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# NPS Field Experimentation Program for Special Operations (FEPSO) TNT 13-3 Final Report

Buettner, Raymond R.; Oros, Carl; Meyer, Ramsey; Turley, Nelly  
Monterey, California. Naval Postgraduate School

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**NAVAL  
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**MONTEREY, CALIFORNIA**

**NPS FIELD EXPERIMENTATION PROGRAM FOR SPECIAL  
OPERATIONS (FEPSO) TNT 13-3 FINAL REPORT**

by

Dr. Raymond R. Buettner  
Carl Oros  
Ramsey Meyer  
Nelly Turley

June 2013

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Prepared for: Naval Postgraduate School, Monterey, CA

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<b>14. ABSTRACT</b> The NPS Field Experimentation Program was initiated in FY02 to provide an opportunity for NPS faculty and students to evaluate new technologies from their research in a field environment. These efforts were continued and integrated to create a cooperative effort with USSOCOM (S&T and J9) that began in FY03. TNT 13-3 marked the end this decade long USSOCOM-NPS field experimentation cooperative. This technical report serves to document this final event. This report provides a consolidated analysis of event statistics and technological trends, to include unmanned autonomous system (UxS) activities from 2010 to 2013. The appendixes contain the Request for Information (RFI), list of experiments and schedule, experiment descriptions and after action reports. With the exception of the appendixes, this document reflects the opinions of the authors and does not represent the official policy or position of the Naval Postgraduate School, the United States Navy, or any other government organization. The data in the appendixes were provided by the participants and have only been edited for clarity. Appendixes C & D are Distribution B and will be published via a separate report.					
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**NAVAL POSTGRADUATE SCHOOL  
Monterey, California 93943-5000**

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The report entitled “*NPS Field Experimentation Program for Special Operations (FEPSO) TNT 13-3 Final Report*” was prepared for and funded by the Naval Postgraduate School.

**Further distribution of all or part of this report is authorized.**

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November 2013

The Naval Postgraduate School (NPS) Field Experimentation Program was initiated in Fiscal Year 2002 (FY02) to provide an opportunity for NPS faculty and students to evaluate new technologies from their research in a field environment. These efforts were continued and integrated to create a cooperative effort with US Special Operations Command (USSOCOM) (J9) that began in FY03. This cooperative was originally known as Surveillance and Targeting Acquisition Network, or STAN for short, and was eventually renamed Tactical Network Testbed, or TNT, in early 2004. STAN/TNT originated out of a NPS Defense Analysis (DA) masters thesis<sup>1</sup> that focused on the “integration of [a] tetherless transmit/receive link[s] between soldiers, tactical vehicles, ground sensors, manned and unmanned platforms to push/pull secure voice, data, and video to USSOCOM components” (Manuel, Murphy and Paxton, 2004, p. V). What initially started as a handful of NPS students, a few USSOCOM funded contractors, and \$300K, eventually evolved into a diversely funded multi-million dollar experimental knowledge crucible with funding from congressional sources (CDTEMS<sup>2</sup>, FEPSO), joint services, and various government agencies. That crucible, or Multi-Institutional Semi-Structured Learning Environment (MISSLE) forged an *informing system* comprised of: industry; academia; military services; government labs; government/non-governmental organizations; federal, state, and local agencies; and first responders, all of whom focused on the operational Science and Technology (S&T) needs of the special operator. In its peak years, TNT hosted 750 participants and 64 experiments (at TNT 11-4) and 90 experiments and 320 participants (at TNT 13-2). The combined ~\$28M of funding from congressional, USSOCOM, and various DoD organizations supported 10 years of 1-2 week long quarterly field experiments. USSOCOM sponsorship and management of STAN/TNT changed over the years, originating with the S&T and J9 organizations, shifting then solely to S&T, and ultimately ending with SORDAC S&T. Over the years, TNT experiments were conducted in several diverse venues. These settings included NPS laboratories on campus, the NPS Beach Laboratory and Monterey Bay, Center for Independent Remotely Piloted Aircraft Studies (CIRPAS) at the Marina, California airport, the MOUT facility at the former US Army post Fort Ord, the NPS-CIRPAS UAV test facility at the California Army National Guard (CANG) base at Camp Roberts, California, and maritime interdiction operations (MIO) experiments in the San Francisco Bay. As the cooperative matured and expanded, other venues for experimentation were added (Avon Park Air Force Range (FL), Camp Dawson (WV), Camp Atterbury (IN), Muscatatuck Urban Training Center (IN), and European MIO experiment venues in support of NATO allies.

TNT 13-3 marked the end of the decade long USSOCOM-NPS field experimentation cooperative. This technical report serves to document this final event.

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<sup>1</sup> CW02 Christopher E. Manuel, USA, Maj H. R. Murphy, Jr., USAF, and Maj K. A. Paxton, USAF, “The Surveillance And Target Acquisition Network (STAN)” (Masters thesis, Naval Postgraduate School, 2004).

<sup>2</sup> Center for Defense Technology and Education for the Military Services (CDTEMS) congressional earmark. Comm. on Appropriations, Department of Defense Appropriations Bill of 2003, H.R. Rep. No. 107-532, Title II(2003).

## I. OVERVIEW AND STATISTICS

TNT 13-3 was conducted at Camp Roberts, California from 4 – 13 June, 2013. 268 participants attended the event, which focused on signature reduction. This figure is consistent with a down-trend in attendance numbers since TNT 11-4 (a record high) and reflects 42% below average attendance (see Fig. 1). Total industry participation declined but total US government participation showed a slight increase (see Fig. 2).

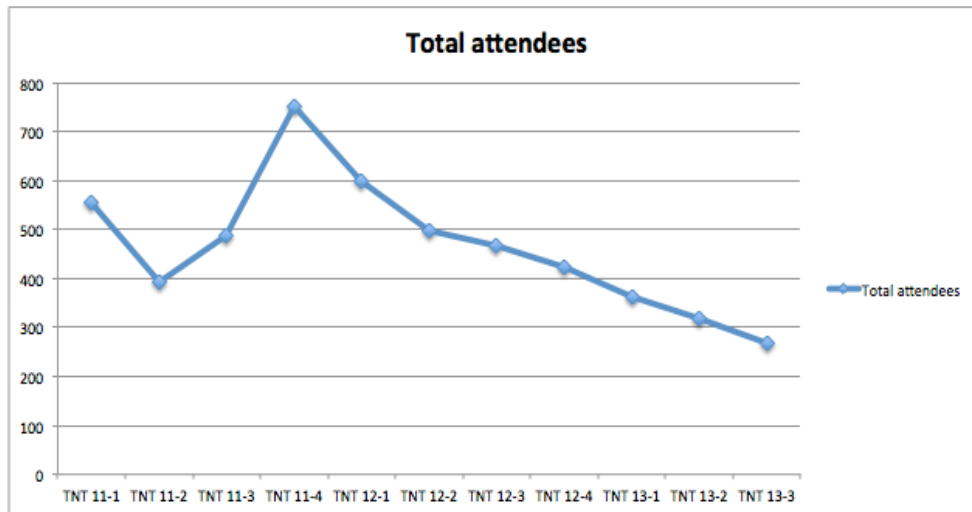


Figure 1. TNT total attendees (2011-2013/Q3)

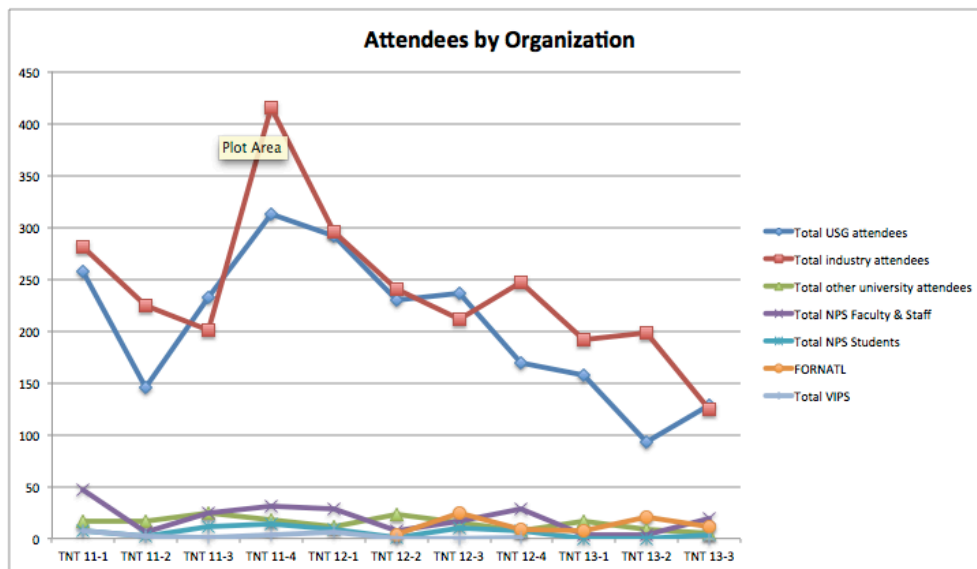


Figure 2. TNT attendees by organization (2011-2013/Q3)

Figure 3 illustrates that government lab (i.e. AFRL, NRL, ARL) and Research, Development, and Engineering Command (RDECOM) attendance—to include ARDEC, CERDEC, ERDEC, TARDEC, and AMREC—has been increasing.

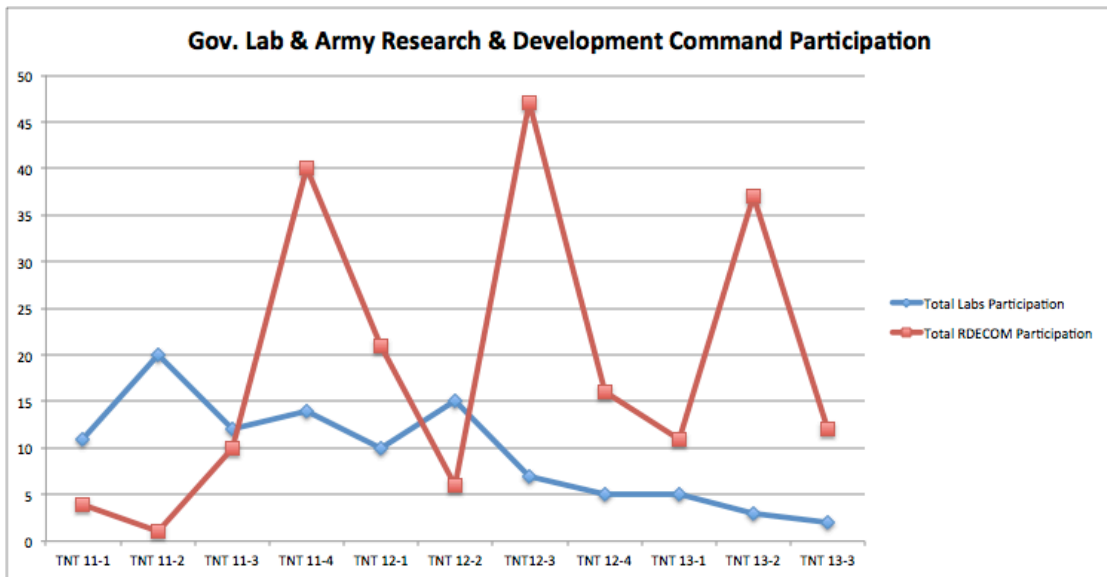


Figure 3. Comparison of gov't labs and ARDEC TNT participation (2011-2013/Q3)

Figure 4 depicts the average TNT experiment Technology Readiness Level (TRL). The majority of technologies observed fall between TRL6 and TRL7. It is important to recognize that TRL numbers are self-reported by experimenters, and sometimes are not validated by outside entities.

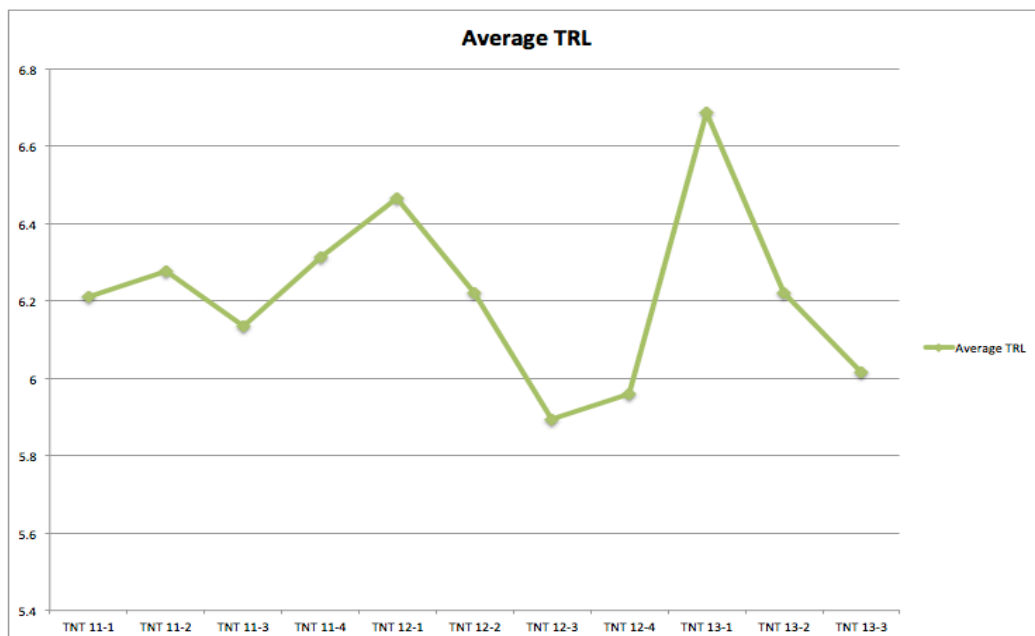


Figure 4. TNT TRL trend (2011-2013/Q3)

TNT 13-2 recorded the most experiments ever conducted during a single event with 90 total experiments (see Fig. 5). This represents a 125% increase over the historic average of 40 (2007-present). This increase in experiments placed considerable demands on SORDAC S&T to formally access vendor technologies and provide written feedback. By TNT 13-3, the number of experiments decreased to a more manageable level (59).

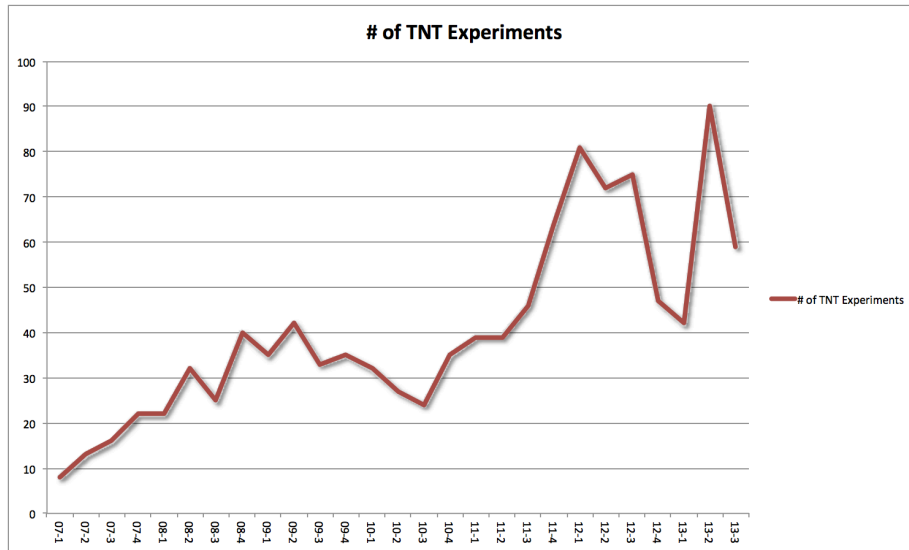


Figure 5. Number of TNT experiments (2007/Q4 - 2013/Q3) \*

{\*Note: Events held in early 2007 and before show low experiment numbers because many technologies were bundled into Mission Based Experiments (MBE) and not recorded as single submissions.}

Figure 6 provides a breakdown of the number of experiments per mission category. The predominant technologies observed consistently fall within the Command, Control, Computers, and Communication (C4) and Intelligence, Surveillance, and Reconnaissance (ISR) categories.

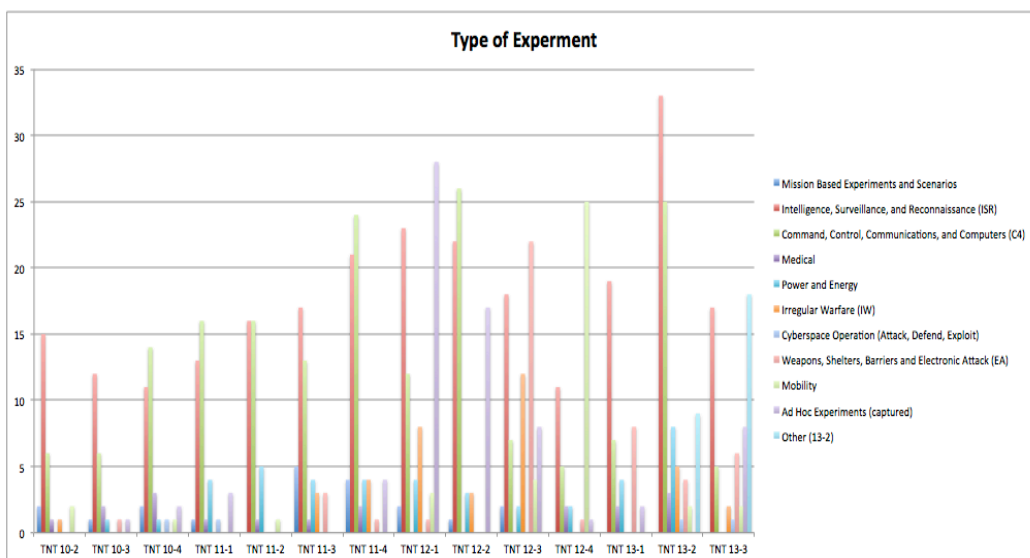


Figure 6. Breakdown of TNT experiment types (2011-2013/Q3)

## II. UNMANNED AUTONOMOUS SYSTEM (UXS) ACTIVITIES

TNT 13-3 presented challenges to the safe conduct of Unmanned Aerial Systems (UAS) operations due to the CANG's 79<sup>th</sup> Infantry Brigade Combat Team (IBCT) Shadow UAS training operations that were scheduled coincident with the field experimentation event. The 79<sup>th</sup> IBCT is currently scheduled to move into their new permanent hangar facility at McMillan Airfield in September 2014 and has been conducting frequent training missions. Figure 8 depicts the Shadow UAS assigned (fixed) operations area where their launcher, Ground Control Station (GCS), and recovery personnel are located. To date Camp Roberts has not completely implemented a comprehensive air command & control (AC2) structure but the base is making progress in this regard and receptive to NPS and Air Boss suggestions. To mitigate this potential safety risk two experienced Air Force Special Operations Command (AFSOC) combat air controllers (Mr. Jeff Golliver and Mr. Alan Tew) assumed the role of McMillan Air Boss and worked out the air procedures for all McMillan flyers with the newly formed Camp Robert's Air Traffic Controllers (ATC), call sign "Robert's Radio."

The Shadow UAS weighs 327 lbs. and is extremely loud. This presented a potential hazard to TNT participants, especially during the take-off and landing phases. A face-to-face meeting with all parties was conducted prior to TNT to discuss mitigating the operational risks and to determine how to conduct joint Shadow-TNT UAS operations. Since Shadow was not capable of relocating elsewhere on the runway, it was mutually agreed that placing concrete K-rails ~100' off of and parallel to the runway would be helpful as a preventive measure should Shadow veer off centerline during landing or take off. These barriers would also serve to keep attendees clear of the hazard area as well as provide a standoff distance (65'-100') away from NPS UAS pilots in accordance with their interim flight clearance (IFC) requirements. On short notice CIRPAS was able to obtain a temporary loan of K-rails from Fort Hunter-Liggett, while Camp Roberts supplied a forklift operator. NPS funded three flatbed trucks to make three round trips in order to move the barriers. After 8 hours all were installed the week before TNT 13-3 began.



Figure 7. TNT 13-3 UAS Safety Barrier Plan

To further mitigate hazards to TNT UAS participants the runway environment was cleared prior to launch and recovery of Shadow. TNT flight operation windows were contingent on the Shadow flight schedule (typically 3-4 hour sorties). Though sub-optimal, it was a necessary operational risk management (ORM) procedure.

TNT 13-3 was also the first time that Camp Roberts integrated an AN/MPQ-64 Sentinel Radar system (Fig. 8) with air traffic controllers from the CANG to create an ATC-like capability. This system and the controllers are now permanently assigned to Camp Roberts. NPS TNT researchers coordinated software support from General Dynamics for their Tactical Airspace Integration System (TAIS) and the Department of Energy's (DoE) Special Technologies Laboratory to convert the Sentinel Link 16 track data to Cursor on Target (CoT) so it could be visualized by RaptorX software, a DoE product. A Persistent Systems Wave Relay wireless mesh link was established between Camp Roberts Range Control (Sentinel radar location) and the McMillan Tactical Operations Center (TOC) via Nacimiento Peak. Initial tests proved successful, though Sentinel was unable to detect UAS at McMillan below 2000' AGL. It has yet to be determined if Sentinel can detect small UASs (i.e. Zephyr, Unicorn, Rascal, Instant Eye, Raven, Puma, etc.).



**Figure 8. AN/MPQ-64 Sentinel RADAR**

The NPS team also explored configuring the Shadow UAS to transmit CoT messages to RaptorX so that Air Boss and ATC could potentially view real time UAS Position and Location Information (PLI), especially for tracks not picked up on RADAR. After speaking with the Tactical Unmanned Aircraft System (TUAS) squadron personnel, AAI contractors, and AFSOC Subject Matter Experts (SMEs), it was determined that there was no easy solution that would enable the Shadow UAS to transmit CoT messages. Discussions are ongoing with Naval Air Weapons Station (NAWS) China Lake, developers of the software and hardware, to enable this capability.

Figure 9 shows the UxS trends from TNT 11-1 to 13-4. TNT 13-3 was the first event where no ground robotic vehicles participated. Obtaining NAVAIR flight clearances for NPS owned aircraft continued to be a challenge. Only NPS, Natick Soldier Research Development and Engineering Center (NSRDEC), and Advanced Tactics flew UAS in support of TNT 13-3. Boeing BAT, Recon Robotics, ARDEC, and Sandia cancelled.

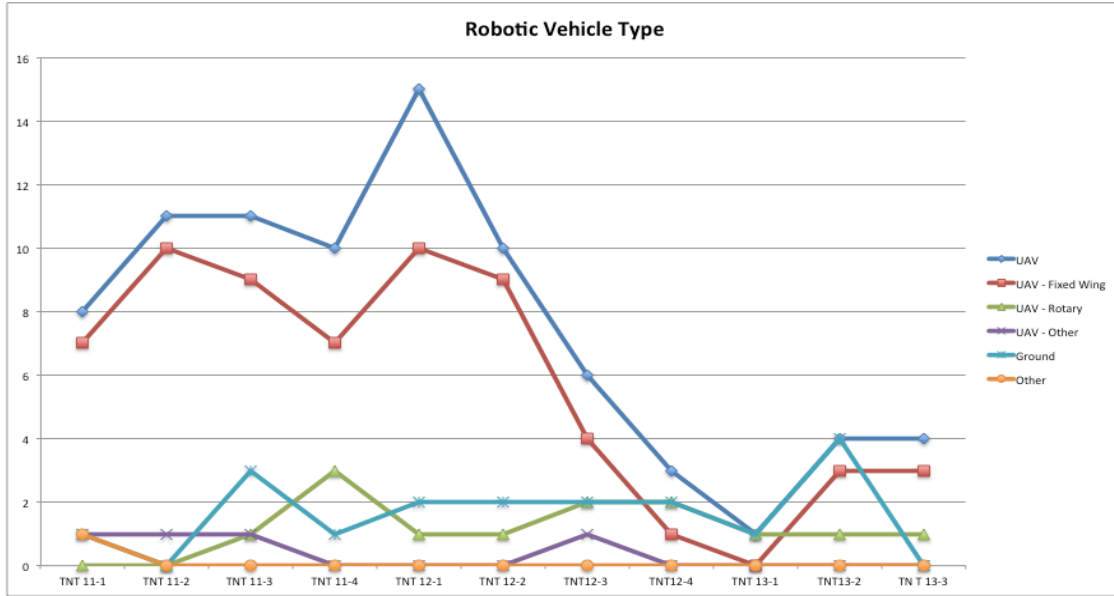


Figure 9. TNT UxS trends (2011-2013/Q3)

UAV sorties (Fig. 10) also reflect the low turnout of UAS participants. UAV sorties (Fig. 10) also reflect the low turnout of UAS participants.

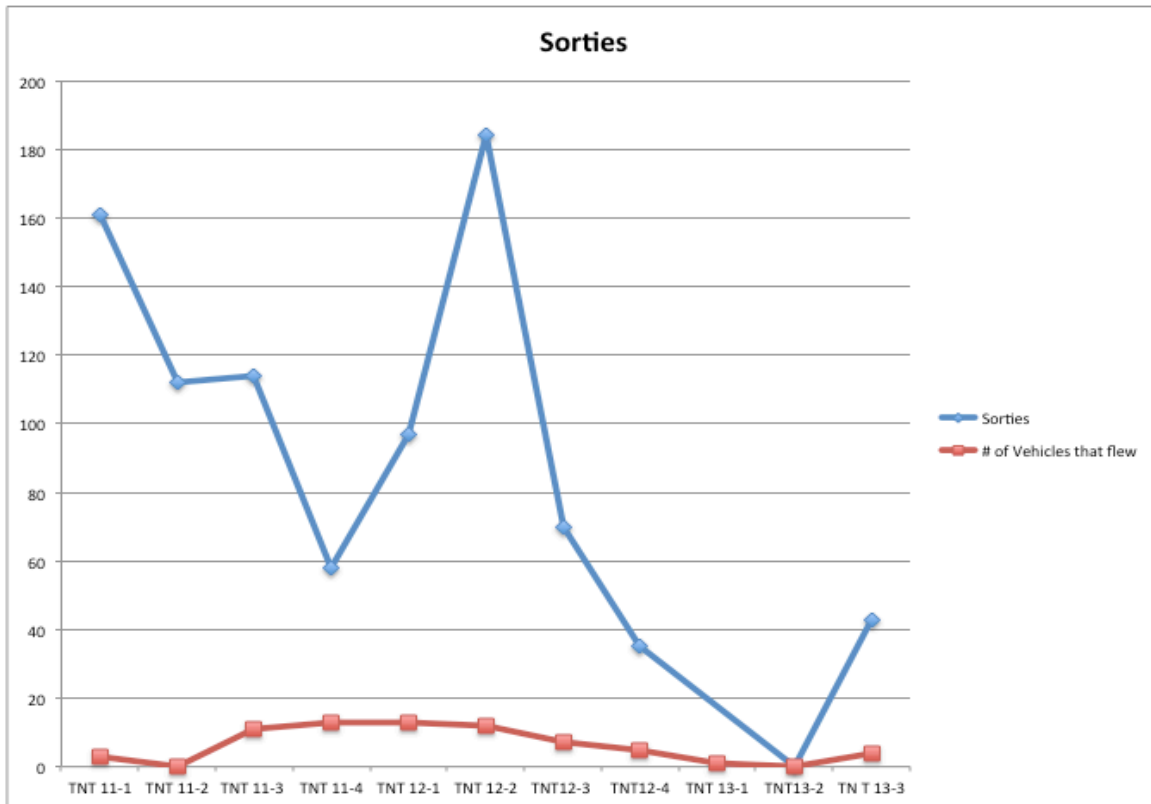


Figure 10. TNT UAV sorties (2011-2013/Q3)

## APPENDIX A: TNT 13-3 REQUEST FOR INFORMATION (RFI)



### TNT-13-3 Experimentation

**Solicitation Number:** RFI-TNT-13-3\_TNT\_Experimentation

Agency: Other Defense Agencies

Office: U.S. Special Operations Command

Location: Headquarters Procurement Division

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**Notice Type:**

Special Notice

**Original Posted Date:**

March 20, 2013

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April 8, 2013

**Response Date:**

Apr 19, 2013 4:30 pm Eastern

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**Classification Code:**

A -- Research & Development

**NAICS Code:**

541 -- Professional, Scientific, and Technical Services/541712 -- Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)

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**Synopsis:**

Added: Mar 20, 2013 2:27 pm Modified: Apr 08, 2013 8:05 am [Track Changes](#)



## A. INTRODUCTION: Tactical Network Testbed (TNT) Collaboration

This Request for Information (RFI) is NOT a solicitation for proposals, proposal abstracts, or quotations.

The purpose of this RFI is to solicit technology experimentation candidates from Research and Development (R&D) organizations, private industry, and academia for inclusion in future experimentation events coordinated by the U. S. Special Operations Command (USSOCOM) and the Naval Postgraduate School (NPS). USSOCOM invites industry, academia, individuals and Government labs to submit technology experimentation nominations addressing innovative technologies leading to possible Government/Industry collaboration for development of USSOCOM technology capabilities. The intent is to accelerate the delivery of innovative capabilities to the Special Operations Forces (SOF) warfighter.

SOF experimentation will explore emerging technologies, technical applications, and their potential to provide solutions to future SOF capabilities.

The final FY13 SOF Experimentation focus area will be conducted on 4-13 Jun 2013 with the theme being

Signature Reduction at Camp Roberts, CA.

Beginning in FY14, SOF technical experimentation event focus areas and locations

are as follows: October 2013 - Preservation of the Family and Force, location TBD

February or March 2014 - Maritime Mobility/Counter Mobility, location TBD

Additional RFIs will be released to FedBizOpps approximately 75 days prior to each scheduled TNT event to provide additional details.

After review of the technology experimentation nomination submissions, the Government may invite select candidates to experiment their technologies at the USSOCOM & NPS sponsored TNT experimentation event. The TNT venue will provide an opportunity for the submitter to interact with USSOCOM personnel for the purpose of USSOCOM assessing potential impact of emerging technology solutions on USSOCOM missions and capabilities. The intent is to accelerate the delivery of innovative capabilities to the Special Operations Forces (SOF) warfighter. Industry participation in experimentation activities does not suggest or imply that USSOCOM or NPS will procure or purchase equipment.

## B. OBJECTIVE:

1. Background: USSOCOM conducts TNT experimentation events at Muscatatuck UTC, IN; at Avon Park, FL, and in cooperation with NPS at Camp Roberts, CA. These cooperative TNT experiments are conducted with representatives from Government R&D organizations, academia, and private industry. TNT experimentation events provide an opportunity for technology developers to interact with operational personnel to determine how their technology development efforts and



ideas may support or enhance SOF capability needs. The environment facilitates a collaborative working relationship between Government, academia, and industry to promote the identification and assessment of emerging and mature technologies for the primary goal of accelerating the delivery of technology discoveries to the SOF warfighter. The event facilitates SOCOM personnel to identify potential technology solutions, impacts, limitations, and utility to meet SOF technical objectives and thrust areas. Materiel solutions brought to the event should be at a Technology Readiness Level (TRL) of 3 but NOT greater than TRL-6. Experiments may be between a half day and five days in duration and be conducted in unimproved expeditionary-like conditions. At the discretion of USSOCOM, respondents may be asked to complete a vendor loan agreement (see attachment).

2. Experimentation Focus: Experiments will be conducted 4-13 Jun 2013 at Camp Roberts, CA and will explore emerging technology solutions and revolutionary improvements in SOF dismounted soldier or platform signature management. Any technology-based experiment conducted at the event will need to be capable of supporting a SOF unit to provide a revolutionary improvement in SOF operations. Any and all solutions must include the necessary software and hardware to accomplish the mission. Signature management technologies should address a combination of the following spectra:

- Visible
- Near Infrared (NIR)
- Short-wave Infrared (SWIR)
- Thermal (Mid-wave Infrared [MWIR] / Long-wave Infrared [LWIR])
- Radar
- Acoustic
- Radio frequency (RF)
- Multispectral

Experiment participants may bring their own electro-optical/infrared sensors to facilitate user evaluations of their technology. However, the Government anticipates bringing sensors as well. If the technology to be tested requires a specific landscape, please note this in the online experiment nomination submission form. Camp Roberts has a wide range of foliage and terrain, and areas should exist to conduct each experiment properly. Night operations will be accommodated if needed for proper evaluation of a participant's technology, but this must also be noted in the online submission form. Note that a New Moon will occur at Camp Roberts on 8 June 2013 and moon rise will occur between 0214 and 0920 over the duration of this TNT event.

3. Security Requirements: Experiment participants should submit technical information associated with their technology experimentation nominations via CD/DVD only. Please see Paragraph C. SUBMISSION INSTRUCTIONS below for further information. All classified and/or proprietary information must be appropriately marked, labeled and secured.

4. All respondents shall prepare a Composite Risk Management (CRM) Worksheet (Department of the Army [DA] Form 7566, attached [Lotus Forms Viewer required]) in accordance with MIL-STD-882E and DA Field Manual 5-19. The risk assessment shall address the likelihood and severity of any inherent risks as well as risk mitigation measures required. The risk assessment shall be submitted as an attachment to the experiment nomination. Nominations submitted without a thorough and complete CRM will not be considered for participation. Reference the attached safety worksheet for assistance preparing the CRM. Also, respondents wishing to conduct experiments of a kinetic or energetic nature are responsible for ammunition and/or explosives shipments to include an Interim Hazard Classification (IHC) or Final Hazard Classification (FHC) and coordination for receipt and storage at Camp Roberts, CA.

If your experiment will be radiating on a given frequency or frequency band, you must have prior approval to transmit on that frequency. Prior approval may include compliance with Federal Communications Commission (FCC) Title 47, Part 15 or a Special Temporary Authority (STA) from the FCC. If equipment is government-owned and operating within a Federal Band, you must have National Telecommunications and Information Administration (NTIA) frequency approval. Your authority to radiate should be submitted along with your nomination or emailed directly to tech\_exp@socom.mil. The FCC recommends you submit your request at least 30 days prior to the start of the event.

5. Other Special Requirements: DO NOT SUBMIT PROPOSALS. SUBMIT TECHNOLOGY EXPERIMENTATION NOMINATIONS ONLY. EXPERIMENTATION NOMINATION SUBMITTALS FOR THIS RFI MUST BE POSTMARKED NO LATER THAN THE CLOSING DATE OF 4/19/2013. No contracts will be awarded based solely on this announcement or any subsequent supplemental RFI announcements planned for FY13 TNT events.

#### C. SUBMISSION INSTRUCTIONS:

Technical information pertaining to Technology Experimentation nominations shall be submitted on CD/DVD and mailed to the address provided below postmarked no later than the closing date of 4/19/2013. Other pertinent

non-technical registration information must be submitted by the closing date of 4/19/2013 by 1600 EST via

USSOCOM webpage: <http://www.socom.mil/sordac/Pages/ExpNominationForm.aspx>.

Do NOT submit technical information via webpage.

The technical information submitted via CD/DVD should include information about Capability, Experiment Objectives, Measurements/Data Collection Plan, Measures of Performance/Measures of Effectiveness, what new capability (or improvement to existing capability) this represents to the war fighter, and which (if any) existing gap does this capability addresses. Please direct questions to tech\_exp@socom.mil.



All CD/DVD submissions, up to and including the SECRET Collateral level, should

be mailed to: HQ USSOCOM  
ATTN: SORDAC-ST/TNT COORDINATOR  
7701 TAMPA  
POINT BLVD  
MACDILL  
AFB, FL  
33621

Classified submissions must be double wrapped in accordance with NISPOM guidance. Inner wrapper should be marked with the appropriate classification and contain the following statement: "To be opened only by SORDAC-ST TNT Coordinator - Conrad Lovell"

Proposed submissions classified higher than collateral SECRET must be coordinated in advance with the TNT Coordinator at (813) 826-4646. Procedures for submission of those proposals will be provided separately.

Multiple nominations addressing different technology experiments may be submitted by each respondent. Submissions will be reviewed by USSOCOM personnel to determine whether an experiment submission will be accepted for invitation. Each technology experiment nomination must address only one experiment.

Select respondents will be invited to participate in USSOCOM experiments. USSOCOM shall provide venues, supporting infrastructure, and assessment (operational and technical, based on availability of resources and written request) personnel at no cost to invited respondent(s). Respondent's travel costs and technology experiments will be at the respondent's expense. The TNT venue will only provide basic access to training areas or ranges to conduct experiments, a facility to connect to the internet, basic venue infrastructure including frequency allocation/deconfliction, and portable power if needed. Invited respondents must be prepared to be self-sufficient during the execution of their experiments and not dependent on venue resources for success.

#### D. BASIS FOR SELECTION TO PARTICIPATE:

Selection of respondents to participate will be based on the extent to which the technology represents a particular class or level of capability that can be provided to Special Operations Forces.

Other considerations include:

- Technical maturity
- Relevance of or adaptability to military operations/missions
- Relevance to current operational needs



- Relevance to Event Focus Area

E. ADDITIONAL INFORMATION: All efforts shall be made to protect proprietary information that is clearly marked in writing. Lessons learned by USSOCOM from these experiments may be broadly disseminated but only within the Government. If selected for participation in TNT experimentation, vendors may be requested to provide additional information that will be used in preparation for the experiments.

F. USE OF INFORMATION: The purpose of this notice is to gain information leading to Government/Industry collaboration for development of USSOCOM technology capabilities and to assist in accelerating the delivery of these capabilities to the warrior. All proprietary information contained in the response shall be separately marked. Any proprietary information contained in response to this request will be properly protected from any unauthorized disclosure. The Government will not use proprietary information submitted from any one firm to establish future capability and requirements.

G. SPECIAL NOTICE: Respondent's attention is directed to the fact that Federally Funded Research and Development Centers (FFRDCs) or contractor consultant/advisors to the Government will review and provide support during evaluation of submittals. When appropriate, non-Government advisors may be used to objectively review a particular functional area and provide comments and recommendations to the Government. All advisors shall comply with procurement Integrity Laws and shall sign non-disclosure and rules of conduct/conflict of interest statements. The Government shall take into consideration requirements for avoiding conflicts of interest and ensure advisors comply with safeguarding proprietary data. Submission in response to this RFI constitutes approval to release the submittal to Government support contractors.

H. Per Federal Acquisition Regulation (FAR) 52.215-3 Request for Information or Solicitation for Planning

Purposes (Oct 1997):

1. The Government does not intend to award a contract on the basis of this RFI notice or to otherwise pay for the information.
2. Although "proposal" and "respondent" are used in this RFI, your responses will be treated as information only.

It shall not be used as a proposal.

3. In accordance with FAR Clause 52.209(c), the purpose of this RFI is to solicit technology experimentation candidates from R&D organizations, private industry, and academia for inclusion in future experimentation events coordinated by USSOCOM.

Contracting Office Address:

7701 Tampa Point Blvd

MacDill AFB, Florida 33621-5323

Primary

Point of



Contact:  
TECH\_EXP  
@socom.mil

Added: Mar 20, 2013 3:06 pm

Add 2 additional attachments: TNT Safety Worksheet and Composite Risk Management Worksheet.

---

**Package #1**

**Posted Date:** March 20, 2013

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[Vendor Loan Agreement.pdf](#) (16.83 Kb)

**Description:** Vendor Loan Agreement

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**Composite Risk Management Worksheet**

**Type:** Other (Draft RFPs/RFIs, Responses to Questions, etc..)

**Posted Date:** March 20, 2013

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[CRM.xfdl](#) (114.89 Kb)

**Description:** Composite Risk Management Worksheet (CRM)

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**TNT Safety Worksheet**

**Type:** Other (Draft RFPs/RFIs, Responses to Questions, etc..)

**Posted Date:** March 20, 2013

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[TNT\\_Safety\\_Worksheet.pdf](#) (218.65 Kb)

**Description:** Safety Worksheet

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**Contracting Office Address:**

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MacDill AFB, Florida 33621-5323

**Place of Performance:**

Notice contains instructions.  
United States

**Primary Point of Contact.:**

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Mar 20, 2013

[CRM.xfdl](#)

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Mar 20, 2013

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### Opportunity History

- Original  
Synopsis  
*Special Notice*  
Mar 20, 2013  
2:27 pm
- Changed  
Mar 20, 2013  
3:06 pm
- Changed  
Apr 08, 2013  
8:06 am



## APPENDIX B: TNT 13-3 EXPERIMENT LIST & SCHEDULE

### Experiment List for TNT 13-3 Camp Roberts, CA 4-13 June:

#### A. Intelligence, Surveillance, and Reconnaissance (ISR):

- 791 – SWIR and SWIR/LWIR Fusion Systems – UTC Aerospace Systems
- 794 – Atmospheric Optical Turbulence Characterization - NPS
- 801 – Tactical Atmospheric Sounding Kit (TASK) – QinetiQ North America
- ~~803 – Squad Level Self Rescue – Sandia National Laboratories - CANCELLED~~
- 808 – Cargo Pocket ISR – Natick Soldier RDEC
- ~~813 – Low Signature Detect, Track, & Locate with Bait UAS – Northrop Grumman - CANCELLED~~
- 818 – Camouflage and Manmade Object Sensing (CAMOS) – Lockheed Martin
- 821 – Search and Persistent Surveillance by Multiple Het – NPS
- 822 – .5-18GHz Spectrum Monitoring & Direction Finding – S2 Corporation
- 823 – HFDF (Transportable, Mobile, Simulator) – Rohde & Schwarz
- 825 – Ultralight SIM and SD Card Locator – Kopis Mobile LLC
- 830 – Direction Finding & Geolocation System – L-3 ASIT & LM ATL
- 836 – Covert Window-Mount UHF & MIMO Vehicle Antennas – Pharad, LLC
- 838 – ULCAN for Personal Protection – Saab Barracuda
- 840 – Laser Gated Imaging – Elbit Systems of America
- 841 – Acoustic Multi-Mission Sensor (AMMS) – Global Ground Systems, Inc.
- ~~842 – Environmental Effects on Detection Signatures – NPS - CANCELLED~~
- ~~844 – Multispectral Fusion & Celestial Compass Handheld – Vectronix Inc. - CANCELLED~~
- 846 – Watchdog – HF Detection System – Harris Corporation & On Target Enterprises
- 847 – Crosswind Digital Push-To-Talk System – WGS Systems, LLC
- 854 – Remote Viewing Periscope - SCHOTT

#### B. Command, Control, Communications, and Computers (C4):

- 792 – SOF Media Cloud – TapHere! Technology
- 800 – Combined DSA/ALE Communications System – Shared Spectrum Company
- 811 – Tactical Operations for Multiple Networked UAVs – NPS
- 832 – Noetic Tactical Cloud (NTC) – Northern Technologies Group w/SRA
- 834 – Urban Radion Communication – Elbit Systems of America
- ~~839 – Transpositional Modulation Communication – Medusa Scientific - CANCELLED~~
- ~~843 – MWIR, LRTV+TVP for video streaming over Mil Radio – Vectronix Inc. - CANCELLED~~
- 849 – Advanced Acoustic Noise Cancellation Technology – Cypher Corporation

#### C. Power and Energy:

- ~~804 – Q-Gen 2.3, 1kW, Multi-Fuel Generator – QinetiQ North America - CANCELLED~~
- ~~850 – Autonomous Electricity Producing Textiles and Films – ParaSol Technologies, LLC - CANCELLED~~

#### D. Irregular Warfare (IW):

- 799 – Camouflage Cosmetics – Johns Hopkins University Applied Physics Laboratory





809 – Snow Storm – US Army ARDEC

**E. Cyberspace Operation (Attack, Defend, Exploit):**

815 – Cyber Capabilities For Automotive ISR and Effects – Raytheon

**F. Weapons, Shelters, Barriers and Electronic Attack (EA):**

793 – Ballistic Reticles for .300BLK, MK17, M4 Platform – Pride Fowler Industries

814 – Next Generation MK48 Suppressor – U.S. Army ARDEC

833 – MK19 Fire Control with Air Burst / M2 Fire Control – Raytheon – EO Innovations

851 – Assess Auto Ranging Full Ballistic Solution Sights for Direct Fire Support Weapons – Burris, GD, Tijicon, L3, Kestral

852 – Assess effectiveness and suitability of prototype of Case Directional Fragmentation Anti Personnel for inclusion in SOF Demo Kit – US Army ARDEC

856 – Remington 300WM with Bimetal Barrel - SORSE

**G. Mobility:**

790 – Thermal Breaching by handheld TEC Torch – EMPI

819 – StopLight – Wearable Smart RF Spectrum Sensor – Asymmetric Technologies LLC

**H. Soldier Systems:**

797 – Evaluation of Camouflage Appliques on DSP-27 Units – US Army Research Lab

807 – GORE Multispectral Concealment Products – W.L Gore & Associates, Inc (GORE)

812 – Miliken SWIR and Thermal Concealment Technology – Miliken & Company

829 – Enhanced JTAC LTD – Elbit Systems of America

837 – Body-Worn Direction-Finding System – FIRST RF Corporation

853 – Controlled Viewing Angle Screen Display - SCHOTT

**I. Other:**

798 – Tire Coatings for Visible Signature Reduction – US Army Research Lab

810 – VATEC, Personal Signature Reduction – ReadyOne Industries, Inc.

831 – XM210 Infrared Ground Illumination Parachute SIGNA – ARDEC

848 – Improved Flash Bang Grenade – NSWC Crane

855 – Harbinger Inc III – AMRDEC

860 – HALLTS – NSWC Dahlgren

**J. Aviation Systems:**

~~816 – Optical Autonomous Recovery System (OARS) for SUAS – ReconRobotics/General Electric Intelligent Platforms - CANCELLED~~

820 – Panther UAV/UGV: Special Ops Transport Challenge – Advanced Tactics Inc.

**K. SOF Small Unit Dominance:**

817 - Lightweight Medium Machine Gun – General Dynamics Armament and Technical Products



- 824** – M72 Airburst – Nammo Talley Inc.
- 826** – Shoulder Launched Munition Extended Range Sight – Nammo Talley Inc
- 835** – M72 LAW Laser Aiming Device – Nammo Talley, Inc
- 845** – TRAP T360-SOF Sniper Variant Testing – Precision Remotes LLC

**Lunch Briefs:**

**11 June:** MIT Lincoln Laboratory

Title: Real-Time Physiological Status Monitoring for SOF Mission Planning.

MIT Lincoln Laboratory (MIT LL) has been directed by USSOCOM to apply real-time Physiological Status Monitoring (PSM) technology to route planning tools for Special Operations Forces small dismounted units. MIT LL will provide a briefing describing the work done to date, with an emphasis on seeking input from potential SOF users on future development goals. An early prototype system will be demonstrated, including an Android display and various PSM sensors.



\*\*\* Due to the exploratory nature of the TNT event, this schedule is advisory in nature and is subject to change\*\*\*

TNT 13-3 Schedule - Camp Roberts, CA										
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday					
3-Jun	4-Jun	5-Jun	6-Jun	7-Jun	8-Jun					
Morning Brief	8:00	7:30	7:30	7:30						
<b>*****Experiments are ALL DAY events unless otherwise noted. Night Events are ALL DAY and continue into NIGHT*****</b>										
Travel Day	832	Northern Technologies	832	Northern Technologies	832	Northern Technologies	832	Northern Technologies		
	846	Harris & On Target Enterprise	846	Harris & On Target Enterprise	846	Harris & On Target Enterprise	846	Harris & On Target Enterprise		
	794	NPS	794	NPS	794	NPS	794	NPS		
	823	Rohde & Schwarz	823	Rohde & Schwarz	823	Rohde & Schwarz	823	Rohde & Schwarz		
	808	Natick	808	Natick	808	Natick	811	NPS		
	815	Raytheon	815	Raytheon	811	NPS	856	SORSE		
	817	General Dynamics	811	NPS	851	Burris, GD, Trjicon, L3, Kestral				
	835	Nammo Talley <i>Night Ops</i>	833	Raytheon - EO Innovations	856	SORSE				
	814	US Army ARDEC <i>Night Ops</i>	856	SORSE						
	831	US Army ARDEC <i>Night Ops</i>	845	Precision Remotes						
	824	Nammo Talley	851	Burris, GD, Trjicon, L3, Kestral						
	856	SORSE								
	826	Nammo Talley								
Hot Wash	1700/ Night Ops 2200	1700	1700	1700	1700	1700				

TOC

McMillian Airfield

McMillian Area

Range 4

Range 18

Chapman Hill

FOB

\*\*\* Due to the exploratory nature of the TNT event, this schedule is advisory in nature and is subject to change\*\*\*

TNT 13-3 Schedule - Camp Roberts, CA								
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday			
9-Jun	10-Jun	11-Jun	12-Jun	13-Jun	14-Jun			
	8:00	7:30	7:30	7:30		Morning Brief		
<b>*****Experiments are ALL DAY events unless otherwise noted. Night Events are ALL DAY and continue into NIGHT*****</b>								
	819	Asymmetric Technologies	819	Asymmetric Technologies	819	Asymmetric Technologies		
	794	NPS	794	NPS	794	NPS		
	798	US ARL	801	QinetiQ North America	801	QinetiQ North America	834	Elbit Systems of America
	822	S2 Corporation	822	S2 Corporation	822	S2 Corporation	847	WGS Systems
	810	ReadyOne Industries	825	Kopis Mobile	834	Elbit Systems of America	800	Shared Spectrum Company
	836	Pharad	836	Pharad	847	WGS Systems	792	TapHere! Technology
	853	SCHOTT	853	SCHOTT <i>Night Ops</i>	800	Shared Spectrum Company	818	Lockheed Martin
	830	L-3 ASIT & LM ATL	830	L-3 ASIT & LM ATL	792	TapHere! Technology	849	Cypher Corp
	807	GORE	807	GORE <i>Night Ops</i>	849	Cypher Corp	791	UTC Aerospace
	841	Global Ground Systems	841	Global Ground Systems	791	UTC Aerospace <i>Night Ops</i>	837	FIRST RF Corp
	812	Miliken & Company	812	Miliken & Company <i>Night Ops</i>	837	FIRST RF Corp	820	Advanced Tactics
	838	Saab Barracuda	838	Saab Barracuda <i>Night Ops</i>	818	Lockheed Martin	839	Medusa
	797	US ARL	797	US ARL	841	Global Ground Systems		
	799	John Hopkins	799	John Hopkins <i>Night Ops</i>	821	NPS		
	793	Pride Fowler Industries	810	ReadyOne Industries <i>Night Ops</i>	839	Medusa		
	821	NPS	798	US ARL	848	NSWC Crane		
	832	Northern Technologies		LUNCH BRIEF	840	Elbit <i>Night Ops</i>		
			855	AMRDEC <i>Night Ops</i>	829	Elbit <i>Night Ops</i>		
			852	US ARMY ARDEC	860	NSWC Dahlgren <i>Night Ops</i>		
			809	US Army ARDEC				
			790	EMPI				
			856	SORSE				
			821	NPS				
			832	Northern Technologies				
Hot Wash 1700	1700	1700/Nite Ops/2300	1700/Nite Ops/ 2200	12:00				

TOC

McMillian Airfield

McMillian Area

Range 39

Range 14

Briefing Room

Range 16

TOC
McMillian Airfield
McMillian Area
Range 39
Range 14
Briefing Room
Range 16



## APPENDIX C: TNT 13-3 EXPERIMENT DESCRIPTIONS

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## APPENDIX D: TNT 13-3 AFTER ACTION REPORTS (AARS)

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