

Geostationary Coastal & Air Pollution Events



NASA's GEO-CAPE Mission

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see poster #89 - science, instrument design & costing

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GEO-CAPE Mission



- ◆ **Mission concept from 2007 Earth Science Decadal Survey**
 - Geostationary mission for air quality and coastal ocean color
- ◆ **Ocean color mission focuses on water quality, biogeochemistry and ecology in coastal waters and their response to environmental or climate variability.**
- ◆ **GEO-CAPE team recommended implementation of mission as 2 or 3 commercially hosted instruments**
 - Reduce risk and cost compared to one dedicated mission
 - Estimate of ocean color mission cost (<\$500M)
- ◆ **Currently in pre-formulation (pre-Phase A)**
 - No launch date (post-2023)
 - Science & engineering studies to continue in FY15 & FY16
 - TEMPO - geostationary atmospheric chemistry mission selected under Earth Venture Instrument (launch ~2019)

GEO-CAPE Pre-Formulation Process



- ◆ Define mission science objectives
- ◆ Define measurement and instrument requirements to meet science objectives (Science Traceability Matrix - STM)
- ◆ Conduct engineering studies to determine technological and cost feasibility
- ◆ Conduct science studies in parallel to refine requirements
- ◆ Iterate between science and engineering to optimize mission science and sensor data
 - Down scale science and instrument capability to match funding opportunities (NASA Earth Venture)
- ◆ Advocate for mission within scientific community, NASA management, and coastal managers
 - Obtain support of data users: NOAA, EPA, Navy, etc.
- ◆ Fine tune message on critical contribution of mission

Competing Technical Challenges

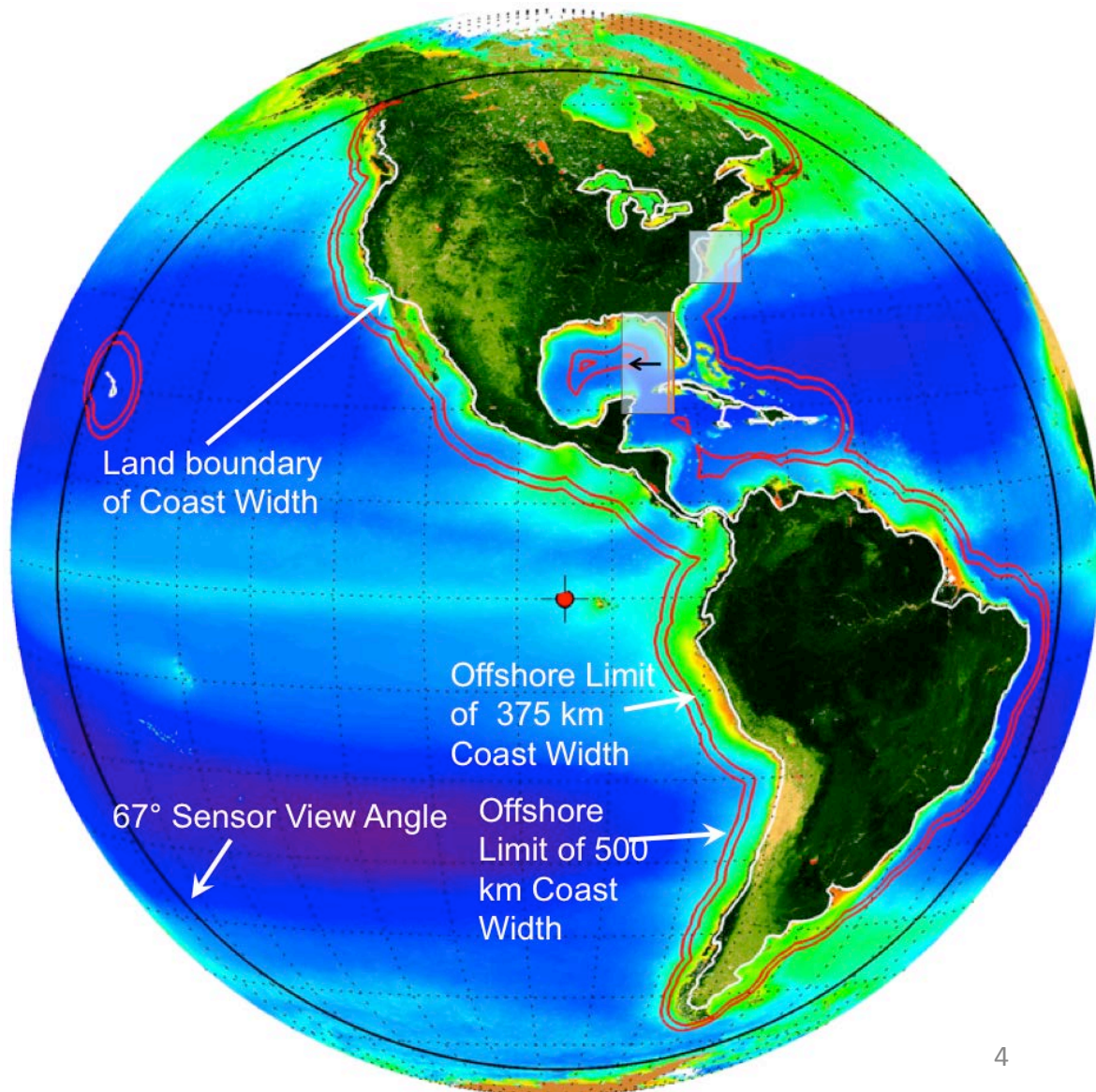


Challenge: achieving an engineering solution for requirements that are in opposition to each other

- Spatial resolution
- Temporal resolution
- Spectral resolution
- Hyperspectral

Instrument concepts

- Filter radiometer (GOCI)
- Single slit spectrometer
- Multi-slit spectrometer
- Wide Field-of-View spectrometer

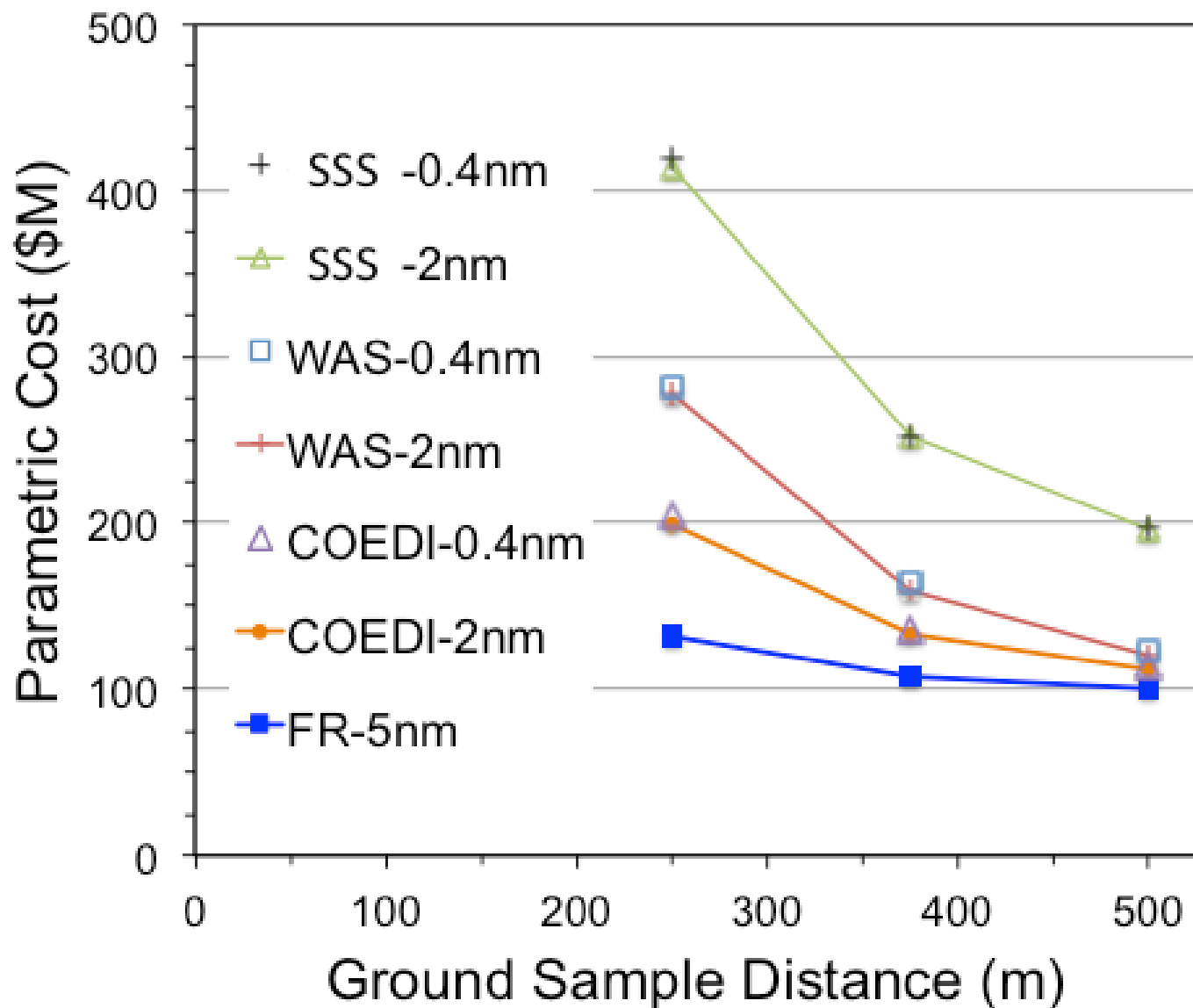


Requirements - under review



	Threshold (min.)	Baseline (goal)
Temporal Resolution Targeted Events	<1 hour	<0.5 hour
Survey Coastal U.S.	<2 hours	<1 hour
Inland & Other Coastal	>1 Region 3 times/day	<3 hours
Spatial Resolution (nadir)	<375 m x 375 m	<250 m x 250 m
Spectral Range	345-1050 nm; 1245 & 1640 nm	340-1100 nm; 1245, 1640 & 2135 nm
Spectral Resolution	≤5 nm (UV-VIS-NIR); ≤0.8nm (400-450nm; NO ₂); ≤20-40 nm (SWIR)	≤0.75 nm (UV-VIS-NIR); ≤20-50 nm (SWIR)
Signal-to-Noise Ratio (SNR) @ Ltyp 70° solar zenith angle	1000:1 for 350-800 nm (10nm FWHM)	1500:1 for 350-800 (10 nm FWHM)
Coastal Coverage (inland to offshore)	375 km width	500 km width
Pointing Stability	<50% pixel	<10% pixel

Instrument Capability vs Cost



See poster # 89 for more details

Instrument Capability vs Cost



Instrument Type	Filter Radiometer FR		Wide Angle Spectrometer WAS	Multi-Slit Spectrometer COEDI	
Spatial Resolution	250 m	375 m	375 m	375 m	250 m
Spectral Resolution	5 nm	5 nm	0.4 nm	0.4 nm	0.4 nm
Spectral Range (nm) (2135 not req)	Multispectral (50) 340-1050; 1245, 1640, 2135	Multispectral (50) 340-1050; 1245, 1640, 2135	340-1050; 1245, 1640, 2135 nm	340-1050 1245,1640 nm	340-1050 1245,1640 nm
Scan Rate (km²/min)	100,105	100,105	48,200	43,200	28,800
Mass CBE (kg)	190.4	126.3	309.4	202.8	358.6
Power CBE (W)	200.1	161.2	341.3	192.5	257.7
Volume (m x m x m)	1.5 x 1.46 x 1.02	1.0 x 0.97 x 0.68	2.6 x 1.8 x 1.5	1.5 x 1.7 x 1.1	2.2 x 2.5 x 1.7
Telemetry CBE (kbps)	15,900	10,600	23,832	23,854	35,765
NICM Cost (\$M)	\$213.4	\$172.9	\$325.2	\$238.8	\$308.0
Parametric Cost (\$M)	\$131.7	\$107.7	\$165.2	\$136.2	\$200.1
NICM Sub-System Cost (\$M)	\$128.7		\$179.3		



◆ Science Studies

- Field Campaigns
 - Chesapeake Bay - July 2011 (CBODAQ)
 - Gulf of Mexico - September 2013 (GoMEX)
 - Korean coastal waters - May-June 2016 (KORUS-OC) - joint w/ KIOST
 - *14-day oceanographic campaign coordinated with KORUS-AQ*
- PI-led scientific investigations

◆ Recent Instrument Design Studies

- 2014 Instrument Cost vs Capability study
- 2015 Functional 50-band filter wheel breadboard

◆ Upcoming Workshops

- GEO-CAPE Community Workshop Aug. 31-Sept. 2, 2015 (Triangle Park, NC)
- Data Synthesis workshop Sept. 2-3, 2015