TDW Gesellschaft für verteidigungstechnische Wirksysteme mbH

Accelerating Precision Strike Technology for Stability Operations and Protection of Coalition Forces

EADS DEFENCE & SECURITY

Penetrating Effector Systems from EADS / TDW

Dr. Helmut Muthig

President & CEO

EADS / TDW

October 18, 2005

Precision Strike Technology Symposium PSTS – 05

Kossiakoff Conference Center
The Johns Hopkins University
Laurel, Maryland

EADS DEFENCE & SECURITY

Who we are

TDW

is

Europe's No. 1

in

"Penetrating Effector Systems for Guided Weapons"

and is on the way to the

U.S.

TDW = Three decades of Penetrating Effectors

TDW = An EADS Company

is the acknowledged ***"Center of Excellence"***
for ***"Lethal Packages"*** within EADS
with more than 47 years of expertise at Schrobenhausen/GERMANY

Business Unit "Missiles" within DS: EADS / LFK
Actual Transatlantic Cooperations

MEADS

Patriot

Stinger

RAM

ESSM

Penetrating Effector Systems from EADS / TDW
Presentation Outline

Accelerating Precision Strike Technology for Stability Operations and Protection of Coalition Forces

- Introduction: Short Company Background
- The Need: Effective Defeat of Hard Targets
- One Solution: Penetrating Effector Systems from TDW
  - Q: What does it take to build effective penetrating effectors?
  - A: Penetrating Effector Capabilities from TDW!
    - Requirement Analysis and Effector System Design
    - Penetration Simulation and Performance Prediction
    - Penetrator Charge Design (Casing and High Explosive)
    - Penetrator Fuzing (Smart Hard Target Fuzing)
- Examples, Tests, Video Clips

Penetrating Effector Systems from EADS / TDW

Accelerating Precision Strike Technology for Stability Operations and Protection of Coalition Forces

- Introduction: Short Company Background
- The Need: Effective Defeat of Hard Targets
- One Solution: Penetrating Effector Systems from TDW
  - Q: What does it take to build effective penetrating effectors?
  - A: Penetrating Effector Capabilities from TDW!
    - Requirement Analysis and Effector System Design
    - Penetration Simulation and Performance Prediction
    - Penetrator Charge Design (Casing and High Explosive)
    - Penetrator Fuzing (Smart Hard Target Fuzing)
- Examples, Tests, Video Clips

The Threat: Hard and Deeply Buried Targets

Plus a complete variety of *additional* hard targets, like:

Hardened Command and Control **Bunker**

Biological Production Facility

EW/GCI Center **Hardened** Building

Air Defense Command Center

Multi-Story Building with **Basement**

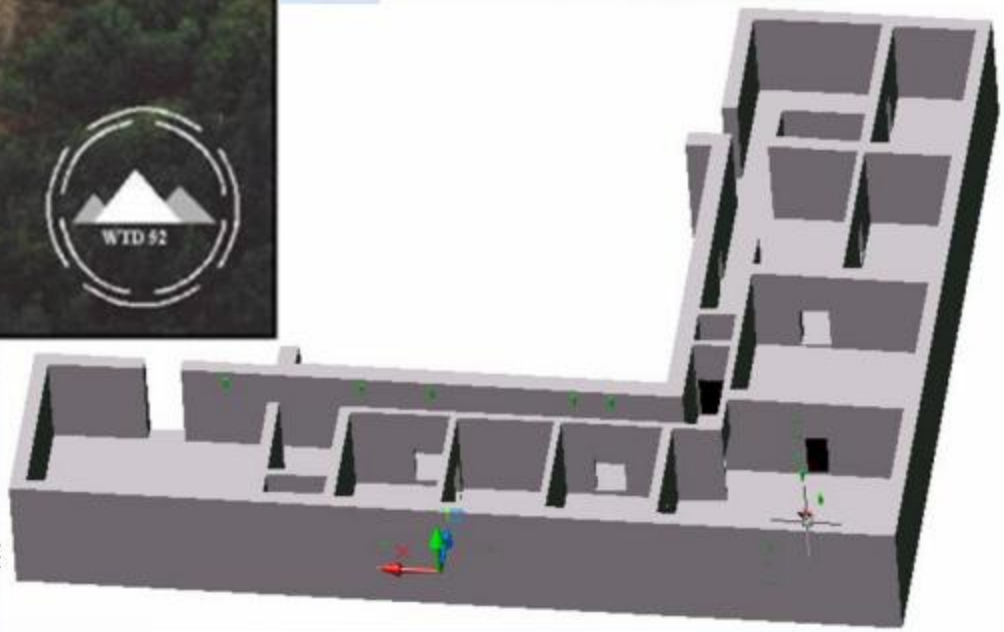
Elevator-Served Radar **Bunker**

Aircraft in **Revetments**

Aircraft Storage **Bunker** Interior

Hard Target Example: *Ladeburg* Bunker Replica at Meppen Federal Proving Ground, GERMANY

US/GE
Hard Target Defeat
Project Agreement



The Threat: Hard Sea Targets and Land Targets: *Naval Strike Missile Targets* (KONGSBERG, NOR)

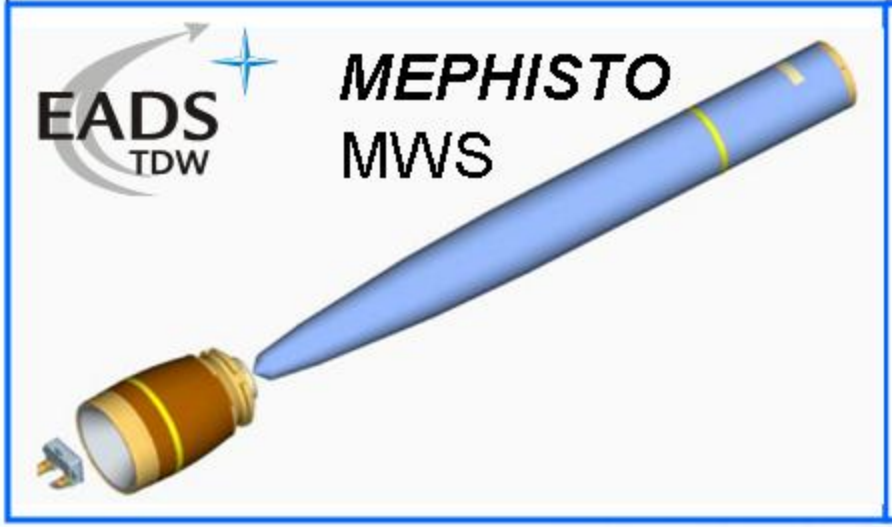
- **Primary:** **Surface vessels**
  From small FPB to large vessels




- **Secondary:** **Land targets**
  Strike missions against SAM sites, C^3I Buildings, Ships in harbour




Weapon Systems with TDW's Penetrating Warheads
Actual Examples



Penetrating Effector Systems from EADS / TDW
Presentation Outline

Accelerating Precision Strike Technology for Stability Operations and Protection of Coalition Forces

- Introduction: Short Company Background
- The Need: Effective Defeat of Hard Targets
- One Solution: Penetrating Effector Systems from TDW
  - Q: What does it take to build effective penetrating effectors?
  - A: Penetrating Effector Capabilities from TDW!
    - Requirement Analysis and Effector System Design
    - Penetration Simulation and Performance Prediction
    - Penetrator Charge Design (Casing and High Explosive)
    - Penetrator Fuzing (Smart Hard Target Fuzing)
- Examples, Tests, Video Clips

Penetrating Effector Systems from EADS / TDW

What does it take to build effective penetrating effectors?

- Requirement Analysis and Effector System Design
- Penetration Simulation and Performance Prediction
- Penetrator Charge Design
  - Casing (Mechanical strength & Structural loads)
  - High Explosive (Performance & Insensitivity)
- Penetrator Fuzing
  - Target Detection Device (Smart Hard Target Fuzing)
  - Safe & Arm Device w/ Firing Unit

Penetrating Effector Systems from EADS / TDW

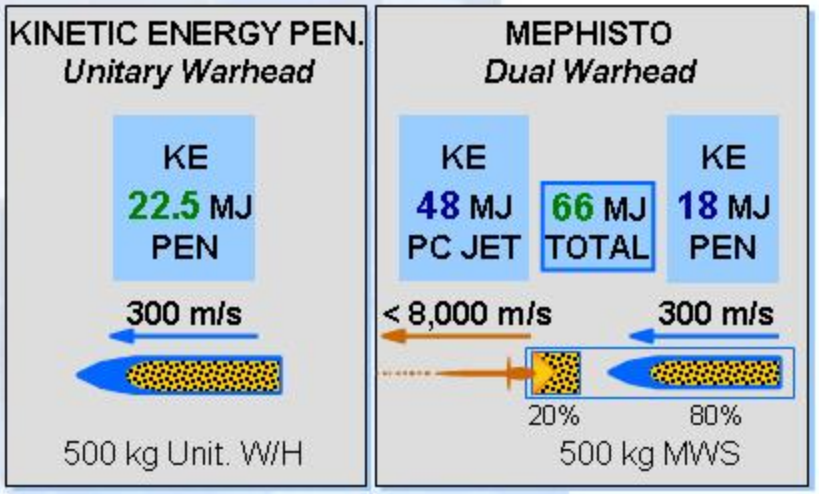
TDW

- is a “Full Service Company“
- *(from the first idea to series production)*
- is working on Effectors (warheads and fuzes) since 1958
- was formerly known as MBB, DASA
- works on one integral site (Schrobenhausen, GERMANY)
- has its own qualified high explosives
- uses its own proving ground
- is reknown in Europe
- is on the way to the U.S.

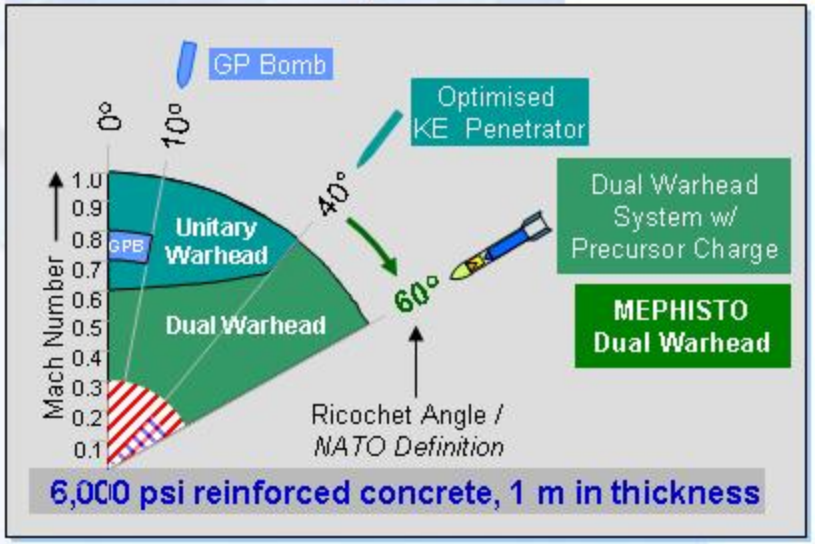
EADS North America Defense

Requirement Analysis and Effector System Design: e.g. *Unitary Warhead vs. Dual Warhead Trade-Offs*

– System Energy Comparison



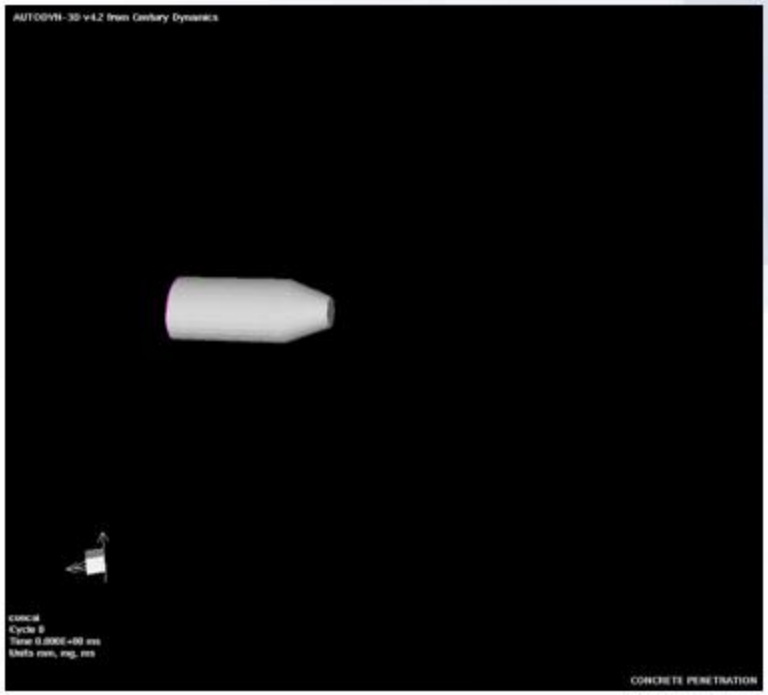
– Impact Velocity and Impact Angle Dependency



Penetration Simulation and Performance Prediction: *Homogeneous, structured and / or reinforced targets*

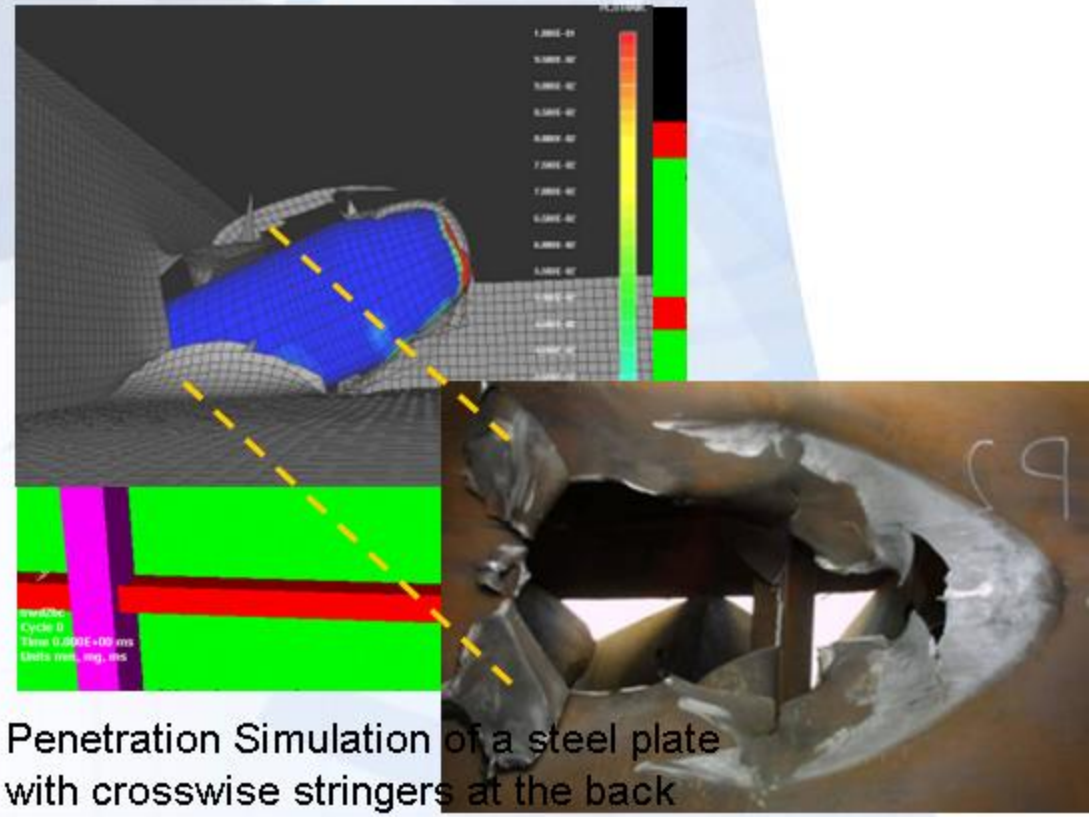
– Penetration Simulation

a) in Concrete *(Bunker)*



Penetration Simulation of a 40 cm reinforced concrete slab

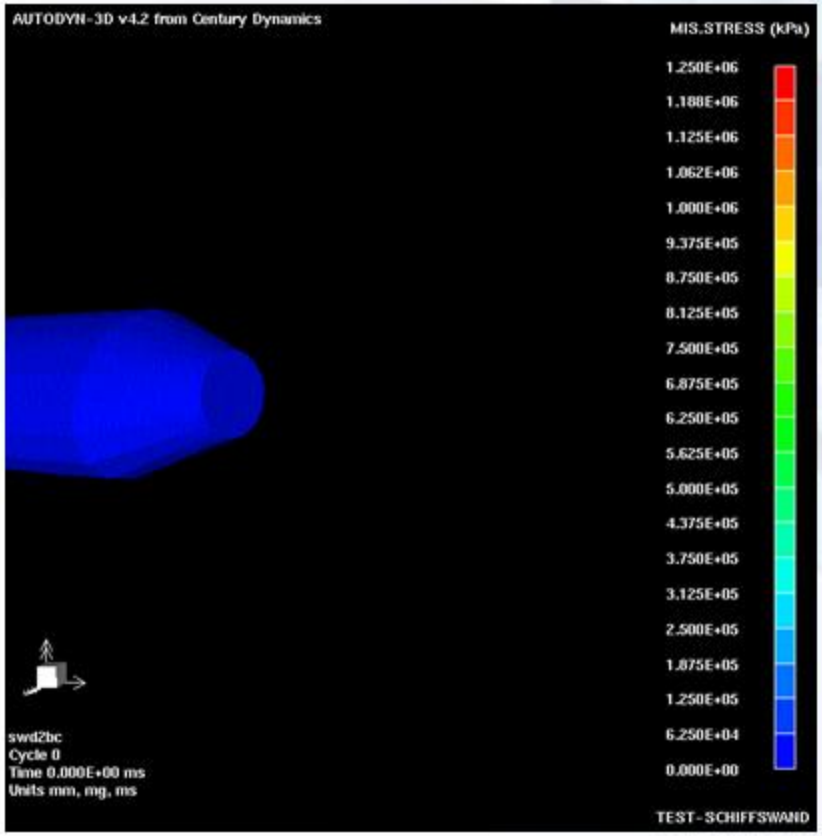
b) in Steel *(Ship Target)*

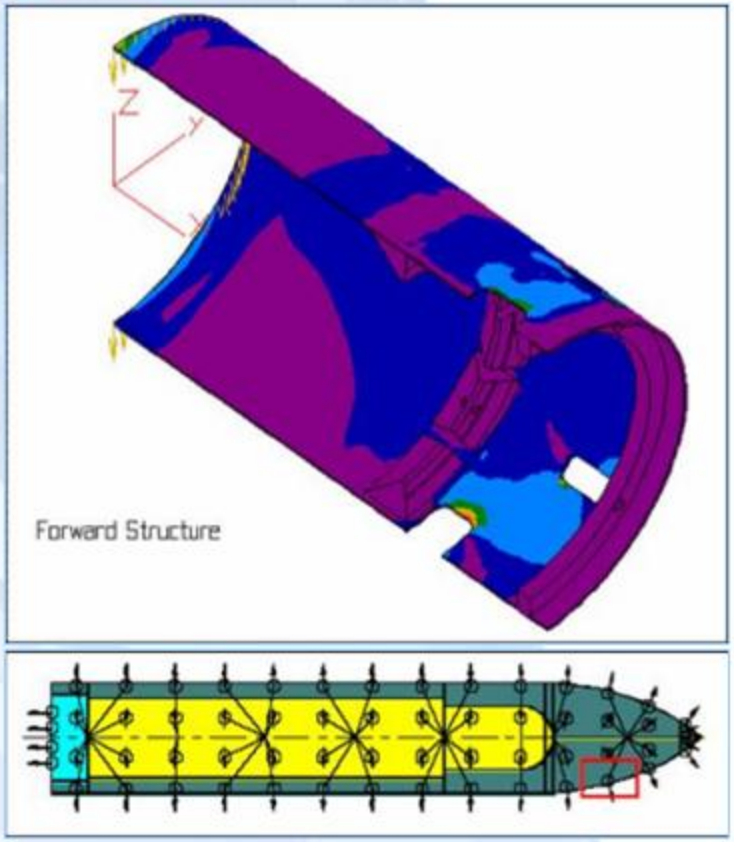


Penetration Simulation of a steel plate with crosswise stringers at the back

Penetrator Charge Design:
Casing (Strength & Structural loads)

– Structural loads simulation





Penetrator Charge Design:
High Explosive (Performance)

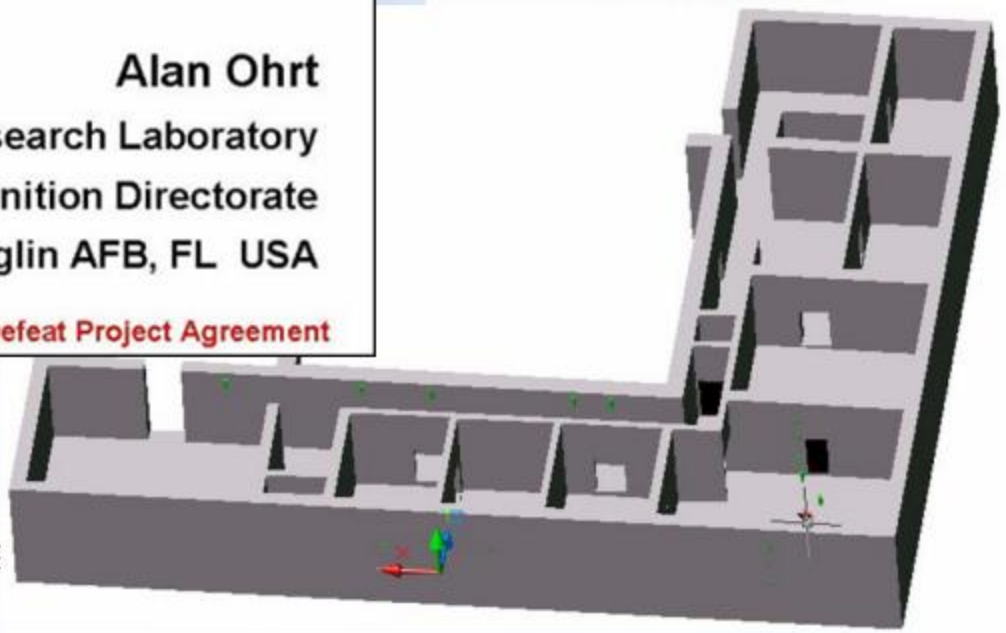
Results From the US/GE Test 17 Series in the Ladeburg Bunker
-- An Update for the March 2004 PA Meeting --

16 March 2004

Alan Ohrt
Air Force Research Laboratory
Munition Directorate
Eglin AFB, FL USA

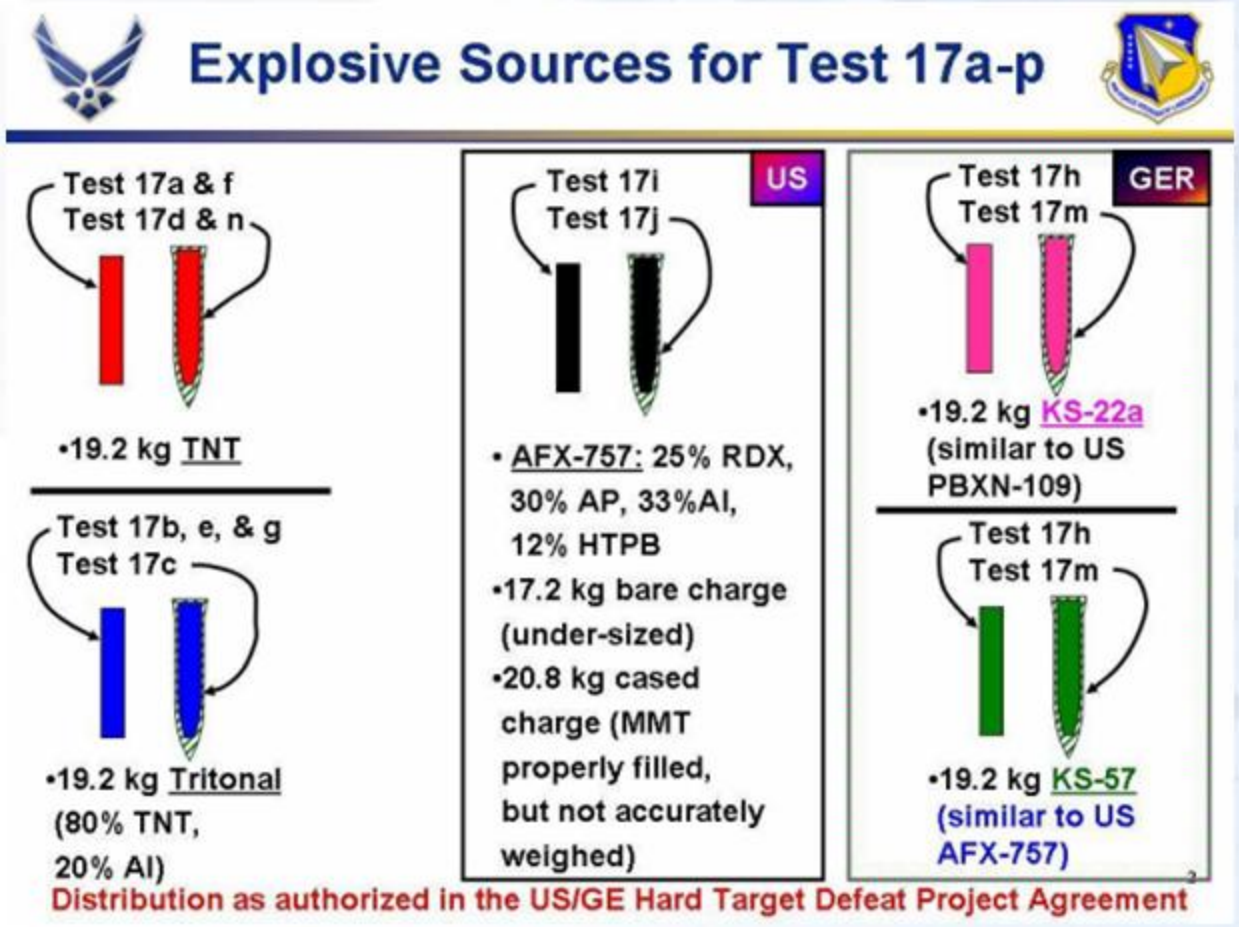
Distribution as authorized in the US/GE Hard Target Defeat Project Agreement

US/GE
Hard Target Defeat
Project Agreement



Penetrator Charge Design:
High Explosive (Performance)

– TDW's **KS22a** and **KS-57** Performance



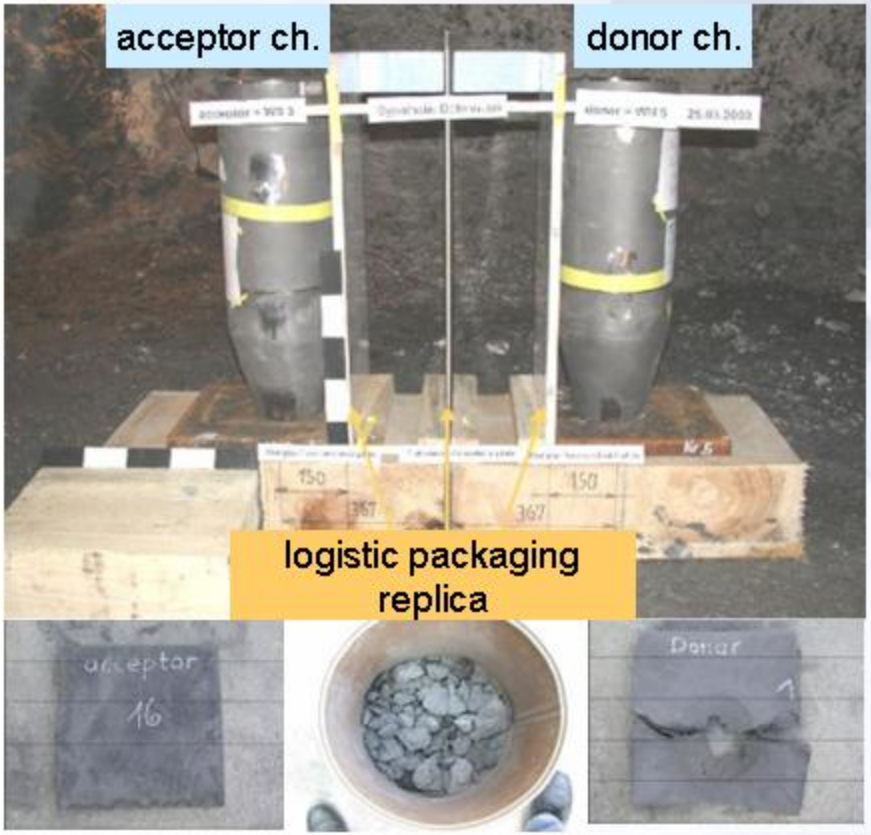
US/GE
Hard Target Defeat
Project Agreement

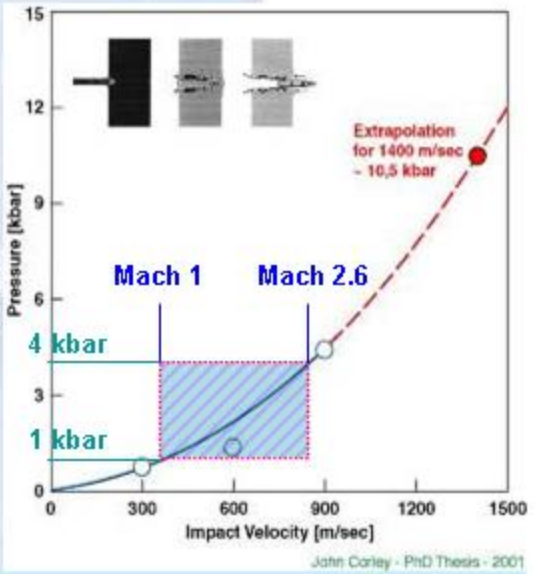
For details see AFRL report

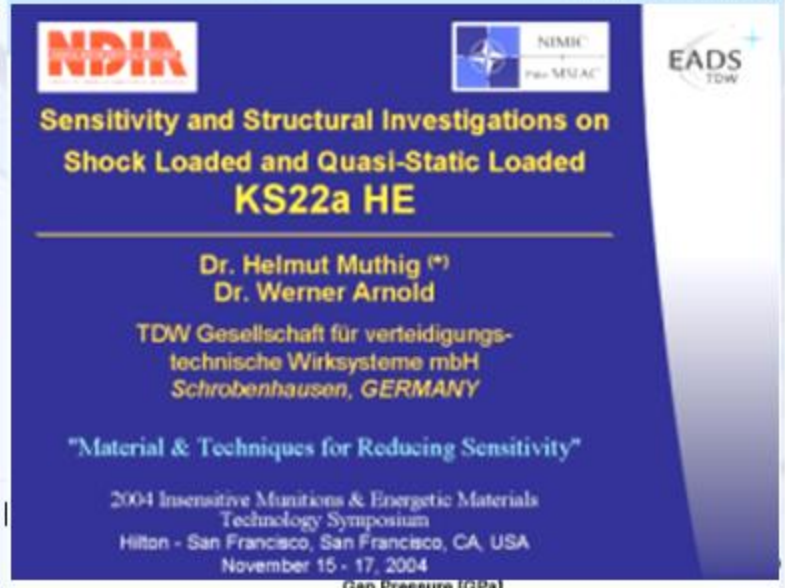
Penetrator Charge Design:
High Explosive (Insensitivity)

– TDW's **KS22a** Insensitivity

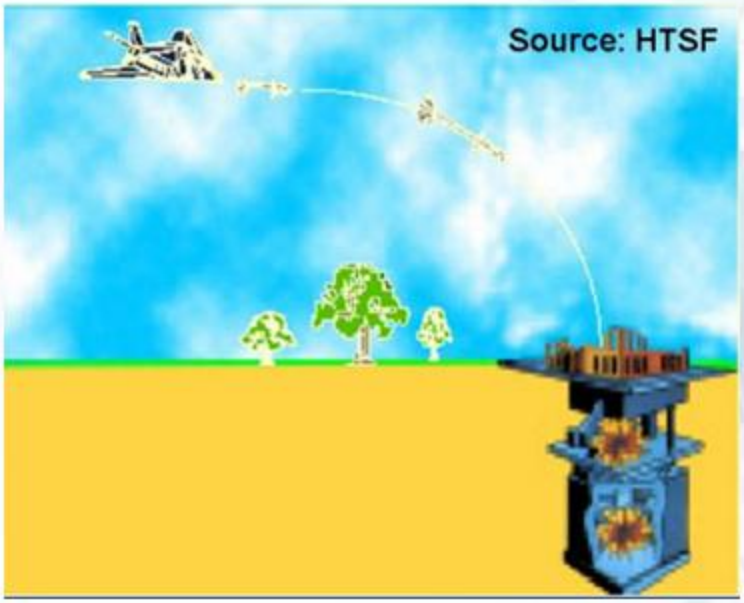
Sympathetic detonation test of NNW







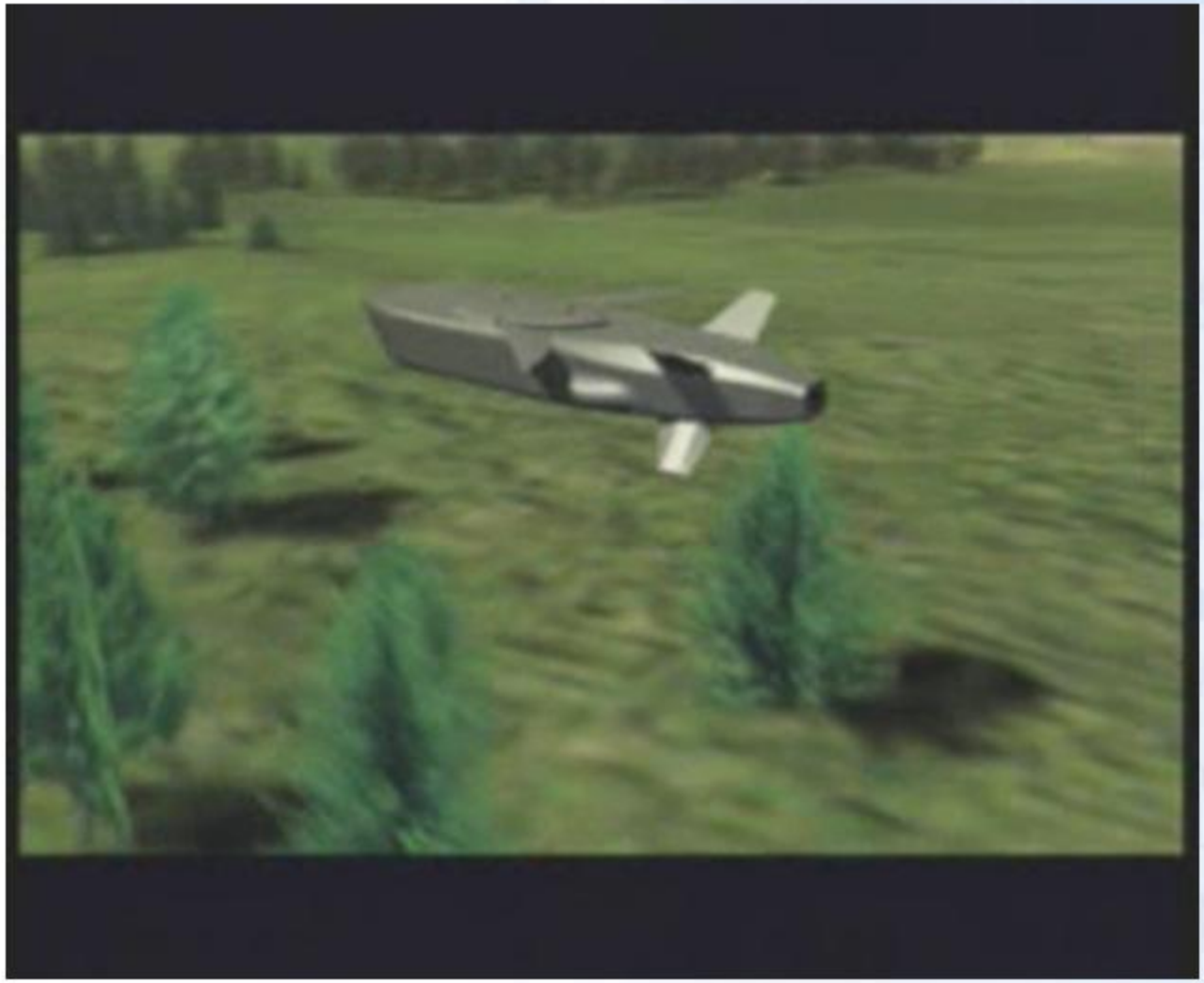
Fuzing Requirement for Penetrating Warheads
Burst Point Control Fuzing



"Smart" / Intelligent
Hard Target Fuzing =

Burst Point Control Fuzing

Fuzing Requirement for Penetrating Warheads
Burst Point Control Fuzing



EADS DEFENCE & SECURITY

Principle Choices of a Penetrator Fuze: *"Traditional"* vs. *"Smart"* Fuzing

"Traditional"

Time delay after impact fuzing

(up to 256 different delay times, 1 msec resolution)

Examples:

JPF (US), MAFIS (UK)

(for Storm Shadow w/BROACH)

vs.

"Smart"

Active decision-making, burst point control fuzing

w/ **void sensing** and **layer counting** capability

Examples:

PIMPF (GER, ESP, NOR),

(US HTSF Requirement)

Principle Choices of a Penetrator Fuze

"Traditional"

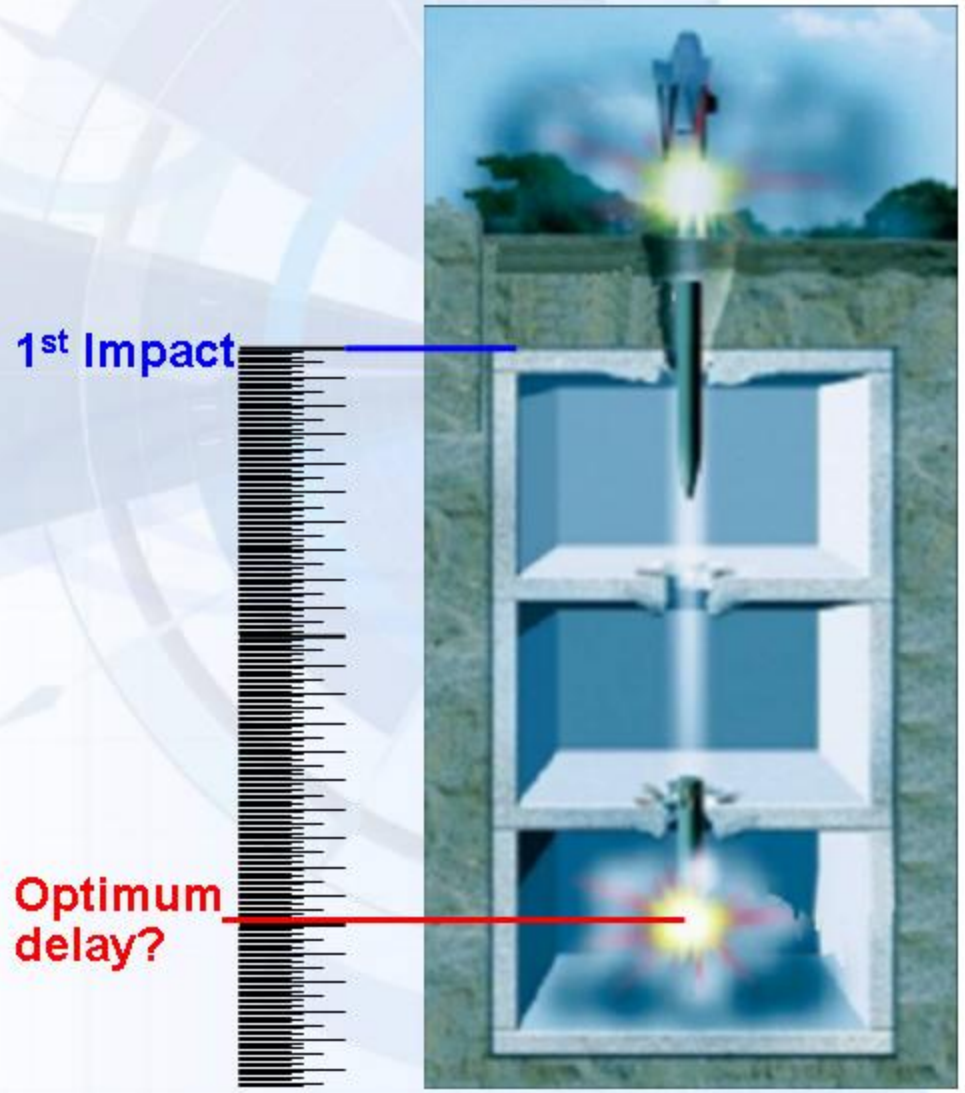
Time delay after impact fuzing

(up to 256 different delay times, 1 msec resolution)

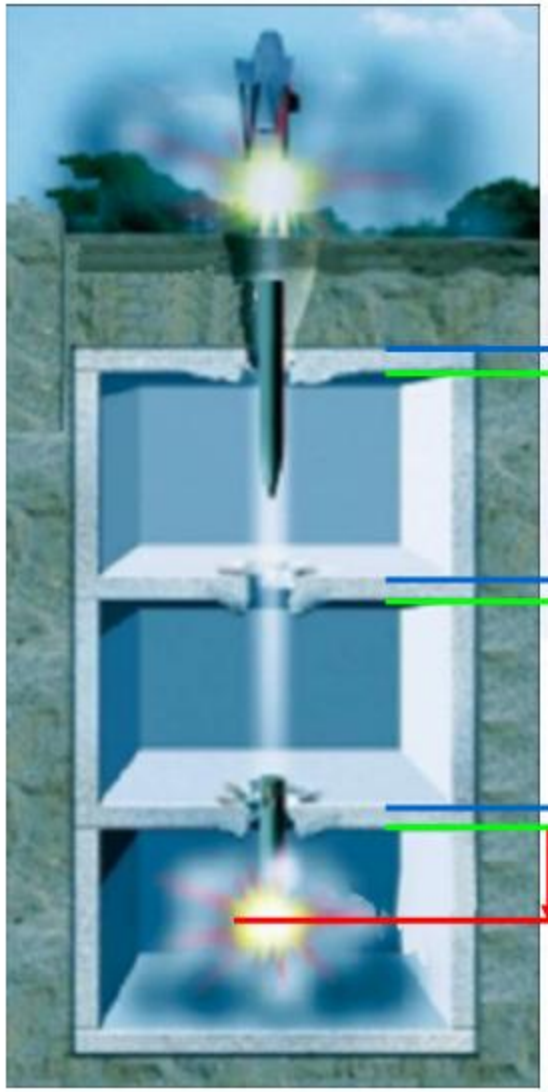
Examples:

JPF (US), MAFIS (UK)

(for Storm Shadow w/BROACH)



Principle Choices of a Penetrator Fuze



"Smart"

Event Detection,
Active decision-making,
burst point control fuzing
w/ **void sensing** and
layer counting capability

Examples:

PIMPF (GER, ESP, NOR)

(US HTSF Requirement)

EADS DEFENCE & SECURITY

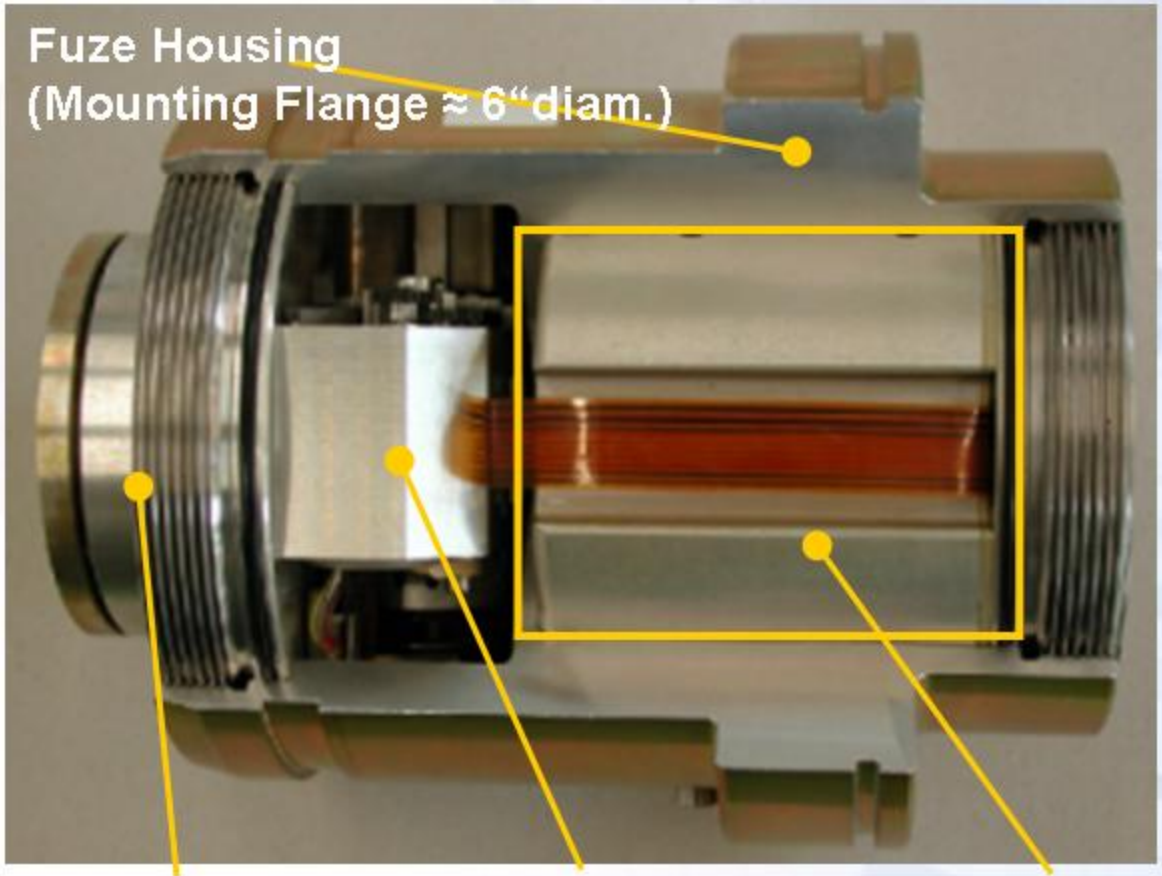
Key Capabilities of PIMPF

PIMPF =

- **active decision-making**, accelerometer-based fuze
- detects hard and soft layers within a structure ⇒ ***event detection*** and ***layer counting*** capability
- senses and counts ***voids***
- detonates the WH at a **desired burst point** inside buried or reinforced concrete targets
- adjustable **backup time delay**
- **programmable,** cock-pit selectable
- **out-of-line fuze** with an electro-mechanical SAD
- **Built-in-Test** capability
- **high reliability**

PIMPF - The Hardware

"PIMPF" as in production for the German Taurus S/OM

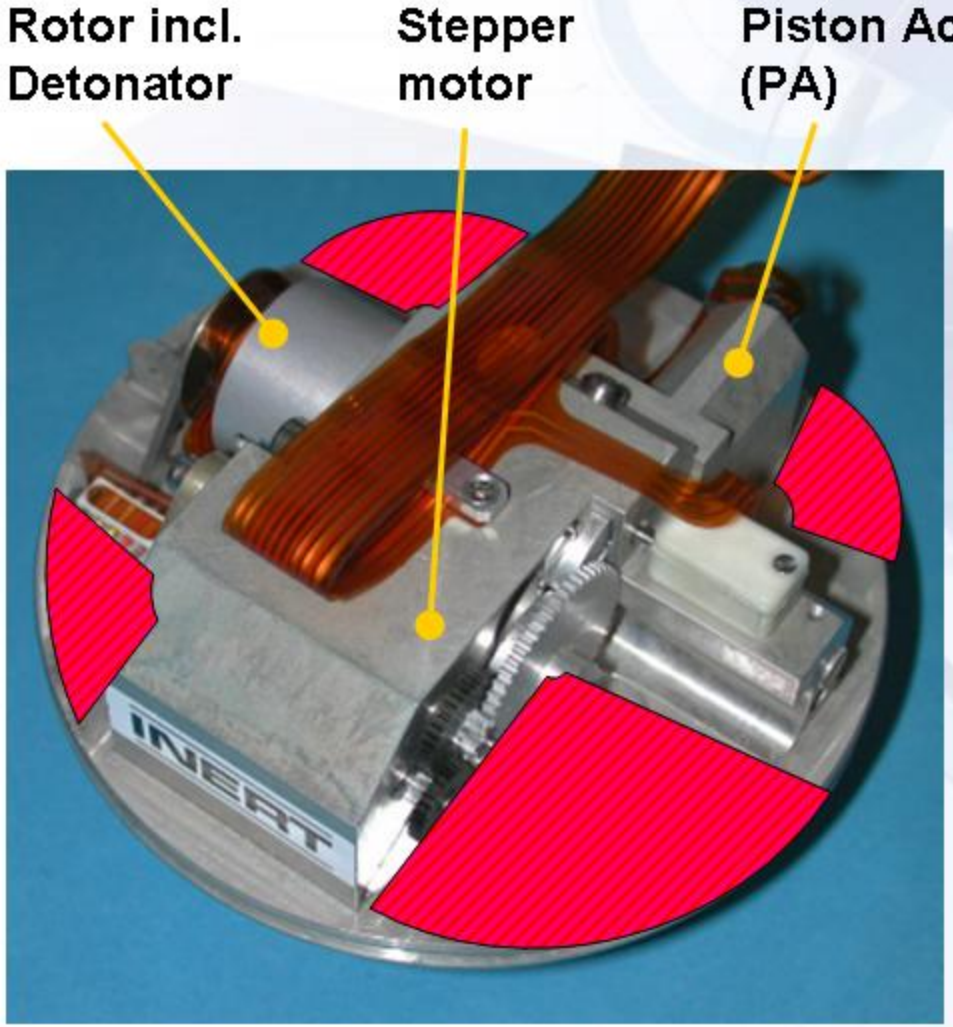


Booster Charge (HNS)

Electro-mechanical ***Safe & Arm Device (4.3“)***

Fuze / Sensor Electronics: ***Target Detect. Dev. (2.5“)***

PIMPF Safe & Arm Device (4.3 inch diam.)



- Compliant to STANAG 4187 (equiv. MIL-STD 1316 D)
- 1st arming event by stepper motor turn (unlock PA)
- 2nd arming event by pyrotechnical actuator (1 W/1 A/5 min)
- Final arming event by stepper motor turn (detonator in line)
- metal layer detonator (100 mA No-Fire, shock-proof)
- 110 mm = 4.3" in diam., but there is room for a **low-risk** repackaging into a 3" standard fuze well

"US PIMPF" = BTF

The way forward – FCT of PIMPF
Rationale

- The Department of Defense currently has **no void sensing smart fuze** suitable for its penetrating weapons systems.
- The cancellation of the USAF's Hard Target Smart Fuze (HTSF) Program has forced penetrating weapon developers to search for alternatives.
- This FCT will evaluate the Programmable Intelligent Multi-Purpose Fuze (**PIMPF**) alternative, a qualified fuze with the ability to detect and count voids in prosecuting hard, deeply buried targets, and **in production** for several NATO countries.
- In addition to e.g. the **CALCM** and **Tomahawk** requirements, also other penetrating weapon systems (fielded and/or in development) will require the capabilities of a PIMPF-type fuze to address emerging threats.
- If successful, this FCT will identify a smart fuze option for these weapon systems as well.
- While not quite a "one size fits all" solution, PIMPF would have many commonalities, retain some necessary differences, and complete an important development toward the needed fuze.

Penetrating Effector Systems from EADS / TDW
Presentation Outline

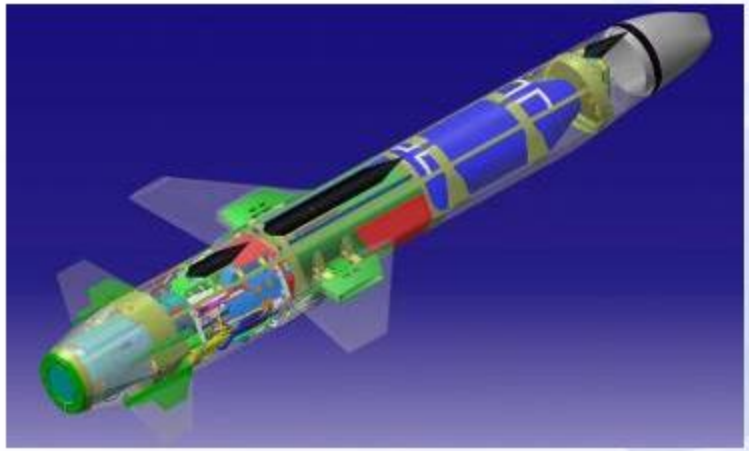
Accelerating Precision Strike Technology for Stability Operations and Protection of Coalition Forces

- Introduction: Short Company Background
- The Need: Effective Defeat of Hard Targets
- One Solution: Penetrating Effector Systems from TDW
  - Q: What does it take to build effective penetrating effectors?
  - A: TDW has it all!
    - Requirement Analysis and Effector System Design
    - Penetration Simulation and Performance Prediction
    - Penetrator Charge Design (Casing and High Explosive)
    - Penetrator Fuzing (Smart Hard Target Fuzing)
- Examples, Tests, Video Clips

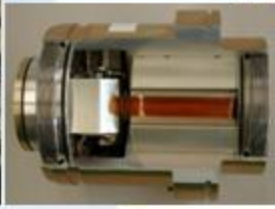
The MEPHISTO Effector is in Series Production ...

... for the NATO countries GERMANY and SPAIN

The NNW is qualified for the Series Production of the Norwegian Naval Strike Missile NSM

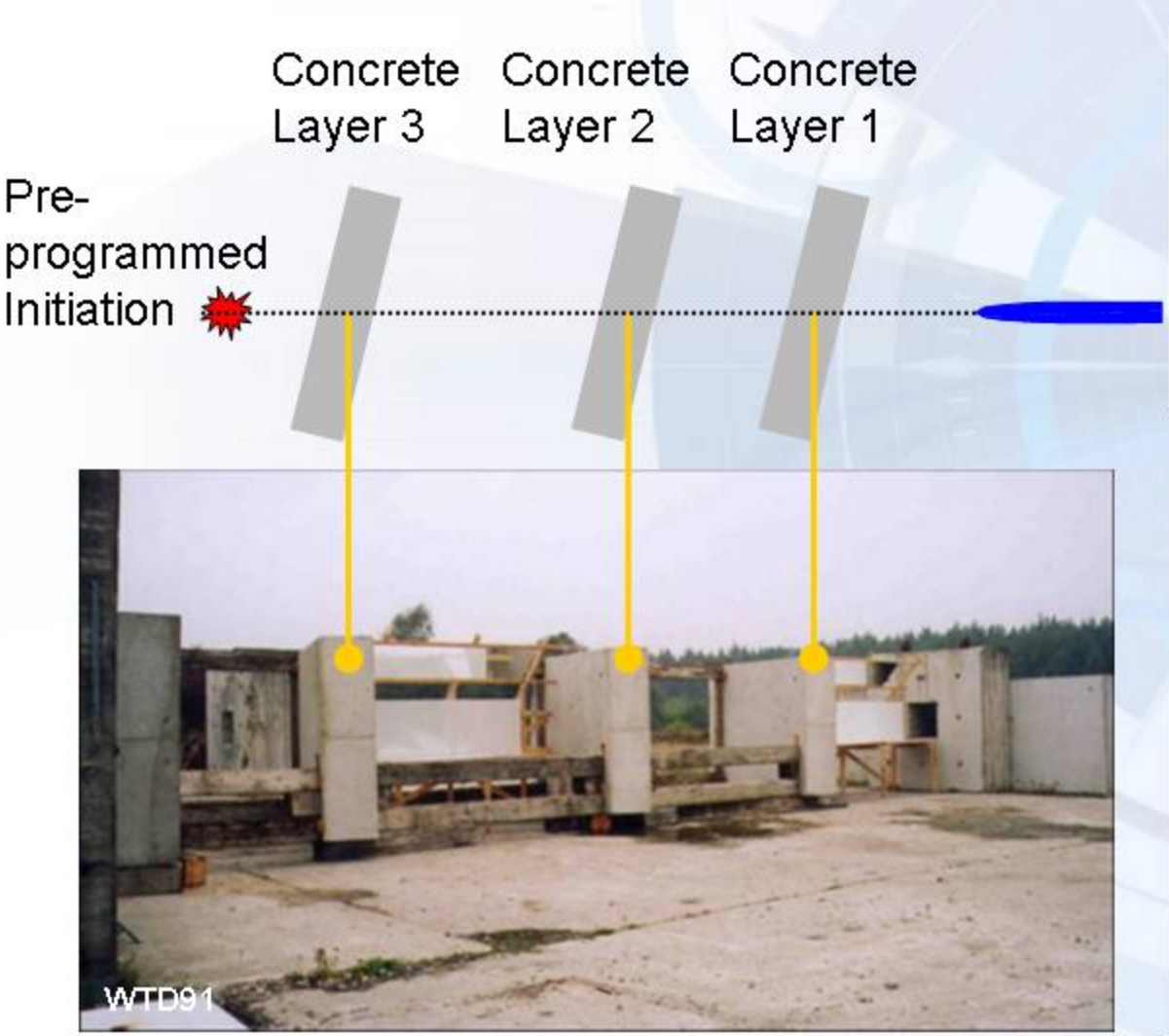


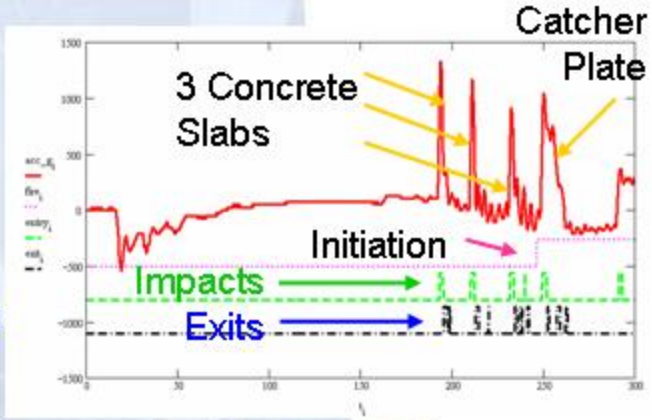
PIMPF is also qualified for Norway



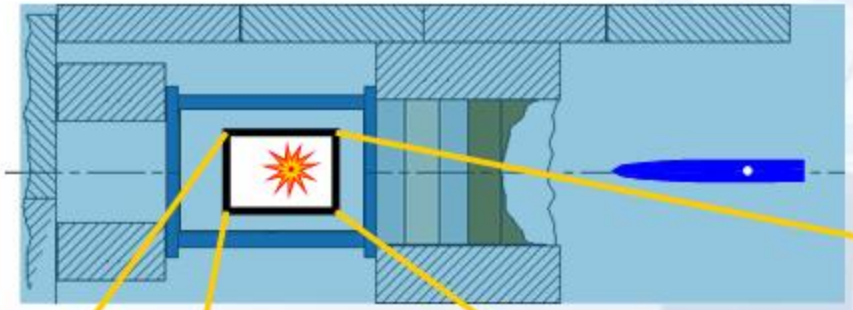
Cannon Testing & Sled Track Testing of MEPHISTO at WTD91, Meppen, Germany

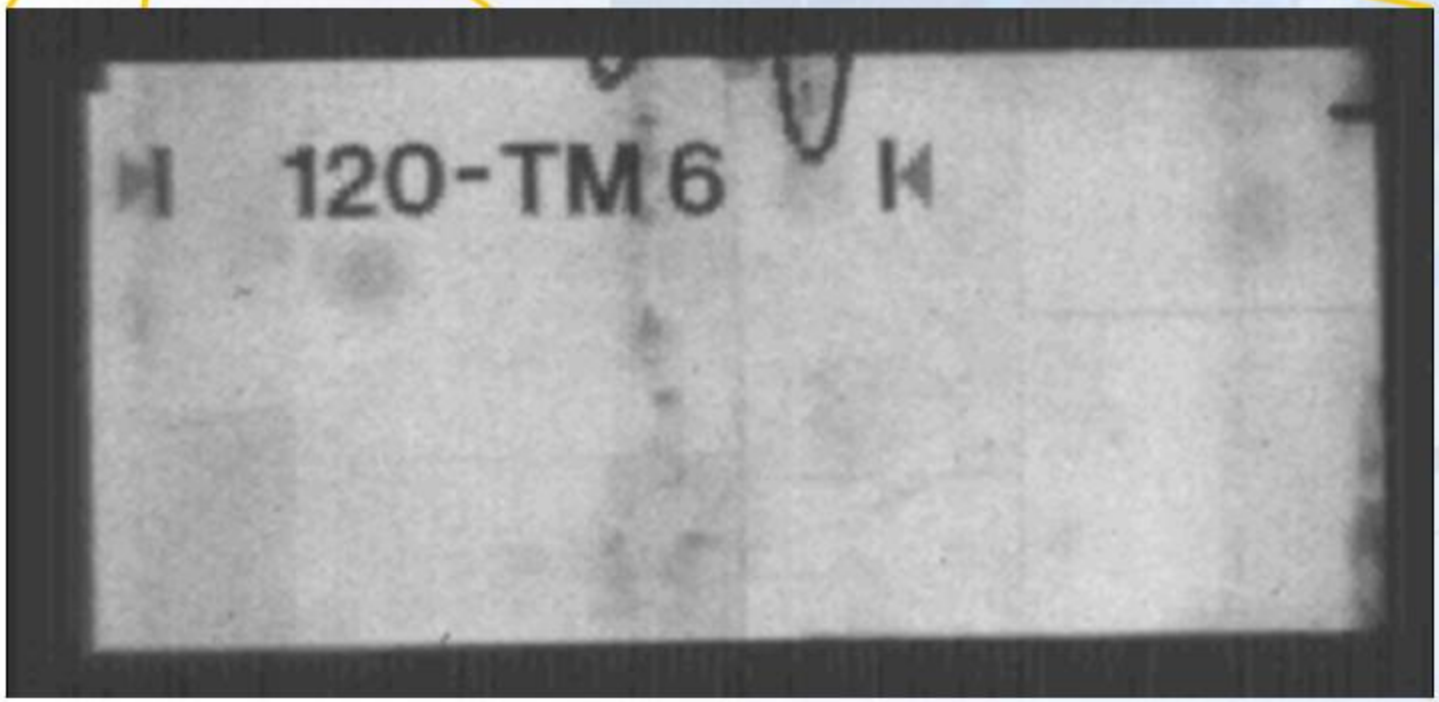
Cannon Testing - Target Set-up



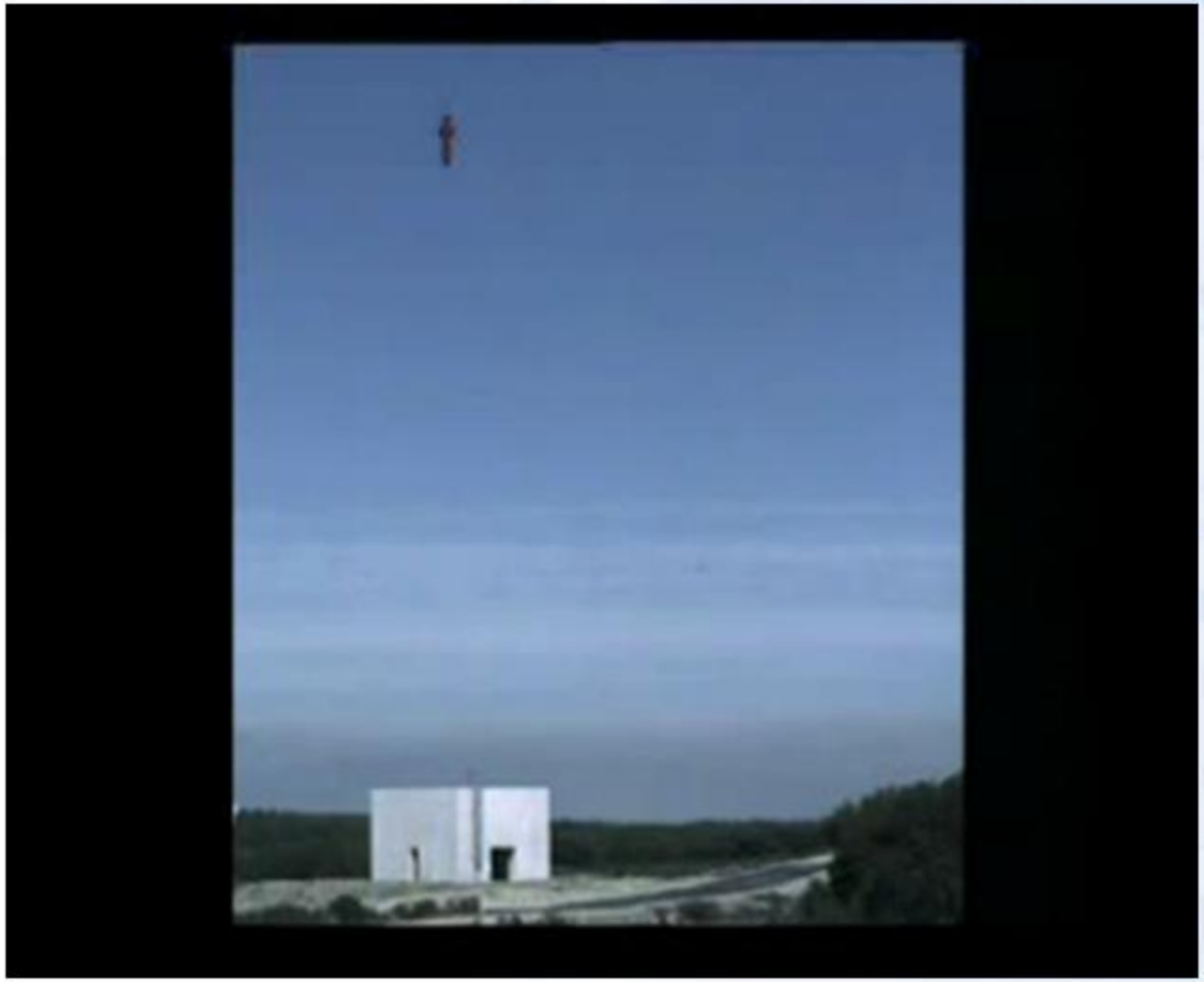


Test Results, Cannon Tests with Flash Indicator Charge & Video





Flight Testing, Videos: Taurus FV1 and FOM



Flight Testing, Videos: Taurus FV1 and FOM

The End

EADS / TDW wants to work U.S. and Coalition Forces Warfighters' priorities!

Thank you for granting this opportunity to help you get more from us.

Thank you for your attention!

Dr. Helmut Muthig
President & CEO
TDW Gesellschaft für verteidigungs-technische Wirksysteme mbH

Phone +49 8252 99 63 43
e-mail helmut.muthig@eads.com