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**Second Line of Defense  
Megaports Initiative  
Operational Testing and Evaluation  
Plan for Port of Lazaro Cardenas,  
Mexico**

JD Hughes

April 2012



**Pacific Northwest**  
NATIONAL LABORATORY

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# **Second Line of Defense Megaports Initiative Operational Testing and Evaluation Plan for Port of Lazaro Cardenas, Mexico**

April 19, 2012

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Prepared for  
the U.S. Department of Energy  
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## **Abbreviations and Acronyms**

CAS	central alarm station
DOE	U.S. Department of Energy
LANL	Los Alamos National Laboratory
LAS	local alarm station
NNSA	National Nuclear Security Administration
NORM	naturally occurring radioactive material
OT&E	Operational Testing and Evaluation
PNNL	Pacific Northwest National Laboratory
RPM	radiation portal monitor
SLAT	System Level Acceptance Testing
SLD	Second Line of Defense
SOP	standard operating procedure

## Glossary

**Alarm:** A particular type of event generated in the central alarm station (CAS) system that requires immediate action/attention by the system operators in accordance with the procedures that have been established for the radiation detection system.

**Central Alarm Station (CAS):** A physical location where the alarm and event evaluation for a given collection of control points and inspection sites is undertaken by designated partner country staff.

**CAS System:** The CAS system (also referred to as the communications system) provides those capabilities required to accept, process, display, and store data from the radiation portal monitors (RPMs); provide images to support alarm and fault event resolution; and provide interfaces allowing the CAS system users to effectively manage the alarm/event processing (i.e., respond to alarm and fault events) and to assess the status of the sites supported by the system.

**CAS Workstation:** A computer workstation located at a CAS used by the partner country staff members to operate the CAS system.

**Monitor:** This term has been superseded by radiation portal monitor or RPM.

**Radiation Portal Monitor (RPM):** The radiation detection device installed at a control point through which traffic passes. Typically these devices are fixed with one or more pillars, usually a master pillar and a slave pillar.

**Radiation Alarm:** An event generated by an RPM when the level of gamma or neutron radiation exceeds the configured threshold level during an occupancy. There are neutron and gamma radiation alarm events, and also a combined neutron-gamma alarm event.

**Secondary Inspection:** The examination of traffic of interest with the purpose of identifying the location and type of radiation already detected by an RPM; typically an in-depth process performed using handheld radiation survey instruments and radioactive isotope identification devices. For some Megaports, secondary inspection may also be conducted using a spectroscopic portal monitor. Additional examination may be conducted using non-intrusive inspection.

**Secondary Inspection Site:** A location where people, vehicles, or cargo that have generated an alarm event have a secondary inspection conducted by staff assigned this role.

**Second Line of Defense (SLD):** A cooperative effort between the U.S. and other foreign governments to deter, detect, and interdict illicit trafficking of nuclear and radioactive materials of proliferation concern.

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## **1.0 Purpose**

The purpose of the Operational Testing and Evaluation (OT&E) phases of the project is to prepare for turnover of the Megaports system supplied by the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA)—located at the Export Lanes of the Port of Lazaro Cardenas, Mexico—to the government of Mexico.

The activities conducted during the OT&E phases must demonstrate that the Megaports system can be operated effectively in real-time by Mexico Customs personnel to the satisfaction of the DOE/NNSA. The activities conducted during the OT&E phases will also determine if the Megaports system, as installed and accepted, is performing according to the Megaports Program objectives such that the system is capable of executing the mission of the Second Line of Defense (SLD) Megaports Initiative.

The OT&E phases of the project also provide an opportunity to consider potential improvements to the system and take remedial actions if performance deficiencies are identified during the course of evaluation. Changes to the system should be considered under an appropriate change control process.

DOE/NNSA will determine that OT&E is complete by examining whether the Megaports system is performing as intended and that Mexico is fully capable of operating the system independently without continued onsite support from the U.S. team.

## **2.0 Approach**

The U.S. project team, in close cooperation with Mexico Customs system operators, reviews procedural compliance and observes responses to events and alarms as the system operates in a production mode. This approach provides an opportunity for Mexico Customs officers to receive on-the-job training. The U.S. team will make recommendations for improvements when appropriate. OT&E will be conducted to ensure consistency of operations and effectiveness of the system.

Due to travel limitations associated with project work in Mexico, OT&E will take place over three days in order to evaluate Mexico Customs operations and use of the radiation portal monitors (RPMs), VACIS® gamma-ray imaging portals, optical character recognition systems, surveillance cameras, handheld instrument interfaces, central alarm station (CAS) and local alarm station (LAS) hardware and software components, and standard operating procedure (SOP).

Approximately one month after the completion of OT&E, a sustainability assessment will be conducted by the Mexico sustainability manager. This activity is intended to confirm system effectiveness, resolve any questions or concerns from Mexico Customs, and to collect data and analyze alarm rates.

## **3.0 Schedule**

The OT&E activities at the Port of Lazaro Cardenas will not commence until System Level Acceptance Testing (SLAT) has been completed. OT&E activities are expected to last approximately three days. SLAT is scheduled for May 9-11, 2012. OT&E and system stabilization will occur concurrently on May 12-14, 2012.



### OT&E Overview Schedule

Activity Description	Duration	Start	Finish	Resource
OT&E Team Briefing and CAS Software Team Training	1 day		5/11/2012	Mexico Customs Aldo Melendez Pete Humphrey Mike Dempsey Interpreter
OT&E	3 days	5/12/2012	5/14/2012	Mexico Customs Aldo Melendez Pete Humphrey Mike Dempsey Interpreter

### OT&E Resource Schedule

	CAS	LAS	Secondary Inspection
5/12/2012 – Saturday	Humphrey	Melendez	Dempsey
5/13/2012 – Sunday	Melendez	Humphrey	Dempsey
5/14/2012 - Monday	Humphrey	Melendez	Dempsey

## 4.0 Criteria for OT&E Readiness

The OT&E readiness criteria contain specific prerequisites and exit criteria. The Mexico project team commits to complete all readiness activities prior to initiating OT&E unless otherwise directed by the DOE country manager. An entrance and exit criteria checklist is included in Appendix C.

### 4.1 Entrance Criteria

Below are the activities and criteria that should be completed and/or met prior to initiating OT&E. Any incomplete activity or unmet criteria should be managed as very high risk as it has a very high potential to impact schedule, cost, and quality.

*System Accepted* – Successful demonstration via the SLAT that the system meets design and functional requirements. If there are unmet initial requirements and a decision is made that the system is acceptable, applicable documentation shall be submitted approving the deviation.

*Operator Training* – All planned training is to be completed prior to OT&E in accordance with Mexico’s training plan. Training is fully indigenized in Mexico.

*System Administrator Training* – A system administrator has been identified and trained.

NOTE: There is not a system administrator for the Port of Lazaro Cardenas since SAIC is the local maintenance provider and will provide communications system maintenance and associated system administrator as well as local maintenance provider tasks.

*OT&E Plan* – An OT&E plan has been developed that details the following:

- Schedule of events, including U.S. and foreign participants

- Roles and responsibilities of members
- OT&E deliverables.

*Readiness Review* – A readiness review has been conducted and the partner country has demonstrated the items outlined below.

- An SOP is developed and approved by all partner country stakeholders
- A staffing plan that coincides with the OT&E plan is in place
- Communications with truck drivers has been completed
- The OT&E plan has been accepted.

*OT&E Member Briefing* – The OT&E team members shall receive training on the country-specific SOP, communications system, system configuration, and OT&E plan.

## **4.2 Exit Criteria:**

The following activities and criteria should be completed and met prior to exiting OT&E.

*Objectives* – Meet the objectives of the OT&E as described in Section 5.0 of this plan.

*Operator and Maintenance Manual* – Manuals are available, including parts list and as-built drawings.

*Maintenance Contract* – Contracts are in place with in-country organizations.

## **5.0 Objectives**

The objective of this OT&E plan is to outline the process and deliverables required to turn over the DOE/NNSA-provided Megaports system to Mexico at the conclusion of the OT&E phase of the project, thereby formally starting the sustainability phase of the project. This turnover will be achieved through the courses of action outlined below:

1. Ensuring the partner country is capable of operating the Megaports system provided by DOE/NNSA, which includes the following components:
  - a. RPM
  - b. Communications system
  - c. CAS location
  - d. LAS location
  - e. Secondary inspection site
  - f. Data transfer, storage, and retrieval
  - g. Underlying operational procedures necessary for operation of the system
  - h. Event response.

2. Evaluating operator performance to ensure Mexico Customs has the ability to operate the system at the Port of Lazaro Cardenas. In the event the provided training is insufficient to enable Mexico Customs to operate the system, DOE/NNSA will notify Mexico that additional training is necessary.
3. Understanding the types of cargo and associated naturally occurring radioactive material (NORM) that is imported or exported through the Port of Lazaro Cardenas. The sustainability team, on the first sustainability visit, depending on lane traffic volume, may adjust alarm thresholds to ensure optimal screening of target special nuclear materials while minimizing innocent alarm rates (i.e., maximize the likelihood of detection while minimizing the impact on port operations and, thus, increased likelihood of long-term continued system operations). The OT&E team shall collect RPM data in support of this effort.
4. Documenting the alarm rates and secondary inspection rates of the operations at the Lazaro Cardenas.
5. Ensuring functionality and accessibility of data storage and retrieval systems such that necessary data are available, on a normal operational basis, so that Customs is able to collect and submit data and log files, as required for troubleshooting, and to collect and submit RPM daily files to Oak Ridge National Laboratory for long-term data analysis.
6. Evaluating and improving the SOP as necessary.

## **6.0 Organizational Responsibilities and Deliverables**

The following are the organizational responsibilities and deliverables of the OT&E phase of the project.

### **6.1 DOE/NNSA**

Responsibilities:

- Review and approve the OT&E plan
- Review and approve results of the OT&E phase of the project
- Turn system over to partner country at conclusion of the OT&E phase of the project

Deliverables:

- System turned over to Mexico

### **6.2 Government of Mexico**

Responsibilities:

- Provide personnel to operate the Megaports system in a fully operational environment
- Provide the OT&E team with access to port facilities
- Provide access to radiation sources as necessary for OT&E activities
- Provide training support and services as identified in the training management plan
- Refine the SOP
- Operate the system upon successful completion of the OT&E phase of the project

Deliverables:

- System accepted for operation

### **6.3 Pacific Northwest National Laboratory**

Responsibilities:

- Provide project management for the OT&E phase of the project
- Ensure U.S. staffing of OT&E and obtain Mexican staffing plan from Lazaro Cardenas Customs
- Coordinate logistics with in-country resources
- Continue implementation of training plan
- Evaluate effectiveness of training plan by assessing competency of system operators
- Prepare overall completion report for the OT&E phase of the project
- Finalize the mechanism for maintenance of the Megaports system for a negotiated period of time

Deliverables:

- OT&E plan
- OT&E report

### **6.4 Los Alamos National Laboratory**

Responsibilities:

- With the partner country, acquire and evaluate occupancy data, load data, and handheld inspection results to understand cargo types and associated NORM for cargo
- Determine alarm rates, secondary inspection rates, and percentages of cargo types
- Document analysis of NORM and occupancy data to characterize terminal and portal dependence of innocent alarm rate versus alarm threshold and provide to Pacific Northwest National Laboratory (PNNL) for inclusion in the final OT&E report to DOE/NNSA
- Support PNNL's training of port personnel on handheld devices and CAS software
- Download raw occupancy data for evaluation on a periodic basis to determine continued proper operation of the RPMs and to determine whether significant changes in NORM characteristics have occurred either due to seasonal variations or changes in shippers utilizing the port
- Support development and performance of exercises and scenarios

Deliverables:

- Provide occupancy and NORM data to PNNL for inclusion in the OT&E report
- Provide alarm rates and secondary inspection rates to PNNL for inclusion in the OT&E report
- Determine final threshold set points

- Optimize RPM alarm thresholds to ensure optimal screening of target special nuclear materials and minimization of innocent alarms in order to minimize impact on port operations
- Provide functional compliance report containing the information outlined in Appendix B

## **6.5 Sandia National Laboratories**

Responsibilities:

- Evaluate the effectiveness and stability of the communications system by assessing the system response to operator actions
- Evaluate Lazaro Cardenas SOP

## **6.6 SAIC, Inc.**

Responsibilities:

- Provide consulting support as needed

## **6.7 TSA Systems, Ltd.**

Responsibilities:

- Provide telephone consulting support as needed

# **7.0 Training and Evaluation of Training**

The training and evaluation of training conducted during OT&E are described in the Mexico training management plan. If training deficiencies are uncovered during the OT&E phase of the project, remedial training will be provided as needed by the SAT.

# **8.0 Standard Operating Procedures**

Mexico Customs will provide an SOP to system operators to improve knowledge of operations, alarm response, and troubleshooting. However, as the OT&E phase of the project will be the first for new operators in Lazaro Cardenas to execute the SOP, the OT&E phase of the project is an opportunity for the SOP to be refined by input from new personnel.

# **9.0 Determination and Setting of RPM Alarm Threshold**

Using data gathered during the background radiation survey, RPMs are initially set up to minimize innocent alarms to the extent possible without affecting the ability to detect materials of interest. Throughout both phases of OT&E, data on the radiation characteristics of cargo containers handled at the Port of Lazaro Cardenas export lanes will be accumulated, evaluated, and archived by Los Alamos National Laboratory (LANL). These additional data will either confirm that the settings are optimal or provide the basis for adjustments to the RPM settings. This information will better balance the objectives

of maintaining sensitivity for the detection of target materials while minimizing the impact on port operations. To perform these analyses, LANL will need to receive the archived radiation profile data from the CAS for all detected occupancies.

## **10.0 Alarm Response**

The alarm response will be in accordance with the Port of Lazaro Cardenas SOP. If assistance is needed from the United States in resolving a neutron alarm, the Neutron Incident Report Form provided in Appendix A will be used to document the event.

## **11.0 OT&E Report**

The purposes of the report are to document results of the OT&E phase of the project, evaluate performance of the system and partner country operators, and recommend any needed corrective action. PNNL will produce a report upon completion of OT&E.

## **12.0 References**

1. *Second Line of Defense, Megaports Initiative, Design Requirements Document: Export Lanes, Port of Lazaro Cardenas*, Version 1.0, August 2010
2. *Second Line of Defense Megaports Initiative Communications System Descriptive Requirements Document, Port of Lazaro Cardenas, Phase II (Export Lanes)*, Version 1.0, August 2010
3. *Office of Second Line of Defense Sustainability Guidelines Required Commitments to Maintaining Radiation Portal Monitor System Operations*, Rev. 0, December 2007
4. *Background Radiation Survey, Port of Lazaro Cardenas, Mexico*, Los Alamos National Laboratory

## Appendix A - Neutron Incident Report Form

Incident Tracking Number: \_\_\_\_\_

Incident Location: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Reporting Technical Support Official: \_\_\_\_\_ Phone: \_\_\_\_\_

<b>Conveyance Information:</b>
--------------------------------

Vehicle Type: \_\_\_\_\_ Make/Model: \_\_\_\_\_

License: \_\_\_\_\_ Country: \_\_\_\_\_

Number of Passengers: \_\_\_\_\_

Manifested Commodity: \_\_\_\_\_

Manifest or Placarding Information: \_\_\_\_\_

Any labels or placarding indicating radioactive or hazardous materials? YES NO

Shipment documents indicate industrial neutron source? YES NO

Shipper Name and Address: \_\_\_\_\_

\_\_\_\_\_

Consignee Name and Address: \_\_\_\_\_

<b>Alarm Information:</b>
---------------------------

Radiation Alarm: Neutron ONLY or Neutron and Gamma

Peak Neutron Alarm Level displayed on CAS/LAS: \_\_\_\_\_ cnts/sec

If present, Peak Gamma Alarm Level displayed on CAS/LAS \_\_\_\_\_ sigma

Has the vehicle been isolated? YES NO

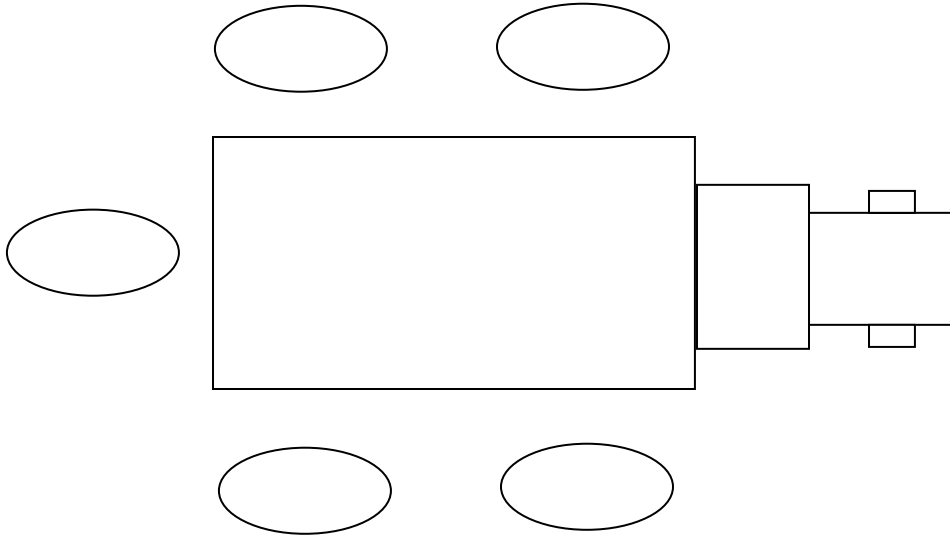
Has a perimeter been established? YES NO

Has the source been located? YES NO

Has the source been isolated? YES NO

Using the figure below,

1. Mark the location of neutron source based on CAS/LAS display,
2. Mark the location of the maximum response from hand-held detector and
3. Fill the oval shapes with measurements of hand-held neutron-responsive detector.



**Gamma and Neutron Information**

Personal radiation detector (PRD) reading of “9” observed?    YES            NO

Maximum PRD reading observed: \_\_\_\_\_

Maximum Survey Meter (TSA 470PRM or equivalent) count reading: \_\_\_\_\_

Maximum RIID dose rate or count reading: \_\_\_\_\_

Distance (in meters) from source at RIID dose rate reading “20 uSv/hr”: \_\_\_\_\_

Radioisotope Identification: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Equipment used for identification:

Manufacturer/Model: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Calibration Date \_\_\_\_\_

**Assessment and Disposition:**

Has the source been identified?    YES            NO

Identification(s): \_\_\_\_\_



Is the source consistent with the industrial neutron sources? Yes or No

Does the source match the declaration, placarding, or shipping manifest? Yes or No

What is the discrepancy? \_\_\_\_\_

Was a detailed inspection required? YES NO

Final Disposition:

- Industrial source configured for legitimate end use
- Industrial source configured for illicit end use
- Neutron Source of Concern: \_\_\_\_\_
- Unresolved credible radiological threat

**INCLUDE  
PHOTO  
HERE**

## Appendix B - Equipment Summary Format

At a minimum, for each deployed RPM, the following information along with a picture needs to be captured:

- RPM type
- Serial number
- RPM spacing
- Background Radiation (sum)
- Threshold settings (documented settings are Official Use Only)
- Firmware version
- Internet Protocol address
- Initial calibration date
- SLAT date

### C Gate, Lane 1



**RPM Type:** VM-250AGN  
**Serial #:** 0090  
**RPM Spacing:** 4.92m

**Background (Sum):** 1009 cps  
**Threshold Setting:** Sigma  
**Firmware Version:** 1.08.8d

**IP Address:** 010.007.007.019  
**Calibration Date:** 19-Jan-2007  
**SLAT Date:** 2-Feb-2007

## Appendix C- OT&E Entrance and Exit Criteria Checklist

Item	Topic to Review	Remaining Work to be Completed	Required to be Completed Before OT&E Begins	Responsible Party/ Representative	Comments
System Accepted	SLAT is complete and system is accepted				
Operator Training	Operator training is complete				
System Administrator Training	System administrator is identified and trained				
OT&E Plan	OT&E plan is complete with a resource loaded schedule, roles and responsibilities, and deliverables				
OT&E Readiness Review and Team Briefing	SOP is in place, import and export lanes staffing plan exists, truck driver communication complete, OT&E plan accepted, OT&E members briefed on concept of operations and SOP, communications system, and OT&E plan				
Operator and Maintenance Manuals	Manuals are available				
Parts List and As-Built Drawings	Lists and drawings are available				
Maintenance Contract	Maintenance contract is in place				
Objective 1: System is Operational	Operators are capable of operating the RPMs, CAS system, secondary inspections, and understand how to respond to alarms and when to involve CNSNS				

Item	Topic to Review	Remaining Work to be Completed	Required to be Completed Before OT&E Begins	Responsible Party/ Representative	Comments
Objective 2: Operator Performance Evaluated	Performance of operators demonstrates capability to operate system without U.S. support				
Objective 3: Types of Cargo and NORM	Begin collecting data to be used on first sustainability visit to optimize the RPM thresholds				
	LANL determines initial alarm rates, secondary inspection rates, and types of cargo				
Objective 4: Data Storage and Retrieval System	Data is stored, accessible, and retrievable				
Objective 5: SOP	SOP has been evaluated and modified if necessary				

