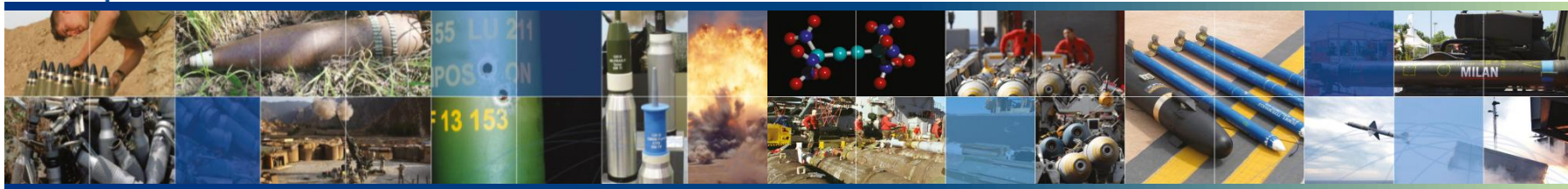




MSIAC

Munitions Safety Information Analysis Center

Supporting Member Nations in the Enhancement of their Munitions Life Cycle Safety



MSIAC SCJ Assessment Workshop

**2013 INSENSITIVE MUNITIONS
& ENERGETIC MATERIALS
TECHNOLOGY SYMPOSIUM**

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CORONADO BAY, SAN DIEGO, CA



- Workshop Needs and Objectives
- Overview of Technical Approach
 - Specific Topics
 - Anticipated Outcomes
- 2014 Workshop
- Path Forward

This workshop will focus on developing an advanced assessment methodology for determining munition response to Shaped Charge Jet Attack.

Based on whole body of evidence approach

- *Identify small scale testing and modelling capabilities to be used along with all-up-round test results in order to improve confidence in the assessment.*
- *Review of the SCJ hazard protocol in AOP-39 to improve our knowledge of munition response mechanisms.*

By developing an improved understanding of the underpinning science of munition response to SCJ, an improved AUR test will be proposed.

- Increased Risk and Exposure during current operations
- IM Technologies that survive SCJ exist
- If SCJ testing is done, significant variance allowed by the Standard
- Last international discussion to focus on SCJ Assessment was in 2000



- In addition, AC326 SG B requested MSAIC support
 - Introduce more realistic aggressions / V^2D
 - Better define SCJ characteristics / measurement
 - Make recommendations for STANAG update

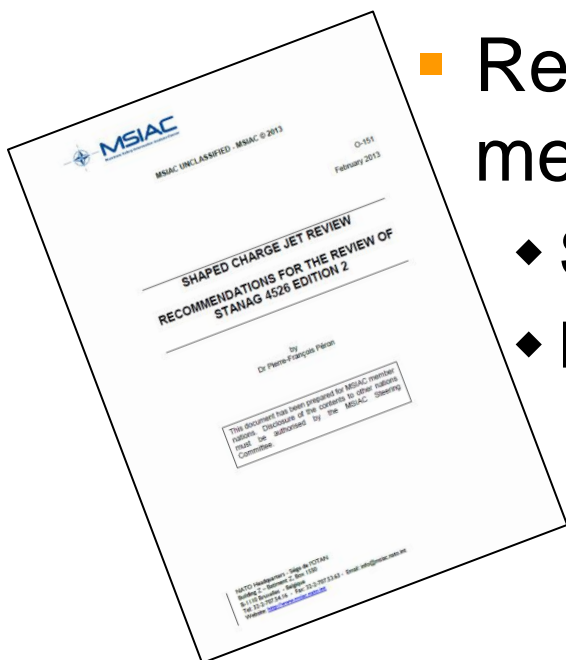
- Rockeye SCJ not readily available
- V^2D concerns expressed
 - 2011 IM Technology Gaps Workshop
 - V^2D not representative or realistic

Table 1: Standardized V^2D Values in STANAG 4526 Edition 2

Threat	Representative V^2D ($\text{mm}^3/\mu\text{s}^2$)
Top Attack Bomblet	200
SCJ with characteristics of 50mm Rockeye	360
Rocket Propelled Grenade	430
Anti-Tank Guided Missile	800

Shaped Charge Jet Review Recommendation for the Review of STANAG 4526 Edition 2

- Provided overview of SCJ formation
- Reviewed Initiation Response mechanisms
 - ◆ Shock-to-Detonation Transition (SDT)
 - ◆ Bow Shock-to-Detonation Transition (BSDT)



Report O-151 by Dr Pierre-Francois Peron

Table 2: Shaped Charges Used in the Some Nations

Nation	Shaped charge	Threat level	Jet velocity (mm/ μ s)	Jet diameter (mm)	V^2D (mm ³ / μ s ²)	Specified in IM policy	Laboratory/ in service*
France	CCEB 62 (former version)	RPG-7	8	3	203	Yes	Laboratory
	CCEB 62 (new version)	RPG-7	To be assessed	To be assessed	To be assessed	Yes	Laboratory
Germany	KB44	Bomblet	8	1.9	122**		Laboratory
	RPG 7 NB	RPG-7	7.2	3.1	166**	Yes	Laboratory
UK	BL 755	Bomblet				No	In service
	M42	Bomblet				No	In service
	K4	RPG-7			100	Yes	Laboratory
USA	81 mm SC	RPG-7	6.4	3.5	141	Yes	Laboratory

* In service means that the shaped charge is produced in large scale.

** The jet tip is not considered.

Report O-151 by Dr Pierre-Francois Peron

Workshop Approach

- The workshop will consist of a number of focused discussion groups on key issues. These will be developed under the following areas:
 - Review of shock stimulus and SCJ Hazard assessment protocol (AOP-39, TTCP protocols)
 - Identify Small Scale Testing and Modelling Capabilities
 - Review SCJ AUR Test (STANAG 4526 Ed2)
- Each discussion group will be chaired by a subject matter expert. Volunteers?

- Review Shock Stimulus

- Examine the events in Shock threat Stimulus / Munition Interaction
- Review AOP-39 IM assessment methodology
- Review Knowledgebase of shock Stimulus
 - ◆ Hot spot mechanisms; approaches: critical energy criterion, statistical hot spot models
 - ◆ Define importance of SDT vs. BSDT (Bow Shock to Detonation Transition) mechanisms
 - ◆ Importance of relative mechanism as a function of jet characteristics and energetic material (in particular critical diameter)

- **Sub SDT or BSDT response:**

Deflagration to Detonation Transition (DDT) Burn to Violent Reaction (BVR)

- Review applicability of DDT and BVR small scale testing and modelling capabilities for SCJ
- Consolidate latest understanding of energetic material reaction growth and violence of response as a function of parameters such as confinement, geometry, and damage.
- Role of spall, SCJ slug

- **Small Scale Testing Requirements**
 - What fundamental properties must be known
 - ◆ During energetic material characterization
 - ◆ To support Models, kinetic parameters, heat flow...
 - Review Sensitivity tests
 - ◆ Capabilities and limitations, use as screening tests...
 - Instrumentation
 - ◆ Recommended vs. State of the Art
 - ◆ Ability to support correlation to AUR testing
 - Identification of gaps and recommendations

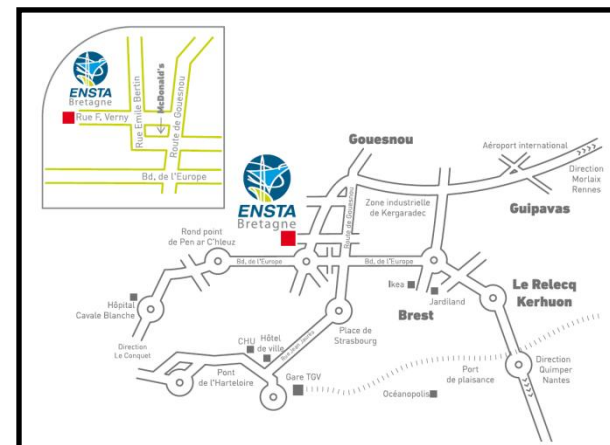
- **Modeling Capability**
 - **Summary of current tools**
 - ◆ Capabilities, approaches, and maturity levels
 - ◆ Availability and accessibility / ease of use -- expert
 - ◆ Identify data input requirements
 - ◆ Discuss validation strategy and implication for AUR testing
 - **Identification of Gaps and recommendations**

- **AUR SCJ Impact Test**
 - Discuss specifics for SCJ Impact (MSIAC Document O-151).
 - Discuss AUR SCJ test STANAG 4526
 - ◆ Agree deficiencies and needs
 - ◆ Define SCJ characteristics based on understanding of the response mechanisms.
 - ◆ Agree on means to characterize SCJ stimuli
 - ◆ Define aggression level(s) for STANAG 4526
 - ◆ Agree test configuration
 - Recommendations for STANAG 4526 improvement

- Development of an assessment methodology for SCJ attack, with improved understanding of reaction mechanisms particularly SDT and BSDT.
 - Recommendations for improving STANAG 4526 SCJ AUR test based on a sound scientific understanding
 - Identified capability gaps with recommendations on improvements
- Exploitation of scientific understanding, small scale tests, and modelling to support IM assessment
 - Inroads to IM assessments based on whole body of evidence approach vs. single AUR test results to improve confidence in assessment



- France has agreed to facilitate location
 - ENSTA Bretagne
 - Brest France
- 13 – 16 May, 2014
 - ~4 days, w Plenary Session
 - Will refine based on interest and pre-workshop inputs



- Workshop announcement
 - Nov 2013
 - Response of interested parties
- Gather IM assessment methodology
 - Use of small scale testing or modelling, screening tests etc...
- Dissemination of relevant information to planned participants
 - Supports Plenary Session and breakouts

- Review of SCJ Assessment methodology
- Improved understanding of the underlying Science
- Review of Small Scale Testing & Modeling
- Recommendations for STANAG 4526

MSIAC Workshop
Brest France
12 – 16 May, 2014

Questions