



System Assessment and Validation for Emergency Responders (SAVER)

Total Containment Vessels Market Survey Report

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Prepared by Space and Naval Warfare Systems Center Atlantic

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FOREWORD

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercially available equipment and systems, and develops knowledge products that provide relevant equipment information to the emergency responder community. The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, operationally oriented assessments and validations of emergency response equipment; and
- Providing information, in the form of knowledge products, that enables decision-makers and responders to better select, procure, use, and maintain emergency response equipment.

SAVER Program knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the responder community: “What equipment is available?” and “How does it perform?” These knowledge products are shared nationally with the responder community, providing a life- and cost-saving asset to DHS, as well as to Federal, state, and local responders.

The SAVER Program is supported by a network of Technical Agents who perform assessment and validation activities. As a SAVER Program Technical Agent, the Space and Naval Warfare Systems Center (SPAWARSYSCEN) Atlantic has been tasked to provide expertise and analysis on key subject areas, including communications, sensors, security, weapon detection, and surveillance, among others. In support of this tasking, SPAWARSYSCEN Atlantic developed this report to provide emergency responders with information gathered during a market survey of commercially available total containment vessels (TCVs), which fall under AEL reference number 02EX-00-TCVV titled Explosive Device Mitigation and Remediation Equipment, Vessel, Containment.

Visit the SAVER website on First Responder.gov (<http://www.firstresponder.gov/SAVER>) for more information on the SAVER Program or to view additional reports on TCVs or other technologies.

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1. INTRODUCTION

Total containment vessels (TCVs) are fully enclosed containers designed to safely secure, transport, and test explosive devices in order to protect critical assets. TCVs are used as mitigation solutions to help protect people, property, and the environment from primary and secondary fragmentation and gas that generally result from the detonation of an explosive device. Once the suspect object is contained in the chamber, the surrounding area is protected from blast effects from the explosive device. TCVs may also provide protection against chemical or radiological devices. To provide emergency responders with information on TCVs, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted a market survey.

This market survey report is based on information gathered from October 2013 through March 2014 from Internet searches, industry publications, and a government issued Request for Information (RFI) that was posted on the Federal Business Opportunities website. For inclusion in this report, the TCVs had to meet the following criteria:

- The product is classified as commercial off-the-shelf;
- The product is designed to contain the explosive blast and fragments up to its explosive rating; and
- The product is gas-tight.

Due diligence was performed to develop a report that is representative of products in the marketplace.

2. TECHNOLOGY OVERVIEW

TCVs are used by bomb technicians worldwide for containment of suspected explosive devices in locations such as airports, post offices, train stations, stadiums, and government and corporate offices. When a suspect object is found, it can be contained in the chamber of a TCV and transported away from the area to protect the facility and personnel.

2.1 TCV Components

TCVs are composed of a core chamber, frame, and control console. The core chamber is mounted on the frame, which can also be used as support for the control console and other optional equipment. A TCV is typically mounted on a trailer or truck so it can be transported to a designated site, such as an ammunition disposal area, where the suspect object can undergo investigation and be rendered safe.

Depending on the needs of an agency, TCV manufacturers provide integration, tactical equipment, and capability, which are discussed in Section 3.

2.1.1 TCV Core Chamber

The key component of a TCV is the core chamber, as shown in Figure 2-1. The core chamber is typically spherical and includes an access door, an internal tray for holding the suspect object, and a yoke system, which holds the access door closed. These core chamber components are shown in Figure 2-2. Most manufacturers of TCVs offer standard size chambers as well as

customized solutions. An example of a small standard chamber is a model with a 40 inch diameter and a large standard chamber's diameter might measure 63 inches.

The chamber is usually made of high-strength steel based on the Naval Sea Systems Command (NAVSEA) technical publication T9074-BD-GIB-010/0300, as referenced in Section 2.4. The wall thickness ranges from 1 to 1.5 inches. For protection from radioactive materials, such as a dirty bomb, a chamber with a protective barrier of lead fill, located between two layers of steel, may be purchased as an option.



Figure 2-1. Core Chamber

Image courtesy of Dynasafe Group

All chambers are rated for a maximum internal blast pressure, which is called the trinitrotoluene (TNT) equivalent. The TNT equivalent is measured by field testing the chamber with explosives and quantifying the energy released in the explosion [e.g., 5 kilograms (kg) of TNT equivalent].

Access Door

The size and location of the access door in a TCV is an important consideration. If the door opening is too small, the suspect object may not fit inside. If the access door is in an awkward location, such as the top of the chamber, it may be difficult to access.

Some manufacturers offer a maximum opening whereby the chamber opens on the largest diameter. Most have side-loading openings ranging from 21.7 to 35.4 inches in diameter.

The chamber door can be opened and closed by using a wireless remote control or a tethered pendant (e.g., a cable with the TCV controls attached), which provides a safe stand-off distance for the bomb technician. All TCVs have a manual door override in case of power failure.

Internal Tray

An internal tray, basket, or cradle type system is provided that enables smooth loading and unloading of suspect objects without the need to reach inside the core chamber. The object remains in the cradle during transport. Some trays are telescopic, whereby rails slide in and out to facilitate loading. Other trays have a fixed loading box that prevents the suspect object from slipping while being transported.



Figure 2-2. TCV Core Chamber Components

Image courtesy of JAKUSZ

Yoke System

The gas-tight capability of some TCVs is achieved by equipping the chamber door with two half-rings, called a yoke system. The two half-rings are clamped together tightly to hold the access door in a closed position. The yoke is powered by an electric, hydraulic, or pneumatic mechanism called an actuator. The door or yoke is equipped with multiple rubber O-rings, which form the pressurized seal and are resistant to high temperature.

2.1.2 Frame

The TCV is mounted on a steel or aluminum frame for support. The frame can also be used to support other equipment such as a manual override for the access door or a lighting system.

2.1.3 Control Console

The control console houses the mechanics and controls for the TCV's operation, such as opening and closing of the chamber and operation of the internal tray. The bomb technician can remain at a safe distance from the chamber by using either a tethered pendant or a wireless remote control.

2.2 Transportation Methods

To provide mobility of the TCV, manufacturers offer mounting to trailers and trucks. Some manufacturers offer tracked transporters, as shown in Figure 2-3, and all-terrain vehicle mounts for specific models. TCVs can also be incorporated into a tractor-trailer for a customized solution.



Figure 2-3. Tracked Transporter

Image courtesy of NABCO

2.3 Applications

TCVs can be deployed to any site where a suspect object is located. Train stations, airports, government buildings, stadiums, and other high traffic areas are susceptible to bomb threats. Bomb squads may bring a TCV to a scene to contain the suspect object and then transport it to a remote site where it can be further evaluated and rendered safe. TCVs can also be used to safely store and transport munitions, such as weapons, ammunition, and explosives.

2.4 Standards/Regulations

Currently, no recognized standards or regulations exist that cover the manufacturing and testing of TCVs. However, guidelines and best practices have been established by TCV manufacturers and government agencies.

In March 2013, the National Institute of Standards and Technology (NIST) published NIST Interagency Report (IR) 7919, *Explosives Standards Forum (ESF) Recommendations*, which outlines proposed explosive standards for the U.S. Department of Homeland Security (DHS) to adopt. ESF conducted a focus group in order to develop the recommendations, and DHS designated the National Bomb Squad Commanders Advisory Board (NBSCAB) to represent the emergency responder community in the forum. NBSCAB reviewed, approved, and recommended standards to be considered for adoption and identified standards to be developed. One standard cited in the report and recommended by NBSCAB for development is:

Explosive Containment Vessels and TCVs - Fully enclosed TCVs were originally designed to contain an explosion but have evolved to include containment of toxic gases and biological or chemical agents. Manufacturers make claims that the vessels can contain repeated explosions and toxic materials, but no standard or testing exists to determine if these claims are true.

The Department of Defense (DoD) Explosives Safety Board (DDESB) has authored two relevant Technical Papers listed below:

- *Technical Paper 15, Approved Protective Construction*, which provides a comprehensive list of ammunition and explosives storage units that have approved protective construction. DDESB provides an independent verification of a TCV's explosive rating by requiring proof that the chamber is able to withstand an explosion 25 percent greater than the vendor rated capability. If approved, the DDESB provides a letter of approval for the manufacturer and adds the TCV to their *Approved Protective Construction* list, <https://www.ddesb.pentagon.mil/documents/TechnicalPapers.aspx>.
- *Technical Paper 16, Methodologies for Calculating Primary Fragment Characteristics*, which publishes methodologies for calculating primary fragment mass and velocity, maximum fragment range, hazardous fragment distance, effects of detonating stacks of items, effects of detonating buried items, and penetration information. DDESB uses these analysis methodologies when certifying a TCV for the *Approved Protective Construction* list, <https://www.ddesb.pentagon.mil/documents/TechnicalPapers.aspx>.

NAVSEA issued Technical Publication T9074-BD-GIB-010/0300, *Base Materials for Critical Applications: Requirements for Low Alloy Steel Plate, Forgings, Castings, Shapes, Bars, and Heads of High Yield (HY) 80/100/130 and High Strength Low-Alloy (HSLA)-80/100, Revision 2*, which covers materials that may be used in the manufacture of TCVs.

3. PRODUCT INFORMATION—MANUFACTURER PROVIDED

Table 3-1 summarizes key features of 10 TCV models identified in the market survey. Product descriptions and additional information for the TCVs are presented in Sections 3.1 through 3.4. All of the TCVs are transportable by trailer or similar means. Additionally, all are gas-tight models with total containment of chemical and biological agents, toxic gases, and the effects from explosions, such as shock waves and lightweight fragments. Gases are contained inside the chamber until they are released through a valve system. All the TCV manufacturers offer training and a 1-year warranty. The cost of the TCVs varies greatly depending on size and additional options. The manufacturer should be contacted directly for pricing information.

Options are available for all TCV models included in this report. Some manufacturers also upgrade older vessels with the latest technology, such as remote control options and chamber self-closing capabilities.

Product data presented in this report was obtained directly from manufacturers and their websites. The information has not been confirmed by the SAVER Program. Clarification on certain specifications in Table 3-1 is provided below, listed in alphabetical order:

Access Door Diameter (inches) refers to the size of the chamber door's opening.

Explosive Rating (kg) refers to the maximum internal blast pressure the chamber is able to control and withstand, rated as TNT equivalent in kilograms.

Maximum Object Dimensions (inches) refers to the maximum size of an object in inches that will fit onto the tray inside the core chamber.

Product Dimensions (inches) refers to the physical dimensions of the core chamber in inches on frame without trailer, unless noted.

Test Methods refers to the standards and methods used to test and evaluate each vessel.

Weight (pounds) refers to the weight of the TCV model in pounds. Unless otherwise noted, this weight is without a trailer.

Table 3-1. TCV Specifications

Company	Product	Explosive Rating	Product Dimensions (inches)	Access Door Diameter (in.)	Maximum Object Dimensions (inches)	Weight (pounds)	Test Methods
Dynasafe Group	DynaSEALR X10-LTR	5.0 kg	79.9x51.6x59.5	NP	35.4x19.7x17.7	7,716 ¹	Factory Acceptance Test
	DynaSEALR X10-HTR	5.0 kg	82.7x51.2x63.0	NP	35.4x26.7x15.7	13,448 ¹	Factory Acceptance Test
	DynaSEALR X12-HTR	8.0 kg	98.4x60.6x66.9	NP	39.4x31.5x26.5	8,378	Factory Acceptance Test
JAKUSZ Sp., z.o.o.	EVA GT	8.0 kg	192.9x97.6x106.0	35.4	45.3x25.6x17.7	14,330	Field Test
	PAULA GT	5.0 kg	82.5x55.1x73.6	55.0	35.4x25.6x19.6	7,716 ¹	Field Test
Mistral Security, Inc.	ARC 5 GT	5.8 kg	53.5x85.0x54.3	21.7	24.0x13.0x13.0	5,200	DDESB
	ARC 8 GT	8.0 kg	80.7x67.0x78.8	34.6	15.0x24.5x9.0	10,360	Non-Destructive Test
	ARC 10 GT	8.0 kg	80.7x67.0x78.8	34.6	15.0x24.5x9.0	12,100	DDESB

Company	Product	Explosive Rating	Product Dimensions (inches)	Access Door Diameter (in.)	Maximum Object Dimensions (inches)	Weight (pounds)	Test Methods
NABCO, Inc.	Model 42-GT-SCS	5.8 kg	132.0x62.0x83.0	22.5	27.0x16.0x16.0	6,500	DDESB
	Model 64-GT-SCS	8.8 kg	132.0x96.0x96.0	34.0	46.0x24.0x24.0	13,500	DDESB
Notes: ¹ Weight includes trailer NP—not provided by the manufacturer							

Information in the table based on data gathered from vendors and their websites from October 2013 through March 2014.

3.1 Dynasafe Group X-Series

Dynasafe offers three gas-tight TCV models: the DynaSEALR X10-LTR (light trailer) model, the DynaSEALR X10-HTR (heavy trailer) model, and the DynaSEALR X12-HTR model. Both X10 models have an explosive rating up to 5 kg of TNT equivalent and the X12-HTR model has a rating up to 8 kg. Dynasafe has a proprietary locking mechanism which provides the gas-tight capability of the chamber. Pricing was not provided by the manufacturer.



Figure 3-1. DynaSEALR X10-LTR

The X10-LTR core chamber resides within an aluminum enclosure. It is mounted on a two-axle trailer that can be towed by a sport utility vehicle or truck. The core chamber rests on a steel frame containing two parts. The stationary part carries the bulk of the chamber. The mobile part allows the access door to open on the chamber's largest diameter and to rotate up to 270 degrees. The chamber is operated remotely with a standard 50 meter tethered pendant. Options available for the X10-LTR model include:

- Actuator buttons for operation of the access door by an explosive ordnance disposal (EOD) robot;
- Wireless remote control to operate the chamber access door and adjust the pressure seals;
- An adjustable trailer tow bar;
- Gas sampling equipment kit; and
- Decontamination equipment on a separate trailer, which is used to clean the inside of the chamber after exposure to toxic gases.

The X10-HTR and X12-HTR contain the same features as the X10-LTR; however, they are mounted on heavy-duty trailers developed to withstand harsh use and heavier weights. The X10-HTR and X12-HTR models offer optional equipment that can be mounted directly on the trailer.

Options available for the X10-HTR and X12-HTR include:

- Actuator buttons for operation of the access door by an EOD robot;
- Remote controlled manipulator arm for loading and unloading of the suspect object on the internal tray;
- Wireless remote control to operate the chamber access door and adjust the pressure seals;
- Fragment shield to protect the interior from excessive bomb fragmentation;
- Vision system with monitor and cameras to allow remote viewing of TCV operation;
- Heating system capable of raising the temperature of the loading tray to approximately 662°F, causing explosives to burn or detonate;

- Gas sampling equipment; and
- Decontamination equipment which is used to clean the inside of the chamber after exposure to toxic gases.

All three models can be configured with an optional layer of lead in the core chamber, at additional cost, as a protective measure against radioactive materials, such as a dirty bomb. This layer is not removable and is a 1.18 inch fill between an outer and inner core of steel. The LTR and HTR models are electrically powered and have a manual hand wheel to operate the chamber door in case of electrical failure.



Figure 3-2. DynaSEALR X10-HTR

Dynasafe performs a factory acceptance test on each vessel before delivery. Additional testing by a third party test center can be arranged at additional cost to the customer. Dynasafe has a Certificate of Registration issued by Intertek, an international organization that assesses industries for conformance to ISO 9001: 2008 quality standards.

The standard warranty on all Dynasafe products is one year including parts and labor. Regular preventative maintenance by a Dynasafe certified company is required in order to guarantee an extended warranty after the first year. Dynasafe manufactures its own TCV replacement parts, which must be used to keep the vessel in warranty. Operator and basic maintenance training are provided by the vendor upon delivery of the vessel. Advanced training is available at additional cost to the customer.

3.2 JAKUSZ Sp. z.o.o. EVA GT and PAULA GT

JAKUSZ offers two gas-tight TCV models: the EVA GT and PAULA GT. The EVA GT has an explosive rating up to 8 kg of TNT equivalent and the PAULA GT has an explosive rating up to 5 kg. Pricing was not provided by the manufacturer.

The EVA GT core chamber rests on a stationary support frame and is installed on a two-axle trailer. A control console, which contains the main operating switch and access door operation, is installed on the frame. The chamber is electrically powered and emergency power is provided by a generator.



Figure 3-3. JAKUSZ EVA GT Tested Chamber

The chamber can be operated remotely via a 25 meter tethered pendant or by an optional wireless remote control up to 80 meters away. The internal tray is remotely operated to enable easy access.

Gases are contained inside the chamber until they are released through a valve system. Options available for the EVA GT model include:

- Radio frequency shield to prevent operation of a radio controlled improvised explosive device (IED) near the TCV;
- Installation on specialized vehicles, trailers, or transport platforms, or equipped with its own wheeled chassis;
- Gas sampling equipment; and
- Decontamination equipment, which is used to clean the inside of the chamber after exposure to toxic gases.

The PAULA GT model's core chamber is similar to the EVA model but resides within an aluminum enclosure which protects the equipment from atmospheric conditions such as dust and ice. The TCV is operated remotely by tethered pendant or wireless remote control. In emergency mode, such as during loss of electricity, the access door can be operated manually with the included wrench. The PAULA GT is equipped with a loading area lighting system and a gas sampling system, which can be fitted with optional carbon filters. The chamber's operation is powered by rechargeable batteries, which can be charged while the vessel is not in use.

The PAULA GT model is integrated with a two-axle trailer, which can be towed at speeds up to 44 miles per hour. The trailer is equipped with a drawbar.

Options available for the PAULA GT model include:

- Remote control capabilities for operation of the TCV;
- Loading boom for remotely placing a suspect object in the internal tray;
- Warning lights;
- Ramps for EOD robots;
- Set of tools;
- Repair kit for internal tray; and
- Video system with cameras and monitor to allow remote viewing of TCV operation.



Figure 3-4. JAKUSZ PAULA GT

JAKUSZ conducts field testing of all vessels to ensure specifications are met. The trailers are also tested to confirm that they protect the vessel from vibration and shock while moving.

The standard warranty on all JAKUSZ products is one year and an extended maintenance and support program is available which includes spare parts. All support and maintenance is performed by JAKUSZ.

Hands on training programs for basic operation and maintenance of the TCV are provided by a JAKUSZ specialist at the customer site and are part of the base price. Other specialized courses at additional cost include:

- Clearance of unexploded ordnance devices;
- Safety issues for explosive material handling;

- IED safety handling;
- Explosion and bomb scene investigation; and
- Counter-terrorism training.

3.3 Mistral Security, Inc. ARC GT Series

Mistral offers three gas-tight TCV models: the ARC 5 GT, the ARC 8 GT, and the ARC 10 GT. The ARC 8 GT has an explosive rating of up to 8 kg TNT equivalent. The ARC 5 GT is DDESB approved up to 5.8 kg of TNT equivalent and the ARC 10 GT is DDESB approved up to 8 kg. The estimated price range for these models is from \$185,000 to \$235,000.

All models have a side loading, automatic hydraulic door, which can also be operated by an EOD robot. The chamber is equipped with a tethered pendant, which is used to operate the door sealing mechanism. The ARC GT series models are electrically powered and can be operated manually in case of electrical failure.

All three TCVs are equipped with gas sampling systems which can be operated by a pressure release valve. This enables taking samples of gases from inside the chamber. All the ARC GT series models are equipped with a trailer.

Options available for the ARC GT series include:

- Remote control capabilities for operation of the TCV;
- Remote-controlled, self-propelled base for easy maneuvering inside buildings or narrow areas;
- Fragmentation sleeve which is used to prevent damage of the inner core chamber by excessive bomb fragments;
- Stand-alone generator to power the operation of the chamber;
- Tarp to protect the chamber from environmental conditions; and
- Decontamination equipment which is used to clean the inside of the chamber after exposure to toxic gases.



Figure 3-5. Mistral ARC 5 GT

Mistral employs a third party laboratory to blast test all new models and then submits the test results to DDESB. Each unit is then built to the DDESB approved design. All units manufactured by Mistral go through a non-destructive testing process, which confirms the vessel's structural integrity. The gas-tight models also go through a hydrostatic test to make sure there are no leaks.

The standard warranty on all Mistral Security products is 1 year. Extended warranties and support are offered.

The ARC GT series vessels include an operation and maintenance training manual. Customer service is available Monday through Friday, 8:30 a.m. to 5:00 p.m. Eastern Standard Time, and

is included in the base price. Operation and maintenance training by Mistral Security is provided at an additional cost.

3.4 NABCO, Inc. 42-GT-SCS and 64-GT-SCS

NABCO offers two gas-tight TCV models: the 42-GT-SCS and 64-GT-SCS. The 42-GT is DDESB approved to 5.8 kg of TNT equivalent and the 64-GT is approved up to 8.8 kg. The estimated price range for these models is \$321,000 to \$357,000.

The self-closing door system includes the action of the yoke and is operated remotely by a hydraulic mechanism. The access door allows side loading, which facilitates the placement of the suspect object by an EOD robot or bomb technician. The internal tray is on a telescopic assembly to further facilitate loading. The TCV can be operated remotely by a tethered pendant.



Figure 3-6. NABCO 42-GT and 64-GT

Standard configurations include a trailer with an on-board generator, lighting, undercoating (to prevent corrosion), and tire safety chains. A decontamination unit is also part of the standard package. Both TCVs are gasoline powered. An on-board 12 volt backup power system provides door yoke operation in the event of generator failure.

Options available for both NABCO models include:

- Wireless remote control capabilities for operation of the TCV;
- Actuator buttons for operation of the access door by an EOD robot;
- Robot storage chamber;
- Tarp to protect the vessel from environmental conditions;
- Radiation shield in barrel stave design (i.e., wrap), consisting of high-strength steel with an inner radiation suppression layer, that can be left on the chamber at all times;
- Decontamination equipment which is used to clean the inside of the chamber after exposure to toxic gases; and
- Transporters including trailers, trucks, tracked transporters, all-terrain vehicles, and customized trucks.

All NABCO chambers are radiographed (i.e., x-rayed) and tested with explosives before delivery.

Older model NABCO TCVs can be upgraded to include an automated door system, gas-tight containment, and sampling systems. In addition, the winch system and internal door can be removed to improve access to the internal tray. The manufacturer should be contacted for upgrade specifications and costs. All upgraded TCVs are DDESB approved.

The standard warranty on all NABCO products is 1 year. Maintenance and support are available 24 hours per day, 7 days per week and maintenance training for all models is performed by NABCO specialists at the headquarters located in Canonsburg, Pennsylvania.

4. PRODUCT DATA–RESEARCHED

This section provides general product specifications on one TCV from OSHO Defense. Specifications were obtained from Internet and industry publication research. The information has not been independently verified by the SAVER Program.

4.1 OSHO Defense HD-5

OSHO Defense has one gas-tight TCV model, the HD-5. It is cylindrical and has an explosive rating up to 2.5 kg of TNT equivalent. The HD-5 has a solid cast manganese alloy steel chamber sealed by a steel door. The vessel's dimensions are 76.0x36.0x56.0 inches, it has an access door diameter of 23.0 inches, and it weighs 3,505 pounds. Pricing was not available.

The HD-5 has a remotely operated hydraulic door which can be operated by an EOD robot and can be manually opened in case of power failure. Due to its size, the HD-5 can fit through standard three foot wide doors and can be taken on most commercial elevators that will support its weight.

Options available include:

- Trailer for transport;
- Tool storage chest;
- Generator for backup power to the chamber; and
- Decontamination equipment, which is used to clean the inside of the chamber after exposure to toxic gases.

5. MANUFACTURER CONTACT INFORMATION

Additional information on the TCVs included in this market survey report can be obtained from the manufacturers listed in Table 5-1.

Table 5-1. Manufacturer Contact Information

Manufacturer	Address/Phone Number	Website/E-Mail Address
Dynasafe Group	Gammelbackavägen 8 SE-691 80 Karlskoga, Sweden +46 586 77 12 70	http://www.dynasafe.com info@dynasafe.com
JAKUSZ Sp. z o.o.	Przemysłowa 40 Str. 83-400 Kościerzyna, Poland +48 58 686 85 27	http://www.en.jakusz.com marketing@jakusz.com
Mistral Security, Inc.	7910 Woodmont Avenue Suite 820 Bethesda, Maryland 20814 (301) 913-9366	http://www.mistralsecurityinc.com securitysales@mistralgroup.com
NABCO, Inc.	1001 Corporate Drive Suite. 205 Canonsburg, PA USA 15317 (724) 746-9617	http://www.nabcoinc.com info@nabcoinc.com
OSHO Defense	2994/5 Second Floor, Ranjit Nagar, Shiv Chowk, Delhi-110008, India +91 11 2627 5055	http://www.oshodefence.com oshodefence@gmail.com

6. SUMMARY

TCVs provide explosive mitigation capabilities to the emergency responder community by safely containing, securing, transporting, and testing explosive devices in order to protect critical assets. This capability helps state and local emergency responders protect the people, property, and environment in their community. TCVs can be used to transport suspect objects to safe havens where they can be further evaluated and rendered safe.

This market survey report includes 11 TCVs manufactured by the companies listed in Table 5-1. All but one of the TCVs are spherical. The TCVs are all made from high-strength steel, are gas-tight, have manual operation features in the event power is unavailable, and offer options, which include transport modes and remote-control capabilities.

Important considerations to take into account when purchasing a TCV are the ease of access to the chamber, the size of the chamber, weight of the TCV with other options on the trailer, assurance that the vessel works in the manner it is advertised, and the availability of service, parts, and support.

Challenges such as lack of standards, manufacturing lead-times, and maintenance and availability of parts apply to all TCVs. Though the TCVs listed in this report are sold as standard models, all are customizable and can be tailored to fit agency requirements.

Emergency responder agencies that consider purchasing TCVs should carefully consider each product's overall capabilities and limitations in relation to their agency's operational needs.