NASA Sensors For CounterTerrorism

Merle McKenzie
Minoo Dastoor

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- NASA Sensor Technology Areas: Interests In Partnering
- Examples Of NASA Sensor Technology
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Needs For Sensors In Counterterrorism: High Level Examples

- Detection, Measurement And Characterization Of Chemical, Radiological, Biological And Toxic Industrial Agents
  - Entry Point Screening Systems To Detect Biological/Chemical Devices
  - Rapid Warning Of Pre-Release Biological, Chemical, Or Toxic Industrial Chemicals
  - Systems To Locate Source Of Released Agents
- Long-Range Monitoring Of Geographic Areas
- Platforms To Deploy Sensors
- Support Systems
  - Communications
  - Data Mining And Analysis
  - Simulation And Modeling
  - Warning Systems
  - Response Planning
**NASA Sensor Technology Areas: NASA Interests In Partnering**

**Explosives And Vapor Detection**

- Imaging Technologies
  - Near/Mid-Term
    - Reverse Geometry X-Ray
    - UV Induced Fluorescence
  - Far-Term
    - Terahertz Electromagnetic Imaging
- Miniature Mass Spectrometry
  - Near/Mid-Term
    - Quadrupole Mass Spectrometer Array
    - Paul Ion Trap
    - Both With Miniature Gas-Chromatograph Front End
  - Reversal Electron Attachment Detector (READ)
- Raman Spectroscopy
  - Near/Mid-Term
    - Mars Microbeam Raman Spectrometer
    - UV Resonance Raman Spectrometer
Chemical Detectors
- Smart Micro/Nano Sensors
  - Near/Mid-Term
    - Electronic Nose
    - Sensor Webs
  - Far-Term
    - Integrated Advanced Sensing, Imaging And Monitoring Techniques Into Micro-Robots
- IR Gas Correlation/Differential Absorption Spectroscopy (Near/Mid-Term)
- Infrared Laser Radar (IR-Lidar)
  - Far-Term
    - Tunable Infrared Lasers
NASA Sensor Technology Areas: NASA Interests In Partnering

Biological Detection:

Collection And Concentration Of Samples Is An Issue

- Near/Mid-Term
  - Expertise In Miniaturization And Systems Integration Can Advance The State Of The Art
- Far-Term: Modification Of Detectors For Explosives And Chemical Agents
  - UV Induced Fluorescence
  - Chemiluminescence
  - Miniature Mass Spectrometry With READ Interface
  - New Smart Sensors Directed Toward Quantum Effects
Examples of NASA Sensor Technology

- Miniature Mass Spectrometers: Jet Propulsion Laboratory
- Miniature Reversal Electron Attachment (READ): Jet Propulsion Laboratory
- Sensor Webs: Jet Propulsion Laboratory
- Aircraft Systems Hardening: Distributed Multifunctional Sensor System For Air Quality Monitoring And Real-Time Cabin/Cargo Bay Surveillance: Glenn Research Center
- Airport Security Protections: Smart Micro/Nano Sensor For Integrated Chemical, Biological, And Explosive Detection: Glenn Research Center
- Mobile Sensing Platform For Improved Baggage Inspection: Glenn Research Center
- Remote Chemical Detection: Langley Research Center
**Points Of Contact At NASA**

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<thead>
<tr>
<th>Location</th>
<th>Name</th>
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<tbody>
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NCTMT Quarterly

NCTMT National Security / Counterterrorism Activity

Merle McKenzie
August 16, 2002
Topics

- Status
- New Security Lead for NASA
- Current Plan
- Membership on the NCTMT Security / Counterterrorism Subteam
Plan for FY02

For the National Security/Counterterrorism Support Work by the Commercial Technology Network for Various Enterprises

1. Choose sub-area for FY02 sensors
2. Determine the interests of the codes
   - R: NASA/FAA agreement
     i. Sensors
   - S: Will support discussions with other Federal Agencies
     i. Sensors
   - Y: tbd
3. Determine interest of Code A
   - Want a NASA-wide effort regarding technology – not sure what yet
   - Support Center efforts
4. Decision: for FY02 remainder
   - Acquire technology lists from all Centers
   - Do a technology assessment on sensors proposed by Centers
   - Compare NASA technologies to those on the market; those being developed
   - Concurrently, continue to research
     i. Federal funding
     ii. Goals of Agencies
     iii. Use needs especially first responders
   - Report to the Codes and NASA HQ on: What NASA has to offer in sensors to the other agencies
     1) Individual technologies
     2) Clustered technologies
     3) Clustered capabilities
   - Concurrently, begin outreach to companies so that they know what NASA has to offer
• Chose “Sensors” as first Technology (for FY02)
• Determined interests of some Codes
  • Code R: NASA/FAA Agreement which is proceeding
  • Code S: Will support NCTMT in working with other agencies
  • Code A: New Leader is Dr. Amy Donohue
• Received sensor technology lists from 4 Centers
• Received technology assessments on 3 JPL test cases
• Will receive Partner Assessments on test cases
• Continue to Research: funding, requirements, first responder community
• Began outreach to companies at the NASA Sensor Conference
Encouraging News

- Great connections through the Network assets
  - MCRTTC: the National Emergency Response Training Center
    - Fire-fighter training – specialty teams
    - Facility for terrorism scenario simulation: 30 buildings
    - Possible test-bed for new technologies
  - NERTTC
    - Critical Incident Command
    - Facial/Biometric Recognition (through an SBIR company)
    - All RTTC-FLC Firefighters Initiative
  - NTTC
    - FEMA technology transfer responsibility
    - NIJ spin-off
  - L.A. County Terrorism Early Warning Group (TEWG) through JPL Testbed MOU
- Strong technologies and experience in the Centers
  - JSC: Firefighter suits, Communications, etc.
  - GSFC: Earth Alert System, etc.
  - AMES: Aeronautics applications, Re-hydration systems, NASA Research Park, etc.
  - LaRC: Aeronautics applications, sensors, etc.
  - Glenn: Aeronautics applications, sensors, etc.
  - JPL: Sensors, robotics, work for Federal Agencies, etc.
  - ETC! All Centers do have technology, capability, and systems abilities to offer
NASA Sensors For Counterterrorism

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July 29-30, 2002
Baltimore, Md

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Generic Sensor Architecture

**Alarm**
- Electronic Nose
- Particle Counter
- Fluorescence

**Analysis**
- Biological:
  - DNA / Protein / Antibody / Tissue
- Chemical:
  - MS / IS / IR / SAW / Raman

**Detection Systems**

- Miniature
- Distributed
- Autonomous
- Real Time
- Continuous
- Cheap
- Networked

- High precision
  - Chemical: ppb-ppt
  - Biological: ~10 cells/well
- Rapid [1-2 hrs]
- Medically Safe
- Automated Sample Collection & Preparation
- Human-Centered Output
NASA Sensor Technology Areas: NASA Interests In Partnering

Explosives And Vapor Detection

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  - Reverse Geometry X-Ray (Near/Mid-Term)
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- Raman Spectroscopy
  - Mars Microbeam Raman Spectrometer (Near/Mid-Term)
  - UV Resonance Raman Spectrometer (Near/Mid-Term)
NASA Sensor Technology Areas: NASA Interests In Partnering

Chemical Detectors

- Smart Micro/Nano Sensors
  - Electronic Nose (Near/Mid-Term)
  - Sensor Webs (Near/Mid-Term)
  - Integrated Advanced Sensing, Imaging and Monitoring Techniques onto Micro-Robots (Far-Term)
- IR Gas Correlation/Differential Absorption Spectroscopy (Near/Mid-Term)
- Miniature Mass Spectrometry with The Paul Ion Trap and the READ Front End (Near/Mid-Term)
- Infrared Laser Radar (IR-LIDAR)
  - Tunable Infrared Lasers (Far-Term)
NASA Sensor Technology Areas: NASA Interests In Partnering

Biological Detectors:

Collection and concentration of samples is an issue

- Expertise in miniaturization and systems integration can advance the state of the art

- Modification of chemical and explosives detectors for biologic agents (Far-Term)
  - UV Induced Fluorescence
  - Chemiluminescence
  - Miniature Mass Spectrometry with READ Interface
  - New smart sensors directed toward Quantum effects
Examples of NASA Sensor Technology

Goddard Space Flight Center

*Capaciflector-based Technology For Advanced Capacitive Sensing:*
Self-sensing System For Clandestine Security

*Multifrequency-scanning Capaciflector:*
Sensor Applicable To Weapon Or Explosive Detection; Motion Detection

*UV Laser Micro-machining Of Micro-Well Detectors:*
Inspection, Monitoring Of Radioactive Material; Environmental Monitoring; Food Inspection

*Cadmium Zinc Telluride Strip Detectors And Detector Arrays:*
Baggage Scanners, Nuclear Surveillance, Environmental Monitoring

*MEMS Fabry-Perot Tunable Filter For Near-Infrared Imagery:*
Material Composition; Composite Material Identification

*Integrated Sol-gel Fiber Optic Device For Space Flight*
Biohazard Analysis

Jet Propulsion Laboratory

*Miniature Mass Spectrometers:*
Explosive, Chemical, And Potential Biological Agent Detection

*Miniature Reversal Electron Attachment (READ) For Generating Near Zero-energy Electrons At A Target Gas Beam*
Front-end For Mass Spectrometers To Detect Explosive, Nerve, And Blister Agents

*Sensor Webs:*
A System Of Distributed, Heterogeneous Sensors For Hazard Detection In Hostile Environments
Examples of NASA Sensor Technology (Continued)

John H. Glenn Research Center at Lewis Field

**Aircraft System Hardening**
Distributed Multifunctional Sensor System For Air Quality Monitoring And Real-time Cabin/Cargo Bay Surveillance

**Airport Security Protections:**
Smart Micro-nano Sensor For Integrated Chemical, Biological, And Explosive Detection

**Mobile Sensing Platform**
Improved Baggage Inspection Through Sensor Arrays Tailored To Security Needs

Langley Research Center

**Chemical Weapons Detector:**
A Gas Filter Correlation Radiometer

**Personal Emergency Beacon Receiver** (Motorola Co-Invention)
New Security Lead for NASA

Amy Donahue

Here to choose OK what to do.

Wants:
1. What do we have?
2. What can it offer?
3. What could we do in sequence?

Work:
1. 10 Cents
2. Code I (eg. Tec Companion)
3. Other Agencies
Plan for FY03

- Re-initiate the Team
  - Members
- Goals and Plans
  - Technology
  - Market position
  - Potential partners
  - Find funding
  - Develop partnerships
- Coordinate with Enterprise Agreements/Activities
- Coordinate with Marketing Team efforts
Participants So Far
(not comprehensive list)

Ames: Carolina Blake
Dryden: Yvonne Kellogg
GSFC: Nona Cheeks / Monica Montague
JPL: Merrilee Fellows
Glenn: Larry Viterna / Bill Saettel
JSC: Jim Aliberti
KSC: Preston Carraway / Rheal Turcotte / Marisol Garcia
MSFC: Vernatto McMillan
Stennis: Kirk Sharp
HQ: Michael Weingarten
NTTC: Joe Allen / Malcolm Webster
FWRTTC: Ken Dozier / Marty Zeller
Mid-Atlantic RTTC: Charlie Blankenship
Mid-Continent RTTC: Gary Seral
Midwest RTTC: Pierrette Woodford / David Salay
Northwest NTTC: Tom Kennedy
Southeast RTTC: David Bridges
RTI: Dan Winfield / Gary Hughes

Please verify your interest