Air Quality Applications Program

April 2002
Numerous examples and enthusiasm for Air Quality
Achieving applications of Earth Science observations
Air Quality a pathfinder for Applied Sciences Program
Organized, mature, and active community
Interagency/community partnerships continue to strengthen
Existing gaps to address
Sound basis/foundation to build from

Remarkable progress warrants enthusiasm,
yet fragile programmatic surroundings
I. Where We’ve Come From

II. Where We Are Now
   - Air Quality Applications Program
   - NASA Applied Sciences & Earth Science

III. Forces, Drivers, and Opportunities
   - Internal
   - External

IV. Where We Want To Go: Future Directions
Section I.

Where We’ve Come From
## NASA Applied Sciences Program

### Integrated Solutions & Decision Support

#### Applied Sciences Program Approach to Integrated System Solutions

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
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<tr>
<td>NASA and Research Partners</td>
<td>Partners with Decision Support Systems</td>
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<table>
<thead>
<tr>
<th>Earth System Models</th>
<th>Predictions/Forecasts</th>
<th>Partnership Area</th>
<th>Value and Benefits to citizens and society</th>
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<tbody>
<tr>
<td>Earth System Models</td>
<td>High-Performance Computing, Communication, and Visualization</td>
<td>Decision Support Systems</td>
<td>Policy Decisions</td>
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<tr>
<td>Land, Atmosphere, Oceans, Cryosphere, Coupled Models</td>
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<td>Assessments</td>
<td>Management Decisions</td>
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<td>Model Products, Data Assimilation, Predictive Capabilities</td>
<td>Standards and Interoperability</td>
<td>Scenario Tools</td>
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<tr>
<td>Earth Observatories &amp; Measurements</td>
<td>Observations</td>
<td>Analysis to support decision-making processes &amp; actions</td>
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<tr>
<td>Satellite, Airborne, Ground, In-situ</td>
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<tr>
<td>Missions, Sensors, Data Products</td>
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</table>

### Key Features:
- **Earth System Models**: Land, Atmosphere, Oceans, Cryosphere, Coupled Models
  - Model Products, Data Assimilation, Predictive Capabilities
- **Earth Observatories & Measurements**: Satellite, Airborne, Ground, In-situ
  - Missions, Sensors, Data Products
- **Data**: Observations
- **Predictions/Forecasts**: High-Performance Computing, Communication, and Visualization
- **Standards and Interoperability**
- **Partnership Area**: Decision Support Systems, Assessments, Scenario Tools
- **Value and Benefits to citizens and society**
  - Policy Decisions
  - Management Decisions

**Impacts**
- Outcomes
- Impacts
Goal
Enable and expand the sustained use of NASA Earth science observations and models in the air quality community to enhance policy, business, and management for societal benefits

Programmatic Themes
• Air Quality Planning
• Air Quality Forecasting
• Air Quality Compliance
• Emissions Inventories (cross-cuts others)
• *Programmatic Activities (studies, outreach, etc.)*
<table>
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<th>Fiscal Year</th>
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<td>FY07</td>
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**Total** 11.05 M

Note: NASA’s switch to full-cost accounting occurred in this timeframe; earlier years may not reflect full-costs.
## NASA Applied Sciences Program - Solicitations

### Total and Air Quality Proposals, by announcement

<table>
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</table>

### Solicitation Information

- 5-year awards: Started 2003-4
- 3-year awards: Started 2006
Air Quality Applications Program

Interagency Developments

• EPA-NOAA Agreement on Air Quality, May 2003
• NOAA pursuing national forecast guidance
  - Next-day Ozone by 2008, PM by 2012
  - Extend forecasts to 2+ days
  - Add additional pollutants
• EPA AIRNow a strong network
  - Air Quality Index widely used
• EPA-NASA Agreement (Research and Applications)
• USDA-NASA Agreement
• Clean Air Interstate Rule
• Stronger Focus on Accountability
• Long-range Transport
Group on Earth Observations

Ministerial-level leadership for coordination of Earth observing systems 10-year implementation plan

Began August 2003

Integrate scientific capacity of organizations and observing systems to support nine societal benefit areas:

- Disasters
- Ecosystems
- Agriculture
- Climate
- Human Health
- Water
- Biodiversity
- Energy
- Weather

An international political endeavor to recognize the importance of Earth Observations

Earth Observation Summit III
Feb. 2005

GEO involves:
70 nations (plus EU)

48+ international Organizations

GEO Secretariat at WMO in Geneva
Air Quality Applications
United States GEO

STRATEGIC PLAN FOR THE U.S. INTEGRATED EARTH OBSERVATION SYSTEM

USGEO & IEOS
Near-Term Opportunities

Air Quality Assessment and Forecast System

Improved Observations for Disaster Reduction

National Integrated Drought Information System

Interagency Working Group on Earth Observations Membership

- Department of Commerce
  - National Oceanic and Atmospheric Administration
  - National Institute for Standards and Technology
- Department of Defense
  - Air Force
  - National Geospatial-Intelligence Agency
  - Navy
  - U.S. Army Corps of Engineers
- Department of Energy
- Department of Health & Human Services
  - National Institute of Environmental Health Sciences
- Department of Homeland Security
  - Federal Emergency Management Agency
- Department of the Interior
  - U.S. Geological Survey
- Department of State
- Department of Transportation
- Environmental Protection Agency
- National Aeronautics and Space Administration
- National Science Foundation
- Smithsonian Institution
- Tennessee Valley Authority
- U.S. Agency for International Development
- U.S. Department of Agriculture
  - Agriculture Research Service
  - U.S. Forest Service
- White House Council on Environmental Quality
- White House Office of Management and Budget
- White House Office of Science and Technology Policy
Air Quality Applications
United States GEO

USGEO & IEOS
Near-Term Opportunities

Air Quality Assessment and Forecast System

Improved Observations for Disaster Reduction

National Integrated Drought Information System

PRE-PUBLICATION

September 2006
Data fusion to support EPA AirNOW & NOAA next-day fine particle air quality forecasting.

**EPA/NOAA interest in PM 2.5:**
AQ Forecasting and Transport

Comparisons of satellite observations data with EPA TEOM ground monitors
- Terra/Aqua MODIS Aerosol Optical Depth

Favorable comparisons, through methodology worked out by AQ team. Visual and statistical correlations.

Developed data fusion techniques to support visualizations of regional transport. Added additional data sets and modeling activities – aerosols, clouds, winds, fire locations, ground aerosols. Multiple day sequences of:
- MODIS AOD
- EPA TEOM
- NOAA EDAS winds
- MODIS COT
- NOAA WF-ABBA fire counts
- Air parcel trajectories

Provided “weight of evidence” supporting EPA transport rule-making.

**Project Successes**
- EPA conducted forecaster training on use of integrated data products
- Demonstration to EPA AA for Air & Radiation
- MODIS and project referenced in EPA’s Clear Air Interstate Rule (Fed. Reg. Jan’05)
- Cover story of BAMS (Sept. 2005)
- Interagency, inter-Center project
- Prompted independent follow-on projects to add CALIPSO for 3-D aspects
- Benchmark report showed general support from forecasters for use of satellite products
- Transition to EPA/NOAA payment of system operations at CIMSS (May 2004)
- Transition to NOAA NESDIS operations

Air Quality: IDEA Project
Use of Globally Assimilated Lateral Boundary Conditions to Improve CMAQ Ozone Estimates

- Context: CMAQ originally developed for regional scale domains. Boundary conditions for initiating CMAQ runs were problematic and not realistic.
- Purpose: Provide and assess lateral boundary conditions generated from a global model output to CMAQ.
- Activity: Use a multi-scale modeling and data assimilation framework to improve the prediction of large-scale transport and local productions of surface ozone and overall CMAQ performance.
- Primary comparison: CMAQ (Baseline) CMAQ (using RAQMS-based BCs)

Project Insights
There were no significant differences in the surface distributions of ozone during the benchmark period between CMAQ/Baseline and CMAQ/RAQMS. Required directed project (rather than solicitation).

Project Results
Average upper tropospheric differences of over 60 ppbv occur in the northern part of the domain.
Mean ozone differences (ppbv) between CMAQ/baseline and CMAQ/RAQMS observed in the upper trop. (sigma= 0.350).
CMAQ/RAQMS was in better agreement with ozonesonde observations (100 – 400 ppbv).

Mean O3 differences (ppbv) in CMAQ with & without time-varying globally assimilated B.C.s

Upper Trop. ozone difference
*Significant over most of US*
Use of Globally Assimilated Lateral Boundary Conditions to Improve CMAQ Ozone Estimates

- **Context:** CMAQ originally developed for regional scale domains. Boundary conditions for initiating CMAQ runs were problematic and not realistic.
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- **Activity:** Use a multi-scale modeling and data assimilation framework to improve the prediction of large-scale transport and local productions of surface ozone and overall CMAQ performance.
- **Primary comparison:**
  - CMAQ (Baseline)
  - CMAQ (using RAQMS-based BCs)

**Project Insights**

There were no significant differences in the surface distributions of ozone during the benchmark period between CMAQ/Baseline and CMAQ/RAQMS.

Required directed project (rather than solicitation)

**Project Results**

Average upper tropospheric differences of over 60 ppbv occur in the northern part of the domain.

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- CMAQ/RAQMS was in better agreement with ozone sondes (100 – 400 ppbv).

**Mean O3 differences (ppbv) in CMAQ with & without time-varying globally assimilated B.C.s**

Note: As part of the project, U.S. EPA graciously agreed to modify Models-3/CMAQ to accept time- and spatially-varying lateral boundary conditions from NASA models and to conduct evaluations of CMAQ performance. Our thanks to EPA for its commitment to the project.
NASA SCIENCE MISSION DIRECTORATE

Earth-Sun System Applied Sciences Program
Air Quality Program Element

Benchmark Report:
Globally Assimilated Lateral Boundary Conditions
Improve CMAQ Ozone Estimates

NASA Air Quality Applications Benchmark Report
The Application of Satellite-Derived High Resolution Land Use/Land Cover Data
to Improve Urban Air Quality Model Forecasts

Prepared for:
Lawrence Friedl
NASA Applications Program Lead
Program Manager for Air Quality Applications
NASA Headquarters
Washington, DC 20546

Prepared by:
Maulood Khan, William L. Crosson, and Maurice
Universities Space Research Association (USRA)
National Space Science and Technology Center (NSSTC)
and
Dale A. Quattrochi
NASA Earth Science Office
Marshall Space Flight Center (MSFC), VP61
320 Sparkman Drive, Huntsville, AL 35812

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Dale A. Quattrochi
NASA Earth Science Office
Marshall Space Flight Center (MSFC), VP61
320 Sparkman Drive, Huntsville, AL 35812

February 23rd 2007

Part 2: Evaluation and Recommendations on the
Potential for Application of NASA Earth Science Research to
International Air Quality Treaties/Policies/Protocols

Prepared by
Jill Engel-Cox and Erica Zell

Battelle
2101 Wilson Boulevard, Suite 300
Arlington, VA 22201-3000

Subaward Agreement #CG0416
To the Joint Center for Earth Systems Technology

Lawrence Friedl
Applied Sciences Program
NASA Headquarters
Washington, DC 20546

February 1, 2005
The RAQMS ozone assimilation utilizes near-real-time total column ozone measurements from the Ozone Monitoring Instrument (OMI) on the NASA Aura satellite (a). RAQMS tropospheric ozone analysis (b) provides information on the regional distribution of ozone that is useful for predicting surface ozone concentrations (c), a key component of photochemical smog. Comparisons between analyzed and observed surface ozone shows that the RAQMS surface ozone analysis (red) compares well with observations from the EPA AIRNow network (black).

In summer 2006, RAQMS chemical assimilation/forecasts were used during the NOAA Texas Air Quality Study (TEXAQS II) to provide estimates of background composition Houston and Dallas metropolitan areas.
Positive Indications

Initiative & Innovation

Strong Proposals

Interagency Collaboration
  - IDEA Collaboration
  - AIRNow
  - USGEO AQ NTO
  - Additional Examples

Project networking

AQ a Pathfinder

Enthusiastic Community
## Air Quality Applications
### Overall Assessment

<table>
<thead>
<tr>
<th>Positive Indications</th>
<th>and Reality</th>
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<tbody>
<tr>
<td>Initiative &amp; Innovation</td>
<td>Issues of Sustainability</td>
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<tr>
<td>Strong Proposals</td>
<td>Satellite Missions</td>
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<tr>
<td>Interagency Collaboration</td>
<td>Budget Environment</td>
</tr>
<tr>
<td>- IDEA Collaboration</td>
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<td>- AIRNow</td>
<td></td>
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<td>- USGEO AQ NTO</td>
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<tr>
<td>- Additional Examples</td>
<td><strong>Remarkable progress warrants enthusiasm, yet fragile programmatic surroundings</strong></td>
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<tr>
<td>Project networking</td>
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<tr>
<td>AQ a Pathfinder</td>
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<tr>
<td>Enthusiastic Community</td>
<td></td>
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</tbody>
</table>
Section II.

Where We Are Now
The Program seems to serve **three** primary, strategic functions for ESD & NASA:

**Science advances and Technology transfer**
Applications projects can further scientific techniques (e.g., data assimilation, data fusion); interoperability standards drive technology; projects reduce perceived risk of its use and support transfer to private sector

**Societal Benefits**
The Program serves the nation and society by helping partners improve their decision making – natural resource management, public safety and health, disaster warnings, etc.

**Outreach, Partnerships, and Marketing**
Projects facilitating partners’ sustained use of Earth science products helps induce demand for Earth science data and research. Applications of the products to policy and management issues shows the relevance of Earth science to key stakeholders.
# Air Quality Applications Program

## Where we are now

<table>
<thead>
<tr>
<th><strong>Goal</strong></th>
<th><strong>Objective</strong></th>
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<tbody>
<tr>
<td>Enable and expand the sustained use of NASA Earth science observations and models in the air quality community to enhance policy, business, and management for societal benefits.</td>
<td>Demonstrate value of at least 7 NASA sensors and models in at least 4 different Air Quality decision support systems by 2011.</td>
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<table>
<thead>
<tr>
<th><strong>Currently</strong></th>
<th><strong>Currently</strong></th>
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<tbody>
<tr>
<td>At least 7 sensors/models in at least 6 different AQ DSSs.</td>
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Air Quality Applications Program

Where we are now

Goal
Enable and expand the sustained use of NASA Earth science observations and models in the air quality community to enhance policy, business, and management for societal benefits

Programmatic Themes

• Air Quality Planning
  - 5 projects

• Air Quality Forecasting
  - 6 projects

• Air Quality Compliance
  - 1 project

• Emissions Inventories
  - 3 projects

• Program Management
## NASA Applied Sciences Program

### Air Quality Projects, by PI Institution Type

<table>
<thead>
<tr>
<th>AQ Theme</th>
<th>NASA</th>
<th>Other Federal</th>
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## Air Quality Applications Program
### AQ Projects

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**Adjusting for EPA-led Project PIs**
# NASA Applied Sciences Program

## Air Quality Projects

### Air Quality Projects, by PI Institution Type

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<td><strong>Total</strong></td>
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<td>5</td>
<td>4</td>
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**Projects Competitively-selected in Red**
### NASA Applied Sciences Program

**Air Quality Projects, by PI Institution Type**

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<tr>
<th>AQ Theme</th>
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<tr>
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<td><strong>Total</strong></td>
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**Projects over $65K in FY07**
Studies for Evaluating Opportunities:
   FY07: Glory, Emissions Inventories
   FY08: OCO

Communications & Outreach:
   Air & Waste Management Association (5th year)
   Considering other venues also (AMS Forecasters?)
   Project Fact Sheets and Smog Stories Prototype

Training:
   Curriculum for Applied Sciences
   Module for Air Quality
   Conduct at A&WMA and 2 other locations in 2007
<table>
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<tr>
<th>Partnership Opportunities</th>
<th>Recent Developments</th>
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<tbody>
<tr>
<td>• USDA</td>
<td>• AQ &amp; SERVIR</td>
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<tr>
<td>• Environment Canada</td>
<td>• Capacity Building</td>
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<tr>
<td>• NPS</td>
<td>• Data Sharing Networks</td>
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<tr>
<td>• Department of Defense</td>
<td>• Project/PI Networking</td>
</tr>
<tr>
<td></td>
<td>• IDEA into Operations</td>
</tr>
</tbody>
</table>
Dr. Teresa Fryberger  
Associate Director for Applied Sciences  
Earth Science Division  
Science Mission Directorate  
NASA Headquarters  
Mail Suite: 3B74  
Washington, DC 20546

June 8, 2007

Dear Dr. Fryberger:

I am pleased to send this letter to confirm the commitment of the NOAA, National Environmental Satellite Data and Information Service (NESDIS), Center for Satellite Applications and Research (STAR) to transition the Infusing Satellite Data into Environmental Applications (IDEA) software to NOAA for operational implementation. The IDEA system was jointly developed by NASA, NOAA, and the EPA to assist with the forecast of long-range transport of aerosol plumes that can impact local air quality. It currently uses NASA Terra MODIS Aerosol Optical Depth (AOD), NASA/NOAA observations of fire locations, EPA surface observations of PM2.5, and a NASA trajectory model to provide forecast guidance for fine particulate matter. The EPA has requested NOAA/NESDIS to transition this product or something similar into an operational setting at NESDIS. Operational implementation will ensure the availability of product without interruptions associated with technical failures.

Sincerely,

[Signature]

Alfred M. Powell, Jr.  
Director, Center for Satellite Applications and Research
1. Establish a routine push of TEMIS-OMI N02 near real-time product for EPA's AQ Portal(s).
2. Develop a WCS-based feed of TEMIS-OMI N02 near real-time product.
3. DATA-FED portlet-based services for additional AQ capabilities including visualization and analysis (TBD).
4. GSFC DAAC and DATA FED provide full access to N02 science data archive @ GSFC.
5. GSFC DAAC and DATA FED collaborate on additional AQ services via SOAP or REST WS.

Special Feature: Fires and Smoke in MesoAmerica
On May 21, we received an email from colleagues with questions about air pollution that parts of MesoAmerica (specifically, Honduras, Costa Rica and Nicaragua) were experiencing, starting May 18. There was concern about toxics and about the possibility of Saharan dust crossing the Atlantic.

MODIS true color images told us there were many fires in Central America that entire week. The MODIS image from May 19 showed significant smoke and clouds in the entire northern part of the region (left image below). This is confirmed by the NOAA NESDIS smoke and fire detection Hazard Mapping System (right).

Additional story and materials on NASA Earth Observatory - http://earthobservatory.nasa.gov/

MODIS – May 19

NOAA HMS -- AVHRR, GOES, MODIS
Earth Science Applications

International Developments

GEO Plenary and Ministerial Earth Observation Summit:
- Nov. 28-30, 2007 in Cape Town, South Africa
- Report on progress since previous summit
- 3-5 major themes for discussion
- Examples and achievements of GEO & GEOSS

USGEO Preparation for Summit – Examples of Possible US Efforts
- Global Air Quality Assessment and Forecasting
- Global Drought Early Warning System
- Global Land Characterization
- Global Environmental Information Delivery Systems
Programmatic Themes

- Air Quality Planning
  - 5 projects

- Air Quality Forecasting
  - 6 projects

- Air Quality Compliance
  - 1 project

- Emissions Inventories
  - 2 projects

Mixed needs for projects

Focused needs for projects

Broad needs for projects
ROSES-2007 Element A.20 – Air Quality Section

[The] program requests proposals focused on Air Quality Compliance, Planning, Emissions Inventories, and particular aspects of Forecasting.

In Forecasting, the program principally requests proposals focused on enhancing GFS.

In Planning, the program encourages a broad range of project concepts, including activities related to regional haze as well as use of land characteristics in air quality DSSs.

In Compliance, the program encourages a broad range of project concepts, including activities to use Earth science results to support accountability efforts and assess policy effectiveness in addition to compliance assistance.

Since the program’s portfolio already includes significant MODIS-based aerosol activities, the program discourages proposals focused narrowly on MODIS-based aerosol/PM forecasting.
ROSES-2007 Element A.20 – Air Quality Section

[The] program requests proposals focused on Air Quality Compliance, Planning, Emissions Inventories, and particular aspects of Forecasting.

In **Forecasting**, the program principally requests proposals focused on enhancing **GFS**.

In **Planning**, the program encourages a **broad range** of project concepts, including activities related to **regional haze** as well as use of **land characteristics** in air quality DSSs.

In **Compliance**, the program encourages a **broad range** of project concepts, including activities to use Earth science results to support **accountability** efforts and assess policy effectiveness in addition to compliance assistance.

Since the program’s portfolio already includes significant MODIS-based aerosol activities, the program **discourages proposals focused narrowly on MODIS-based aerosol/PM forecasting**.

...
### NASA Applied Sciences Program - Solicitations

**Total and Air Quality Proposals, by announcement**

<table>
<thead>
<tr>
<th></th>
<th>REASON</th>
<th>Decisions-04</th>
<th>ROSES-05</th>
<th>ROSES-07</th>
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<td>145</td>
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<td><strong>Selected</strong></td>
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<td><strong>Air Quality</strong></td>
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<tr>
<th><strong>Solicitation Information</strong></th>
<th>5-year awards</th>
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<td><strong>Started 2003-4</strong></td>
<td><strong>Started 2006</strong></td>
<td><strong>Started 2006</strong></td>
<td><strong>Start 2008</strong></td>
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### Applied Sciences - Program Budget (FY07-11)

*FY07-11: Based on FY07 President Request*

<table>
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<tr>
<th>Solicitations</th>
<th>2006</th>
<th>2007</th>
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<td>ROSES2008</td>
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*Note: The years of funding often pre-date the years of project activities.*
2002 – 2005: The Program worked with many federal agencies. In most cases, the Program worked with people that were either:

a) early adopters of technology; or

b) already familiar with Earth science data and remote sensing.

2006: The Program identified a need to build on these initial users and cultivate use by their peers within their respective agencies.

2007+: The Program may need to access the “next level” of users – people that may have heard about and seen their peers use the Earth science products but don’t necessarily know how to use the products themselves.
Science and Technology Transfer

Societal Benefits

Outreach (Marketing & Partnering)
Section III.

Drivers, Factors, and Opportunities
NASA Earth Science Applications

Program Changes

- Agricultural Efficiency
- Air Quality
- Aviation
- Carbon Management
- Coastal Management
- Disaster Management
- Ecological Forecasting
- Energy Management
- Homeland Security
- Invasive Species
- Public Health
- Water Management
Program Director’s Thoughts

Reviewing the crosscutting aspects of the program
- Supports activities for idea generation
- Formality of Rapid Prototyping and Solutions Networks

Communications
- Internal & external

Review Number and Topics of Application Themes

National Academy Review of the Program

Report due imminently

May address NASA connections to State, Local, Tribal governments

May address NASA’s role in the development of decision support systems/tools
Missions is primary focus for the Division Leadership

Decadal Survey
- Mission schedule rather than science priorities
- Adjust to funding, schedules, partners’ plans

NASA-NOAA-OSTP NPOESS Remanifestation Studies
- Realistic, affordable solutions (involving OMB)
- Desire for science-based solutions (rather than $-based)
- Bryant Cramer leading

Under TITLE III—SCIENCE
Subtitle B—Remote Sensing
- Sec. 311. Definitions.
- Sec. 312. General responsibilities.
- Sec. 313. Pilot projects to encourage public sector applications.
- Sec. 314. Program evaluation.
- Sec. 315. Data availability.
- Sec. 316. Education.

Subtitle B calls for NASA Administrator to “… in conjunction with United States industry and universities, research, develop, and demonstrate prototype earth science applications to enhance Federal, State, local, and tribal governments’ use of government and commercial remote sensing data, technologies, and other sources of geospatial information for improved decision support to address their needs.”

June 15th: Meeting with House Science Committee Staffers (Hartman, Freilich, Fryberger)

June 28th: Freilich to testify to House Science Committee
House Appropriations Committee
Commerce, Justice, Science Subcommittee - June 11th Markup

NASA: +286M over request  (SMD: +180M)

Climate Change/Global Warming:  +171M
  *Significant portion for NASA ESD*

Chair noted resources included for non-specific restoration of
NPOESS climate sensors and moving Decadal Survey forward
Air Quality Applications Program

Interagency Activities

- NOAA national forecast guidance
  - Next-day Ozone by 2008, PM by 2012
  - Extend forecasts to 2+ days
  - Add additional pollutants
- Clean Air Interstate Rule
- Long-range Transport
  - HTAP Study
  - LRTAP Convention
- Activities under USGEO & AQ NTO
- SIP Calls

National NOx and SO2
Power Plant Emissions:
Clean Air Interstate Rule (CAIR)

- SO2
- NOx

Projected w/ CAIR
MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: JOHN H. MARBURGER, III
DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY

JOSHUA B. BOLTEM
DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET

SUBJECT: FY 2007 Administration Research and Development Budget Priorities

This memo highlights the Administration’s research and development (R&D) priorities and emphasizes improving management and performance to maintain excellence and leadership in science and technology. The memo provides general guidance for setting priorities among R&D programs, interagency R&D efforts that should receive special focus in agency budget requests, and reiteration of the R&D Investment Criteria that agencies should use to improve investment decisions for and management of their R&D programs. These updated R&D budget priorities reflect an extensive, continuous process of consultation with the President’s Council of Advisors on Science and Technology (PCAST) and collaboration within the Interagency National Science and Technology Council (NSTC).

General R&D Program Guidance
From the OSTP/OMB Guidance Memo for 2008 (July 2006):

Global earth observations support research in a wide range of sciences important for society. The *U.S. Strategic Plan for an Integrated Earth Observations System* provides guidance for agencies contributing to these efforts and establishes six Near Term Opportunities that serve as the focal point of U.S. R&D activities. Agencies are encouraged to align their R&D programs in this area with the recommendations in the U.S Group on Earth Observations’ annual report, *Development of the U.S. Integrated Earth Observations System: Progress and Recommendations for the Way Forward*.

2007 G-8 Science Advisors Meeting:

Marburger brought Earth observations as US paper
Fundamental goals include:
- Increase the benefits of civil exploration, scientific discovery, and environmental activities;
- Enable a robust science and technology base supporting national security, homeland security, and civil space activities;

Guidelines to meet the goals include:
Departments and agencies shall conduct the basic and applied research that increases capability and decreases cost; encourage an innovative commercial space sector, including the use of prize competitions; and ensure the availability of space related industrial capabilities in support of critical government functions.

The United States will study the Earth system from space and develop new space-based and related capabilities to advance scientific understanding and enhance civil space-based Earth observation. In particular:
- NASA shall conduct a program of research to advance scientific knowledge of the Earth through space-based observation and development and deployment of enabling technologies; and
- Commerce, NASA, and other departments/agencies as appropriate, shall transition mature research and development capabilities to long-term operations, as appropriate.
USGEO Re-organizing - Evaluating roles and responsibilities for four primary committees (names are tentative)
- Policy and Planning
- Architecture and Data
- IEOS Coordination
- Outreach & Partners

*Decadal Survey* Recommendation:

The Office of Science and Technology Policy, in collaboration with the relevant agencies, and with consultation with the scientific community, should develop and implement a plan for achieving and sustaining global Earth observations. This plan should recognize the complexity of differing agency roles, responsibilities, and capabilities as well as the lessons learned from the implementation of the Landsat, EOS, and NPOESS programs.
Committee on Earth Observing Satellites (CEOS)
- To Coordinate the Space Component of GEO
- Developing “Virtual Constellations”
  Land Surface Imaging (Lead - USGS)
  Ocean Surface Topography (NOAA, EUMETSAT)
  Precipitation (JAXA, NASA)
  Atmospheric Composition (NASA) – the “pathfinder”

GEO Air Quality Community of Practice

GEO Ministerial Summit

Climate Change
  - Acceptance of a problem may lead to demands for options
Section IV.

Program Directions
AQ Community Using All Appropriate Observations
- Smooth transition between MODIS & VIIRS
- Private Sector forecasters to gain confidence & build demand for obs/models

Strong Public Familiarity, Demand, Expectations for AQ Forecasts
- Earth Science supports stakeholder/media outreach to public

AQ Decision Tools Using Best Land Surface Characteristics

Air Quality a successful example Nationally and Internationally
- Successful example for US GEO, CEOS, International GEO
- AQ Forecasters & EPA AIRNow receive Excellence in Government Award
- Cooperation with GMES on AQ approaches; more international data sharing
- Use in Central America (SERVIR) and other regions

Routine Short Courses on Sat.Obs/Models for AQ Management
Routine, Two-Way Personnel Exchange (NASA Centers & Partners)
### Ideal Annual Budget

<table>
<thead>
<tr>
<th>Category</th>
<th>Budget</th>
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<tbody>
<tr>
<td>Solicitations:</td>
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<tr>
<td>(10 on-going projects/year)</td>
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<td>Joint Solicitation:</td>
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<td>Strategic/Directed Projects:</td>
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<td>(5 projects/year)</td>
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<td>Proof of Concept Projects:</td>
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<td>(4 per year)</td>
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<tr>
<td>Early Stage/Seeding Ideas:</td>
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<td>Strategic Studies:</td>
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<td>HQ Support/Communications</td>
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<td>Program Management:</td>
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<td><strong>Total</strong></td>
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Solicitations
Project Focus
Communications
New Initiatives
Missions, Models, Technology
### Applied Sciences Program
**Solicitation Schedule**

<table>
<thead>
<tr>
<th>Program</th>
<th>Announced Date</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>REASoN CAN</td>
<td>(Announced 2003)</td>
<td>Runs FY04 – FY09</td>
</tr>
<tr>
<td>Decisions CAN</td>
<td>(Announced 6/05)</td>
<td>Runs FY05+ – FY08+</td>
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<tr>
<td>ROSES 2005</td>
<td>(Announced 3/06)</td>
<td>Runs FY06 – FY09</td>
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<tr>
<td>ROSES 2006</td>
<td></td>
<td>No solicitation was planned</td>
</tr>
<tr>
<td>ROSES 2007</td>
<td>(Awards 10/07)</td>
<td>Runs FY08 – FY10</td>
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<tr>
<td>ROSES 2008</td>
<td>(Awards 10/08)</td>
<td>Runs FY09 – FY11</td>
</tr>
<tr>
<td>ROSES 2009</td>
<td>(Awards 10/09)</td>
<td>Runs FY10 – FY12</td>
</tr>
<tr>
<td>ROSES 2010</td>
<td>(Awards 10/10)</td>
<td>Runs FY11 – FY13</td>
</tr>
</tbody>
</table>

...
Review the Applied Sciences Approach

Currently: Project funding at \(~$300K/\text{year}\) for 3 years

Considerations:
- More, smaller projects? Fewer, larger projects?
- Include mechanisms for testing prototype ideas
- Other factors
To date, projects have focused strongly on decision support.

As the program matures and partners utilize the Earth science products more routinely, what roles or changes does the AQ Applications Program need to make:

- Address risk reduction more in satellite transitions?
- Invest in strengthening algorithms?
- Expanding user community?
- Strengthening activities with existing partners?
- Increase use of small-scale prototypes?
What methods and venues to communicate opportunities for use of Earth science research?

- Project Descriptions for meetings, conferences, etc.
- Visualizations
- *Earth & Sky* radio spots
- Analyses of socio-economic benefits from projects

- Review articles
- Special issues of journals
Earth System Science Fellowships (ESSF)
- Funds for graduate students to pursue Earth science research.
- Approximately $36K per student per year for 3 years

_Idea:_ Create an Air Quality Applications Portion to ESSF
- Support graduate students pursuing PhDs and Masters related to use of Earth science observations for appropriate air quality management/policy issues
- Facilitate the familiarity and use of Earth science data in studies, work, research

Mission/Science Teams
NASA Observing Spacecraft for Earth System Research – 2006 and beyond
2006 NASA Strategic Plan (Sub-goal 3A)

NASA’s Applied Sciences Program will continue the Agency’s efforts in benchmarking the assimilation of NASA research results into policy and management decision support tools that are vital for the Nation’s environment, economy, safety, and security.

NASA also is working with NOAA and interagency forums to transition mature research capabilities to operational systems … and to utilize fully those assets for research purposes.
State of the Program

Sound, collaborative foundation

Remarkable progress, challenges, and opportunities

State of the Program Manager

Humbled and appreciative