U.S. DEPARTMENT OF ENERGY

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Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Second Line of Defense Megaports Initiative

Operational Testing and Evaluation Plan - Kingston Container Terminal, Port of Kingston, Jamaica

TJ DeForest
S VanDyke

March 2012

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Pacific Northwest National Laboratory
Richland, Washington 99352

Operational Testing and Evaluation Plan
Kingston Container Terminal, Port of Kingston, Jamaica

Concur:

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Abbreviations and Acronyms

CAS	central alarm station
DOE	U.S. Department of Energy
GOJ	Government of Jamaica
IT	information technology
KCT	Kingston Container Terminal
LANL	Los Alamos National Laboratory
NNSA	National Nuclear Security Administration
NORM	naturally occurring radioactive material
OT&E	operational testing and evaluation
PNNL	Pacific Northwest National Laboratory
RAPIDS	Radiation Portal Information and Display System
RDSC	Radiation Detection Straddle Carrier
SCIDS	Straddle Carrier Interface and Dispatch System
SLAT	system level acceptance testing
SNL	Sandia National Laboratories
SOP	standard operating procedure
TAA	threat analysis algorithm

Glossary

Alarm: A particular type of event generated in the central alarm station (CAS) system that requires action/attention by the system operators (i.e., CAS 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 the radiation detection system is undertaken by designated partner country staff.

CAS System: (also referred to as the communications system) provides those capabilities required to accept, process, display, and store data from a Radiation Detection Straddle Carrier (RDSC) and to provide interfaces allowing CAS system users to effectively manage alarm/event processing (i.e., respond to alarm and fault events) and assess the status of the detection systems supported by the CAS system.

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

Radiation Detection Straddle Carrier (RDSC): A straddle carrier equipped with radiation detectors, optical character recognition, global positioning, and communications equipment to simultaneously scan containers for the presence of radiation, obtain container number and GPS location, and wirelessly transmit the information to the CAS.

Radiation Alarm: An event generated by the RDSC when the level of gamma or neutron radiation exceeds the configured threshold level during an occupancy. For gamma alarms, the RDSC automatically attempts to identify the isotopes associated with the radiation and categorize the alarms as threat, suspect, or innocent. There are neutron, gamma, and combined neutron-gamma radiation alarm events.

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

Secondary Inspection Site: The location where a secondary inspection is conducted on people, vehicles, or cargo that generate an alarm event.

Second Line of Defense: A cooperative effort between the United States and other foreign governments to deter, detect, and interdict the illicit trafficking of nuclear and radioactive materials of proliferation concern.

Contents

Tables

1.0 Purpose

The purpose of the Operational Testing and Evaluation (OT&E) phase of the project is to prepare for turnover of the Megaports system supplied by U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA)—located at the Kingston Container Terminal (KCT) of the Port of Kingston, Jamaica—to the Government of Jamaica (GOJ).

Activities conducted during the OT&E phase must demonstrate that the Megaports system can be operated effectively in real time by Jamaica Customs and KCT personnel to the satisfaction of the DOE/NNSA. These activities 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 Megaports Initiative.

The OT&E phase of the project also provides an opportunity to consider potential improvements to the system and to take remedial action 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 the GOJ is fully capable of operating the system independently without continued onsite support from the U.S. team.

2.0 OT&E Approach

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

Over the course of one week, OT&E will be conducted to evaluate KCT personnel operations and maintenance of the Radiation Detection Straddle Carrier (RDSC) and Jamaica Customs operations and use of the overall radiation detection system, including dispatching the RDSC for primary and secondary/tertiary scanning, evaluating and adjudicating radiation alarms, coordinating operations and maintenance activities with KCT, and performing system administration of the communications system.

Approximately two months after the completion of OT&E, a sustainability assessment is planned to be conducted by the Megaports sustainability manager for Jamaica. This activity is intended to confirm the effectiveness of the system at KCT, resolve any questions or concerns from Jamaica Customs or KCT, and collect data and analyze alarm rates.

3.0 OT&E Schedule

OT&E activities for the Megaports system at KCT will not commence until System-Level Acceptance Testing (SLAT) and Driver and Maintenance Training have been completed. OT&E activities are expected to last approximately one week. RDSC Maintenance Training was completed on February 21, 2012, and SLAT was completed on March 4, 2012. RDSC Driver Training began on March 5, 2012, and

is expected to be completed on March 18, 2012. OT&E is scheduled to be conducted March 19-23, 2012. The sustainability assessment is tentatively scheduled for the week of May 13, 2012.

A Megaports system has been in operation since May 2009 for the Kingston Wharves Limited terminal and Jamaica Customs personnel are already familiar with radiation detection systems and alarm adjudication. The primary difference related to the KCT system will be the central alarm station (CAS) software for dispatching the RDSC and for alarm adjudication. Therefore, the first day of OT&E will involve a classroom training session to familiarize Customs officers with the KCT CAS software. These officers will then rotate through the CAS for the remainder of the week so the OT&E team can observe their proficiency operating the system and provide additional hands-on, practical training. A follow up classroom training session will be held later in the week for officers unable to attend the initial session.

Since OT&E will involve both the CAS operation and operation of the RDSC for container scanning, members of the OT&E team will dispatch the RDSC from the CAS to observe the overall system functionality as well as KCT operation of the RDSC. Once a cadre of Customs officers has been trained on the CAS software, operation of the CAS will be turned over to Customs.

Finally, Sandia National Laboratories (SNL) will provide instruction related to system administration for the KCT Megaports system. The instruction will include approximately 2 days of both overview presentation material and hands-on practical exercises.

Table 3.1. OT&E Overview Schedule

Activity Description[1]	Duration	Start	Finish	Resources
OT&E Team Briefing	1 day	3/19/2012	3/19/2012	Jamaica Customs KCT Personnel Tom DeForest Todd Bardin Bridget Bersell Novella Bridges Chip Babb Richard Greco L-3 Staff
OT&E Phase – KCT Megaports System Operation	5 days	3/19/2012	3/23/2012	Jamaica Customs KCT Personnel Tom DeForest Todd Bardin Bridget Bersell Novella Bridges Chip Babb Richard Greco L-3 Staff
CAS Operator Training (two 1-Day sessions)	2 days	3/19/2012 3/21/2012	3/19/2012 3/21/2012	Bridget Bersell Novella Bridges
Practical Hands-On CAS Operator Evaluation and Assistance	4 days	3/20/2012	3/23/2012	Bridget Bersell Novella Bridges
System Administration Instruction	2 days	3/19/2012	3/20/2012	Chip Babb
Sustainability Assessment	3 days	5/14/2012	5/16/2012	Jamaica Customs KCT Personnel Todd Bardin James Schol Keith Lash

[1]Activities may be conducted concurrently and are not mutually exclusive.

Table 3.2. OT&E Resource Schedule

	Central Alarm Station	RDSC Parking Area	Training Classroom
3/19/12 – Monday	System Administration Instruction – Babb OT&E Readiness Review – DeForest, Greco, Babb	KCT and L-3 Staff Prepare the RDSC for Scanning	CAS Operator and Dispatch Training – Bersell, Bridges
3/20/12 – Tuesday	Practical/Hand-On Evaluation/ Assistance for CAS Operators – Bersell, Bridges System Administration Instruction – Babb OT&E Observation/Coordination – DeForest, Greco, Babb	KCT and L-3 Staff Prepare the RDSC for Scanning	
3/21/12 – Wednesday	Practical/Hand-On Evaluation/ Assistance for CAS Operators – Bersell OT&E Observation/Coordination – DeForest, Bardin, Greco, Babb	KCT and L-3 Staff Prepare the RDSC for Scanning	CAS Operator and Dispatch Training – Bridges
3/22/12 –Thursday	Practical/Hand-On Evaluation/ Assistance for CAS Operators – Bersell, Bridges OT&E Observation/Coordination – Bardin, Greco, Babb	KCT and L-3 Staff Prepare the RDSC for Scanning	
3/23/12 – Friday	Practical/Hand-On Evaluation/ Assistance for CAS Operators – Bersell, Bridges OT&E Observation/Coordination – Bardin, Greco, Babb	KCT and L-3 Staff Prepare the RDSC for Scanning	

4.0 Criteria for OT&E Readiness

OT&E readiness contains specific prerequisites and exit criteria and will be performed as part of the system stabilization period between SLAT and OT&E. The Jamaica 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 OT&E 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 high risk as it has the potential to impact schedule, cost, and quality.

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

- RDSC Maintenance and Driver Training – Training will be provided to KCT staff. The Maintenance training occurred February 8-21, 2012 and is followed by Driver training March 5-18.
- CAS Operator and Dispatch Training – At the beginning of OT&E, Jamaica Customs will be trained to dispatch the RDSC and adjudicate alarms using the Straddle Carrier Interface and Dispatch System (SCIDS) and Radiation Portal Information and Display System (RAPIDS). On-the-job training will continue throughout OT&E.

  NOTE: Jamaica Customs personnel have been operating the Megaports system for the Kingston Wharves Limited terminal since June 2009. As such, CAS Operator Foundations training is not expected to be required. If new Customs personnel are brought in to staff the CAS, it is expected Jamaica Customs training personnel will conduct foundations training prior to the start of OT&E.
- System Administrator Training – SNL will conduct system administrator on-the-job instruction during the OT&E period. Jamaica Customs information technology (IT) personnel are expected to be the primary system administrators. KCT IT personnel are also expected to attend the system administrator training.

  NOTE: As the designer and developer of the CAS system for the RDSC in Jamaica, SNL will initially have equal responsibility for system administration with Jamaica Customs IT. During the 3-year transition period, it is expected that SNL will progressively transfer full system administration responsibilities to Jamaica Customs.
- OT&E Plan - A 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 will be conducted on the first day of OT&E. The following items will be verified with the host country during this review.
  - A standard operating procedure (SOP) has been developed and approved by all host country stakeholders.
  - A staffing plan that coincides with the OT&E plan is in place.
  - Communications protocols between Customs and the terminal operator have been established.
  - The OT&E Plan has been accepted.
- OT&E Member Briefing – The OT&E team members shall receive training on the country-specific SOPs, communication system, system configuration, and the OT&E Plan.

4.2 OT&E Exit Criteria:

This section discusses the activities and criteria that 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 including parts list and as-built drawings are available.

- Maintenance Strategy – A strategy for performing both routine maintenance and emergency repair is in place and has been agreed to by 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 GOJ at the conclusion of the OT&E phase, 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 the DOE/NNSA, which includes the following:
    a. RDSC
    b. Communications system
    c. CAS location
    d. Data transfer, storage, and retrieval
    e. Underlying operational procedures necessary for operation of the system
    f. Event response.
2. Evaluating operator performance to ensure Jamaica Customs has the ability to operate the system at KCT. In the event the provided training is insufficient to enable Jamaica Customs to operate the system, DOE/NNSA will notify GOJ that additional training is necessary.
3. Understanding the types of cargo and associated naturally occurring radioactive material (NORM) that transits through the Port of Kingston. RDSC data shall be collected during OT&E in support of this effort including identifying cargo types associated with various alarm types.
4. Documenting the alarm rates and secondary inspection rates of the operations at KCT.
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, if required for troubleshooting, and collect and submit RDSC 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 organizational responsibilities and deliverables of the OT&E phase of the project.

- DOE/NNSA
    – Review and approve the OT&E Plan
    – Review and approve results of the OT&E phase
    – Turn system over to partner country at conclusion of the OT&E phase
    – Deliverable: System turned over to the GOJ

- GOJ
  - Provide personnel to operate the DOE/NNSA-provided Megaports system in a fully operational environment
  - Provide DOE/NNSA OT&E team with access to port facilities
  - Provide access to radiation sources as necessary for OT&E activities
  - Refine the SOP
  - Operate the system upon successful completion of the OT&E phase
  - Deliverable: System accepted for operation
- Pacific Northwest National Laboratory (PNNL)
  - Provide project management for the OT&E phase
  - Ensure U.S. staffing of OT&E and obtain staffing plan from Jamaica Customs and KCT
  - Coordinate logistics with in-country resources
  - Provide CAS Operator and Dispatch training to Jamaica Customs personnel
  - Evaluate effectiveness of training by assessing competency of system operators
  - Prepare overall completion report for the OT&E phase
  - Finalize the mechanism for maintenance of the Megaports system for a negotiated period of time
  - Deliverables:
- OT&E Plan
- OT&E Report
- Los Alamos National Laboratory (LANL)
  - With the partner country, acquire and evaluate primary and secondary/tertiary RDSC scan data, cargo manifest data, and handheld inspection results to understand cargo types and associated NORM for cargo
  - Determine alarm rates, secondary/tertiary inspection rates, and percentages of cargo types
  - Document analysis of NORM and RDSC scan data to characterize terminal and innocent alarm rates and provide to PNNL for inclusion in the OT&E Report
  - 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 RDSC detectors and determine whether significant changes in NORM characteristics have occurred
  - 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

- Provide Functional Compliance Report, containing information outlined in Appendix B
- SNL
  - Evaluate the effectiveness and stability of the communication system by assessing the system's response to the operator actions
  - Provide training to Jamaica Customs and KCT IT personnel on system and network administration
  - Evaluate the overall effectiveness of the Megaports-KCT SOPs
- L-3 Security and Detection Systems (L-3 SDS)
  - Provide oversight, assistance, and refresher training as needed to KCT for the routine startup, operation, and maintenance of the RDSC
  - Provide emergency repair for the RDSC as needed

7.0 Training and Evaluation of Training

Training will be provided at the start of OT&E for CAS operators and KCT personnel. The topics included in this training will include:

- RDSC overview
- RDSC SOPs
- SCIDS
- RAPIDS

Two separate classroom sessions will be conducted to accommodate the number of personnel expected to be trained. After completion of the initial classroom session, practical hands-on evaluation and assistance will be provided for a subset of Jamaica Customs personnel for the remainder of the week.

System administration instruction will be provided for Jamaica Customs and KCT IT staff.

Training for operations and maintenance of the RDSC will be completed prior to the start of OT&E. During OT&E, L-3 SDS will observe the RDSC drivers and maintenance personnel to ensure they are comfortable with their roles and responsibilities. L-3 SDS staff will provide assistance and refresher training as needed during OT&E and report their observations of the level of proficiency to the PNNL project manager. If training deficiencies are uncovered during OT&E, remedial training will be provided as needed by the sustainability assessment team.

8.0 Standard Operating Procedures

An SOP has been developed with input from Jamaica Customs and KCT to assist with operations, alarm response, and troubleshooting. However, as OT&E will be the first time new operators in Kingston execute the SOP, the OT&E phase is an opportunity for further refinement.

9.0 Determination and Setting of RPM Alarm Threshold

Threshold settings for the RDSC have been initially setup based on laboratory measurements, modeling, and simulation to minimize innocent alarms to the extent possible without affecting the ability to detect materials of interest. Throughout OT&E, data on the radiation characteristics of cargo containers handled at KCT will be accumulated, evaluated, and archived by LANL and may provide the basis for adjustments to the threshold 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. These data may also be directly downloaded by LANL from the RDSC.

10.0 Alarm Response

Alarm response will be in accordance with the KCT SOP. If U.S. assistance is needed to resolve 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 purpose of the OT&E Report is to document the results of the OT&E phase, evaluate performance of the system and the 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, Kingston Container Terminal, Port of Kingston, Jamaica, Version 1.0, February 2011
2. Second Line of Defense Megaports Initiative Communications System Design Requirements Document, Radiation Detection Straddle Carrier Installations, Version 1.0, November 2011
3. Background Radiation Characterization Survey for the Radiation Detection Straddle Carrier, Port of Kingston, Kingston Container Terminal, Jamaica, Los Alamos National Laboratory, December 2009

Appendix A: Neutron Incident Report Form

This form was developed specifically for traditional RPMs and as such not all fields are applicable to a neutron alarm from the RDSC. The general information in the form can be used, however, to record the pertinent information for resolving the alarm.

Incident Tracking Number: _____

Incident Location: _____ Date: _____ Time: _____

Reporting Technical Support Official: _____ Phone: _____

Conveyance Information:

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: _____

Alarm Information:

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

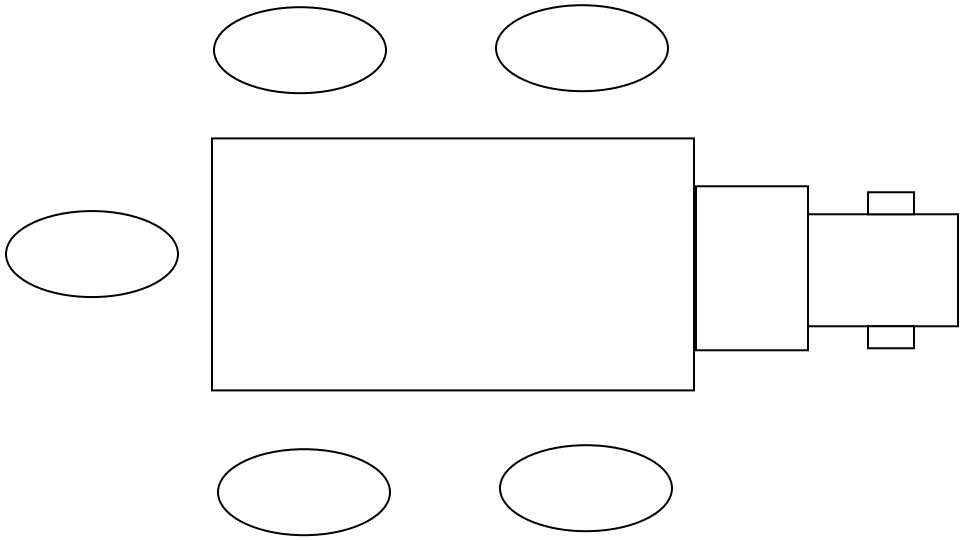
Has a perimeter been established? YES NO

Has the source been located? YES NO

Has the source been isolated? YES NO

Using the figure below,

4. Mark the location of neutron source based on CAS/LAS display,
5. Mark the location of the maximum response from hand-held detector and
6. 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, the following information, along with a picture, needs to be captured for the RDSC deployed in Kingston, Jamaica:

- Monitor type
- Serial number
- RDSC panel spacing
- Background radiation profile
- Threshold and configuration settings (documented settings are Official Use Only)
- Threat analysis algorithm (TAA) Configuration XML
- Firmware version
- Primary TAA
- Primary data acquisition
- Secondary TAA
- Diagnostic display graphical user interface
- Internet Protocol Address
- Initial calibration date
- SLAT date

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				CAS operators have been trained for the KWL system; Training related to the RDSC CAS and dispatch software will be conducted at the beginning of OT&E
System Administrator Training	System administrator is identified and trained				System administrator training for both Jamaica Customs and KCT personnel will be conducted during OT&E
OT&E Plan	OT&E Plan is complete with resource loaded schedule, roles and responsibilities, and deliverables				
OT&E Readiness Review and Team Briefing	SOPs are in place, driver and maintenance personnel have been identified and trained, OT&E Plan accepted, OT&E members briefed on operations and SOPs, communications system, and OT&E Plan				
Operator and Maintenance Manuals	Manuals are available				
Parts List and As-Built Drawings	Lists and drawings are available				
RDSC and Megaports System Maintenance	Maintenance strategy has been finalized and agreed to by responsible parties				

Item	Topic to Review	Remaining Work To Be Completed	Required to be Completed before OT&E Begins	Responsible Party/ Representative	Comments
Objective 1: System is Operational	Operators are capable of operating the RDSC, CAS system, secondary inspections, and understand how to respond to alarms				
Objective 2: Operator Performance Evaluated	Demonstrated capability to operate system without U.S. support				
Objective 3: Types of Cargo and NORM	Collecting data for first sustainability visit to analyze RDSC performance				
	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: SOPs	SOPs have been evaluated and modified if necessary				

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