



Abstract number: 20319

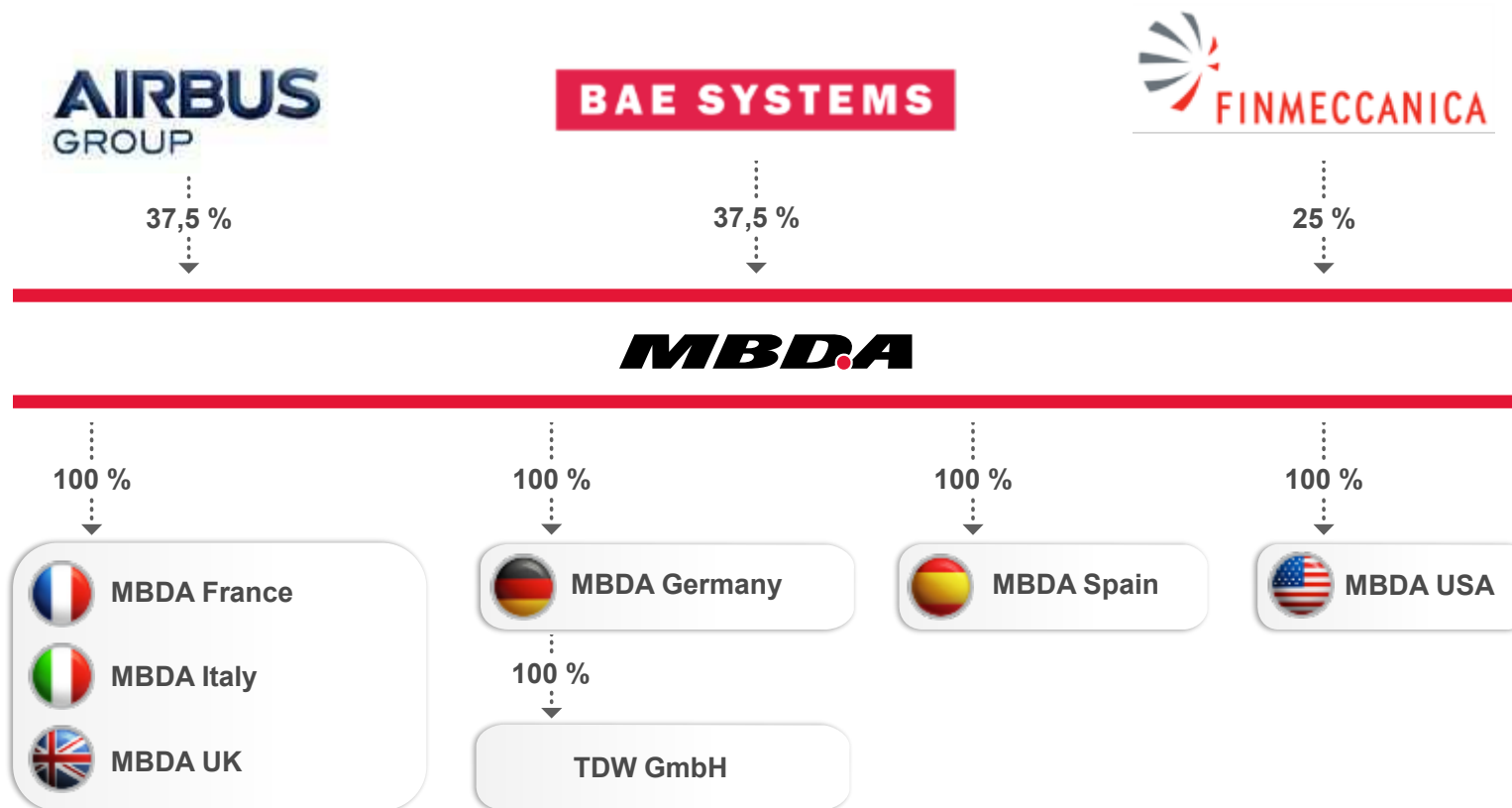
**Dynamic High g-Shock Fuze  
Testing with support of a  
Reverse Ballistic Gun &  
Sled Track**

**TDW, Christian Euba**

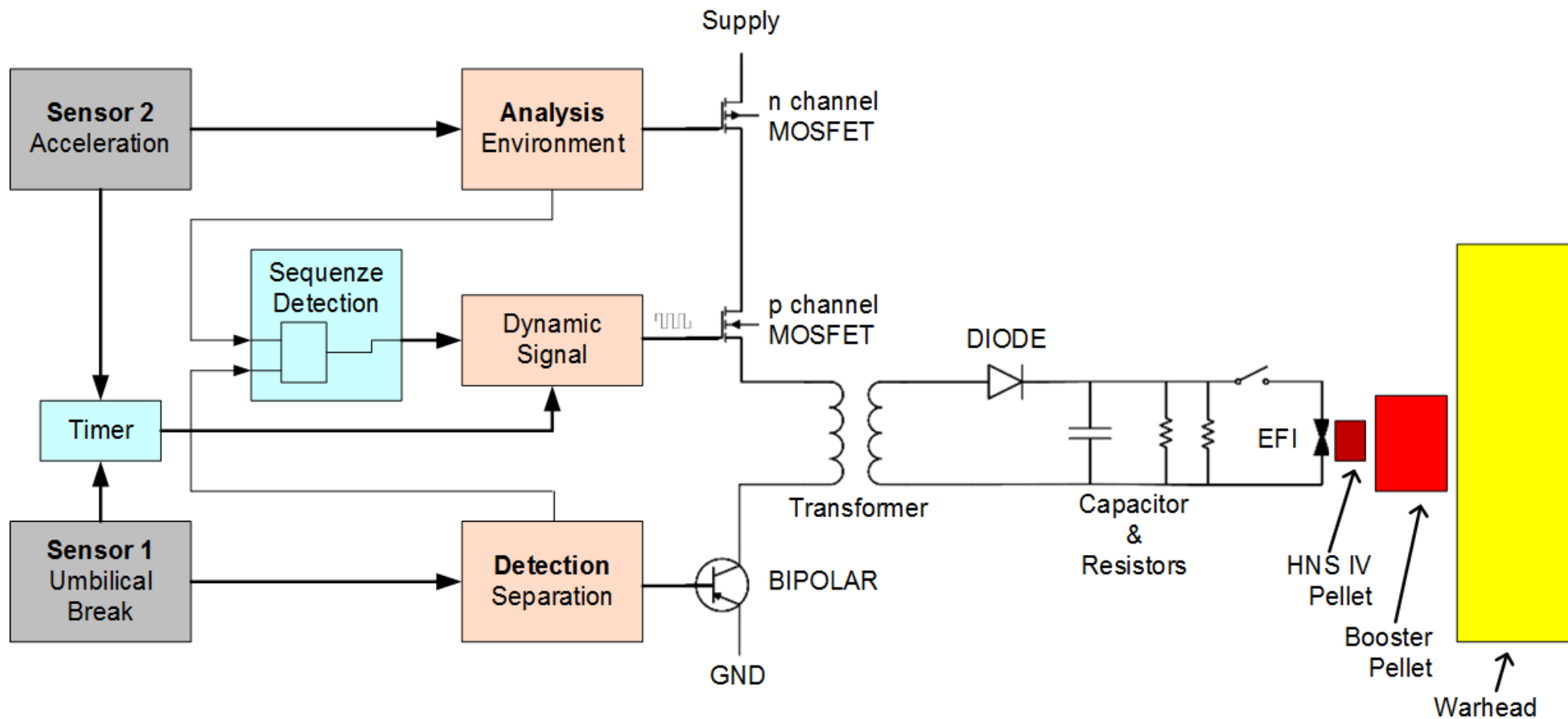
May 15-17, 2018  
NDIA, 61<sup>TH</sup> Fuze Conference

**TDW**  
an **MBDA** company

- 1) **TDW Structure**
- 2) Fuze Design
- 3) Gas Gun Test
- 4) Sled Test
- 5) Conclusion



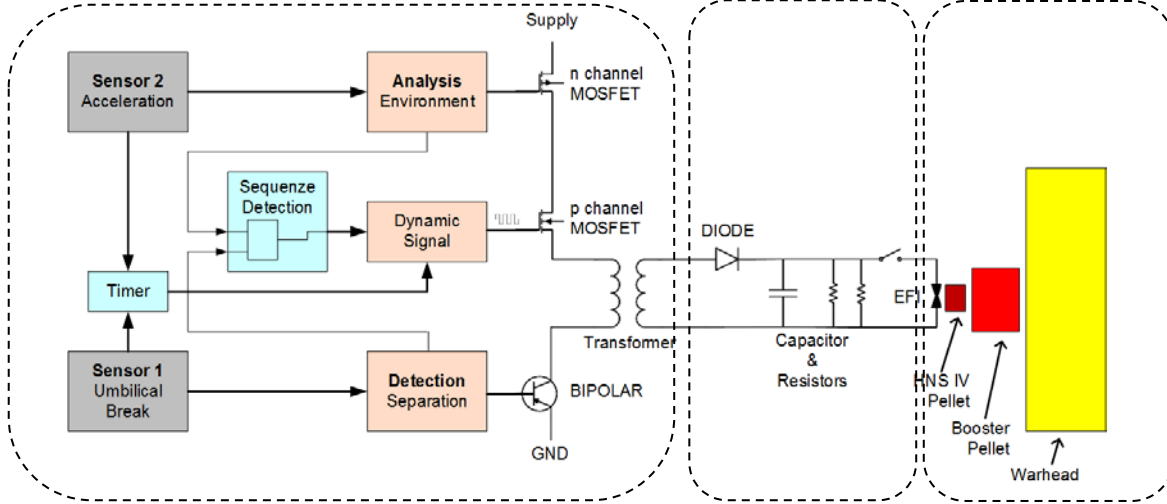
- 1) TDW Structure / Products
- 2) **Fuze Design**
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LEVEL1

LEVEL2

LEVEL3



LEVEL 1 – INERT – Low Voltage

- Electronic laboratory tests
- Centrifuge tests
- Shakers
- Drop table

LEVEL 2 – INERT– High Voltage

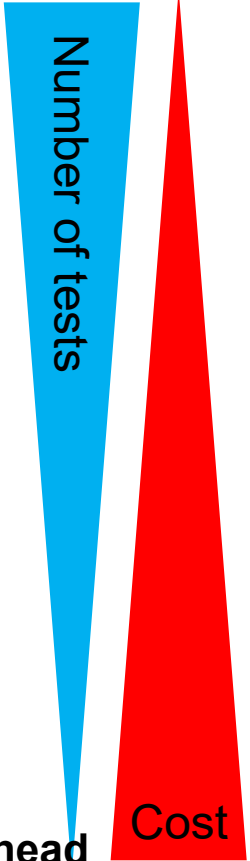
- Special test areas required
- EFI typically replaced by shunt resistors
- Shakers
- Drop table

LEVEL 3a – INERT – with EFI PCB

- Complete electronic part is tested.

LEVEL 3b – LIVE – with boosters / warhead

- Complete initiation chain





## Testing (Number of tests versus costs)

Bench Test	Centrifuge	Shaker	Drop Table	Gas gun	Sled
unlimited	unlimited	unlimited	15 per hour	3 per hour	2-3 per week

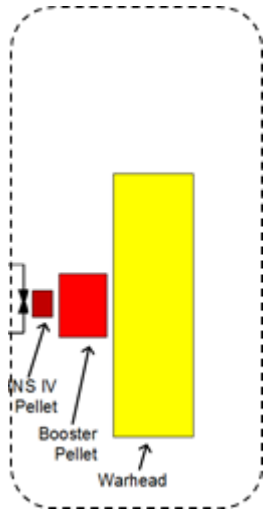
Number of tests

Cost



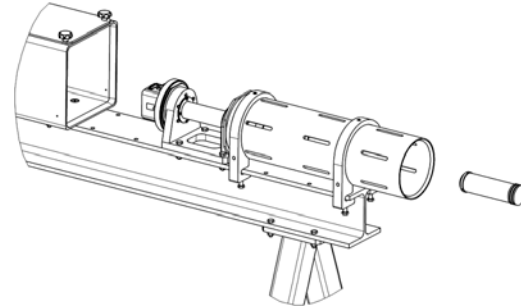


### LEVEL 3



### LEVEL 3a – INERT – with EFI PCB

- Gas Gun Testing



**Fuze acts as a fireset.**  
Safety is bypassed.

### LEVEL 3b – LIVE – with boosters / warhead

- Sled Test

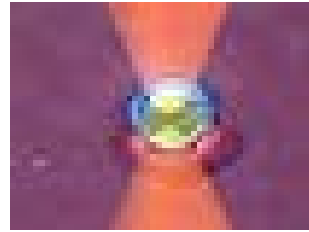


**Fuze is operational.**  
Safety is not bypassed.



- 1) TDW Structure / Products
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- Investigation programme has shown that using an IR Diode to detect the EFI Flyer explosion is the best strategy.

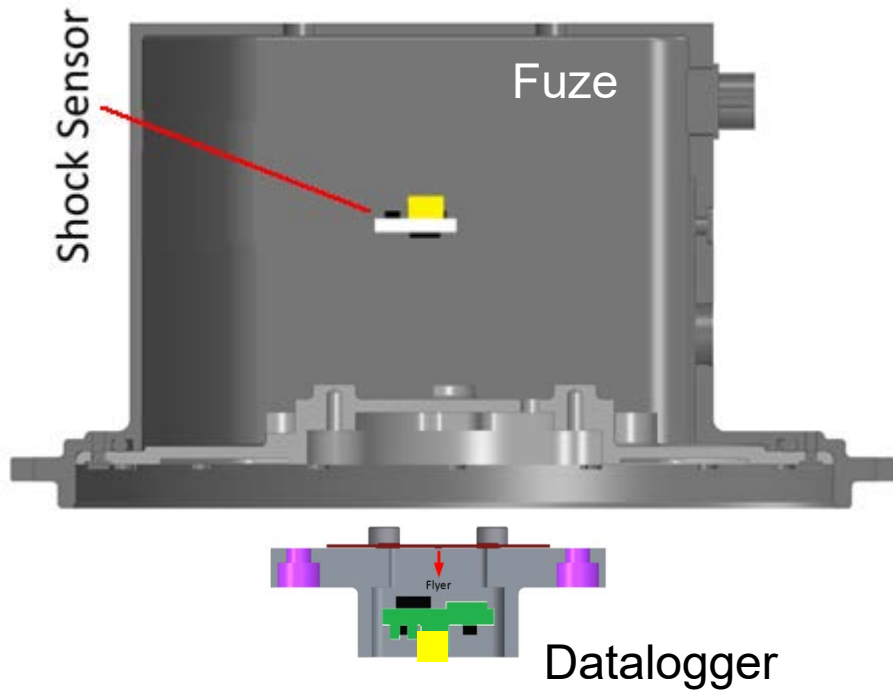


- Test Setup



**Advantage to use an IR Diode:**

- + Digital signal (No complex sampling algorithm required)
- + Easy to sample



### Datalogger with enhanced functions (programmed by TDW)

- Sample Rate 5 $\mu$ s
- Two shock sensors
  - One sensor inside the datalogger (60000g, 3501A1260KG)
  - One shock sensor inside the fuze (60000g, 3501A1260KG)
- EFI Flyer explosion detection with IR diode
- Trigger input (projectile detection)
- Trigger output (to trigger fuze)

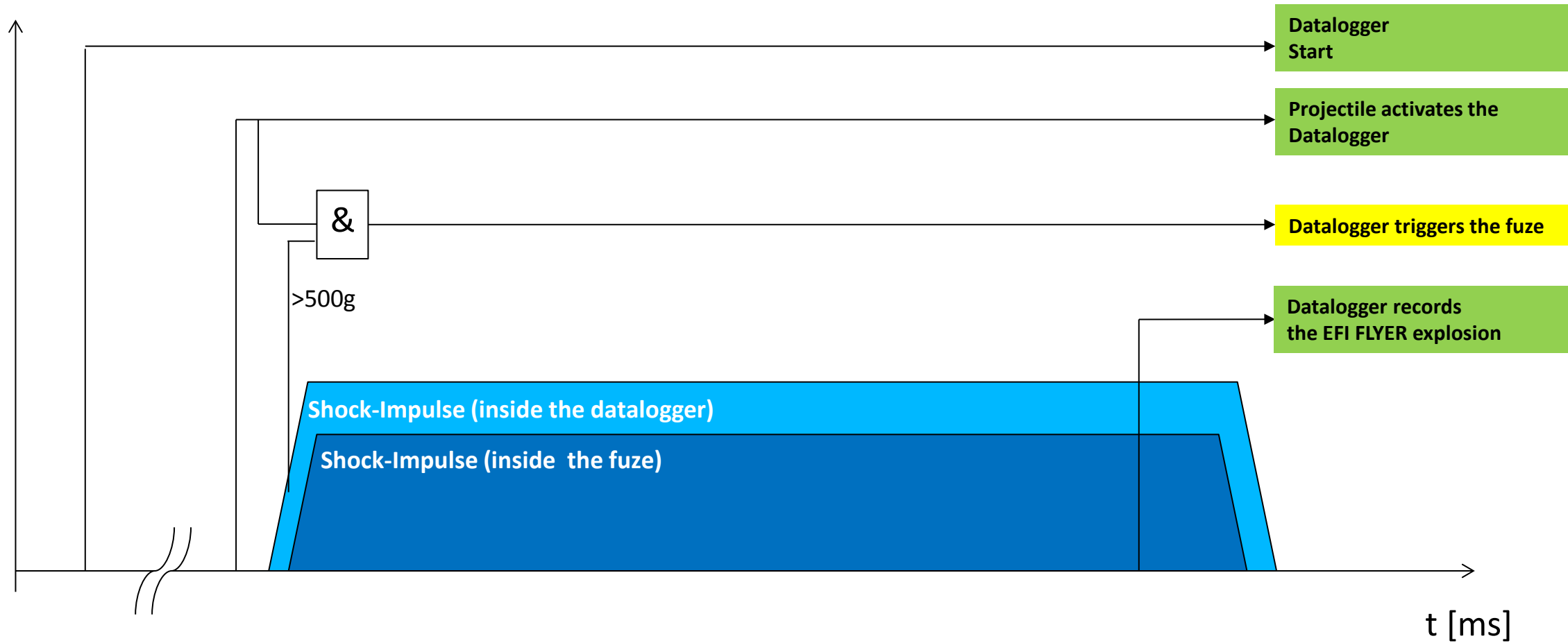
### Output of the Datalogger:

Timing diagram showing in one time stamp following:

- Fuze armed signal
- Projectile entry edge
- Trigger signal to fuze
- Two shock curves (data recorder & fuze)
- EFI Flyer explosion

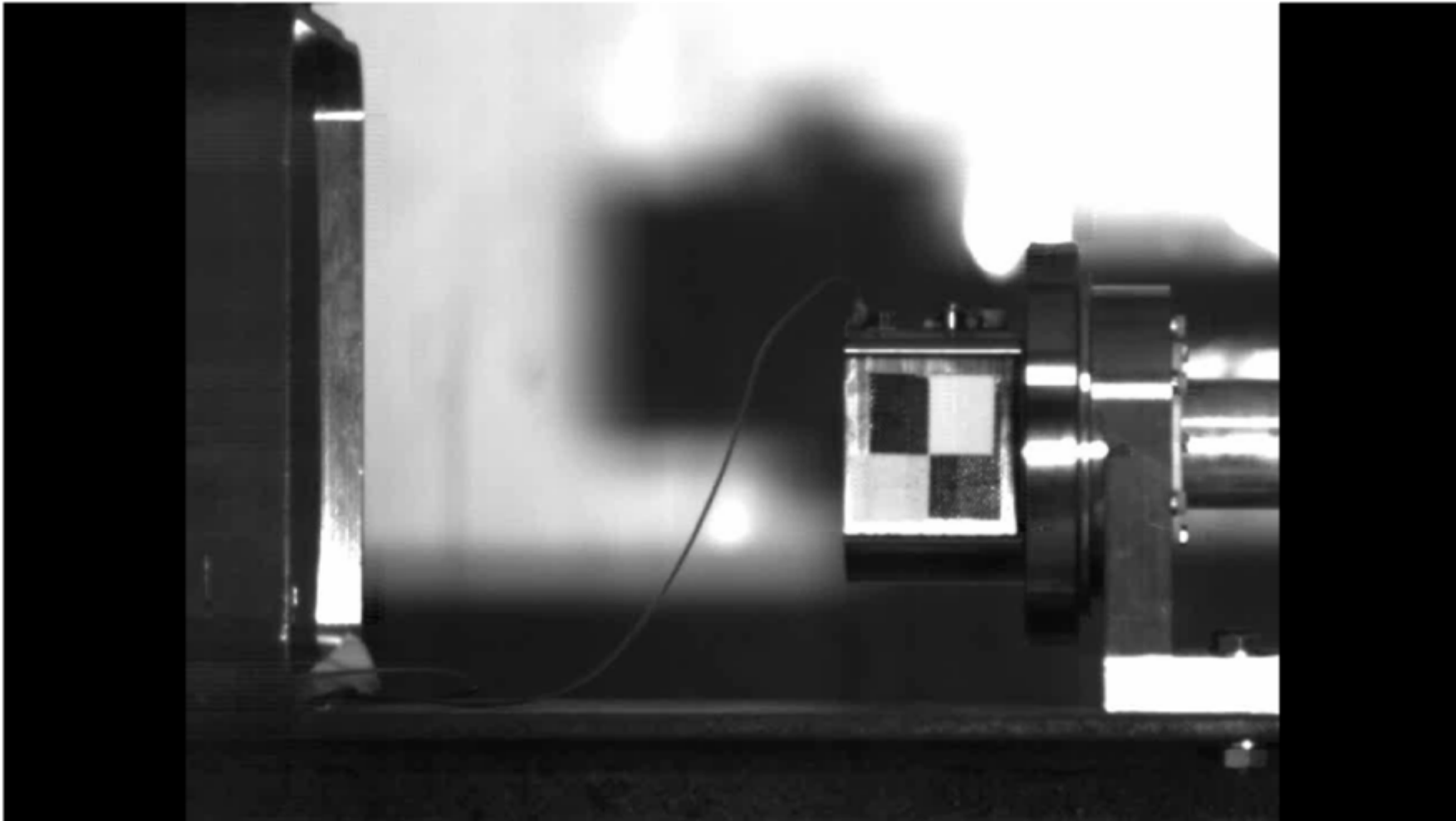


# Gas Gun – Diode to detect EFI Flyer explosion

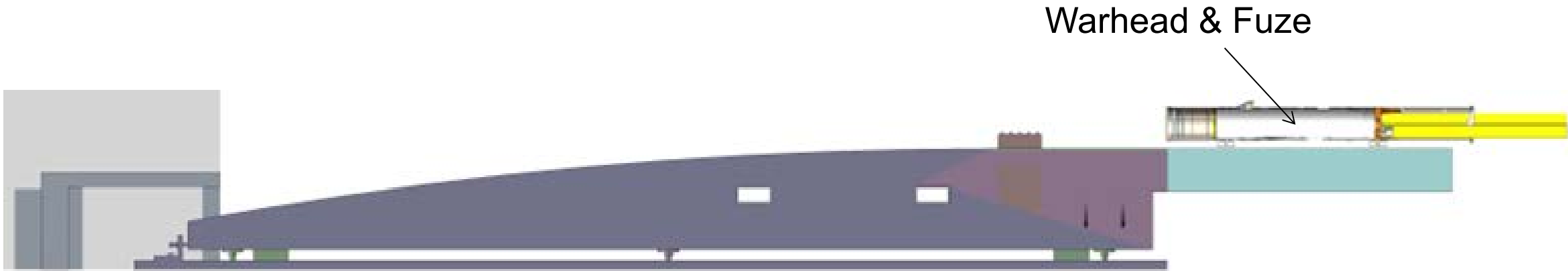




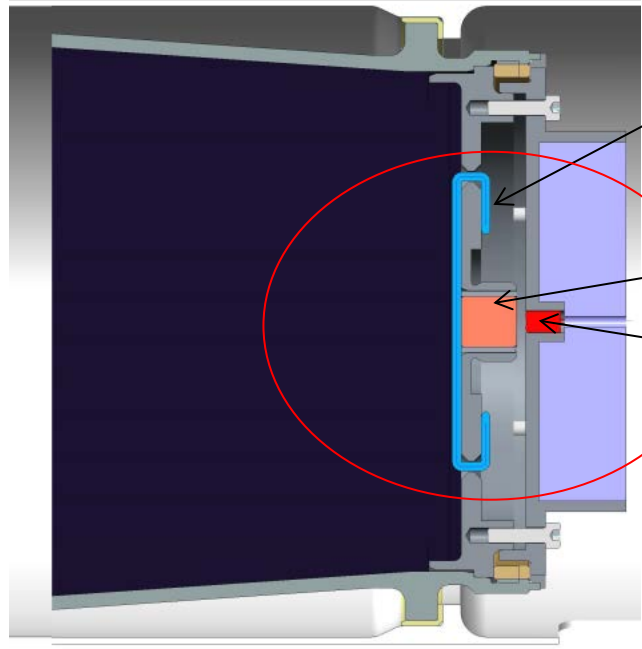
*Gas Gun – EFI Flyer explosion detection during flight & shock impact*



- 1) TDW Structure / Products
- 2) Fuze Design
- 3) Gas Gun Test
- 4) Sled Test**
- 5) Conclusion



- (1) Fuze is operational – Safety is not bypassed.
- (2) Warhead is partly live.
- (3) Pre-Tests required to demonstrate that no life is in danger during the acceleration on the sled track.
- (4) In case of a malfunction the fuze might initiate the warhead on the sled track.

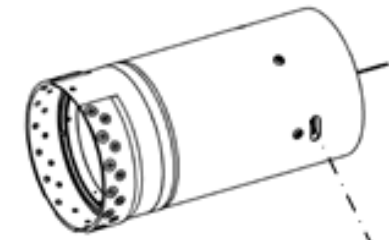


Wire to detect booster activation

Booster

HNS IV Pellet

Inside the target the light flash will be detected.



High Speed Kamera







Sled acceleration distance 160 m  
Target dimension 4x4x4m

*Sled*



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- 5) **Conclusion**

The presentation gives an overview on the basics and techniques for testing the complete **initiation chain** prior integration into the missile.

- (1) This approach allows to analyze the initiation chain of the fuze performance **without restrictions** and verifies at the same time that the fuze survives shock requirements.
- (2) This strategy helps in the context of a **fault localization**.
- (3) Increase the reliability and durability of the fuze design.

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