS (once a day) globally and migrate to using geostationary (hourly) data when they become available.
- Joint Center for Satellite Data Assimilation
  - Interested in sounder data over the Indian Ocean region for data assimilation activities and forecast improvement studies
- Current operational users of MTS and MSG data in the U.S. could use INSAT-3D data as well
- Algorithm/product development
  - STAR scientists will use the data to test algorithms/products developed for GOES on INSAT-3D
- DoD
  - IODC

Potential Issues – SCATSAT-1

- **NESDIS is funding Level 1 calibration/validation efforts but has not yet made a decision about Level 2 products.**
  - **Level 2 products won't be available until FY18 assuming resources are made available**

- FCDAS Availability
  - Desire operational Mar 2018

- Network Connectivity
  - See next charts
  - Identified three options
    1. N-WAVE/Internet2/NKN
    2. N-WAVE and commercial/"last mile"
    3. Direct dedicated commercial leased line



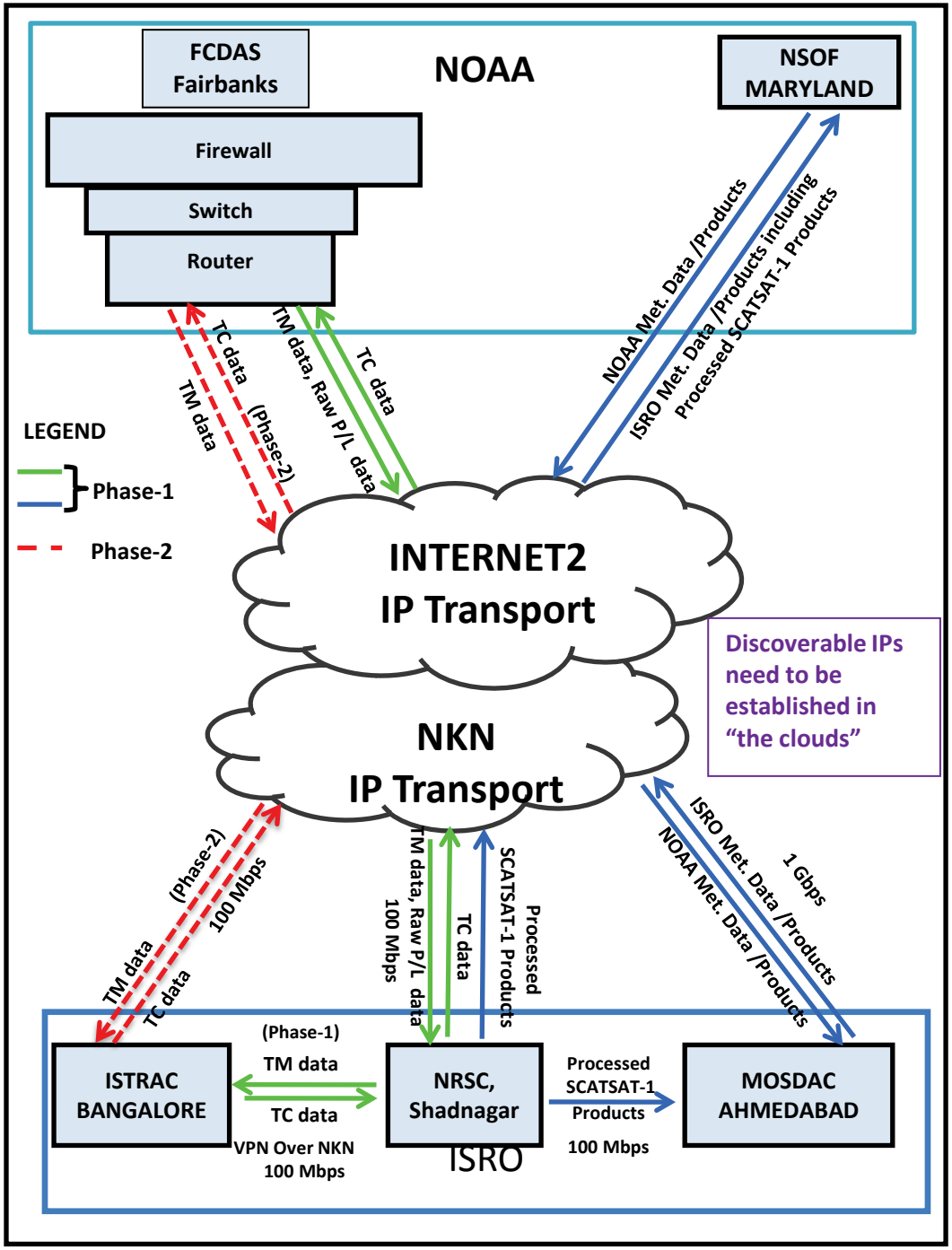
ISRO Centers/Network Hubs

*Internet2/NKN POP
"Landing Point"
New Delhi

*MOSDAC/SAC
Ahmedabad

*NRSC/Shadnagar
Hyderabad

*ISTRAC
Bengaluru



Discoverable IPs need to be established in "the clouds"

Links

1. Payload (P/L) FCDAS ⟷ NRSC
2. TM, TC FCDAS ⟷ ISTRAC
3. SCATSAT-1 Data Products NSOF ⟷ MOSDAC
4. All met/ocean sat data NSOF ⟷ MOSDAC
5. DoD-funded direct line ?? ⟷ ??

Three IP Addresses in India (NRSC, ISTRAC, and MOSDAC)
Three IP Addresses in U.S. (FCDAS [2] and NSOF/NCWCP)
Four Configurations:

1) FCDAS ←→ NRSC
2) FCDAS ←→ISTRAC
3) NSOF ←→MOSDAC
4) NSOF ←→NRSC

Internet2 is an exceptional community of U.S. and international leaders in research, academic, industry and government who create and collaborate via innovative technologies. As an organization, Internet2 members leverage their high-performance network and worldwide partnerships to support and enhance their educational, scientific and research missions.

NOAA N-WAVE maintains Five N-WAVE U.S. TICAP's:
All data transport to government systems must come through a TICAP in order to meet OMB / DHS mandates.

N-WAVE is our provider and representative to the Internet2 Consortium

Potential Issues – INSAT-3D/3DR

Receipt of Data

- NESDIS has not yet determined a robust and reliable way to bring in the data and store/process the data due to lack of funds to develop products and obtain hardware.
- One day's worth of imager and sounder data takes approximately 11 hours to download via FTP and files require 3.5GB per day storage so it is not feasible to use an open/public network to bring the data for routine operations.
- India has given access via anonymous FTP so the data can be received regularly but STAR is not pulling regularly as STAR does not have the resources to pull and store the data.

Timeliness and Quality of Data

- INSAT-3D/3DR data are not yet available in timely manner to meet operational requirements
  - ISRO stated during Aug 17 bilat that the processing time for INSAT-3D/3DR data is down to 8 minutes after acquisition
  - ISRO and NOAA will conduct an INSAT-3D data transfer test between MOSDAC and STAR utilizing NWAVE/Internet2/NKN

Requirements for Indian Data?

- **Aug 2017** – TPIO analysis to determine where ISRO products might have the most impact
- **Apr 2017** – HQ USAF/A3WX URF to OSPO for access to INSAT-3D/3DR L1B data
- **Aug 2016** – Letter from Joint Typhoon Warning Center to NOAA requesting SCATSAT data acquisition support
- **Jun 2016** – NCEP request for access to Indian scatterometer data – letter and URF to OSPO

Conclusions/Remarks/Any other Points for Discussion

Dhanyavad

Agenda

- Opening Remarks: COES Cochairs
- Action Item Review: Executive Secretary
- Indian Environmental Satellite Programs:
  Kerry Sawyer (NOAA-NESDIS)
- DoD Space–based Environmental Monitoring (SBEM) Program:
  Major Luke Rederus (HQ USAF SAF-SP)
- Committee For Operational Processing Centers (COPC):
  James Vermeulen (FNMOC)
- COES Update to ICMSSR:
  COES Cochair, Dave McCarren (USN)
- Open Discussion: COES Members.
- Action Item Review / Next Meeting: Executive Secretary
- Adjourn: The meeting is expected to end by 3:00 PM EDT.

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COPC "Operational" Satellites

Committee for Operational Environmental Satellites (COES) Meeting
18 Sept 2017
(OFCM – Silver Spring, MD)

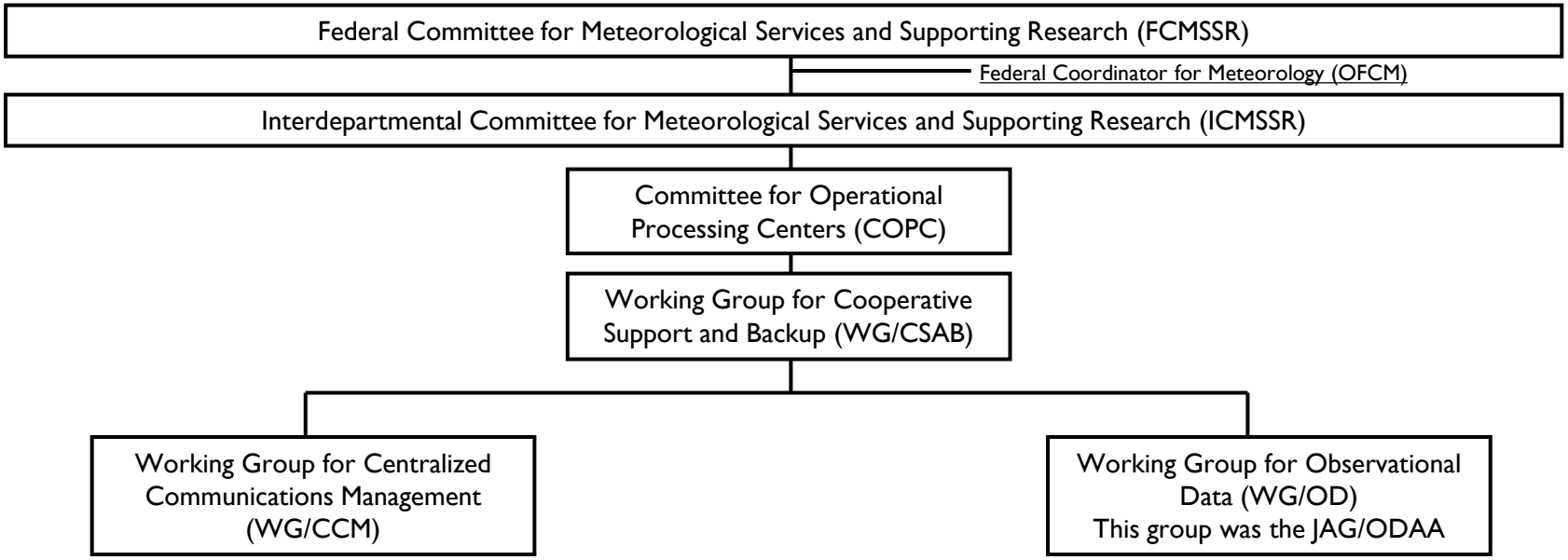
James A. Vermeulen
Fleet Numerical Meteorology Oceanography Center (FNMOC)
FNMOC Data Ingest Team Supervisor N38
FNMOC Satellite Programs Manager
FNMOC OFCM/COPC/CSAB/ODAA Inter-agency Coordinator

Briefing Purpose/Goal

- **Purpose:** To inform the COES members on the purpose/scope of COPC and how the COES' decisions can impact the Operational Processing Centers (OPCs') operations.
- **Goal:** Gain COES agreement to consider the potential impacts to the OPCs when deciding courses of action.
  - Keeping operations in mind when department level planning for both operational and research satellites with the intent of increasing access to data in a more "operational like" posture.

COPC Core Mission

- COPC facilitates the exchange of observational data, modeling products, and backup of services between the member organizations:
  - NWS National Centers for Environmental Prediction (NCEP), College Park, MD
  - NESDIS Office of Satellite and Product Operations (OSPO), Suitland, MD
  - Air Force 557 Weather Wing, (557WW) Offutt AFB, NE
  - Fleet Numerical Meteorology and Oceanography Center (FNMOC), Monterey, CA
  - Naval Oceanographic Office (NAVOCEANO), Stennis Space Center, MS



Background

- **Concerns raised at the last COPC meeting in May created 2 AIs:**

- **COPC Action Item 2017-1.2:** Request the CSAB and WG/OD Satellite members be invited as observers to the COES meetings.
- **Purpose:** To increase the COPC's understanding of the future environmental satellites.
- **OPR:** OFCM
- **Suspense:** Before the next COES meeting.

- **COPC Action Item 2017-1.1**: The CSAB will request to brief the Committee for Operational Environmental Satellites (COES) about the need to better understand the planned future and near-term, research and operational, domestic and international satellites.
- **Purpose:** To be more proactively involved in the planning process to potentially obtain data in a more "operational like" timeframe.
- **OPR:** CSAB
- **Suspense:** September COES meeting.

OPC Involvement

The OPCs recognize the need to be proactively involved in the planning process to potentially obtain data "operationally" within a reduced timeline. (Including potential research satellite efforts.)

Benefit:

- Operational value in addressing at earliest opportunity those things that take up the most time for creating data availability
- Saving to the tax-payers in the long run; providing better Return On Investment (ROI) for each stakeholder involved.
- Drive down integration timelines and costs by having a complete understanding of a real time Concept of Operations (CONOPS).
- Research satellite efforts data needs to be scientifically proven but trade-offs should be done as to the cost differences between real time data access and that of just allowing for researchers and developers to gain access to it at later periods of time.
  - Why not build this right into the design if you have partners to help pay for it?

Examples

- PACE (Pre-Aerosol Clouds and ocean Ecosystem mission) as an example has applications to not only the ocean but atmosphere.
  - The data can be used also in aerosol modeling, creation of tactical imagery, and atmospheric Numerical Weather Prediction (NWP) with Atmospheric Motion Vectors (AMVs) just like we do for the Moderate Resolution Imaging Spectroradiometer (MODIS) sensor on the NASA Earth Observing System (EOS).
  - Data sharing and a CONOPS addressing quality, latency, Information Assurance, and the whole end to end business model would be useful for both oceanographic and atmospheric functionalities.
- CYGNSS (Cyclone Global Navigation Satellite System)
  - Measure ocean surface wind speed in all precipitating conditions, including those experienced in the tropical cyclone (TC) eyewall
  - Measure ocean surface wind speed in the TC inner core with sufficient frequency to resolve genesis and rapid intensification
  - Eight satellites in low earth orbit at 35° inclination, each carrying a four-channel modified Global Positioning System (GPS) receiver capable of bi-static radar measurements of GPS signals reflected by the ocean surface
  - Near Real-Time (NRT) availability is not formally part of the project deliverables (cost versus technical)
  - There will be attempts to try some NRT acquisitions over tropical cyclones

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OPCs and Commercial Data

- For the OPCs, access to commercial data must address a larger context for the providers such as a viable CONOPS addressing quality, latency, Information Assurance, and the whole end to end business model.
- How is a commercial provider supposed to deliver without an understanding of all the constraints involved?
- How will the DOD OPCs and NOAA address processes for information technology security, data rights and distribution, and real time data ingest?
- Agency level decision makers will need to have knowledge of the efforts so they can all tie into the executive and legislative branches strategy addressing on-going future programs and budget issues.
- Each federal partner has to have an understanding of the others so that appropriate budgets and understandings can take place well into the future.

Questions / Discussion

Agenda

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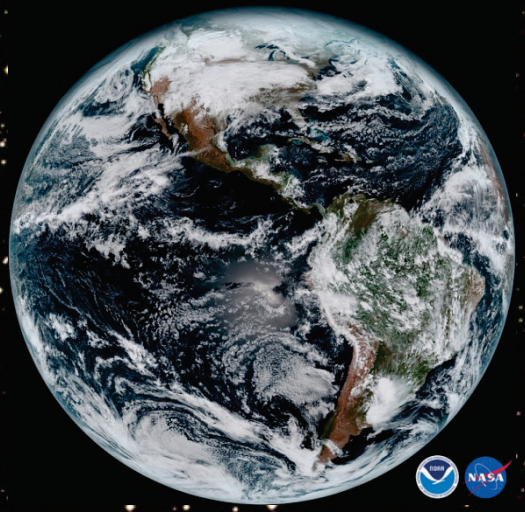
Committee for Operational Environmental Satellites (COES) Update

Interdepartmental Committee for Meteorological Services and Support Research (ICMSSR)

Meeting 2017-3

September 27, 2017



Overview

- Background
- Terms of Reference
- Activities / Issues / Interests
- Conclusion

Background

- 1982: COES established as part of the FWE coordinating Infrastructure
- 1996: COES deactivated after the NPOESS Senior Users Advisory Group (SUAG) was established
- 2010: NOAA response to GAO 10-799, Recommendation 3 stated GOES-R would report status through OFCM to the interagency partners annually.
- 2013: US Navy requested and ICMSSR approved COES be reactivated to provide interagency coordination of environmental satellite issues.
- 2014: COES was re-established in 2014
- 2016: GAO- 16-252R recognizes COES value:
  - "One potential vehicle for formalizing collaboration"
  - "DOD official have stated (COES) is one way DOD can connect with NOAA's international affairs "
  - "…we believe DOD should formalize its coordination and collaboration…through committees… such as COES.."

ToR: Purpose

The COES shall advance the goals of the ICMSSR to achieve interagency coordination in planning for use of sustained environmental satellite systems to support federal meteorological and oceanographic operational services providers and their customers.

NOAA, NASA, and USAF partner on DSCOVR

DMSP Operations at NOAA NSOF

NOAA, NASA, DoD Partnership in JCSDA

ToR: Objectives

- Ensure interagency review and coordination of approved requirements for operational environmental satellite programs.
- Promote an open dialog concerning environmental satellite systems development, satellite data systems architecture, continuity plans, data exploitation readiness plans.
- Consider potential use of research satellite capabilities to augment operational systems in meeting user needs, and plans to transition research data into operational products and new applications.
- Facilitate working-level relationships between Federal members and other stakeholders to effectively resolve interagency issues with regard to the availability of environmental satellite data and products from future systems.

ToR: Objectives

- Establish dialog with other standing groups currently engaged in various aspects of environmental satellite and data readiness and exploitation, including: USGEO, CEOS, CGMS, GOES User conference, and other relevant user groups.
- Coordinate with the Committee for Operational Processing Centers (COPC) on issues of mutual interest, i.e. data availability and data assimilation, and share information.
- Address other matters as directed by the ICMSSR.
- Provide regular updates to the ICMSSR and other elements of the Federal Coordination Infrastructure as necessary.

Participation

CoChairs

- NOAA
  - NWS (Joe Pica)
  - NESDIS (CoChair starting 2018: Ajay Mehta)
- DOD
  - Oceanographer & Navigator of the Navy (Dave McCarren)
  - HQ USAF Dir. of Weather (CoChair in 2019: Col Jeff Jarry)

Members/Participants:

- DOC: NOAA: NWS, NESDIS, OMAO
- DOD: USAF, USN, USA, AFSPC, USSTRATCOM, SMC, PDSA
- DOE: LANL
- DHS: FEMA, USCG
- DOI: BLM, USGS
- DOT: FAA, FHWA
- NASA: ESD, JASD
- NGA, NRO
- NSF: AGS
- USDA
- EOP: OSTP (Observers)

Activities, Issues, and Interests

Activities

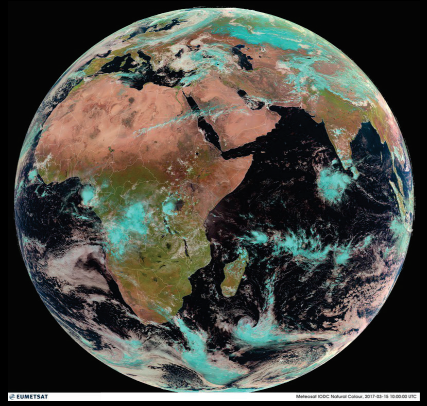
- Monitoring plans for environmental satellite programs
  - S-NPP, JPSS, GOES-R, COSMIC2
- Satellite Radio Frequency encroachment
  - Provided an Advocacy letter to ICMSSR

- COES ToR renewal
  - Signed on 3/17/2017
- Environmental Satellite Coordination Briefing to ICMSSR
  - Provided briefings to ICMSSR on 6/1/2016 and 9/29/2016
- Satellite Telemetry Interagency Working Group (STIWG) ToR Renewal
  - Primary user group for GOES Data Collection System
  - STIWG is aligned under COES and the Advisory Committee on Water Information (ACWI) Subcommittee for Hydrology (SOH)

Activities, Issues, and Interests

Issues

- DoD SBEM programs and data gaps
  - Joint Requirements Oversight Council Memo 092-14
  - Prioritized gaps for DoD:
    - Ocean Surface Vector Winds
    - Tropical Cyclone Intensity
    - Low Earth Orbit Energetic Charged Particle
  - Numerous other DoD requirements to be provided from "Civil and International Partners."
- Indian Ocean satellite coverage and data exploitation
  - Use of INSAT 3D-R if practical
  - 2017 USAF / NOAA MOA for Interagency Cooperation on Collection of SBEM Data
  - Leverage DoD-unique assets to meet IO data requirements if possible



Activities, Issues, and Interests

Interests

- Leveraging NASA research satellite capabilities
  - CYGNSS, TROPICS, PACE, RapidScat, CATS, GPM
- International Cooperation
  - Presented US Government issues for NOAA and NASA representatives to international conferences
  - Back-brief from CGMS and other international meetings
- Emerging GPS-RO capabilities
  - Monitoring COSMIC-2 and other GPSRO developments

- Commercial Weather Data Acquisition Programs
  - Monitoring Commercial Weather Data Pilot programs in NOAA, DOD, and NASA
  - Monitoring progress on Commercial Weather data provisions of the Weather Forecast Improvement Act of 2017

Conclusion

- COES supports coordination between Federal Agencies, EOP, and International groups
- The GAO recognizes the need for coordination and has identified COES as part of the solution for interagency environmental satellite issues
- COES provides a forum for issue discovery and the means to connect stakeholders with organizations providing environmental satellite services and system development

The FWE agencies can work together to solve environmental satellite issues beyond the reach or scope of individual agencies.

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Action Item Review

AI #	Text	Responsible Office	Comment	Status	Due Date
2016-3.1	Draft and coordinate a letter from the Federal Coordinator to NTIA describing the impact of spectrum allocation reduction on the Federal Weather Enterprise.	OFCM, COES Members	9/12/17: The letter is being held at NOAA by the FCMSSR Chair. No further action will be taken	Closed	03/17/17
2017-2.1	Prepare a one-page summary of NOAA, USAF, and NASA commercial weather data procurement projects and plans for ICMSSR information.	D. McCarren	5/31/17: Mtg schedule and briefings arranged	In progress	07/30/17

Commercial Data buy

- NASA - **$20 M**, 7/2016 RFI - focus on Radio Occultation - others will be considered – Next step solicitation for data to evaluate
- NOAA - **$3 M**, 2016 focused on Radio Occultation, timeline on next slide, **$5 M** in 2017 for 2nd round RFI in May for 2nd assessment
- Air Force - **$5 M**, 2017 focused on Radio Occultation, Contract to be awarded in Sep '17, final report due in Sep '18

Action Item Review / Next Meeting

- **The Executive Secretary will document any action items taken during the meeting**
- **The Executive Secretary will coordinate with the cochairs and schedule the next meeting.**
  - **Our goal is to conduct 4 COES meetings in 2017 (March, June, September, and December)**
    - Dec 8, 2017, 1-3pm (TBD)
  - **Our goal is to conduct 4 COES meetings in 2018 (March, June, September, and December)**

BACK-UP