How to Better Support the Need for Quick Reaction Capabilities in an Irregular Warfare Environment

Quick Reaction and Rapid Reaction Funds

"Breaking the Terrorist/Insurgency Cycle"

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Rapid Reaction Technology Office (RRTO)

- **Quick Reaction Special Projects**
  - **QRF**
  - **RRF**

- **Emerging Capabilities Fund**

- **Open Business Cell**

- **Test / Demonstration Opportunities**

- **Contact Info**

Quick Reaction Special Projects (QRSP)

- ✦ <u>Program Motivation:</u> Technology cycle time is as short as 12-18 months in some technologies; adversaries and peers are not bound by a two-year budget process. QRSP allows:

    - ✛ DoD to Apply Small Amounts of funding to
        - ✧ Provide technology for new capability options for Combatant Commands
        - ✧ Accelerate or spur technology options for insertion into acquisition programs
        - ✧ Rapidly develop technology to provide capability options to counter adversaries operational capability
        - ✧ Jump start discrete demonstrations to counter new adversary capabilities
    - ✛ Defined deliverables in less than standard S&T program

- ✦ <u>Approach:</u> QRSP is comprised of complementary projects that address different aspects of the maturity / cycle time space

    - ✛ **Quick Reaction Fund** (Project 826) – Focus is on shorter cycle time Conventional Forces
    - ✛ **Rapid Reaction Fund** (Project 828) – Focus is on Technologies Addressing Counter Terrorism / Counterinsurgency

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Quick Reaction Fund (QRF)

- **Description**
  - Managed by DDR&E Plans and Programs
  - Focus on responding to emergent needs during the execution years that take advantage of breakthroughs in rapidly evolving technologies.

- **Goal:**
  - Accelerate promising research that will enable transformation or fill critical gaps in DoD acquisition programs.
  - Maturation of technologies critically needed by combatant commanders for operation.
  - Typically these projects are on the technology maturity scale where an idea or technology opportunity is proven and demonstrated.
  - Projects will last no longer than 12 months.

- **Key Technology Areas**
  - Lightweight armor (personnel & vehicle)
  - Data link and Network interoperability
  - Reduced logistics costs
  - Potential "Red Team" activity
  - Spectrum and information management
  - Reduced unanticipated risk in acquisition programs

- **Transition opportunities are realized when the technology is demonstrated**
  - Moved into an acquisition program of record
  - Technology has been demonstrated and made available via
    - GSA schedule, Deploy in AOR, Letters of Availability, etc.
  - Technology is demonstrated and testing continues for other applications

USMC M1A1 Rear Sensor (QRF)

**Rear Sensor
replaces
existing taillight**

Project Description/Objective

The Tank Commander is exposed to enemy fire when the tank is backing up.

This effort integrated a rear thermal sensor into the tail light of the USMC M1A1 Main Battle Tank.

The rear sensor image is displayed to the driver in a field of view that covers the entire rear of the tank and enables him to know the distance to Marines (on the ground), obstacles, and objects up to 150 meters.

Key Accomplishments/Outcomes

All lab testing has been completed. Rear Sensor integrated into tail light with Driver Display integrated into Driver's Compartment.

Two prototype units were tested in the Joint Assault Bridge. Minor improvements were identified and will be incorporated into the production units.

Deliverables

- QRF Deliverables
  - Seven Rear Sensor Systems
  - Lab Test Report on the Rear Sensor and Display
  - Field Test Report on the M1A1 with Rear Sensor

- Production
  - USMC Systems   447

Gunslinger (QRF)

Project Description/Objective

- Gunslinger is the spiral development of a modular, vehicle based, on-the-move hostile fire detection and counter-fire capability.

- Gunslinger Spiral 2 (GS-2) system was integrated onto a modified MXT-MV truck for deployment to Iraq.

- GS-2 is a hostile fire detection system capable of detecting enemy fire, targeting the source, and returning fire.

Key Accomplishments/Outcomes

- System was operationally deployed and provided a capability that did not exist.

- The Remote Gun and high end sensors (especially FLIR) operated 7 days (12-16 hrs/day)

- Gunslinger completed its operational experimentation in support of OIF in September 2007.

- The system remained fully functional throughout the deployment cycle and logged hundreds of missions and thousands of hours.

Deliverables

- Deliverable: GS-2 on-the-move hostile fire detection and counter-fire system.

- GS-2 transitioned to the USMC for operational use in Iraq.

- GS-3, and a remotely controlled version for integration onto an unmanned boat, Unmanned Surface Vehicle Spiral 1 (USV-1).

- USV-1 will transition to PM Robotic Systems JPO.

- Gunslinger systems are being considered for deployment by the Naval Expeditionary Combat Command for naval costal warfare, riverine operations, and expeditionary operations ashore.

Deployable Satellite Communication System (QRF)

Inflatable Antenna during 1-to-1 testing at SOCSOUTH

Project Description/Objective

⊕ Effort is field-deploying innovative, *inflatable* satellite antenna, designed to provide high-bandwidth SATCOM capability in a smaller, lighter package than conventional systems.

⊕ Objective is to increase deployable aperture (dish size) for greater reliability, higher bandwidth and improved portability <u>while</u> lowering transportation and operation costs.

Key Accomplishments/Outcomes

⊕ Enabled testing to verify design and performance criteria.

⊕ Delivered initial units to integrating command and trained operators.

⊕ Supported shore-to-ship communications for 2007 USNS Comfort mission to South America.

⊕ Demonstrated interoperability with existing Joint Communication Support Element (JCSE) baseband equipment.

Deliverables

⊕ 5 systems for utilization by Special Operations Command South operators in exercises and missions within the command's AOR.

⊕ 5 systems for alternate deployment sites and technical evaluation.

⊕ Technology development / fielding plan, and rapid prototype development.

⊕ Product integration / documentation / training.

⊕ User support, evaluation and reporting.

Rapid Reaction Fund (RRF)

- **Description**
  - **Managed by DDR&E's Rapid Reaction Technology Office (RRTO)**
  - **Focus primarily on 6-18 month timeframe for development through a supporting spiral development approach.**
- **Objectives**
  - **Leverage all the DoD science and technology base and those of other Federal Departments**
  - **Stimulate interagency coordination and cooperation**
  - **Identify and examine technological and organizational impacts of emerging and potential, future military issues**
  - **Anticipate adversaries' exploitation of technology, including available and advanced capabilities.**
  - **Provide input and feedback to guide long-term science and technology investments**
  - **Identify and exploit technology developed outside of DoD in the commercial sector, in academia and internationally**
  - **Accelerate fielding of affordable, sustainable capabilities and concepts to counter emerging threats**

RRTO Developing Focus Areas

- During the past four years the following areas have become the focus for significant S&T Investments:
  - Biometrics & Forensics
  - Ground Based Electronic Warfare
  - Electromagnetic spectrum Monitoring and Management in Urban Environments
  - Cultural & Social Understanding and Modeling
  - Strategic Communications
  - Surveillance & Reconnaissance for CI/CT
- What are the emerging areas which will require S&T Investments?
  - Language Translation Capabilities?
 - Non-Kinetic Capabilities?
  - Large Data Handling and Analysis?

- **Identify critical focus areas**
- **Mitigating factors**
  - **Potential drawdown / refocus from current areas of emphasis**
  - **Services recapitalization challenges**
  - **Future levels of defense spending**
  - **Re-examination of Irregular Warfare strategy**
  - **Global insurgency / terrorist challenges**
  - **Competition for resources: energy, food and water**
  - **Geographic access**
  - **Smaller but networked terrorist groups**
  - **Terrorist and criminal groups and organizations affiliations**
- **Actions**
  - **Expand Irregular Warfare focus beyond Afghanistan / Iraq**
  - **Examine terrorist / criminal interfaces**
  - **Develop non-kinetic capabilities including support for strategic communications**
  - **Increase interagency coordination**

RRTO Fiscal Year 2009 Focus Areas

- **Thunderstorm and surveillance system testing**
- **The interface of law enforcement and military operations**
- **Strategic Communication and Influence Operations**
- **Interagency coordination**
- **Biometrics and forensics capability development**
- **Establish an open business cell**
- **Capabilities to support denied area operations**
- **Small dispersed unit operations**
- **Autonomous system operations**
- **Strategic Multi-Layer Assessment**
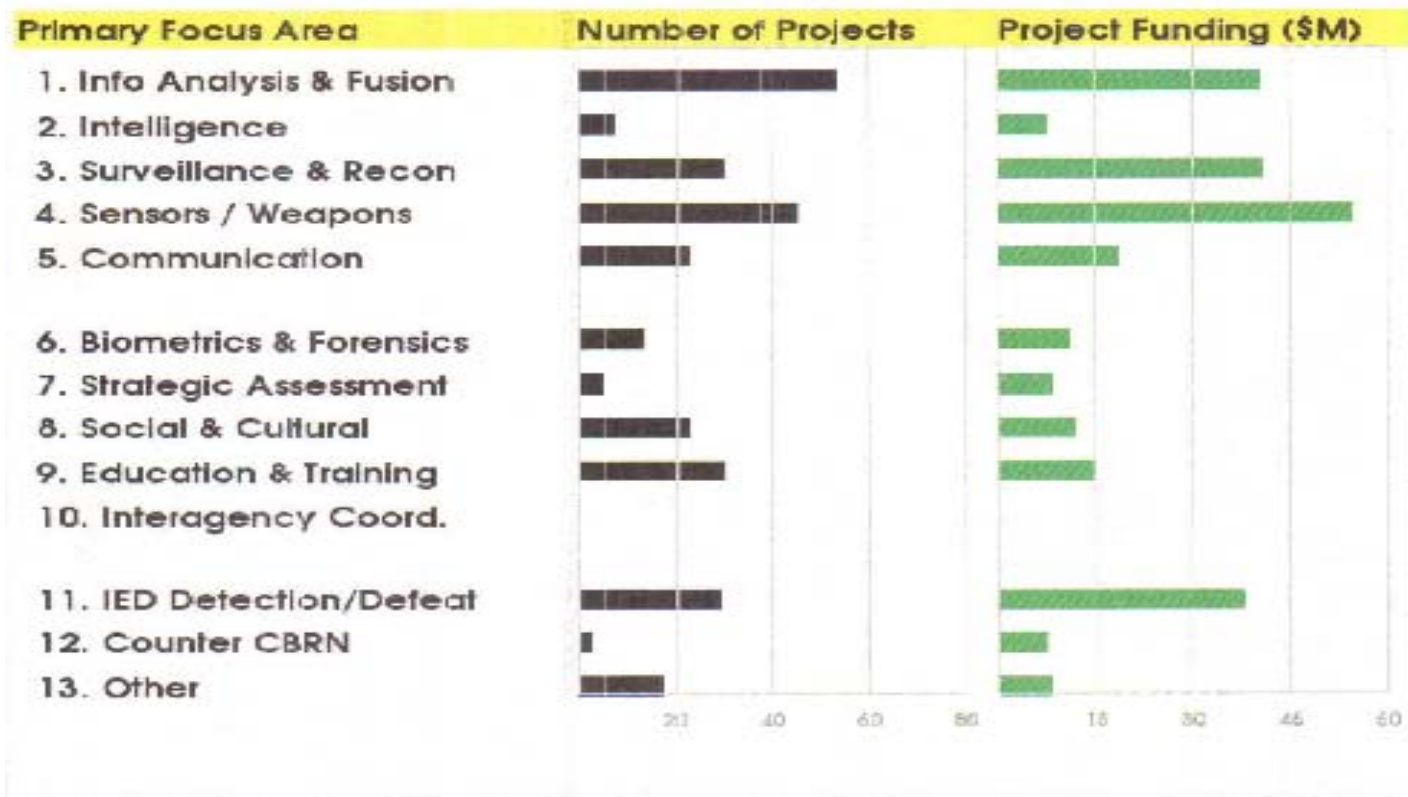
306 Projects from FY 04 to FY09

Link 16 Multi-role Adaptable Xceiver (MAX) (RRF)

Technology / Key Deliverables

- Dual Channel Link 16 Radio Terminal (Link 16, UHF or SATCOM)
- SCA compliant waveform with JANUS Crypto Chip
- Falconview software integration for SOF applications
- Targeting capability
- Watertight Pelican Case configuration for harsh environment portability
- Multiple power source adaptability (including 5590 battery operation)
- Integration of weather, AIS and FAA traffic software applications
- Integrated GPS feature and multiple display option capability
- Chat and mission execution features
- Small form factor for
    - SPECWAR and Riverine watercraft
    - Disadvantaged aircraft (MV-22, OH-6, MH-60, AV-8, CH-53)
    - UAV and non-traditional ISR platforms
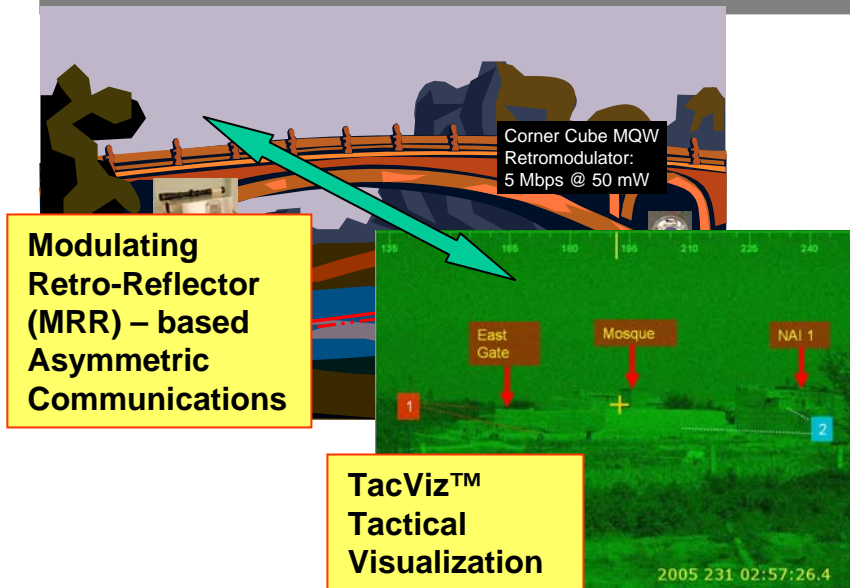   - AFSB (Amphibs & LCU/RHIB watercraft)

Description

Link 16 is currently fielded with a variety of USAF, USMC and USN platforms and provides unprecedented data and Situational Awareness (SA) to platforms capable of hosting the relatively large MIDS or JTIDS terminals needed to join the Link 16 net. MAX provides Link 16 capability in a small form factor thus enabling platforms and units heretofore unable to have access to the Link 16 and its robust ability to provide a jam resistant reliable situational awareness and Data exchange capability to disadvantaged warfighters. MAX L16 provides capability to operate in ground, air and sea applications as a standalone configuration or integrated into existing displays. Addresses standing ODR from SOF Community and leverages USAF single channel WDL L16 terminal ATD and Rockwell Collins IR&D investments.

Schedule/Phases

- **Phase I**
    - JANUS Chip certification
    - Dual Channel terminal development
    - SW additions (AIS, FAA traffic, targeting, WX)
    - Combat Validation Using "Time to Kill" Metric in SOF CAS scenario
- **Phase II**
    - Dual Channel terminal configuration demo
    - Software integration
    - Man portable configuration development

TINA: Tactical Infra-red Networked Awareness (RRF)

Modulating Retro-Reflector (MRR) – based Asymmetric Communications

Corner Cube MQW Retromodulator: 5 Mbps @ 50 mW

TacViz™ Tactical Visualization

Objectives:

- Improve situational awareness for operators

- Enables covert, compact, high bandwidth means to harvest

data quickly

Payoff:

A fieldable means to quickly and covertly acquire and understand data from remotely placed sensors where the information is enhanced by location, orientation, and other relevant metadata; units now can quickly locate and harvest

Description: TINA takes advantage of significant DOD investment in communications and visualization technologies to integrate the MRR long-range asymmetric communication technology with the TacViz™ tactical data visualization tool. The new system will provide an advanced reconnaissance asset that will allow operators to access, collect, and understand data from various remote sensors.

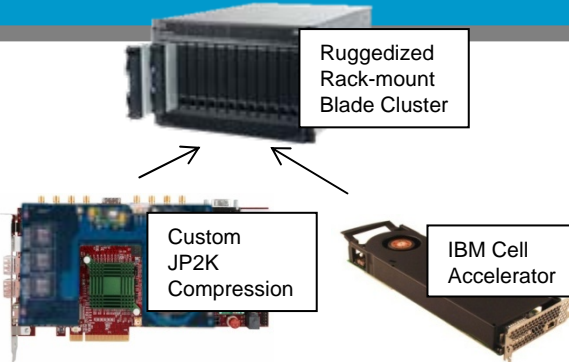**Key Participants**: OSD, NRL, SOCOM

Milestones / Deliverables

⊕ Define Interface Requirements: TACVIZ & MRR System (MRR terminal & Interrogator)

⊕ Interface TACVIZ w/sensor

⊕ Drive MRR with enhanced data

⊕ Integration tests at CBD (iterative)

⊕ Two Demonstrations at CBD

⊕ Develop integration plan for TENCAP experiment if TENCAP proposal is awarded

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MASIVS: Giga-pixel Video Onboard Processing (RRF)

MASIVS Sensor

8"
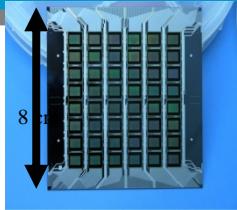
Giga-pixel Video Processor

Ruggedized Rack-mount Blade Cluster

Custom JP2K Compression

IBM Cell Accelerator

Enabling wide area electro-optical persistent surveillance

Technology

- **Novel Giga-pixel-scale processing:**
  - **MASIVS - 880 Mpixel, 2fps, color**
  - **Onboard stabilization, detection, compression utilizing IBM Cell processor**

Capability:

- FY08: 220 Mpixel color - compression & stabilization
- FY09: 880 Mpixel color - compression, stabilization and detection

Key Participants

- **MIT/LL: Development of Hardware, Algorithms & Software**

- **ARMY / Air Force: Operational deployment**

Key Deliverables

- **Flight demonstration**

Key Deliverables

880 mega-pixel camera system
Documentation on integration and calibration test results
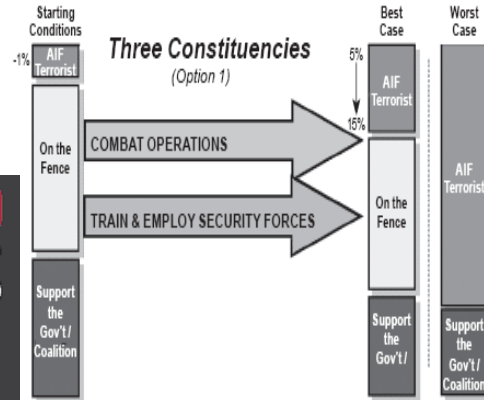**Ruggedized for field deployment**

Milestones Leading to Fielded Capability

- **February / June engineering flights**   **FY08**
- **First quarter full capability test flight**   **FY09**
- **Ruggedization and deployment**   **FY09**

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MEASURING PROGRESS IN CONFLICT ENVIRONMENTS (MPICE) (RRF)

(From Chiarelli, "Winning the Peace," July/Aug 2005)

Objectives

⊕ **Develop a comprehensive measures and metrics framework**

⊕ **Provide conflict transformation baseline capability**

⊕ **Support policymakers and planners at the Joint Task Force and Country Team level**

⊕ **Develop an understanding of illicit power structures in SRO situations to strengthen strategy development**

Description: Develop an integrated system and definitive guidelines for baseline assessment, measurement and monitoring of conflict transformation. Define an application methodology and test against relevant and critical case studies.
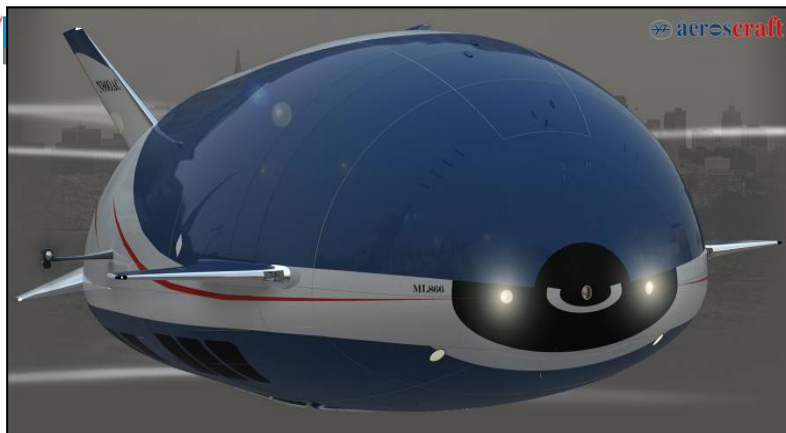
Key Participants: USAID, S/CRS, JCS J5, PKSOI, OUSD(I)

Key Deliverables: Conflict Transformation Measurement Tool and Methodology; Illicit Power Structure Taxonomy

Milestones / Steps Leading to Fielding Capability

⊕ **Initial metric framework report**

⊕ **Preliminary conflict transformation measurement tool**

⊕ **CONUS-based analysis report for Iraq & Afghanistan**

⊕ **Conflict baseline report**

⊕ **Data fusion methodology, results**

⊕ **Integrated conflict transformation measurement tool**

Emerging Capabilities Fund

- ✦ **Purpose: Anticipate and inform the JCIDS and acquisition processes through risk-reducing prototypes and advanced capability development activities with emphasis on inter-agency cooperation**

- ✦ **Goals:**

  - ✦ **Increase visibility into inter-agency capability gaps of concern to DOD with leveraged funding to stimulate cooperation and develop capabilities**

  - ✦ **COCOMs, Services, and Defense Agencies benefit from risk-reduction prototyping and experimentation in advance of (or in conjunction with) formal acquisition programs**

  - ✦ **Increase access to inter-agency S&T programs**

  - ✦ **Prototypes with military utility provided to COCOM, Service, or Defense Agency for further development or experiments**

Project Pelican
Rigid Aeroshell Variable-Buoyancy (RAVB)

Energy-Efficient, High-Capacity, Direct Delivery Airlift

Technology / Product
- Rigid structure, ballast-independent vertical takeoff/landing air vehicle with vastly improved energy efficiency
- Capable of unimproved surface/water operations

The So What
- Will reduce airlift energy use per ton-mile to commercial trucking levels
- Will enable heavy-lift air access to austere regions with little infrastructure
- Will enable direct delivery, cutting in-transit times from point-of-origin to point-of-need
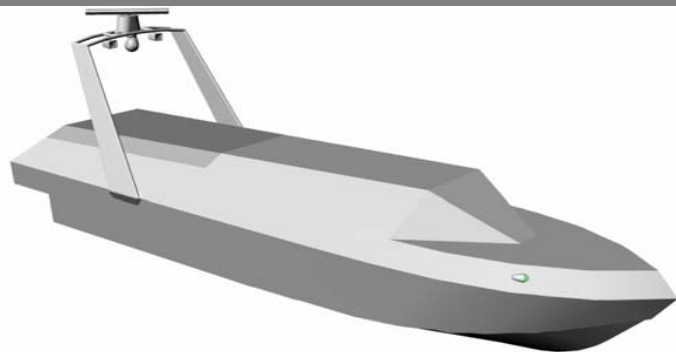
Key Participants
- Gov't Contributors: NASA, Aerospace Corp
- Industry: Aeros Aeronautical Systems Corporation
- Operational Advocate: USEUCOM

Key Deliverables
- Scaleable prototype RAVB air vehicle
- Ground and flight test data
- Evaluation of scaleability and technical risks for full-scale articles

Milestones Leading to Prototype Delivery

- Program milestones (FY09 increment)
  - Subsystem component demos   ongoing
  - Conceptual design   1 Aug 09

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Griffin USV

Technology / Product

- Software supporting autonomous 24 hour patrol under controlled conditions
- Extensible Mission Package implementation software
- Capable of cooperative operation between USVs

The So What

- Autonomy remains critical missing piece in unmanned systems
- Reduced manning for unmanned systems, currently approx 2x manned requirements

Multiple autonomous USVs cooperating to complete a basic MDA patrol

Project description: Develop and install autonomous C2 system on two current USVs which will permit the unmanned systems to execute a MDA task cooperatively

Key Participants
Sponsor(s): OSD/RRTO, NSWC Carderock
Gov't Contributors: NSWC Dahlgren
Industry: PSU's Applied Research Lab, TSI

Key Deliverables:
Software and hardware installed on 2 USV Demonstrators
Extensible Mission Package software
Training / CONOPS manuals
Safety release for UAS, SSSTRP accreditation

Milestones Leading to Fielded Capability

- Intelligent Controller Framework S/W
- Extensible Mission Package S/W
- Safety Release/Software Reliability
- Underway Testing

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Open Business Cell

- **Established in February 2009**
- **Pilot project that seeks to engage nontraditional performers to solve some of DoD's needs**
- **"Technology Brokers" are facilitators and guides to shepherd non-traditional performers through prototype development and testing**
- **Contracting cell using Other Transaction Authorities (OTAs) to establish prototype/proof of concept programs**
- **www.DefenseSolutions.gov provides background and clear instruction on how to submit a proposal.**
- **Current focus is on Battlefield Forensics.**
    - **Large data analysis**
    - **Autonomous control of UAVs / USVs**

- **October 2003. The IED challenge emerges.**
  - **The first thing we need is a "representative" test site in which to examine systems.**
- **23 Dec 2003: Construction on the Joint Experimental Range Complex (JERC) begins in Yuma.**
  - **ATEC Yuma**
  - **Naval Air Systems Command Special Projects**
  - **CTTTF**
- **15 Jan 2004: First testing at new JERC facility in Yuma.**
- **Aug 2004: 'What are you doing to test systems?'**
  - **Commander CENTCOM to the Joint IED Task Force**
- **Nov 2005: Idea of National Counter Insurgency/Counter Terrorism Test Facility**
  - **CTTTF cedes Yuma to Joint IED Task Force and Joint IED Defeat Organization**
- **2005-Present. CTTTF/RRTO maintains test windows at Yuma for testing.**
  - **Support to industry, labs and academia with an emphasis on small vendors.**
  - **RRTO provides test director, facility use, testing support and archives test reports.**
  - **Testing status reviewed at regular Force Protection VTCs**
  - **To date 250 systems have been tested at the JERC under CTTTF/RRTO sponsorship**

- **Sixty day proof of concept that focused ISR assets on a 20 km road segment to detect IEDs and IED emplacement activities**
- **Employed a "persistent surveillance" approach with multiple sensors including:**
    - **EO / IR**
    - **SAR**
- **Manually fused numerous ISR inputs and developed capabilities to move large amounts of data from theater to CONUS.**
- **Identified numerous items of interest, none of which were confirmed as IEDs.**
- **IED Blitz assessed as a failure.**
- **The IED Blitz identified challenges associated with conducting persistent surveillance and led to development of numerous effective capabilities.**
    - **GMTI**
    - **Sonoma / Constant Hawk**
    - **FOPEN**
    - **SIGINT TIVO**
    - **FADE**
    - **LIDAR**
    - **COIC**
    - **SAR CCD**
    - **Bluegrass**
    - **Thunderstorm**

> **Does the department need a venue to conduct high risk enterprises/experiments to capture constructive lessons learned?**

- **Dec 2006: S&T Division of the former Office of Force Transformation assigned to RRTO**
  - **Tactical Relay Mirror System**
  - **Operationally Responsive Space**
  - **Project Wolf Pack**
  - **Stiletto**
- **Stiletto proposed as an operational demonstration platform with potential application to future Navy missions. Not embraced by the Navy.**
- **Under RRTO sponsorship:**
  - **Avoid trying to force the Navy to embrace Stiletto**
  - **Focus on establishing Stiletto as a "test platform" with outreach to laboratories and industry. A maritime environment test bed (at no cost to users) without the paperwork associated with traditional test venues.**
- **Summer 2008: Deploys to Cartegena, Columbia with 10 vendor and "test" systems aboard.**
  - **OPCON – SOUTHCOM   TACON – JIATF-South**
- **Jun 2009: Incorporate into Project Thunderstorm and redeploy to SOUTHCOM AOR.**

RRTO "Testing History" Bluegrass

- **RRTO has been the initial funder / fielder of a number of surveillance capabilities.**
  - Derived from the IED Blitz in the fall of 2004
  - GMTI backtracking with JSTARS and P-3 LSRS
  - Sonoma, Mohawk Stare, Constant Hawk wide area electro-optic surveillance
- **We continue to develop systems to enhance the base surveillance capabilities.**
- **There is no "organized" investment to improve the analytic capabilities of GMTI and wide area EO. Most analysis is manual and time consuming**
- **Project Bluegrass: Develop a data set, with ground truth of GMTI and EO to facilitate future tool and capability development to exploit wide area surveillance systems.**
  - Participants included: RRTO, CIA (OCS), NSA and DTRA.
  - MIT/LL functioned as Test Director
  - Data available at no charge to government laboratories and industry for capability development.
  - RRTO and CIA approve each data release.
- **7 Oct 2008: BAA released through TSWG with a series of Bluegrass "Challenge Problems."**

- **Support Service / Coalition / Interagency efforts to enhance <u>small unit</u> ground force operations across a spectrum of mission profiles and environments.**
- **Identify, integrate and assess emerging but relatively mature concepts and technologies that are sustainable and deployable.**
  - **Focus on communications**
  - **Produce prototype support equipment for field experimetation**
- **Partners include:**
  - **USMC**
  - **US Army**
  - **JFCOM**
  - **USNORTHCOM**
  - **DHS S&T**
  - **Joint Non-Lethal Weapons Office**
  - **Technical Support Working Group**
  - **Australian Army**
  - **Israeli Ministry of Defense**

RRTO "Testing History" Thunderstorm

- **Operational outgrowth of Project Bluegrass**
- **Goal is to establish an enduring multi-int ISR test bed focused on the JIATF-S AOR to exercise evolving architectures, emerging capabilities and transformational concepts**
  - **Demo new capabilities**
  - **Provide relevant intelligence**
  - **Encourage greater cooperation**
  - **Identify ISR CONOP improvements**
  - **Make data available**
- **Exercise with a series of ongoing spirals**
- **MIT/LL acting as test director**
- **Participants in initial spirals include:**
  - **JIATF-S**
  - **CIA**
  - **NSA**
  - **NRO**
  - **DHS**
  - **Industry partners**

Submission Routes

- **Quick Reaction Fund**
  - **DDRE@dtic.mil**

- **Rapid Reaction Fund**
  - **RRTO@dtic.mil**

- **Emerging Capabilities Fund**
  - **RRTO@dtic.mil**

- **Open Business Cell**
  - **www.DefenseSolutions.gov**

- **JERC / Stiletto / Bluegrass Data / Wolf Pack / Thunderstorm**
  - **Glenn.Fogg@osd.mil**