

DAVINCH Detonation System

*...for the safe, secure and environmentally
compliant disposal of recovered, abandoned
or expired munitions*

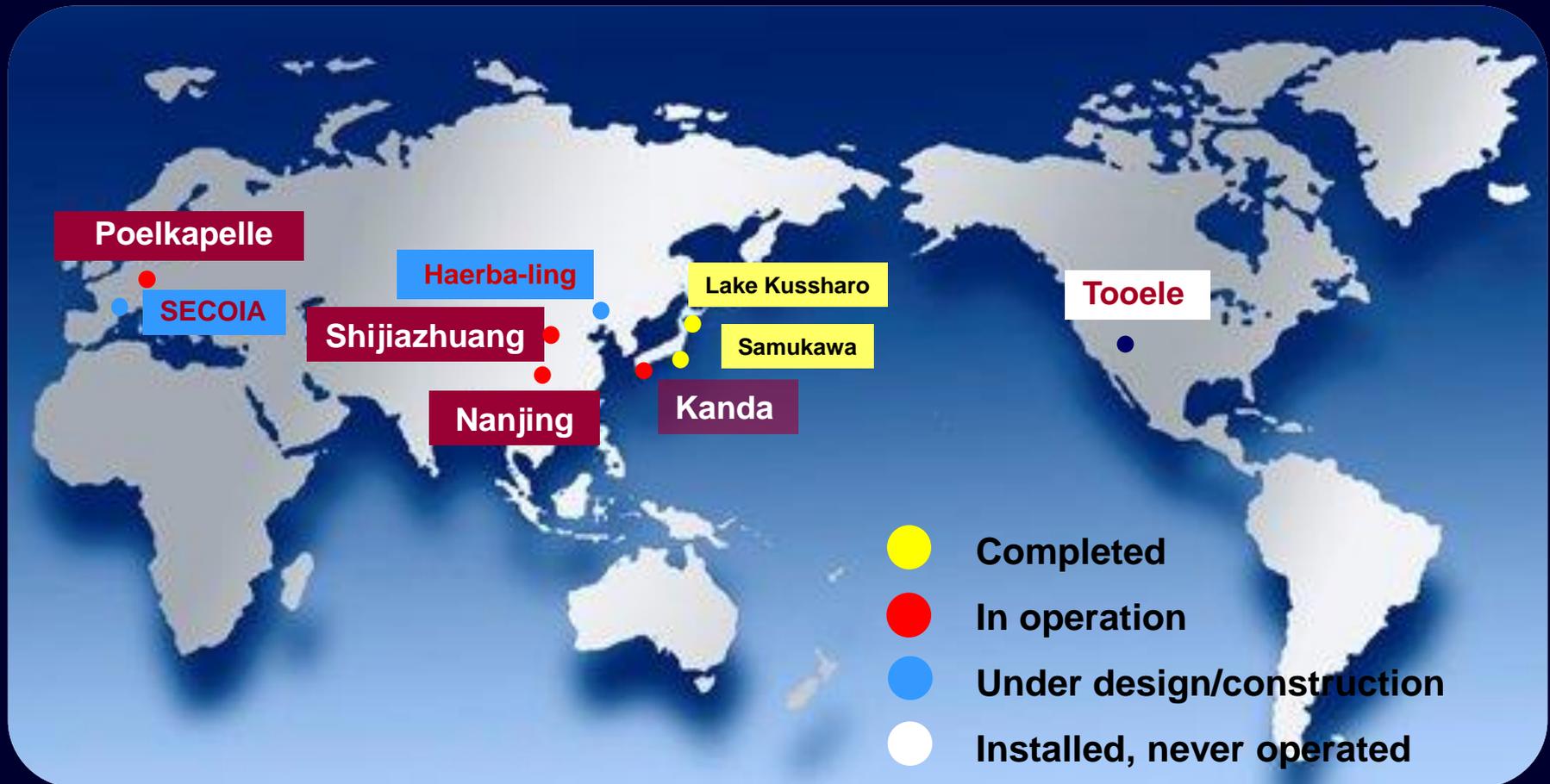


DAVINCH
DV50

”

DAVINCH Experience

Internationally Proven Technology



DAVINCH Capability

Conventional munitions,

Abandoned or recovered munitions

Off spec, or shelf life expired munitions

Chemical munitions

Leakers,

Overpacked munitions,

M55 Nerve agent rockets, simulant filled

Other categories of munitions,

Smokes and Incendiaries

Missiles

Basic DAVINCH System

Munitions

Donor Charge

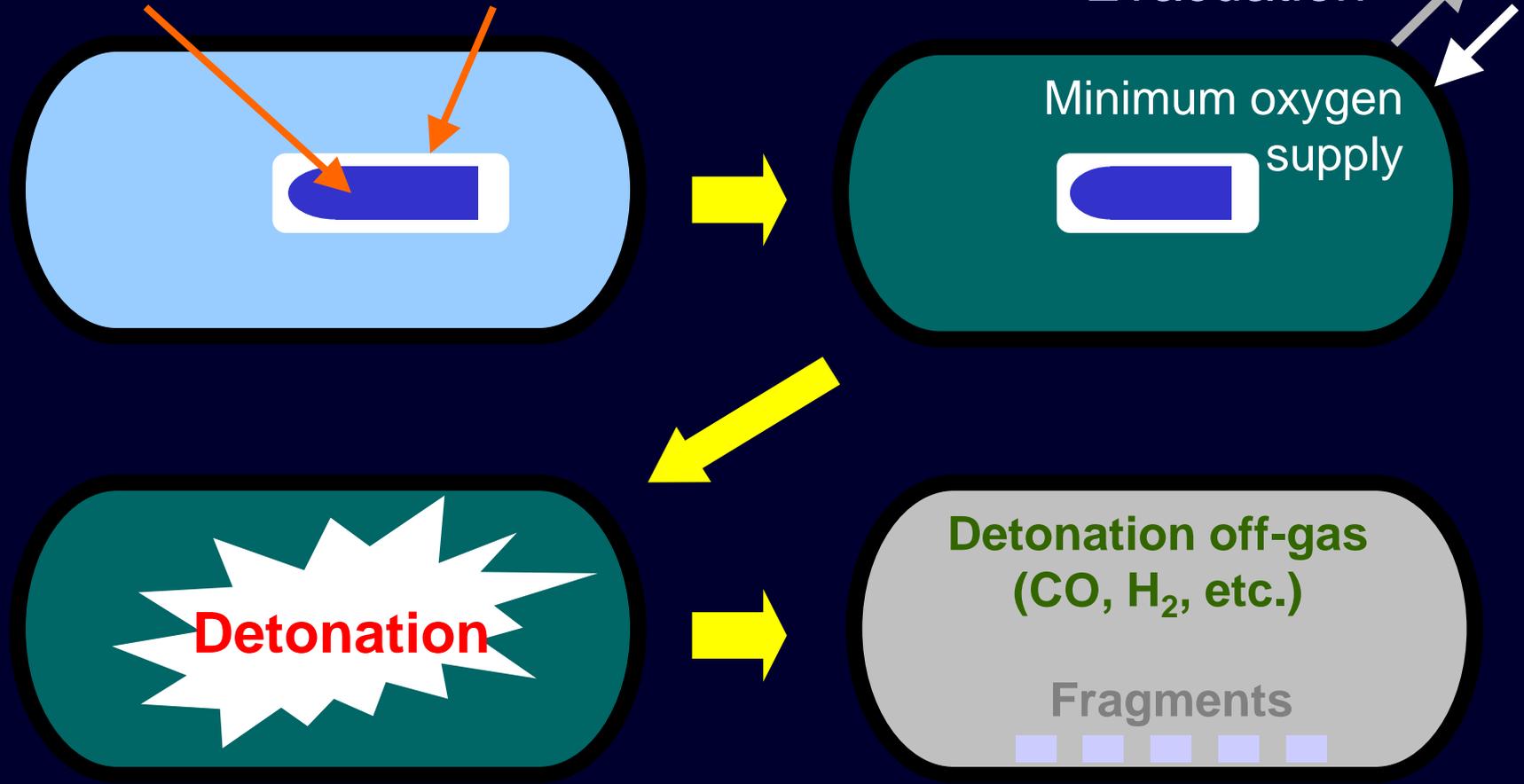
Evacuation

Minimum oxygen supply

Detonation

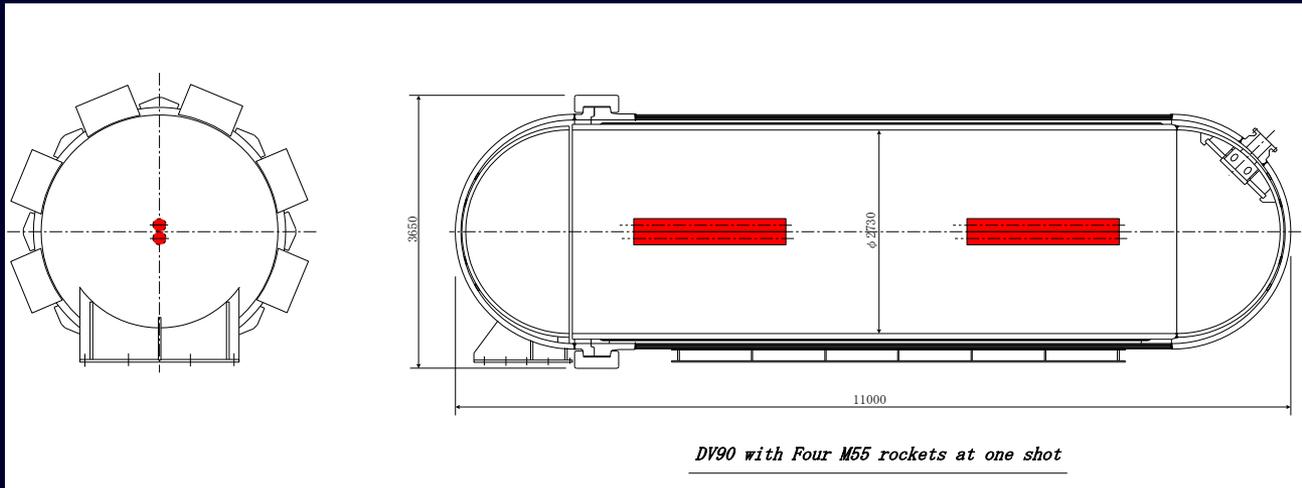
Detonation off-gas
(CO, H₂, etc.)

Fragments



Structural Advantage

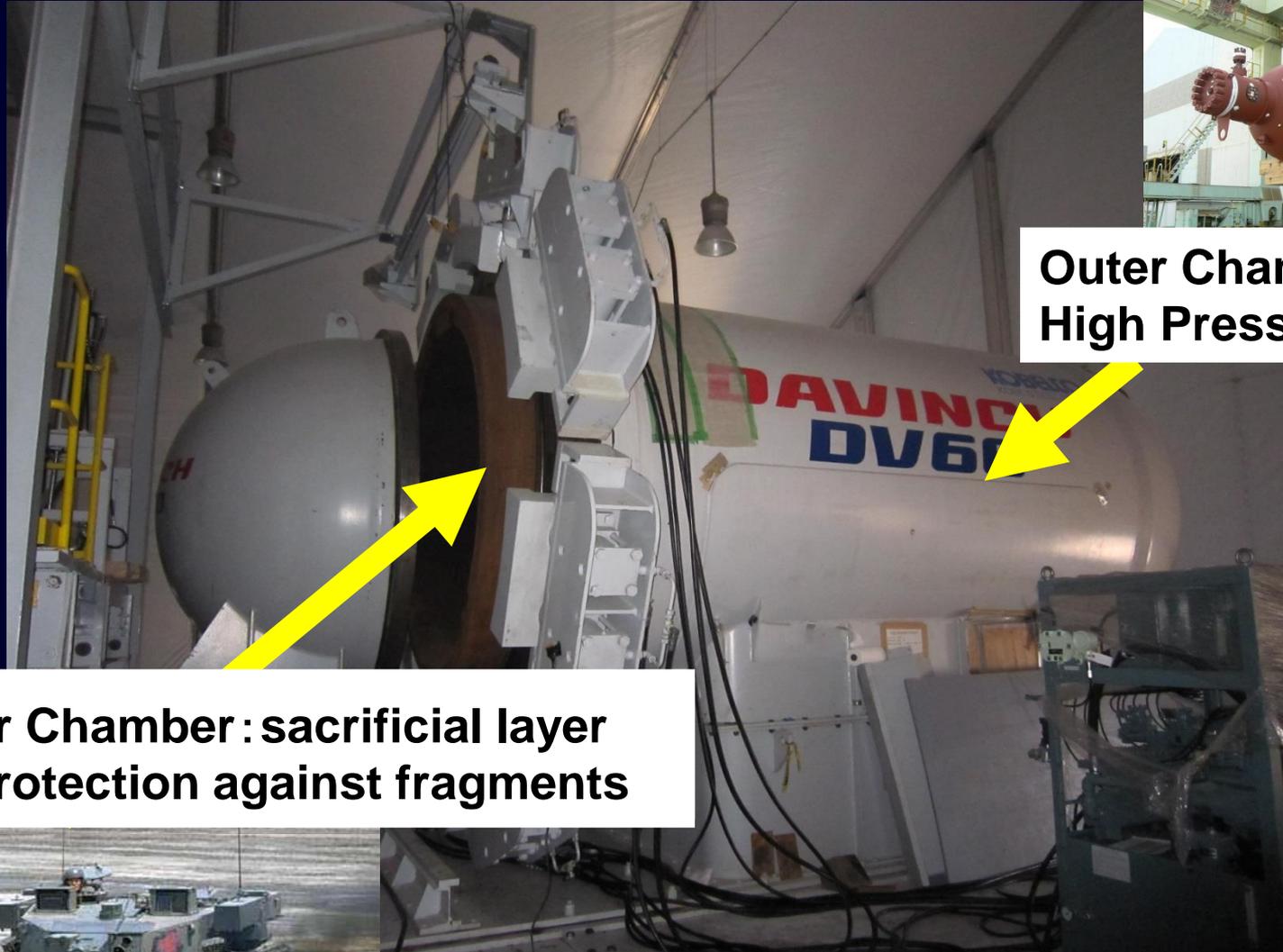
- Double Walled Chamber Structure
- Laminated Steel Construction
- “Leak- Before-Burst” Mode of Failure Design
- Real-Time Fatigue Damage Monitoring System



Double-Walled Chamber



**Outer Chamber:
High Pressure Vessel**

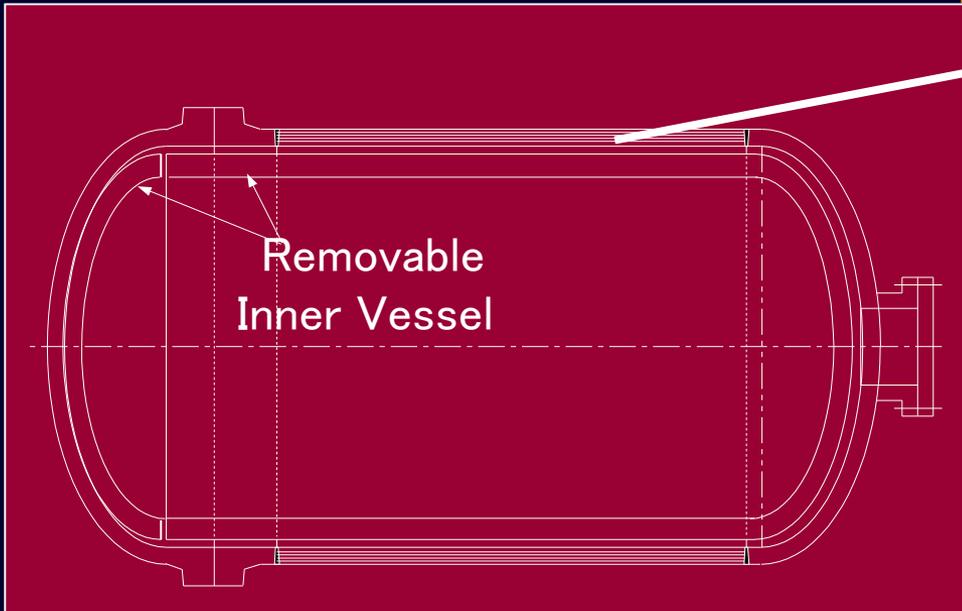
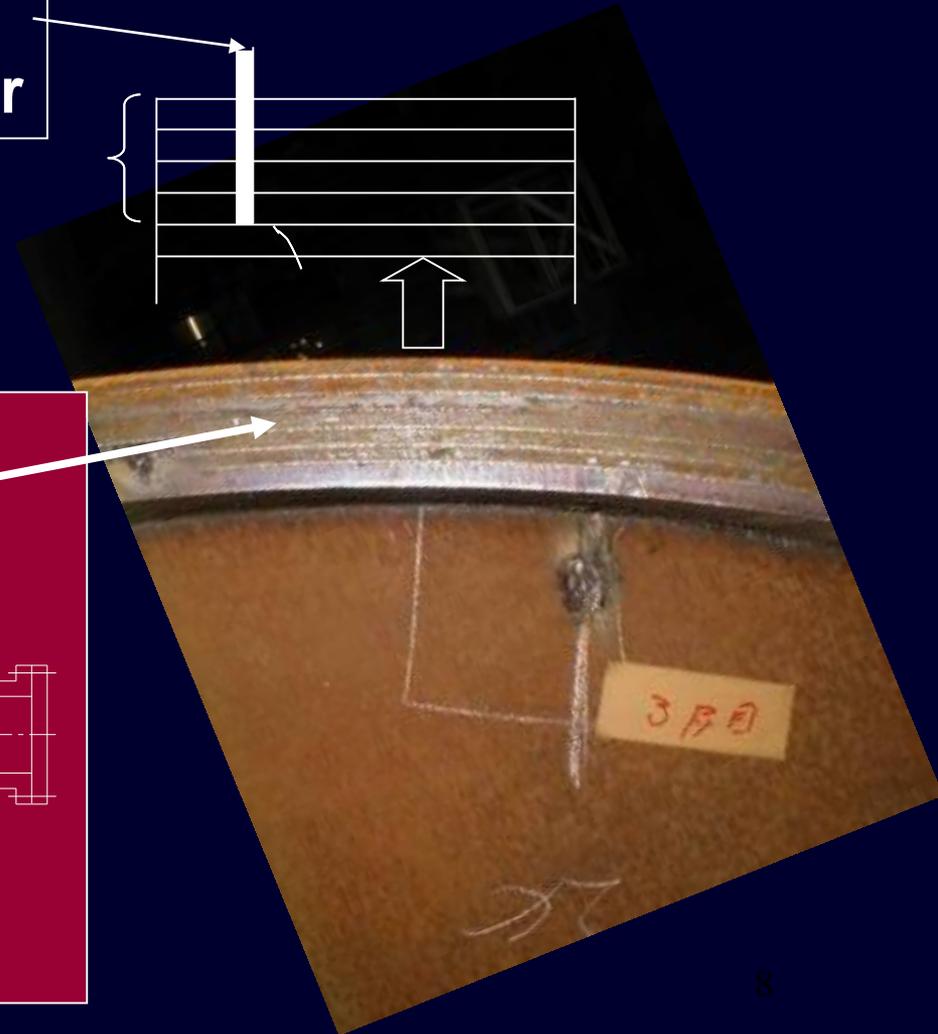


**Inner Chamber: sacrificial layer
for protection against fragments**



Unique Laminated Steel Construction

Detection hole to monitor the leakage from the 1st layer



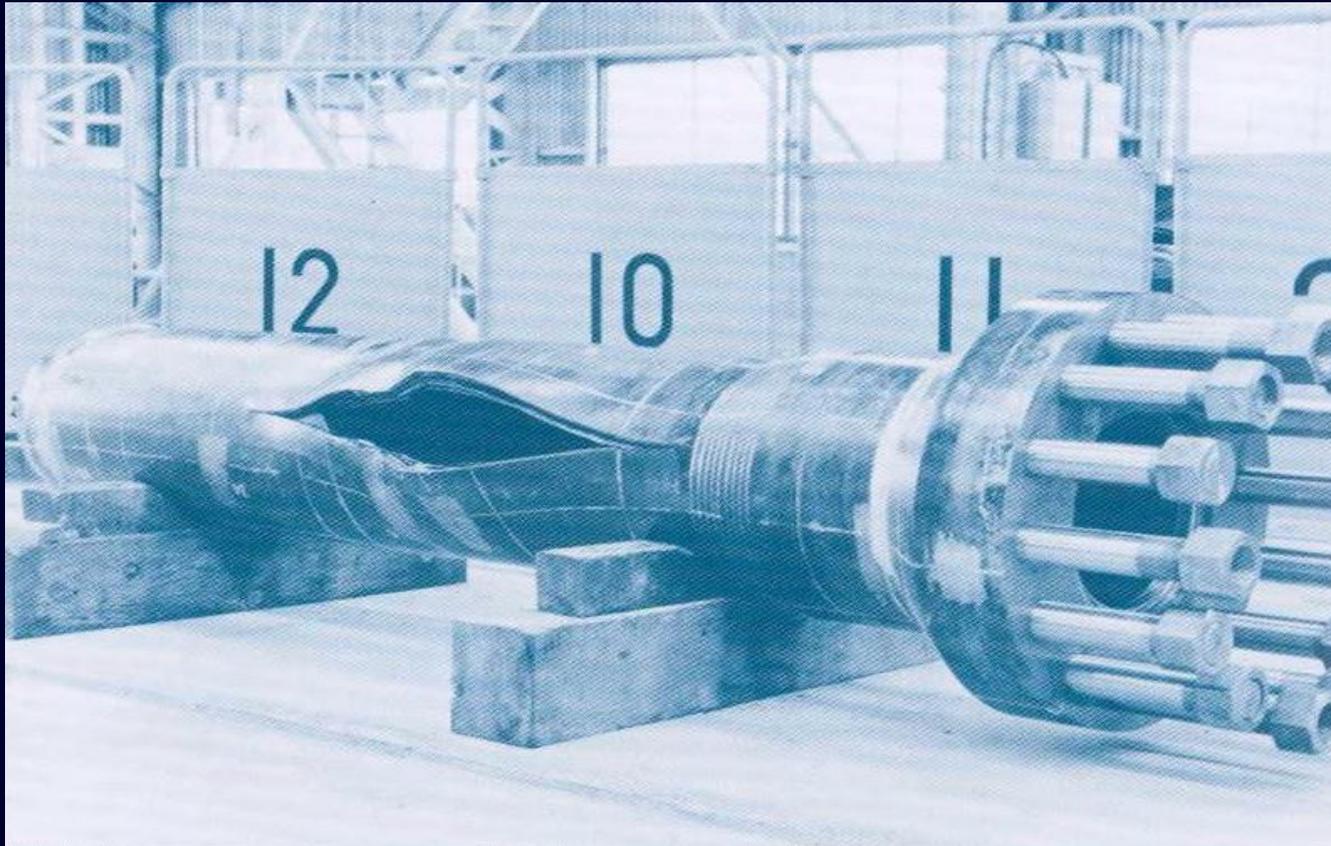
Leak-Before-Burst Mode of Failure

Design based on New ASME Rule for
Detonation Chambers



ASME: American Society of Mechanical Engineers

New ASME “Leak- Before –Burst” Mode of Failure Certification



Example of Burst-Before-Leak,
Antithetical Phenomena of Leak-Before-Burst

Real-Time Fatigue Damage Monitoring System

“DESTINY”

Dynamic Analysis

Selection of Points of Interest

Real-time Strain Measurement

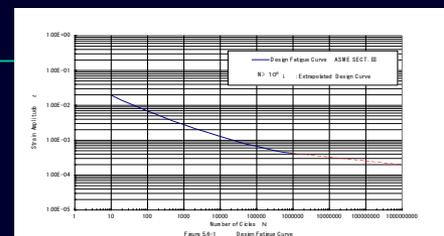
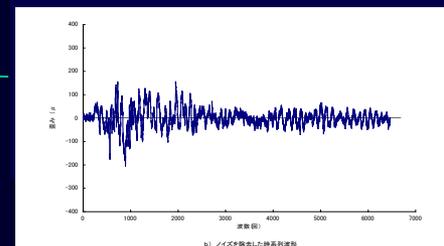
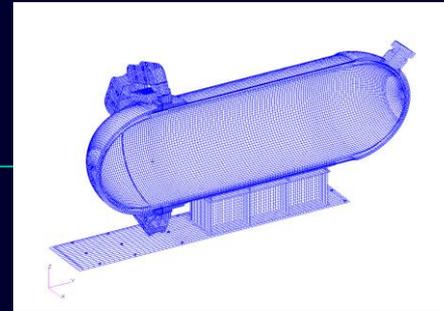
Preparation of Strain Wave by single Detonation

Calculation of cumulative Fatigue Damage $\sum n/N$ for single Detonation

Calculation of Total cumulative Fatigue Damage $\sum \sum n/N$ for all experienced Detonations

Monitoring of time to crack initiation

Information for scheduling of Maintenance/Repair/Replacement

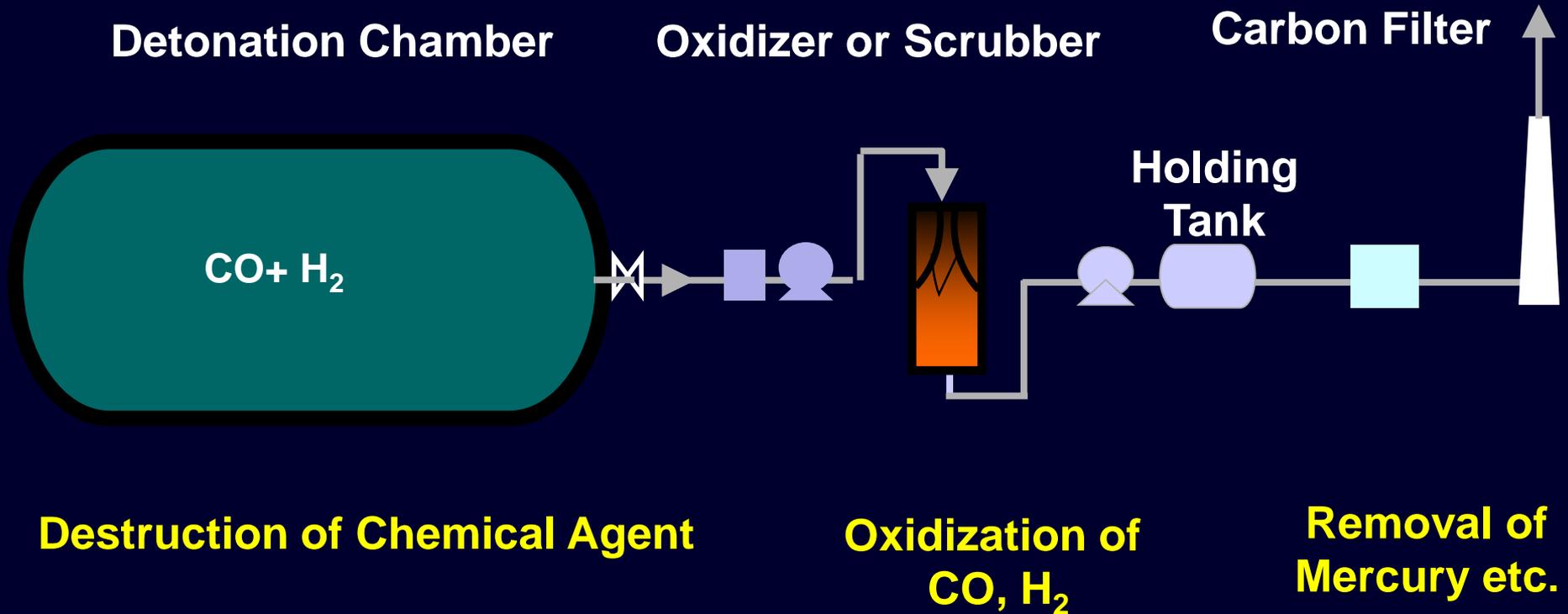


Environmental Compatibility

- Incineration Free Process
- High Destruction Efficiency of Chemical Agent
- Closed System of “Hold, Test and Release”
- No Dioxin Generation
- Safe Containment of Heavy Metals and Mercury
- Minimum Secondary Waste

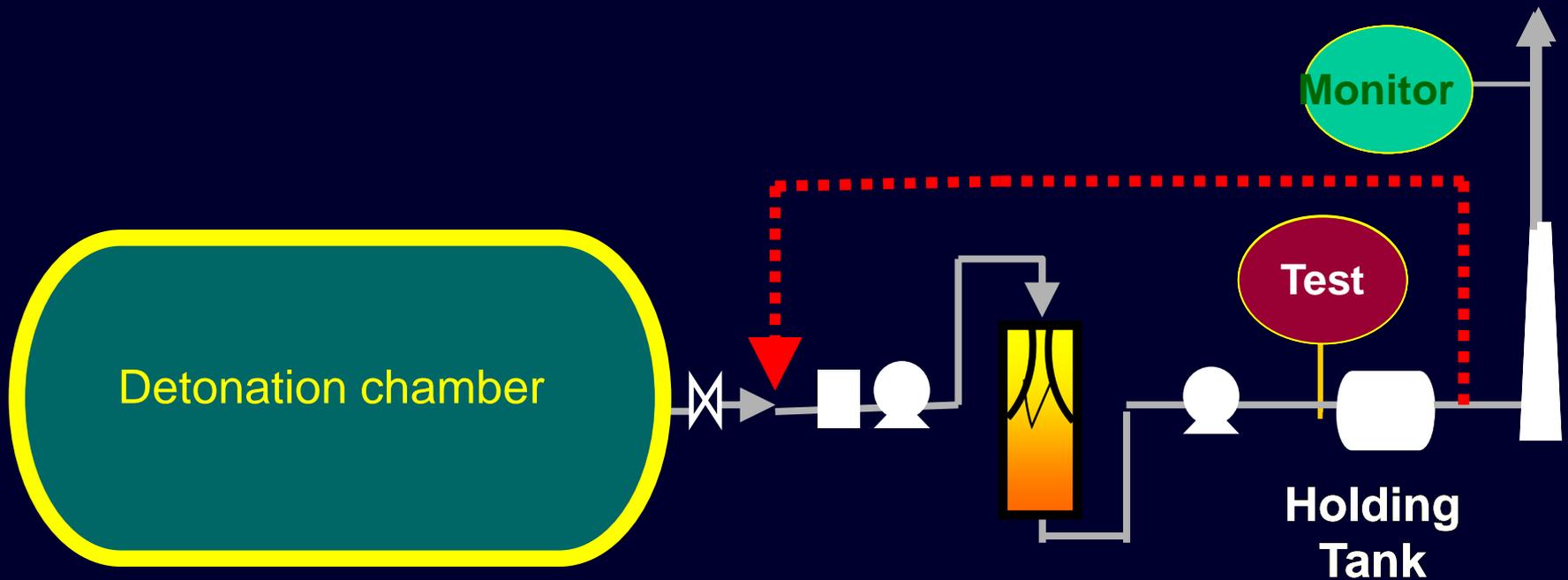


Off-gas Treatment Options



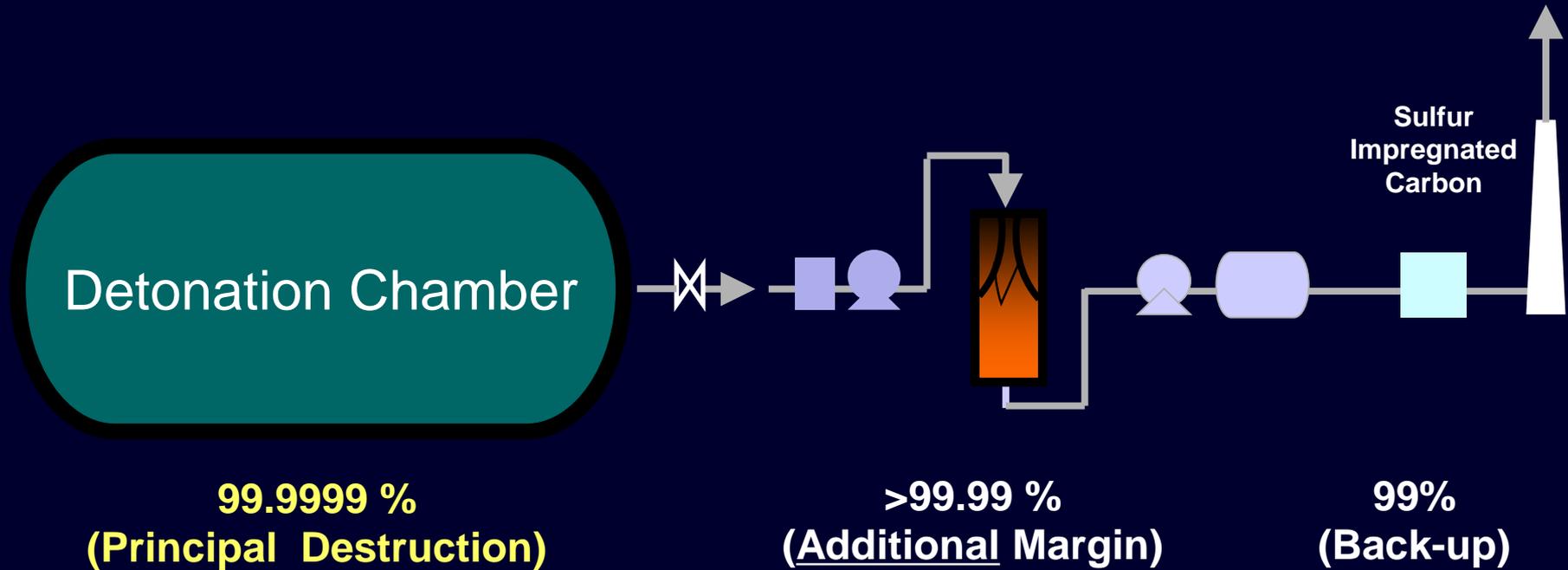
The off gas system is tailored/simplified depending upon munitions to destroyed and local regulations.

Closed System of “Hold, Test and Release”



All off gases are compressed and held for analysis. Non-compliant batches are recycled until clean.

High Destruction Efficiency



Low Volume of Secondary Waste



Solid Waste:

Fragments from munitions.

Collected with magnetic sweeper, stored and “head space” analysis conducted.

Liquid waste:

Water generated from hydrogen in the explosive.

Reused in off-gas neutralization column.

At Port Kanda project, all the rain water is collected in pits.



Expendable Materials Waste

- Secondary waste can be destroyed in the DAVINCH



HEPA filter



Charcoal filter



Current Deployment Sites 2014



DV65 at Port Kanda, Japan

~3,000 Sea Dumped Chemical Weapons of WW II
(65 kg or 146 lbs of TNT eq)

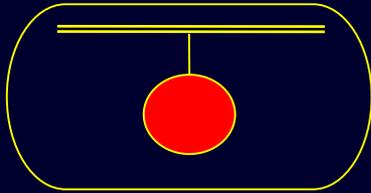


DV50 at Poelkapelle , Belgium

~4,000 Recovered Chemical Weapons of WW I
(50 kg or 110 lbs of TNT eq)

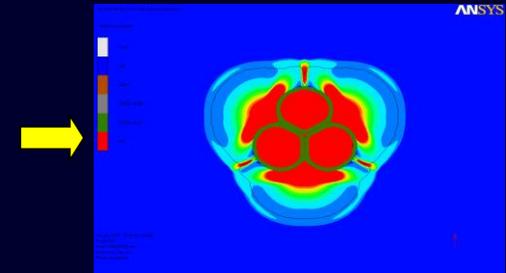
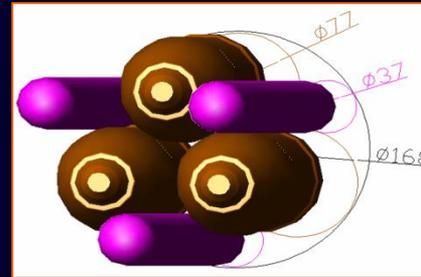
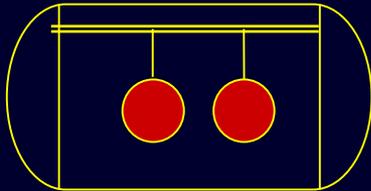


Example Munitions at Poelkapelle



One 201cm (8.3") German Clark shell at one shot

Munition Preparation at Poelkapelle



Six 10.5cm (4.1") German Clark shells at one shot

Two DV65s at Nanjing, China

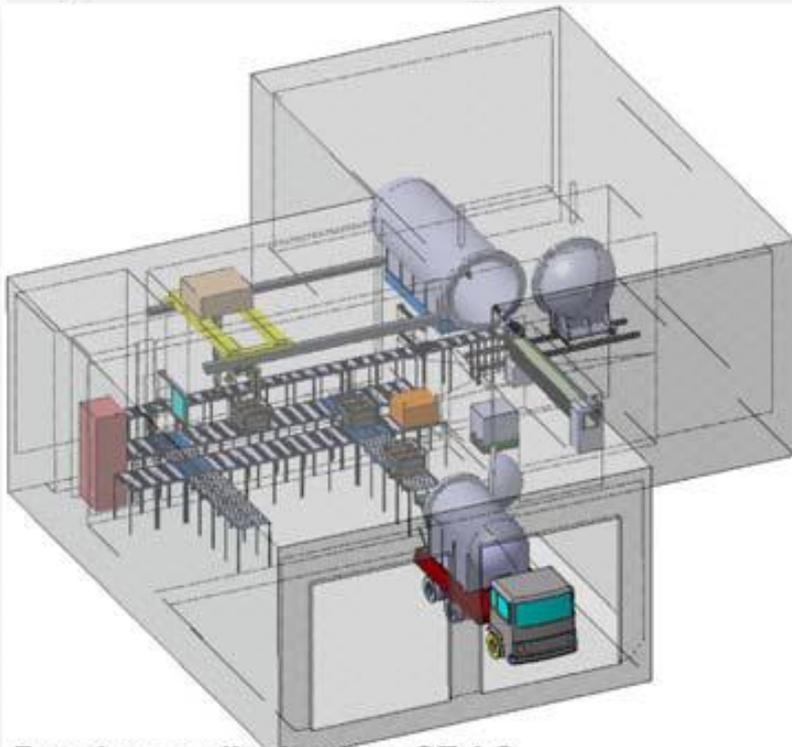
~36,000 Abandoned Chemical Weapons of WW II
(65 kg or 146 lbs of TNT eq)



Tandem Operation for Increased Production

French SECOIA Project

Fully Automatic DAVINCH System for SECOIA



Drawing credit: Astrium ST AQ

012-4177

- Fully automatic System
- 20 year project
- Destruction of 600 tons of chemical munitions of WW II.

Detonation Test of DV60 for DDESB

Department of Defense Explosive Safety Board



125% load of 60 kg (75kg=165lbs)

Looking to the Future

DAVINCH *Lite*

A compact unit designed to be easily road transportable and rapidly installed.

The Latest Model of the DAVINCH Series

7th Generation



Mobile DAVINCH^{lite}

6th Generation



DV60 for Tooele

5th Generation



DV50 for Poelkapelle

4th Generation



DV65 for Kanda

3rd Generation



DV60 for Kanda

2nd Generation



DV45 for Kanda

1st Generation



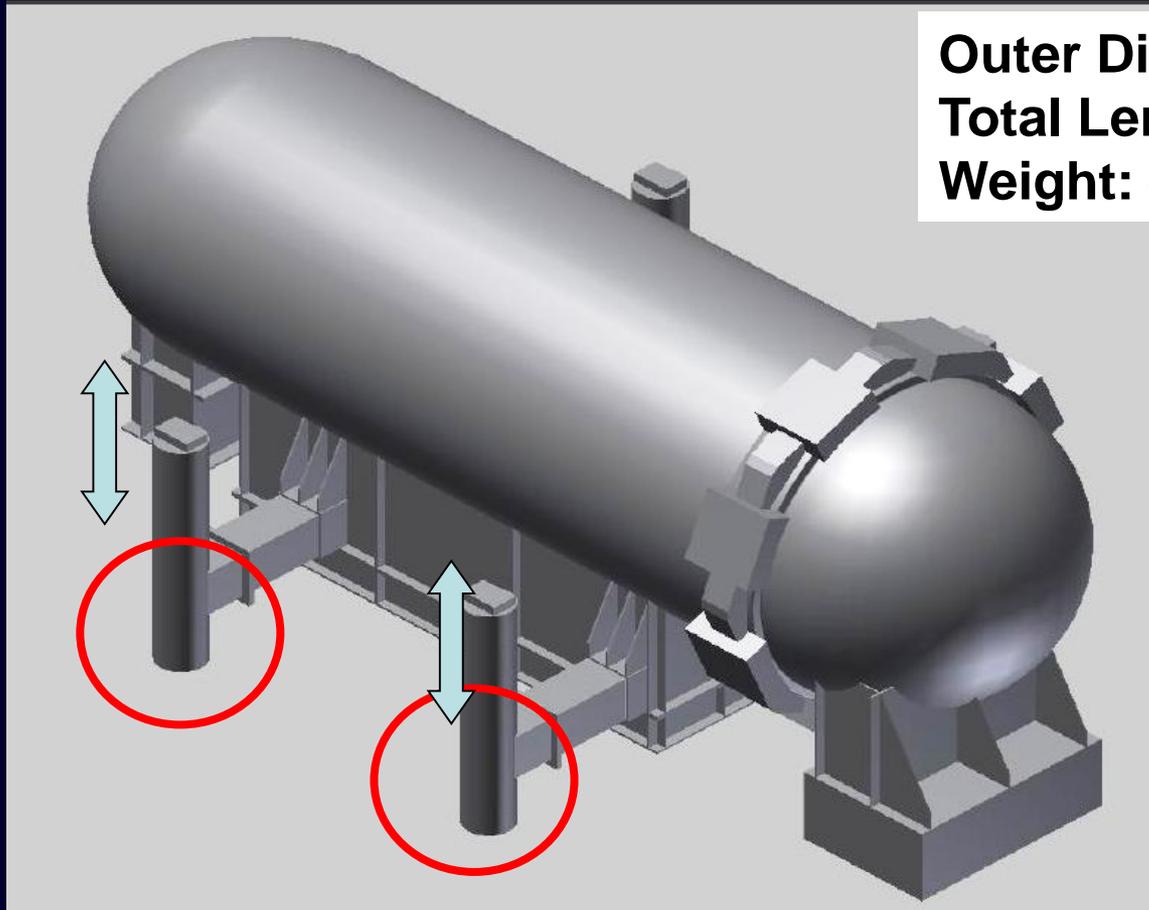
**Mobile DV10
Lake Kussyaro**

DAVINCH *Lite* Chamber



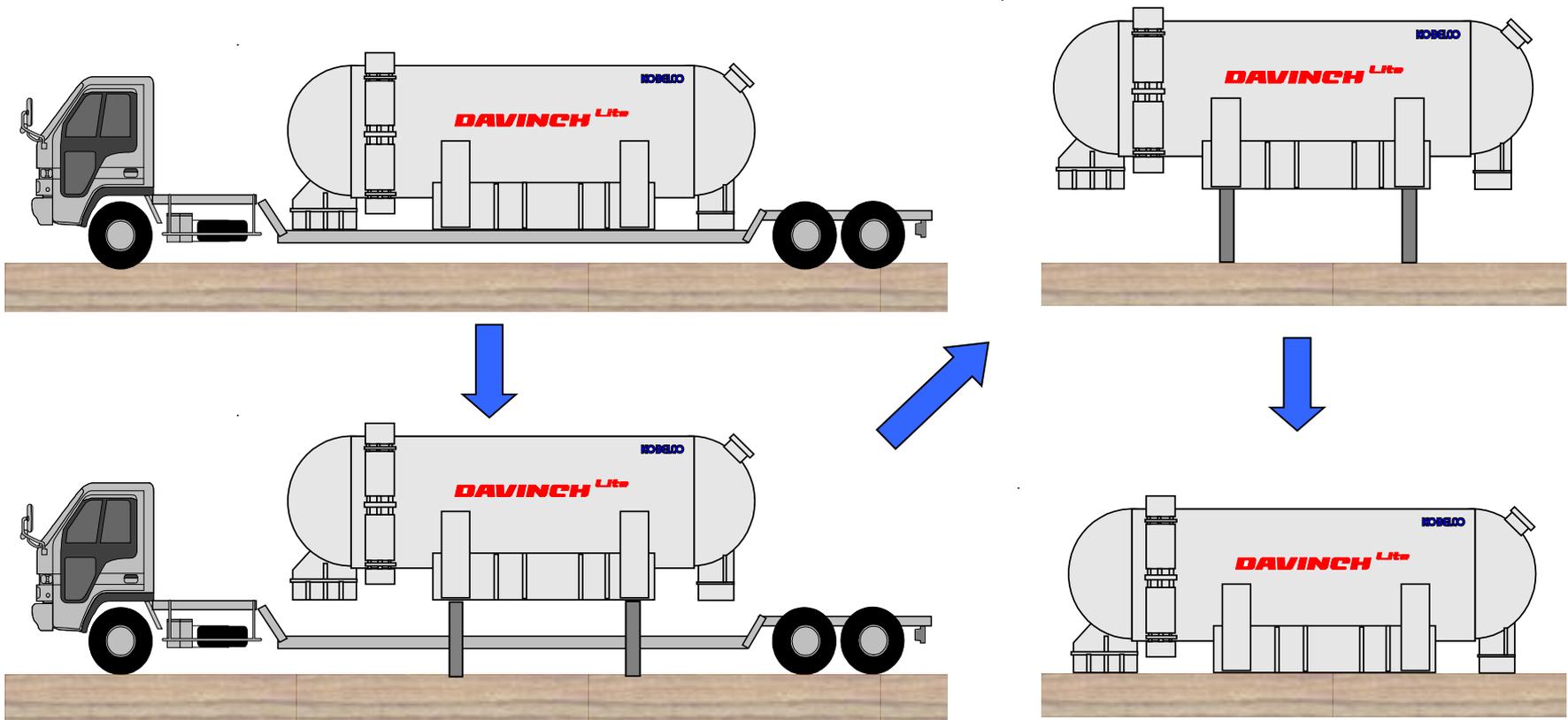
Mobile DAVINCH^{lite}

Outer Diameter: 2.1 m
Total Length: 7 m
Weight: 45 tons



Self Unloading System by Outrigger

Novel Outrigger Design for Unloading



No crane is required for installation

Off gas Treatment Modules



Assembled in 20ft. Standard Conex Frames
Designed for Road, Ship or Air Transportation

Summary

DAVINCH is...

- Environmentally friendly process, driven by Closed System of “Hold, Test and Release”
- Structurally robust chamber, design by ASME “Leak-Before –Burst” mode of failure
- Historically proven process, demonstrated by destruction of ~43,000 chemical munitions and numerous recovered conventional munitions in Belgium.
- Well experienced process, developed, designed, manufactured and operated by Kobe Steel
- Mobile Application is ready for conventional munitions destruction