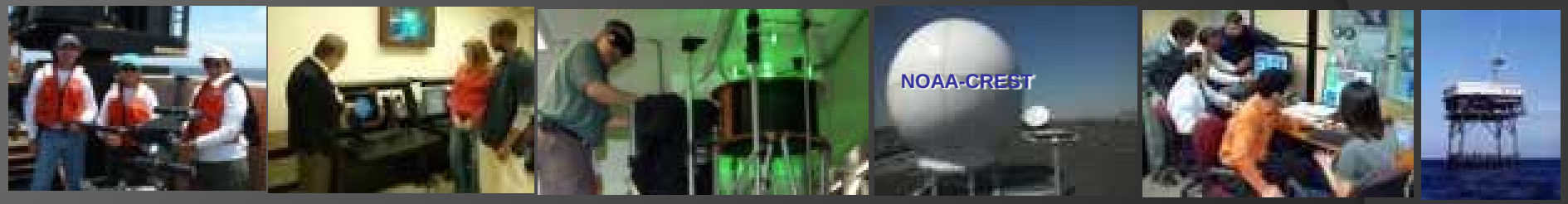
CREST NESDIS Partnership
Current and Future Directions

Reza Khanbilvardi



CREST – NESDIS/STAR Technical Meeting
December 7-8, 2009
SSMC3, NOAA Office
Silver Spring, MD

Presentation Overview

- **CREST At-a-glance**
- **SCIENCE**
  - Research Thrusts
  - Science Accomplishments
- **STUDENTS**
  - Students at CREST
  - Success Stories and Accomplishments
- **EDUCATION; RECRUITMENT & OUTREACH**
  - Academic Programs & Courses
  - Recruitment
  - Seminars
  - Conferences & Workshops
- **FUTURE DIRECTIONS**
  - In line with NOAA's NGSP (Next Generation Strategic Plans)
  - National Enterprise/partner of NOAA/NESDIS/STAR
  - International Collaborative Vision (Research and Education)

CREST Goals & Objectives

Science

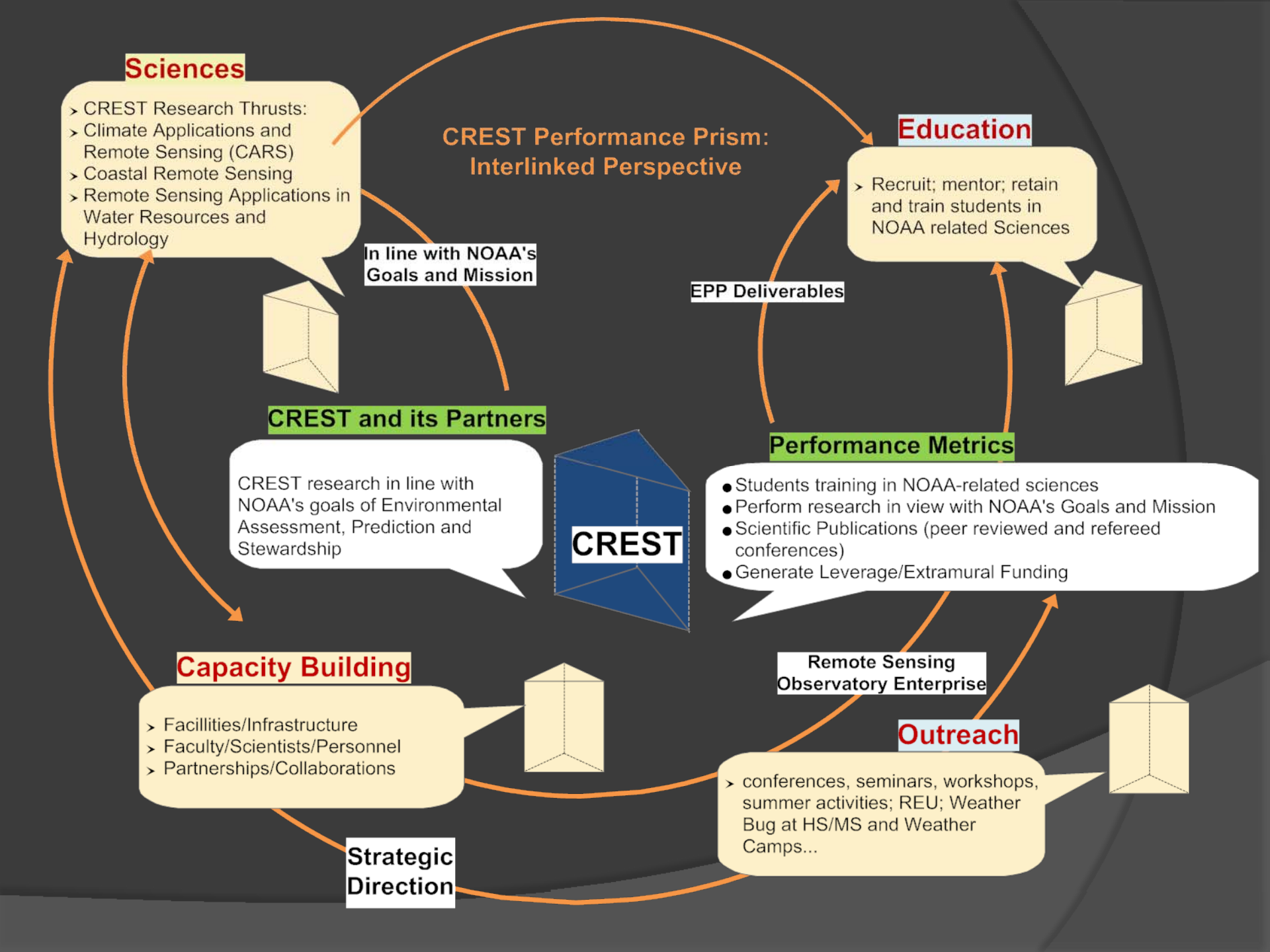
Conduct cutting-edge research in Remote Sensing Science and Technology in line with NOAA's Mission Goals, and in support of NOAA line offices

Education

Educate and train students in science, engineering, and technology relevance to NOAA to provide diverse future workforce for NOAA, NOAA contractors and other related federal, state, and industrial stakeholders.

Recruitment & Outreach

Recruit, retain students by developing a pipeline from high school through college level to train them in NOAA sciences


CREST Performance Prism:
Interlinked Perspective
Sciences
CREST Research Thrusts:
Climate Applications and Remote Sensing (CARS)
Coastal Remote Sensing
Remote Sensing Applications in Water Resources and Hydrology
In line with NOAA's Goals and Mission
Education
Recruit; mentor; retain and train students in NOAA related Sciences
EPP Deliverables
CREST and its Partners
CREST research in line with NOAA's goals of Environmental Assessment, Prediction and Stewardship
CREST
Performance Metrics
Students training in NOAA-related sciences
Perform research in view with NOAA's Goals and Mission
Scientific Publications (peer reviewed and refereed conferences)
Generate Leverage/Extramural Funding
Capacity Building
Facillities/Infrastructure
Faculty/Scientists/Personnel
Partnerships/Collaborations
Remote Sensing Observatory Enterprise
Outreach
conferences, seminars, workshops, summer activities; REU; Weather Bug at HS/MS and Weather Camps...
Strategic Direction

CREST

Partners & Alliances

CUNY

- City College
- CUNY Lehman College
- Bronx Community College
- NY City Tech College, CUNY
- Hunter College, CUNY
- LaGuardia Community College

Columbia University

- University of Maryland – Baltimore County
- Bowie State University-Maryland
- Hampton University-Virginia
- University of Puerto Rico, Mayaguez
  - UPR, Rio Pedras

- University of Maryland, College Park (CICS- NESDIS/CI)
- Colorado State University, Fort Collins (CIRA – NESDIS/CI)
- University of Wisconsin, MI (CIMSS- NESDIS/CI)

- NOAA-Environmental Science CSC FAMU
- NOAA-Interdisciplinary Science & Technology Cooperative Science Center, ISETCSC, NC A&T
- NOAA-Center for Atmospheric Sciences (NCAS), Howard University

CREST Industrial Partners

CREST RESEARCH THRUSTS

Climate & Air

Coastal Waters

Land & Hydrology

Recruitment; Education & Outreach

Weather & Water

Ecosystem

Climate

Provide Critical Support to NOAA's Missions Support

NOAA's Current Goals and Missions

NOAA's Support Mission

CREST RESEARCH THRUSTS

Global Climate and Atmosphere

Sub-themes

Tropospheric Air Quality (TRAQ)	Climate Applications and Remote Sensing
Satellite Algorithm Development and Validation	Middle Atmospheric Remote Sensing
Ground-based Remote Sensing Network	Integrated Analysis of Global Observations
Ground-based In-Situ Measurements Sampling, Sample Analysis and Speciation	Hyper-Spectral Remote Sensing
Modeling and Validation	Data Compression Algorithms
Health Impacts	

Coastal Remote Sensing

Sub-themes
Evolution of measurements approaches for Coastal Water Parameters
Field Measurement in Coastal Waters for Algorithms development/testing & Satellite Validation
Improvement/development for Remote Sensing of Coastal Waters

Data Management/ Quantitative Image Restoration

Precipitation and Water Resources

Sub-Themes

Hydro-Climate	Land Hydrology
Develop and improve satellite-based precipitation retrieval algorithms	Develop advance technique for snow-cover and depth monitoring using microwave satellite observations
Validation of existing Precipitation Retrieval Algorithms	Estimate vegetation characteristics from Geo-stationary Satellite Data
Flood Forecasting using Rainfall Estimates	Reducing the negative effect of Vegetation Cover on Soil Moisture Retrieval from Microwave Satellite Data

NOAA Missions / CREST Thrust Areas	NOAA Strategic Missions				
	Missions & Goals				Support Mission
	Ecosystem	Climate	Weather and Water	Commerce and Transportation	Provide Critical Support to NOAA's Mission
Remote Sensing Applications in Climate & Air Quality Stratosphere (NESDIS/NWS/OAR) Troposphere (NESDIS)		* *	 *		* *
Precipitation & Water Resources (NESDIS & NWS/OAR)	*		*		*
Remote Sensing of Coastal Waters (NESDIS & NOS)	*		*		*

CREST	NOAA Line Offices Missions			
	NESDIS	NWS	NOS	OAR
Remote Sensing Application in Climate and Air Quality a)Stratosphere	1. Satellite Services Program 2. Climate Observation Analysis 3. Integrated Observing and Data Management System	1. To understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond		1. Decision Support Climate Information and Assessments
b) Troposphere	1. Weather & Water Science Technology 2. Infusion Program through Algorithm Refinement for Current Satellite Instruments & Algorithm Development for future Instruments 3. Climate Missions			

CREST	NOAA Line Offices Missions			
	NESDIS	NWS	NOS	OAR
Precipitation and Water Resources	1. Weather & Water Science Technology 2. Infusion Program through Algorithm Refinement for Current Satellite Instruments 3. Climate Missions	1. Serve Society's needs for Weather and Water Information		1.Scenarios for future climate mitigation and adaptation studies – including land use changes 2.Water resource & drought forecasting 3.Weather related disease forecasts (e.g Malaria, SARS, West Nile Virus)
Coastal Water Remote Sensing	1. Algorithm Development Strategy for Improved Coastal Water Retrieval		1.perform coastal monitoring and observations through measurements of physical, chemical, biological and meteorological phenomena affecting the marine environment.	

NOAA Strategic Goals & Missions

Weather and Water Climate Ecosystem	Climate	Ecosystem Weather and Water
•Serve Society's needs for Weather & Water Information •RS, Weather & Water, Improvement of rainfall estimation (QPE) for precipitation and flood forecasting (QPF & QFF)	•To Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond	• Integrated Earth Observing System & Data Management •Manage Coastal Resources to Optimize benefits to the Environment, the Economy, and Public Safety

CREST Science Goals

• Air Quality Monitoring Program to Assess Impact on Regional and Global Climate Change • Precipitation and Rainfall Estimation	Stratospheric Ozone Analysis	• Data Compression/Quantitative Image Restoration • Remote Sensing of Coastal Waters

CREST Accomplishments

Established the CREST lidar network across NE corridor (NY, NJ, MD & Puerto Rico) PR went operational in 2009) Developed an algorithm for Radar gap area by merging satellite- rainfall data and Next Generation Radar (NEXRAD) Stage-IV rainfall data. Developed operational nowcasting for server storms in NY metro region.	Validation, calibration, and trend analysis of SBUV/2 and Brewer-Umkehr algorithm development.	Reached data reductions of 3.7-to-1 overturning widely held perceptions that Lossless compression was limited to a 2-to-1 reduction. Developed & Validated polarization discrimination technique (patent pending) to separate fluorescence from overlapping elastic scattering.

NOAA ORGANIZATION

CORPORATE FUNCTIONS

Under Secretary of Commerce for Oceans & Atmosphere & Administrator
Dr. Jane Lubchenco

Assistant Secretary of Commerce for Oceans & Atmosphere and Deputy Administrator
Vacant

Deputy Under Secretary for Oceans & Atmosphere
Mary M. Glackin

Chief of Staff
Margaret Spring

Deputy Assistant Secretary for International Affairs
Dr. James M. Turner

Deputy Assistant Secretary for Oceans & Atmosphere
Vacant

Deputy Chief of Staff
Jeff Payne (A)

Office of Decision Coordination & Executive Secretariat
Kelly Quickle

Program Coordination Office
Jeff Payne (A)

Office of Military Affairs
LT Col David Miller, USAF
CAPT Mike Angove, USN

General Counsel
Jane Chalmers (A)

Legislative Affairs
John Gray

Communications
Justin Kenney

Workforce Management
Eduardo Ribas

Education
Louisa Koch

Chief Information Officer/High Port, Computing & Comm
Joe Klimavicz

Program Analysis & Evaluation
Stephen D. Austin

Chief Administrative Officer
William Broglie

Chief Financial Officer
Maureen Wylie

Federal Coordinator for Meteorology
Sam Williamson

Acquisition & Grants
Mitchell J. Ross

Marine & Aviation Operations
RADM Jonathan W. Bailey

LINE OFFICES

Assistant Administrator
Oceanic & Atmospheric Research (OAR)
Dr. Rick Spinrad

Assistant Administrator
National Ocean Service (NOS)
John H. Dunnigan

Assistant Administrator
National Environmental Satellite, Data & Information Service (NESDIS)
Mary Kicza

Assistant Administrator
National Marine Fisheries Service (NMFS)
Dr. Jim Balsiger (A)

Assistant Administrator
National Weather Service (NWS)
Dr. Jack Hayes

Assistant Administrator
Program Planning & Integration (PPI)
Laura Furgione

MISSION GOALS

Ecosystem
Steve Murawski

Climate
Chet Koblinsky

Weather & Water
Edward Johnson (A)

Commerce & Transportation
CAPT Steven Barnum

MISSION SUPPORT

Satellite Services
Michael Crison

Fleet Services
Tajr Hull

Modeling & Observing Infrastructure
Kenneth McDonald

Leadership & Corporate Services
William Broglie

CREST-NOAA Interactions and Collaborations

- 18 major Research Projects with 104 tasks in collaboration with NOAA Scientists
- 87 Students involved in the research projects (mostly MS and PhD)
- 37+ NOAA-Collaborators
- 66 CREST Faculty

NOAA Collaborators	Project Description	Students* Supported
NESDIS (S. Kondragunta, M. Goldberg, R. Heymann, I. Laszlo, A. Prados) & **ESRL** (M. Hardesty)	Ground Based Remote Sensors & Sensing Networks (3 Tasks)	9 (PhD); 3 (MS) & 2 (UG)
NESDIS (S. Kondragunta, M. Goldberg) **ESRL** (M. Hardesty) and **AOML/HRD** (J. Gamache)	Air Quality Remote Sensing Applications (10 Tasks)	5 (PhD); 2 (UG)
Paul Menzel (**CIMSS- NESDIS/CI)**	Approaches to Aerosols Studies (5 Tasks)	2 (PhD); 3 (MS); 5 (UG)
NESDIS (B. Ramsay; R. Ferraro; G. Dittberner), **NWS** (J. McQueen & M. Cohen), **NOS** (M. Monaco)	Environmental Health Impacts (3 Tasks)	2 (PhD)
NESDIS (L. Flynn), **ESRL** (J. Elkins & I. Petropavlovskikh)	Stratospheric Ozone Analysis (10 Tasks)	3 (PhD)
NWS (D. Kitzmiller, C. Kondragunta), **NESDIS** (R. Ferraro & B. Kuligowski') & **NWS/MDL** (Ama Ba; Stephan Smith) ; **OAR** – Bob Rabin	Precipitation & Rainfall Estimation (9 Tasks)	4 (PhD); 3 (MS); 1 (UG)
NESDIS (P. Romanov), **NOHRSC/NWS** (Carrol), **NWS** (I. Matos); **NESDIS** (Fuzhong Weng; Cesar Konguli;	Soil Moisture & SWE (4 Tasks)	2 (PhD); 2 (MS); 10 (UG)
NOS (M. Wang; D. Clark; M. Ondrusek; R. Stumpf)	Remote Sensing of Coastal Waters (4 tasks)	5 (PhD); 3 (MS); 3 (UG)
NESDIS (R. Heymann, M. Goldberg, N. Nalli; Walter Wolf; Lihang Zhou, Ingrid Guch)	Data Compression ; Quantitative Image Restoration (QIR)	1 (PhD); 1 (MS); 2 (UG)

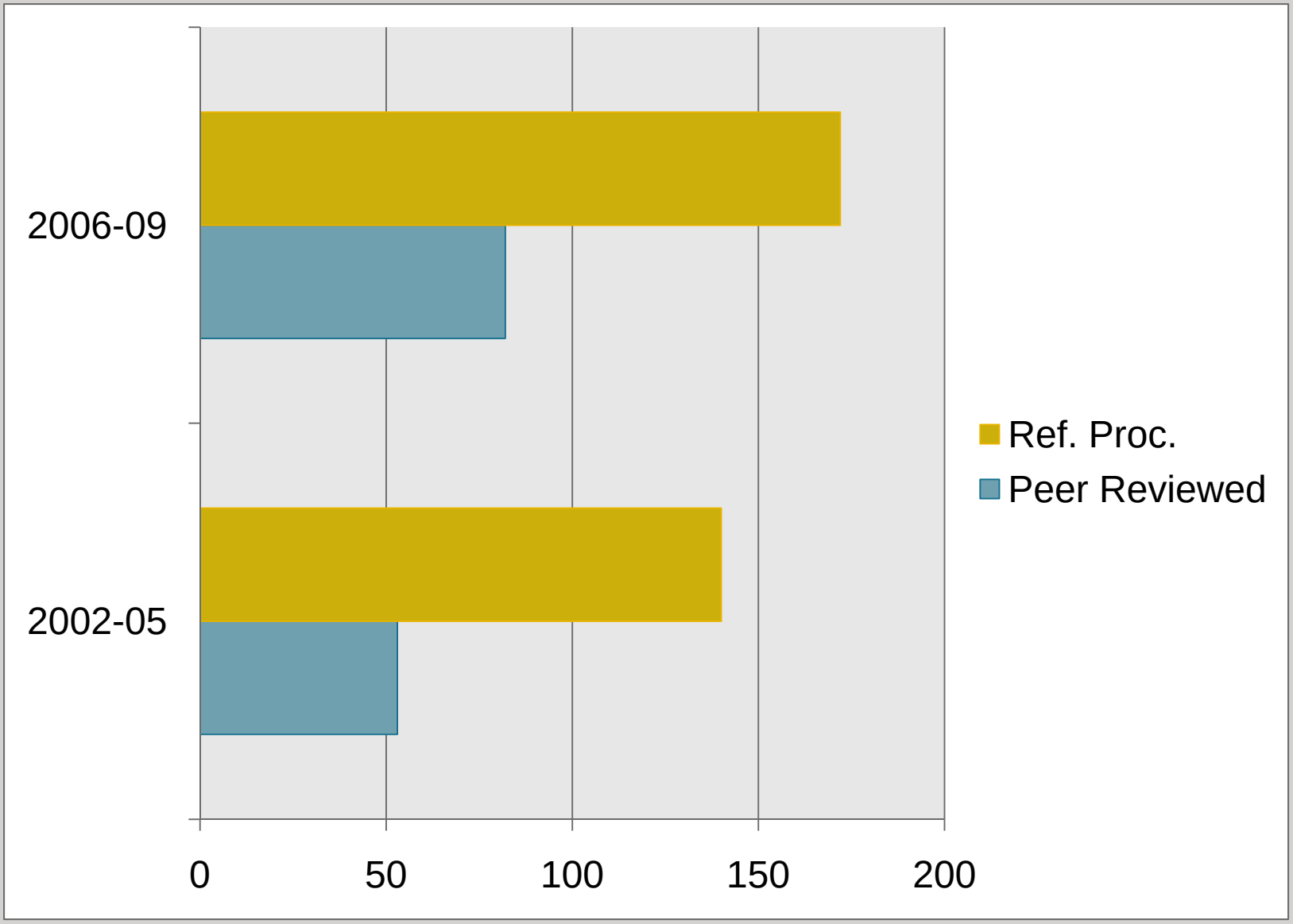
Publications & Patents (2006-09)

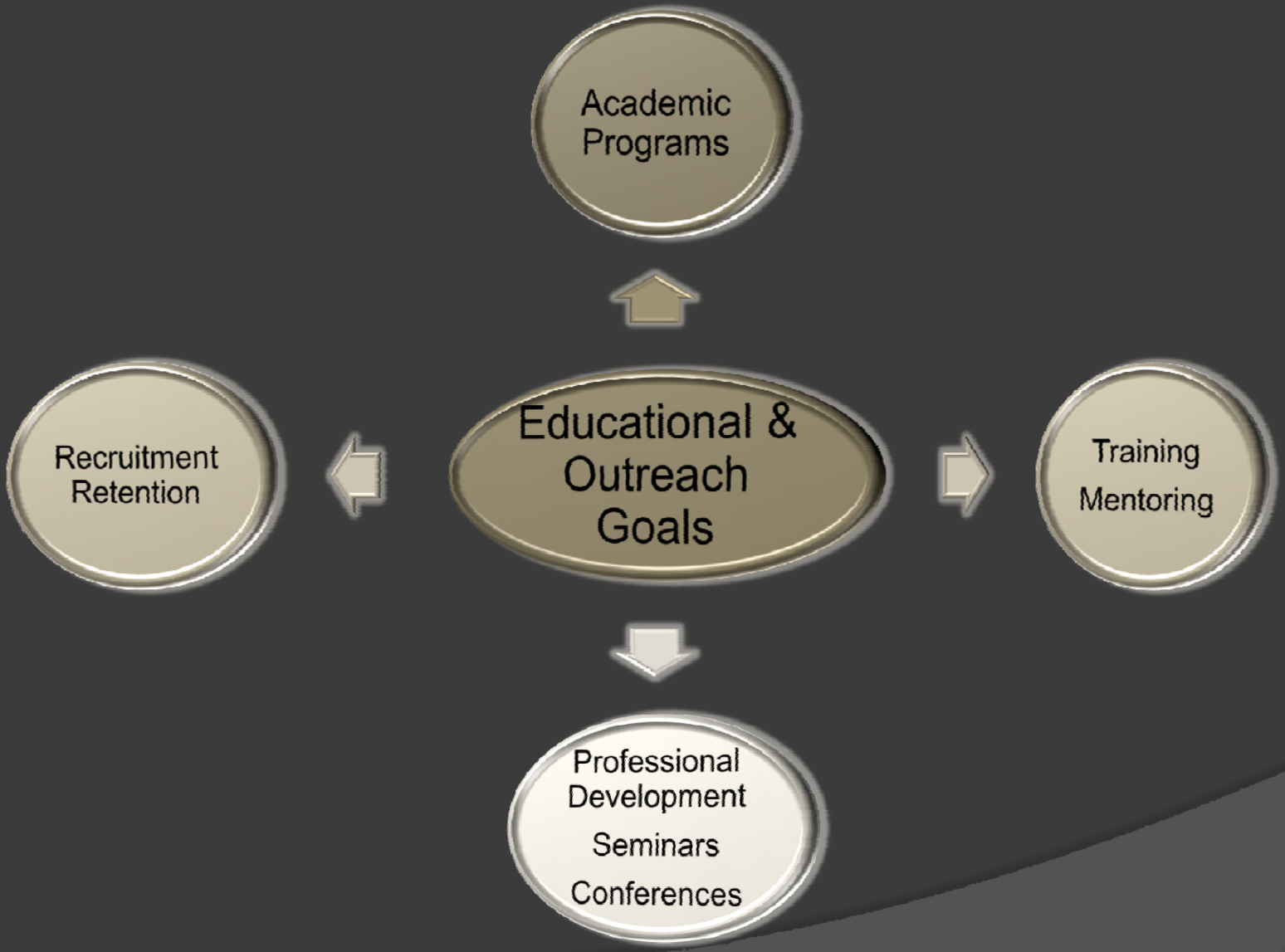
Peer Reviewed		Refereed Proc.		In Press		Under Review	
Faculty	**With Students**	**Faculty**	**With Students**	**Faculty**	**With Students**	**Faculty**	**With Students**
132 (includes 50*)	34	172	131	33 (includes 18)*	7	46 (includes 17)*	10

*Leveraged Publications

Three Patents filed one by Coastal RS group and two (Serial Number: 11/774,704) by Data Compression group

	THRUST I	THRUST II	THRUST III	TOTAL
Peer Reviewed	85	7	40	132
Refereed Proc.	105	20	47	172


2006-09
2002-05
0
50
100
150
200
Ref. Proc.
Peer Reviewed


Academic Programs
Recruitment Retention
Educational & Outreach Goals
Training Mentoring
Professional Development
Seminars
Conferences

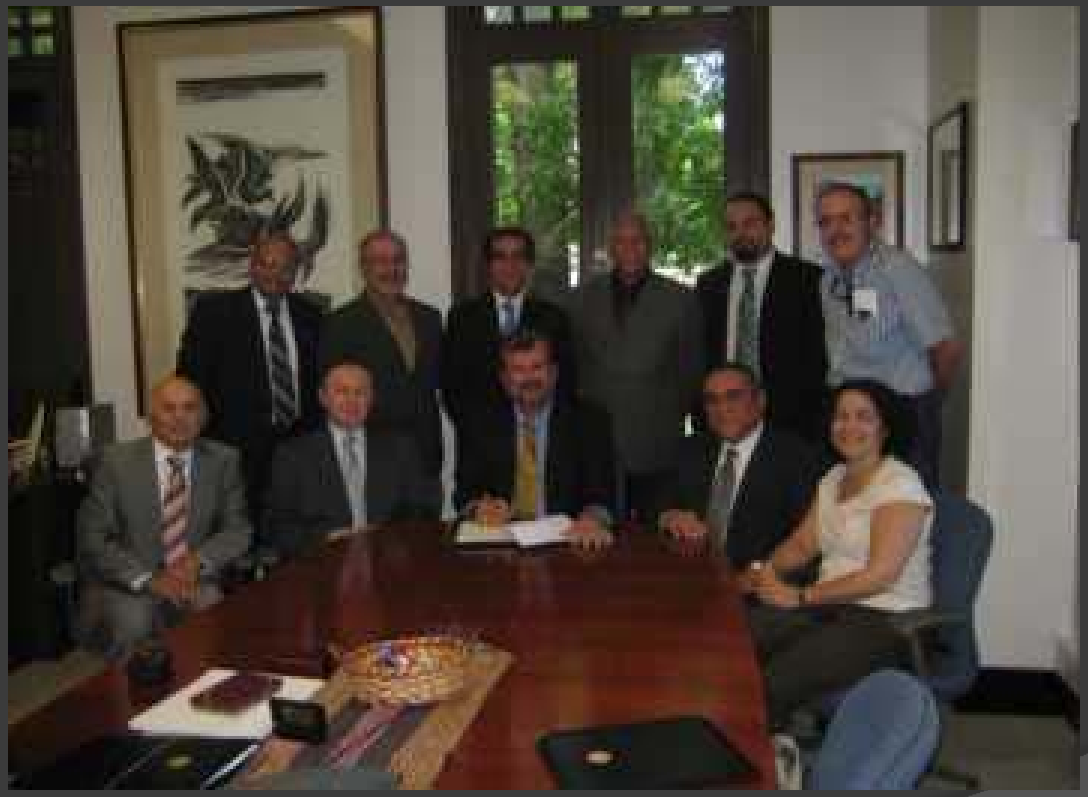
New and Modified Courses/Program

- EESE **(Earth Environmental Science & Engineering)** 4-year BS/BE degree program at CUNY
- SEAS **(Space Earth & Atmospheric Sciences)** minor undergraduate program at Hampton University, which led to formation of a New Department (Atmospheric and Planetary Sciences)
- A one-year certificate course in GIS at Lehman College.
- Overall **6 Undergraduate and 10 Graduate** (existing and new) courses have been impacted since the inception of CREST in 2001.

New Programs in Pipeline

- MS degree in Geographic Information Sciences (MGISc) – Lehman College of CUNY
- MS dergree in Earth System Sciences and Environmental Engineering (ESSEE) by CCNY, CUNY
- Submitted a proposal on Science Masters' Program (SMP) for funding through NSF

CUNY/UPRM Joint Ph.D. in Engineering Signing Ceremony, October 15, 2007

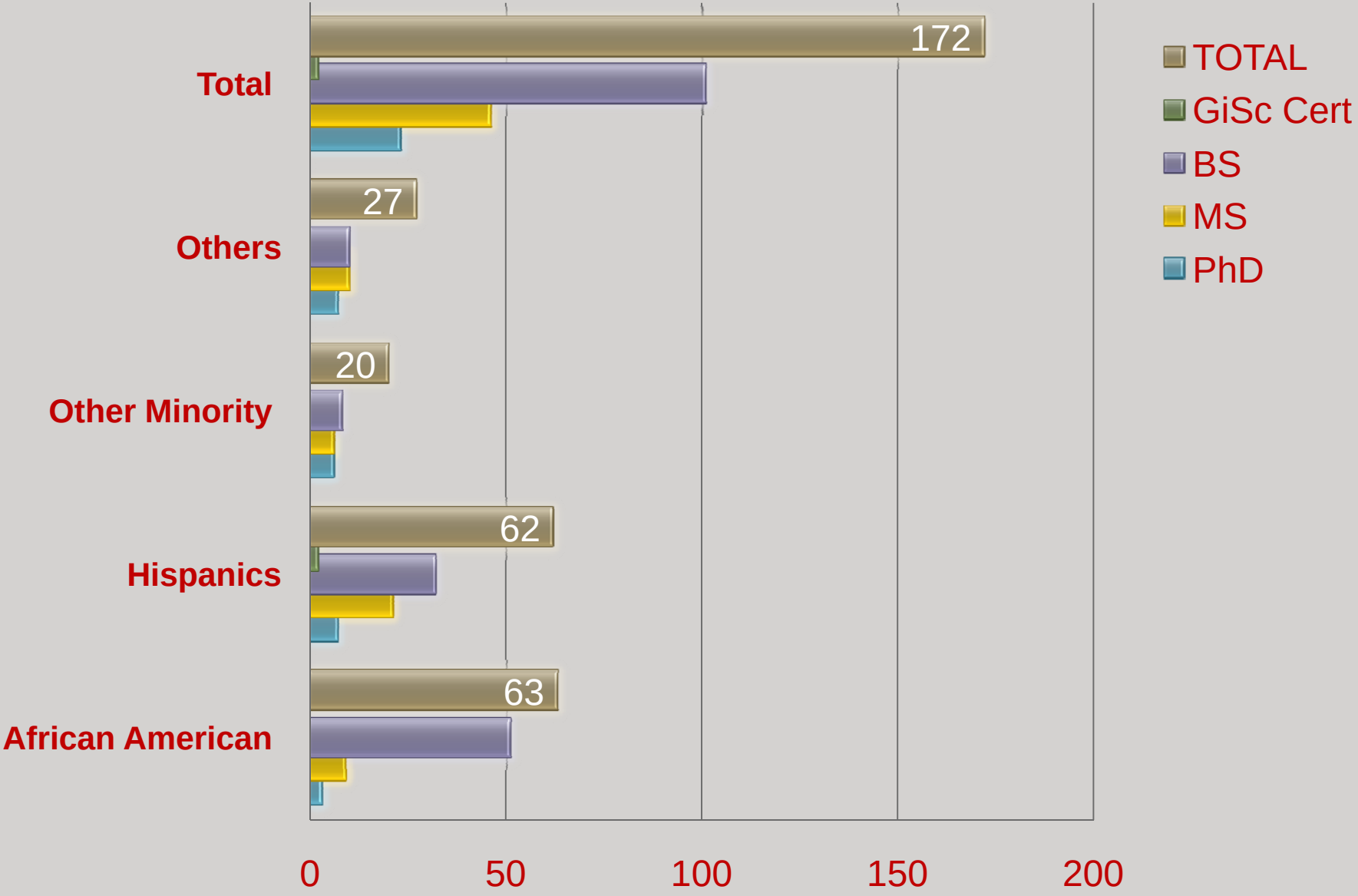


A **joint PhD program** between CUNY and UPRM since October 2007

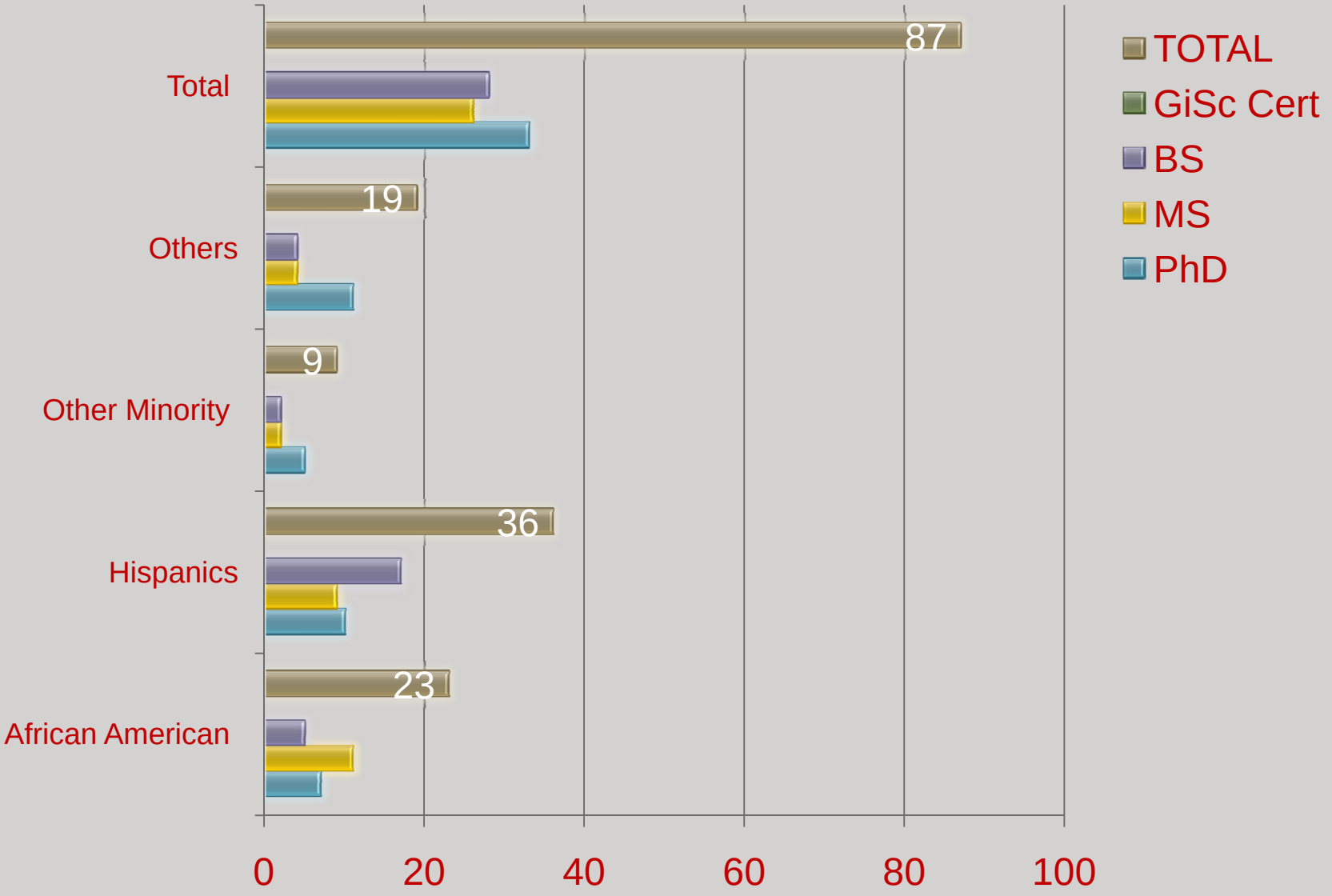
CREST Students Statistics (2001-2009)

Students	African American		Hispanics		Other Minority		Others		Total	
	A*	P	A	P	A	P	A	P	A	P
PhD	3	7	7	10	6	5	7	11	23	33
Masters	9	11	21	9	6	2	10	4	46	26
BS	51	5	32	17	8	2	10	4	101	28
GISc. Cert.	0	0	2	0	0	0	0	0	2	0
Total	**63**	**23**	**62**	**36**	**20**	**9**	**27**	**19**	**172**	**87**

Ethnicity-wise breakdown of Students Graduated in NOAA Sciences



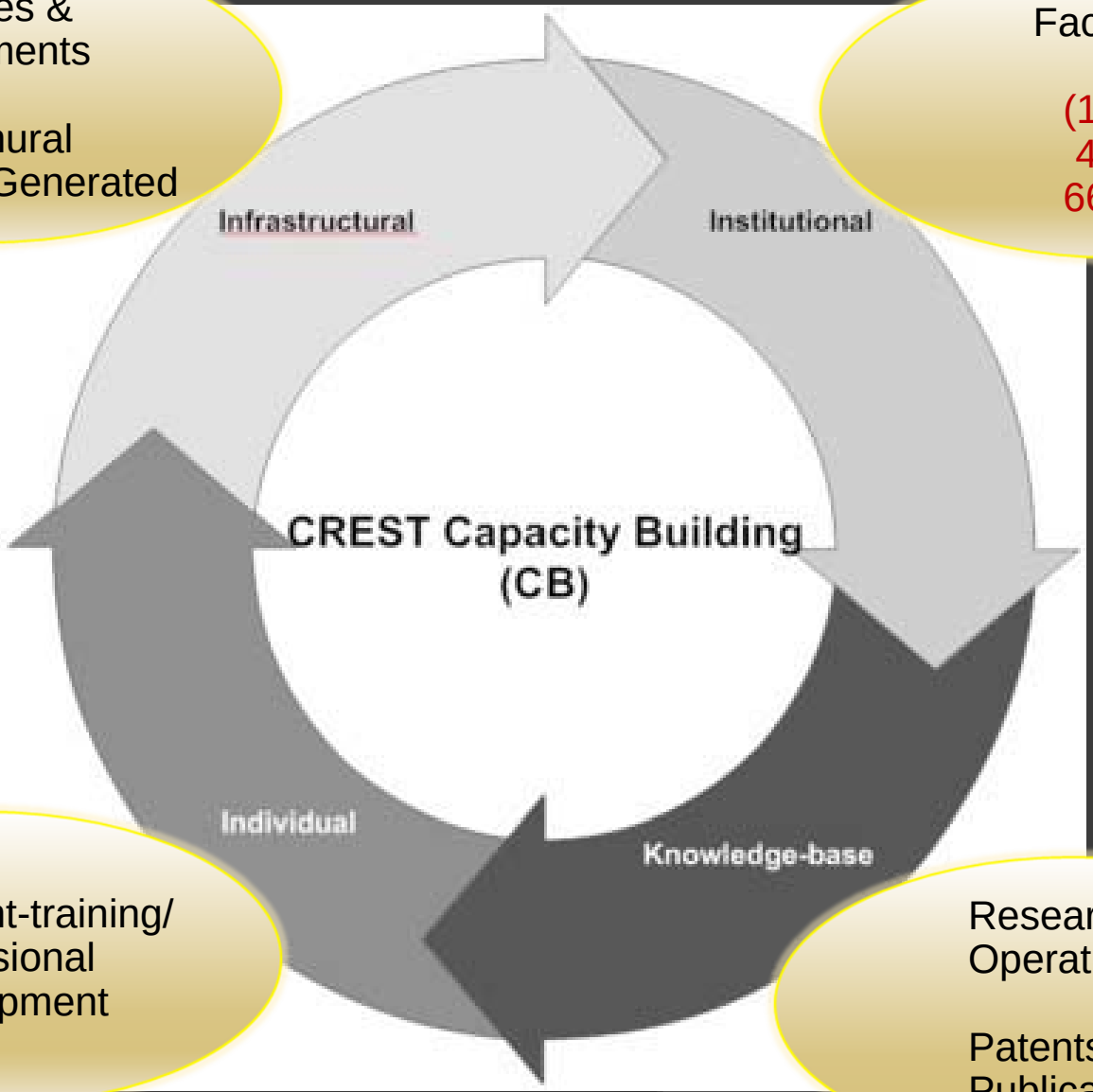
Ethnicity-wise breakdown of Students in Pipeline being trained in NOAA Sciences



Facilities &
Equipments

Extramural
funds Generated

Faculty & Staff
Growth
(18 in 2002
44 in 2005
66 in 2009)



Student-training/
professional
development

Research to
Operations

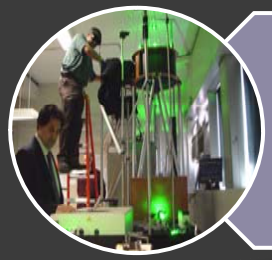
Patents &
Publications

Facilities at CREST

CREST Microwave Observation Unit

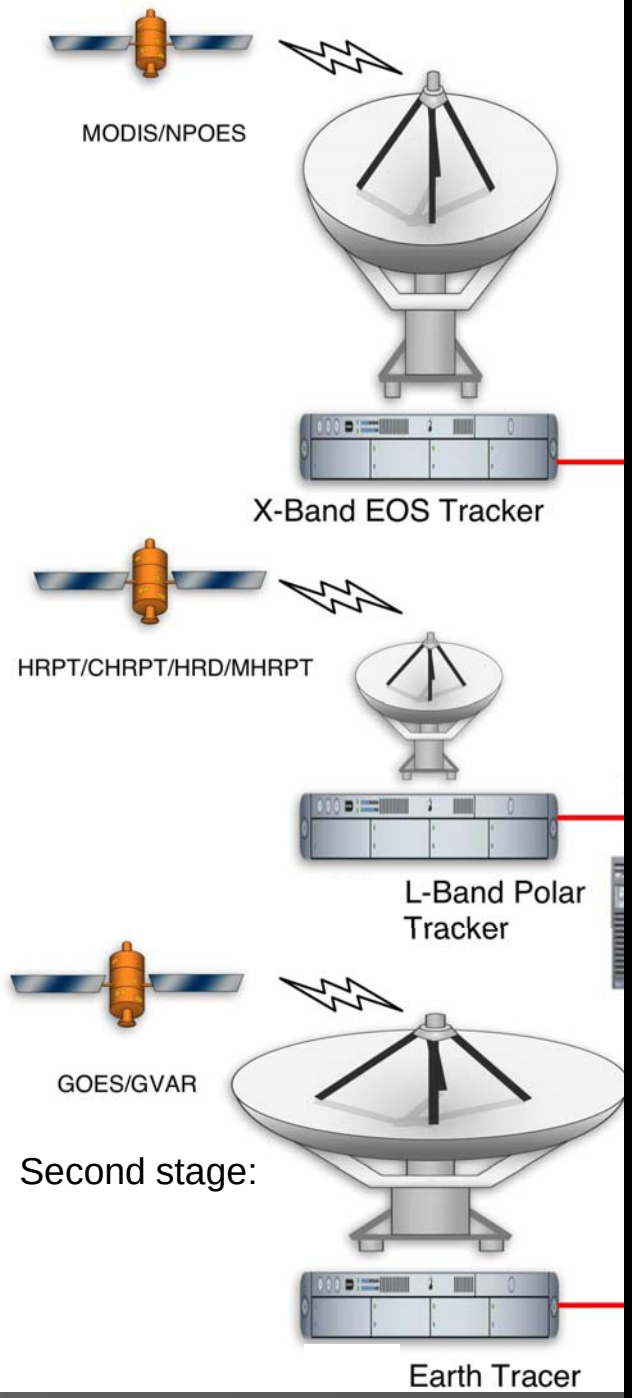
Coastal Measurement Platform

CREST Earth Observation Unit



CREST LIDAR NETWORK (CLN)

NEW SATELLITE DATA ACQUISITION UNIT

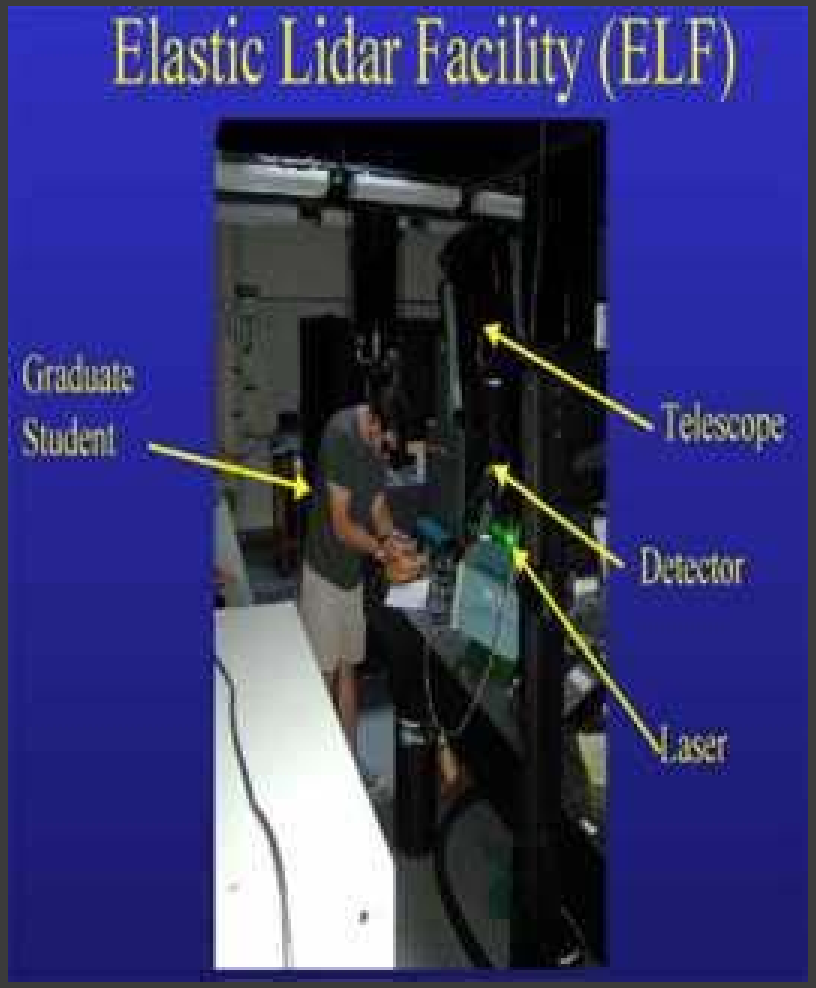


Second stage:

NAC building roof

LIDAR @ The City College of New York

LIDAR @ Hampton



LIDAR @ University of Maryland, Baltimore County

LIDAR @ University of Puerto RIco, Mayaguez

Ground-Based Remote Sensing Instrumentation
@ The City College of New York

Ground-Based Remote Sensing Instrumentation @ The City College of New York

Coastal Remote Sensing Lab @ The City College of New York

CALIPSO Workstation @ Hampton

Advanced Computational Center @ University of Puerto Rico, Mayaguez

Tropical Center for Earth and Space Studies (TCESS)

NOAA Future Potential Goals

"Now is the time…for NOAA to spur the creation of new jobs and industries, revive our fisheries and the economies and communities they support, improve weather forecasting and disaster warnings, provide credible information about climate change and ocean acidification to Americans, and protect and restore our coastal waters and ecosystems. ……"

December 2, 2009
Stakeholder Forum, Washington DC.
Dr. Jane Lubchenco
Under Secretary of Commerce
for Oceans and Atmosphere
(NOAA Administrator)

NOAA's proposed Long-Term Strategy

MISSION

MISSION: To understand and predict changes in Earth's Environment and Conserve and Manage Coastal and Marine Resources to meet our Nation's Economy, Social and Environmental needs.

- Research & Education (Science)
- Observations & Predictions (Service)
- Management & Conservation (Stewardship)

VISION: Healthy and Productive Communities, Economies, and Ecosystems within a Changing World

GOALS

- Climate Adaption & Mitigation
- Weather Resilience
- Sustainable Coastal Communities and Economics
- Sustainable, Resilient Fisheries, Species & Habitats

CREST' commitment and partnership with NOAA in its long term strategy

CREST DRAFT STRATEGIC PLAN

NOAA

Satellite Services	• Development of Multi-Data Analysis methods for A-train leading to NPOESS & GOES-R. • Calibration/Validation (SMAP; GOES-R; etc)
Climate Services	• Develop climatology of cloud-aerosol (Lidar & Satellite) interactions & Coastline Climatology of Land-Air-Water interactions in Eastern North America. • Develop Capability to monitor variations of Eastern US Regional Water Resources.
Promote Healthy Coastal Land-Water Zone	• Develop Remote Sensing Capability to Study Correlation of Air-Land-Ocean Interactions in Coastal Region. • Monitoring & retrieval capabilities for coastal water bio-optical properties & floodplain Evolution & Prediction
Improve Weather Forecasts	• Develop Operational Nowcasting capability for severe storms; precipitation and Flooding
Adaptation to Climate Change	• Develop tools for Water Resources Vulnerability • Investigate vulnerability of coastal cities and adjacent areas to climate change

CREST

Education; Outreach; Professional Development

Past, Present, and FUTURE…

2002

Few Handful of Students

Limited Research Areas/ Expertise

2005

Cluster of more defined research themes and projects

Substantial growth in Students population

Extended collaborations with other NOAA L/O

2 Students trained by CREST joins NOAA workforce….

Increase in the research publications

2009

Significant projects/tasks in line with NOAA's missions & goals

Substantial graduation and pipeline of the students

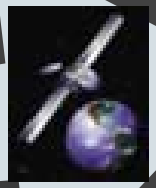
Extensive Collaboration with NESDIS and NWS, NOS, OAR

Major Science Accomplishments; Satellite Receiving Station

4 Students trained by CREST joins NOAA workforce….

Substantial increase in research publications and patents

2010-15



The NOAA Remote Sensing **Institute/Center of Excellence** in Research & Education (National & International)

GOALS:

- Improve/Expand Research Collaborations
- CREST Students Mentoring by NESDIS Scientists
- Potential Exchange Programs between CREST-NESDIS
- Help in Refining our Strategies
- Other Innovative Ideas – National and International