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Future Fuzing: New Operational Needs and Fuze Technical Challenges

Max Perrin

53rd Annual Fuze Conference
May 19 - 21, 2009 – Lake Buena Vista, FL
"Next Generation Fuzing - Maximum Advantage for the Warfighter"

Company Presentation

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- **A global leader in the field of ammunition fuzes and S&A devices**
- **Full range of products**
- **Key competences in**
  - Fuzing technologies
  - Micro-technologies
  - Ammunition electronics

Fuze Missions

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- The Fuze provides most of the performance of the munitions, in terms of:
  - ***Terminal Effect***: by optimizing the warhead initiation time/place/mode on target
  - ***Safety and Reliability***: by providing maximim safety for the friendly troops while dealing with enhanced reliability requirements (no hazardous duds)
  - ***Flexibility***: by enabling the user to always get the relevant product whatever the missions and the threats are, and reducing the logistic footprint
- New trends in modern warfare highlight new operational needs

New operational requirements for munitions

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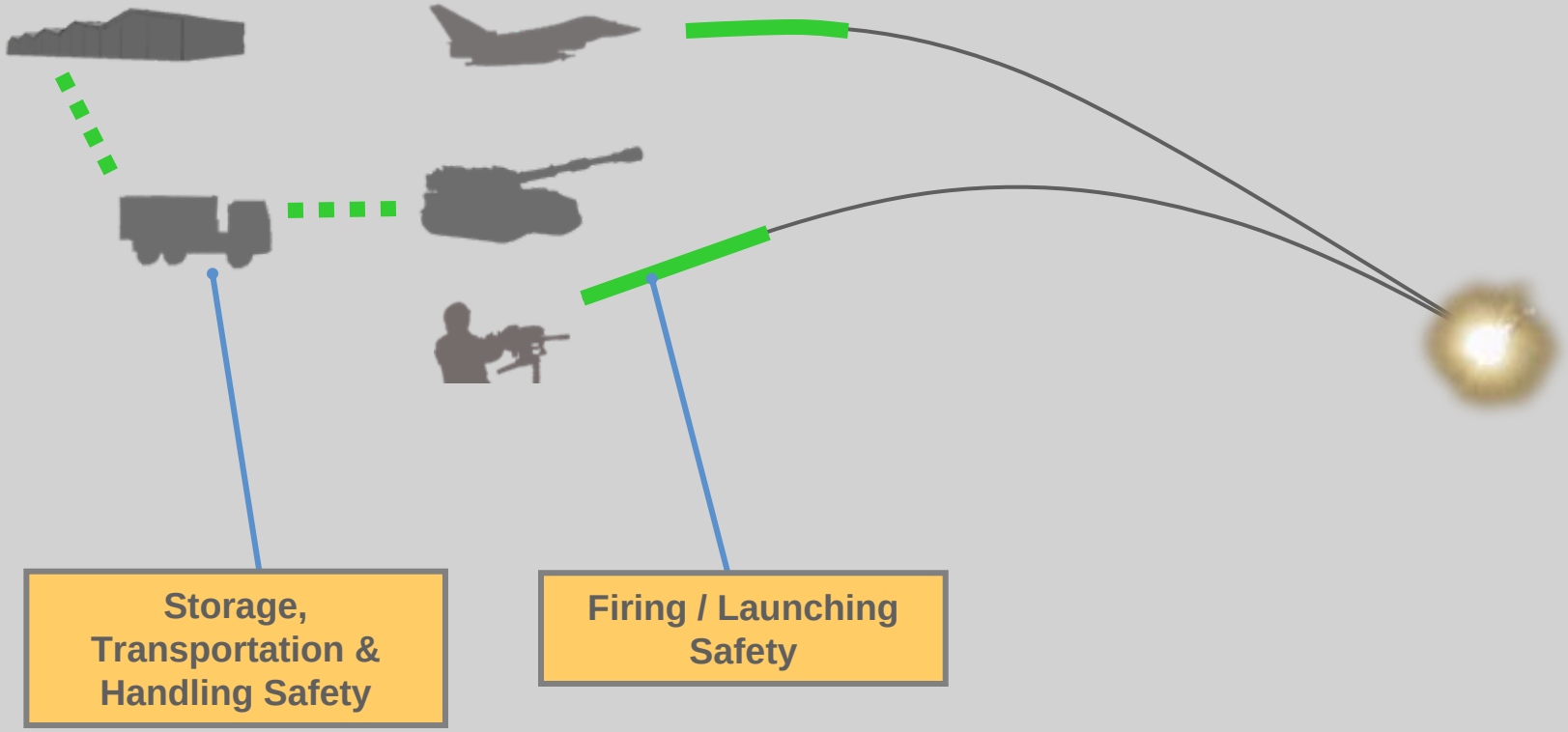
Improvement of fuze functions and
Development of new technologies for fuzes

Safety: Conventional requirements



Safety: New operational requirements

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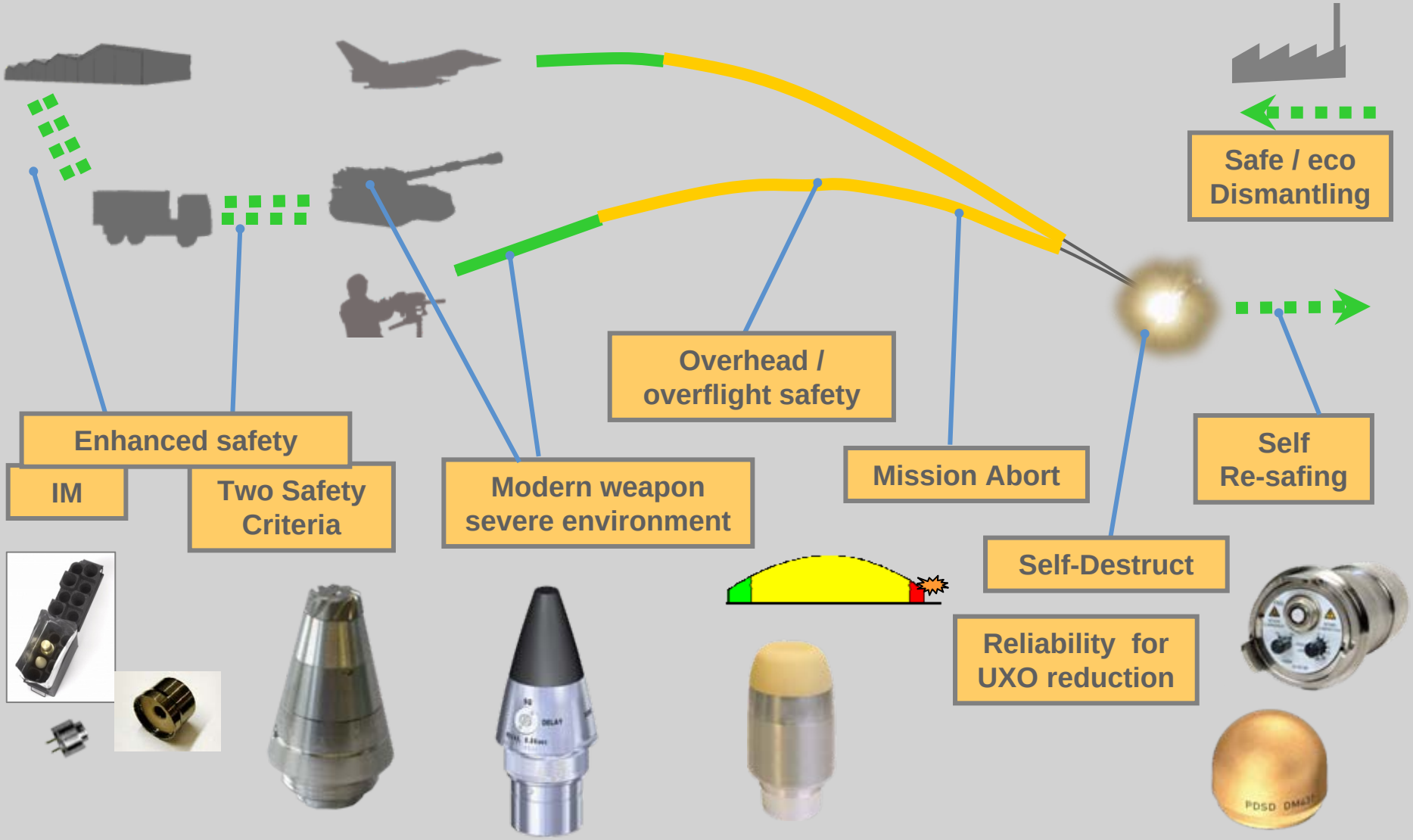
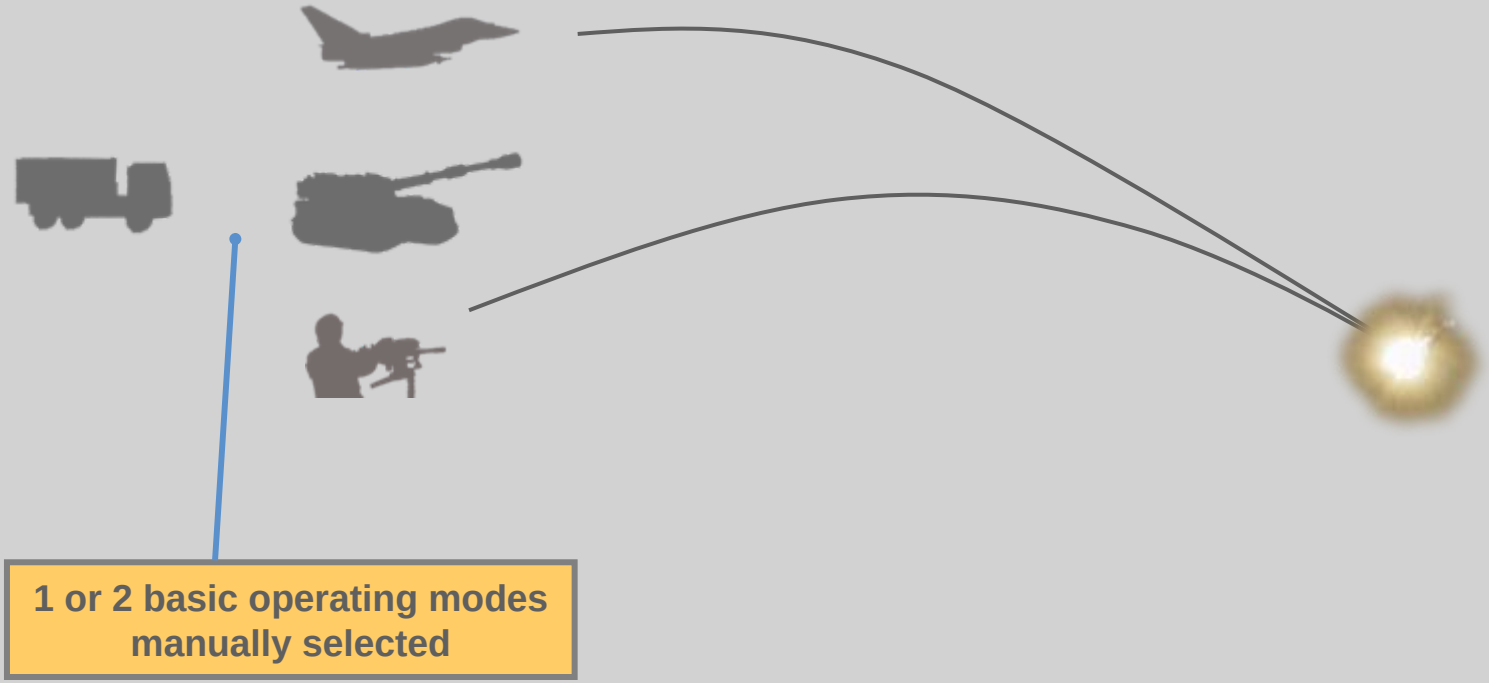


Flexibility : Conventional requirements



1 or 2 basic operating modes manually selected

Flexibility : New operational requirements

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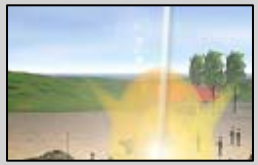


Fuze Setting

All parameters

Automatic

Multi-mission Multi-function

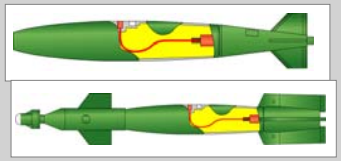
Activity Control

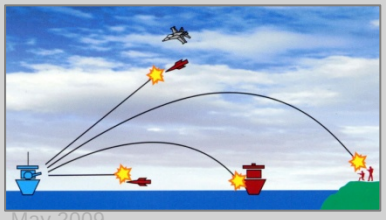
Mission Abort

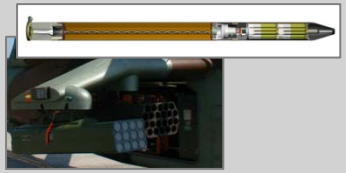
Target conf.

Terminal Effect Control

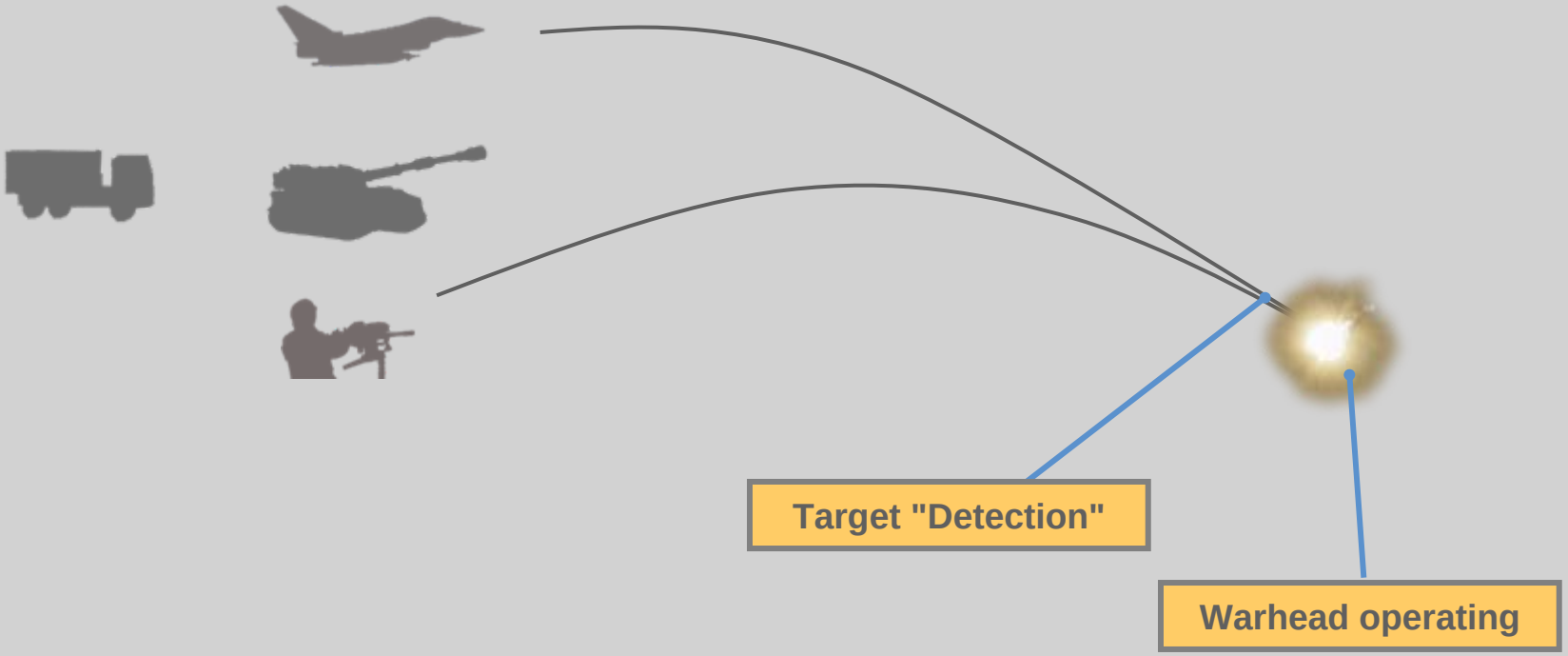
Logistic Footprint Reduction







Terminal Effect: Conventional requirements



Terminal Effect: New operational requirements

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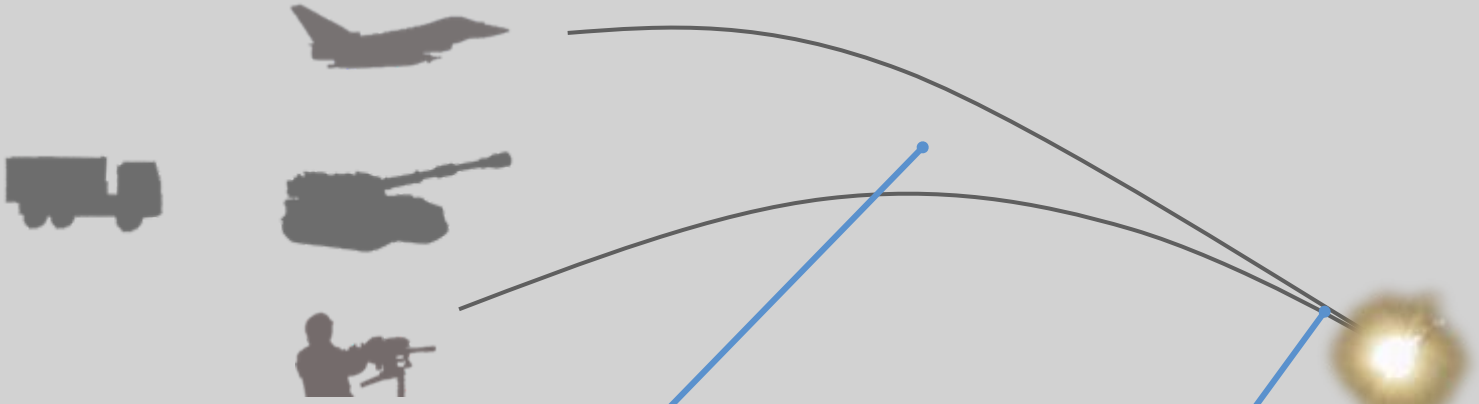


Terminal Effect Adjustment

"Smart Warhead"

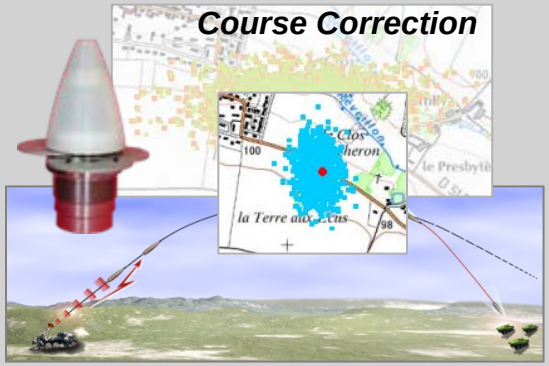
Precision Enhancement

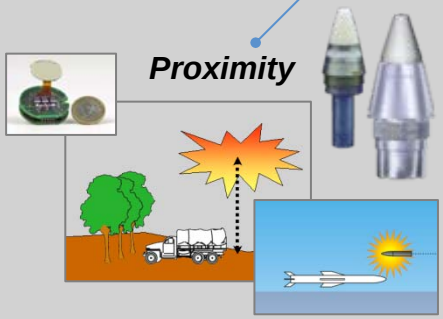
Cost Effectiveness

Collateral Damage Reduction

Logistic Footprint Reduction

Effect Optimization / Target Detection





Common Needs

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- The new needs and requirements applies to all arms:

The fuzes dedicated to the various applications can <u>share</u> the same technologies and technical solutions

Main Technical Challenges

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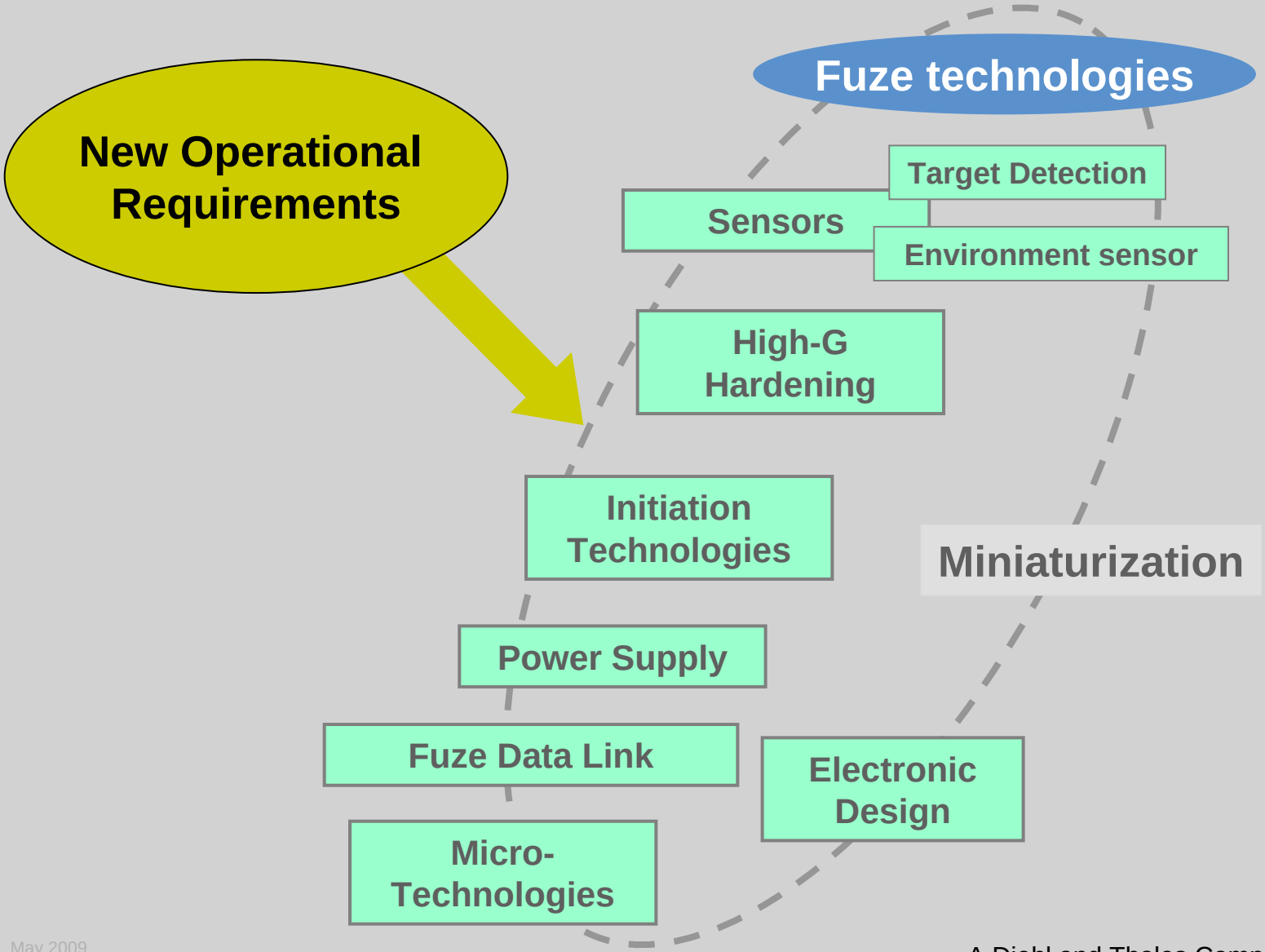
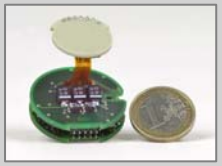


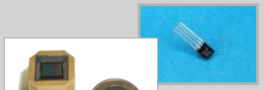
Sensors – Target detection

- More information on targets, for better accuracy and discrimination
  - Better discrimination in disturbed environment: clutter, jamming
- Compliant with fuze applications
  - Small, low energy: have to be integrated with other functions. More critical in small fuzes and smart fuzes
  - Low cost, G-hardened
- Advanced signal processing

Proximity Sensors



Radar Sensor / FMCW



IR, Magnetic, Acoustic, Sensors

Impact Sensor

Precision Accelerometers

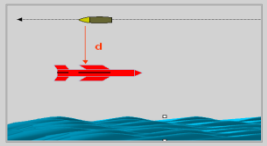
MEMS Sensors

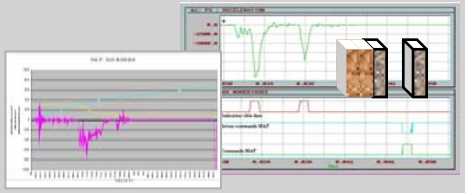
Low Cost Precision Accelerometers

Signal processing

Algorithmes

DSP, CPLD





Sensors – Target Detection

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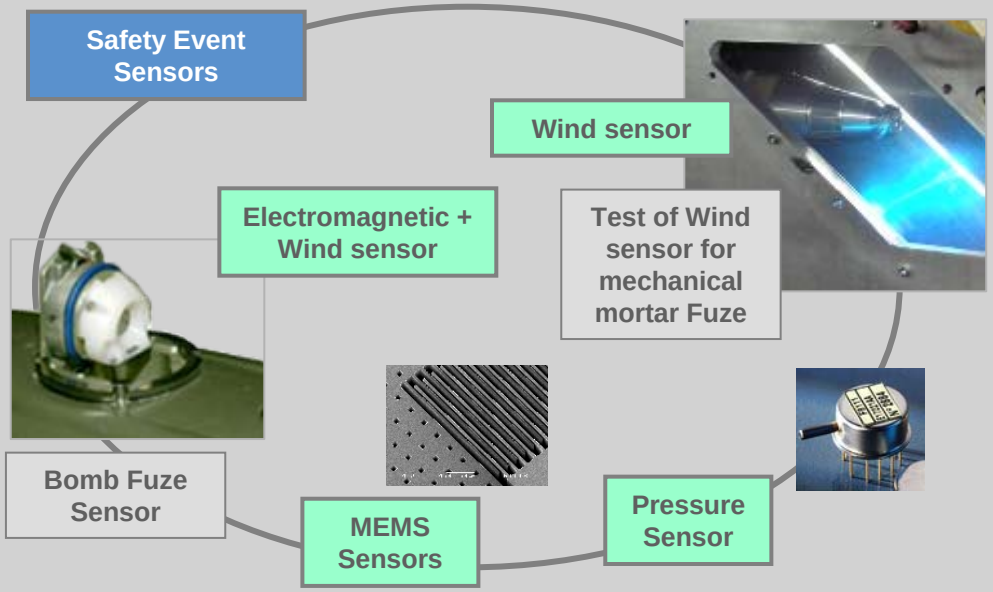
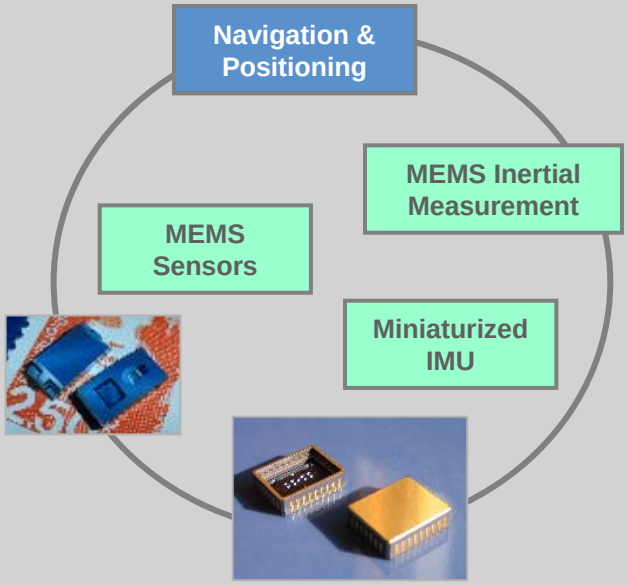
Video

Sensors – Environment Sensors

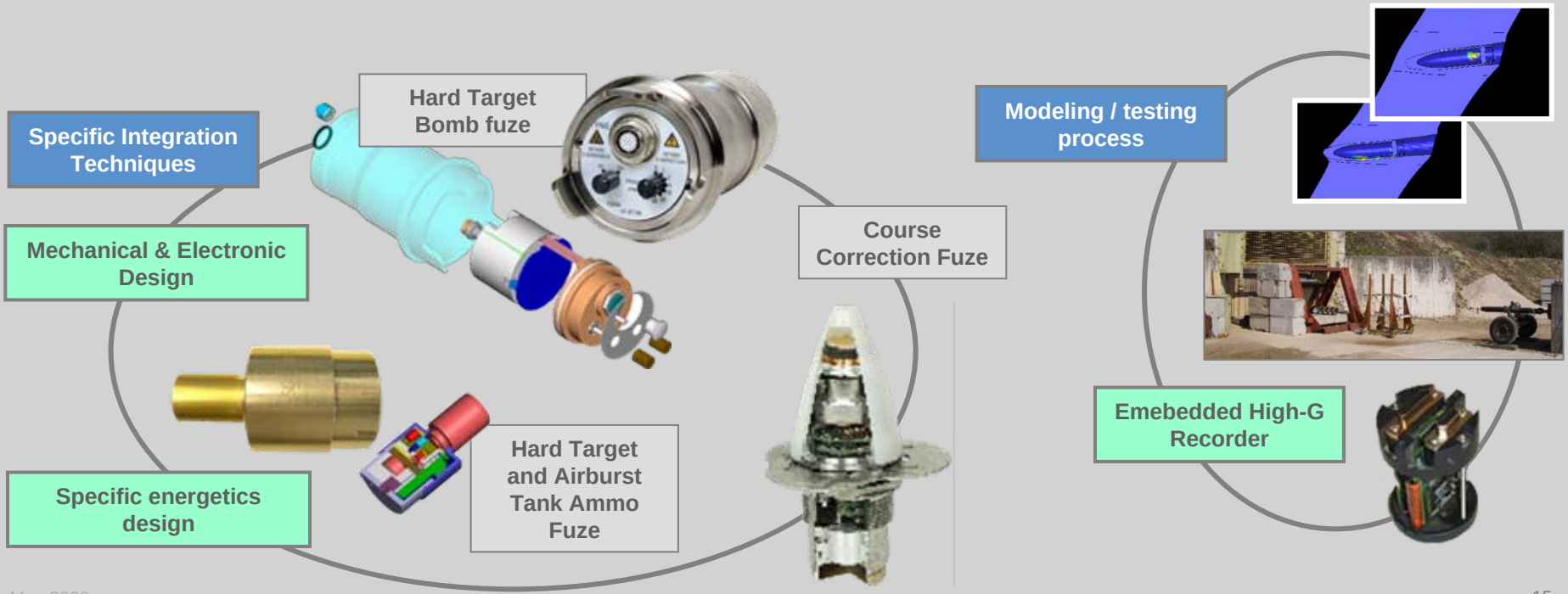
- Mechanical or electronic sensors
- Single safety event sensors
- or, accurate positioning sensors & multi-sensors, for trajectory control
- Low cost, small size, G-hardened
- Electronics safety architecture design





High-G Hardening

- Resistance to stress generated by modern weapon systems
- Hard target penetration and post-impact processing: Now often required, for all type of weapons and munitions
- Integration of more complex systems: Now necessary for smart fuzes. Use of devices not initially designed for munitions severe environments (navigation system, sensor, actuators)



High-G Hardening

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Video

Miniaturization

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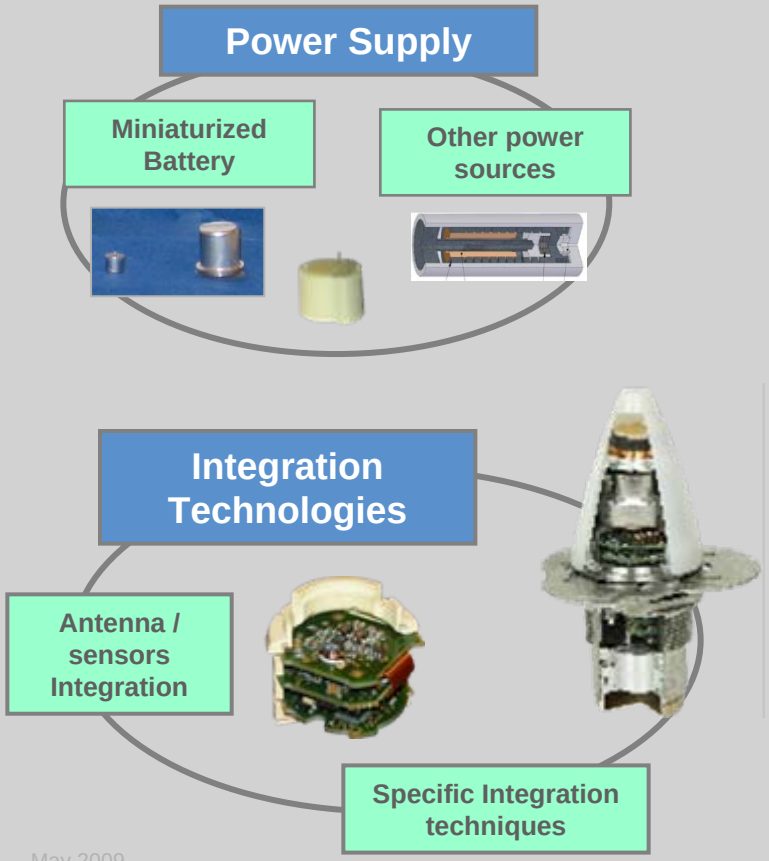
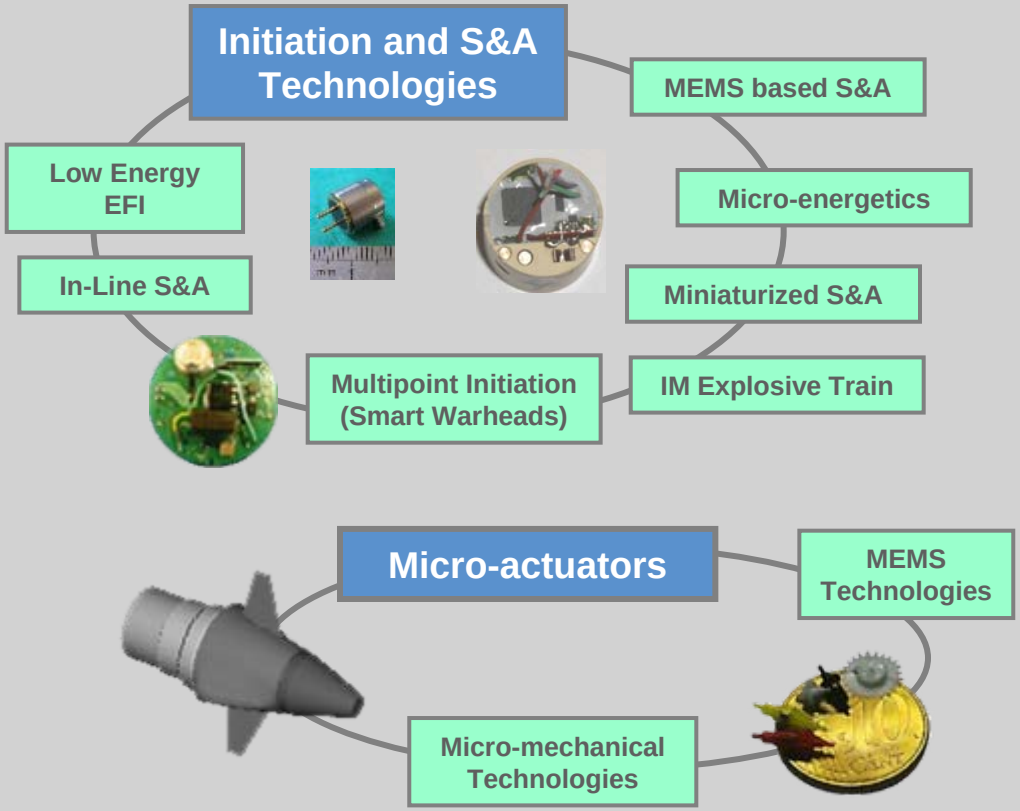
- General requirement, essential for designing new generation of fuzes
- Main stakes : Small caliber fuzes and Smart fuzes: Advanced multifunctions fuzes and 1D or 2D Course Correction fuzes





Fuze Integration Technologies

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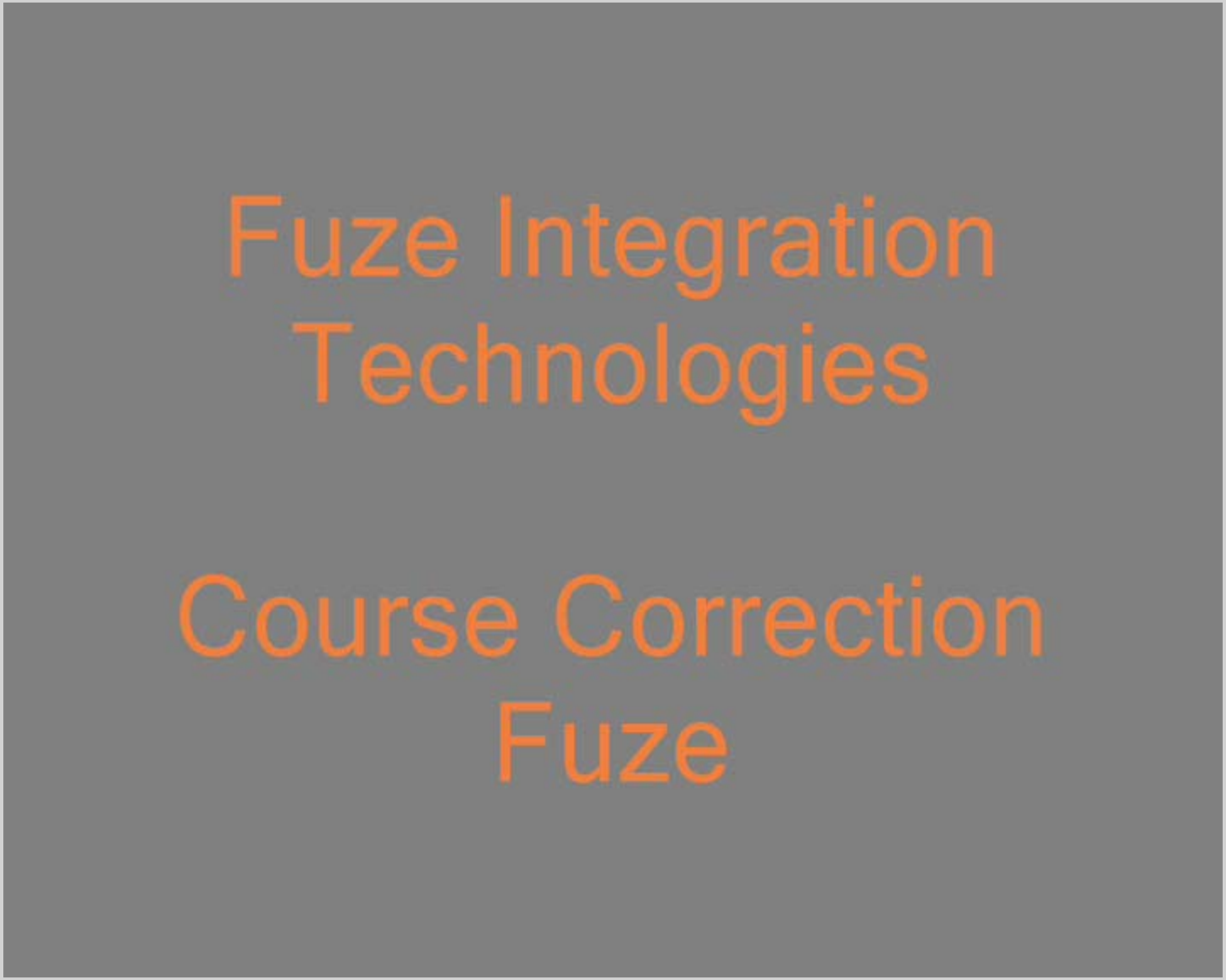
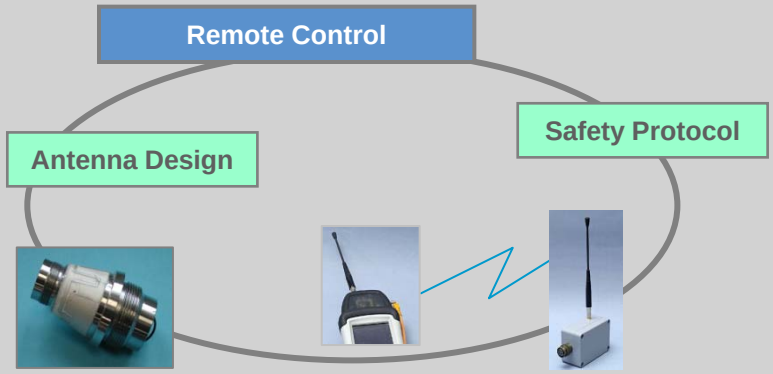
Video

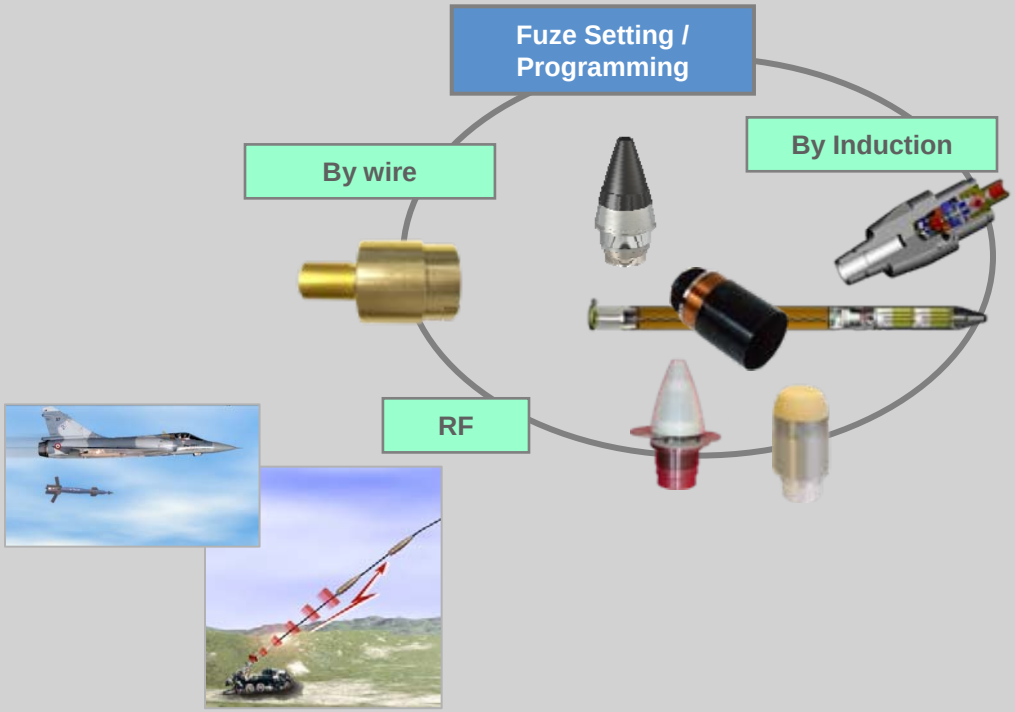


Fuze Data Link

- From simple fuze setting …

  … to the full control of fuze status during its active phase, up to the target
- More and more parameters to program in smart fuzes
- Safety and security management in all communication phases
- Wireless solutions, High rate
- Electronic safety design





Fuze Technology Developments - Trends

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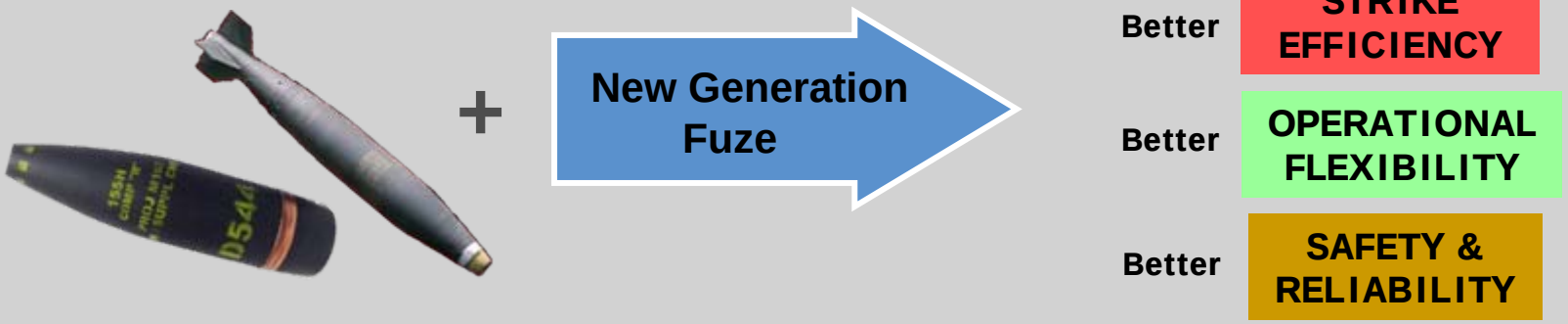
- Different categories

COTS component	" Hardened" COTS component	Dedicated component based on commercial technology	Specific technology or component development
Basic electronics Processors …	Environment sensor Specific components …	MEMS sensor Micro-technologies Specific electronic components …	Specific energetics Power supply Target sensors …

- … and always: low cost / small size / low power
- The modern fuze is a mix and concentrate of technologies which have to live together in a very small volume and under severe conditions.
- Expected technological breakthroughs in the next future should provide a significant step forward to real fuze "intelligence"
- The various munitions, for all type of weapons, will share similar technology and component developments

Conclusion

- New generation and next generation fuzes will provide maximum advantage for the warfighter



- The fuze designer / producer has a key role in the future munitions performances
- Thanks to its technological leadership **JUNGHANS** is able to
  - Provide all warfighters with state-of-the-art, efficient and cost effective fuzing solutions
  - Take up technological challenges to provide them with next generation fuzes

Thank You

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