

Alliant Techsystems

The Evolution of The Future Mine System

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Volcano Mine System (M139)

- Racks of canisters of mines are adaptable to many vehicles and aircraft.
- Canisters in the racks rapidly dispense a complete minefield under control of the operator.
- The dispensing vehicle can travel 5-55 mph for a ground vehicle or 20-120 knots for an air vehicle with minefield density compensation and resulting minefield uniformity.



Volcano Mine System Mission Sequence

Launch



Start Disperse

Emplacement



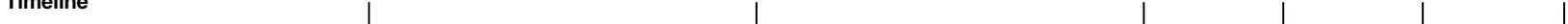
Arm (2-4 minutes)

Mine Function



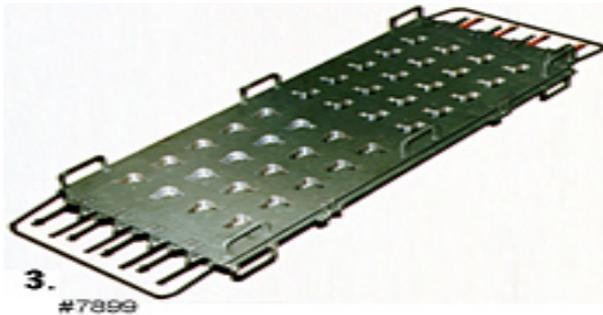
T₁ 4 hours T₂ 48 hours T₃ 15 days Self Destruct

Timeline



Volcano Mine System Primary Subsystems

- Volcano subsystems are evolving in response to future needs and requirements.
- The FCS (Future Combat Systems) program demands new technology with more multi-mission and multi-response flexibility.



Display Control Unit

Vehicle/Aircraft Launcher Racks (Several Variations)



Hand-Held Control Unit

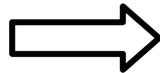


Munitions (Mines and Canister)

Volcano Mine System Evolution

- A key improvement to the Volcano Mine System is the redesign of the mechanical Safety and Arming (S&A) mechanism within the munition, to a completely Electronic Safety and Arming (ESA) device.

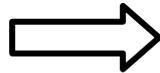
**Control
Units
(Display Version
or Hand-Held)**



Improvements Underway for Computerized Control

- Enhanced maintenance self tester
- On-Board GPS
- Visual display for troubleshooting

**Vehicle/Aircraft
Launcher
Racks**



Other Dispensing And/or Delivery Methods Under Study

Munitions



Many Upgrades underway:

- Improved Electronics
- Canister to Mine Communication
- **Mechanical S&A to Electronic S&A Redesign**

Volcano Mine (M87A1) Subsystems

The Volcano Mine contains five basic subsystems:

- A package tailored to the delivery system and expected environments,
- A warhead designed for the intended target class,
- A power source,
- A target sensor with processing electronics, and
- A safety and arming device (S&A).

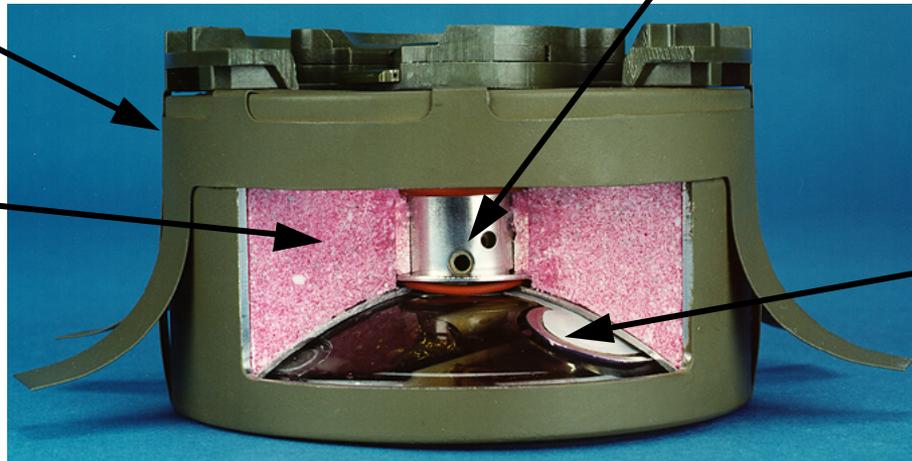
1) Package with Spring Fingers

2) Warhead

5) Mechanical S&A

4) Processing Electronics and

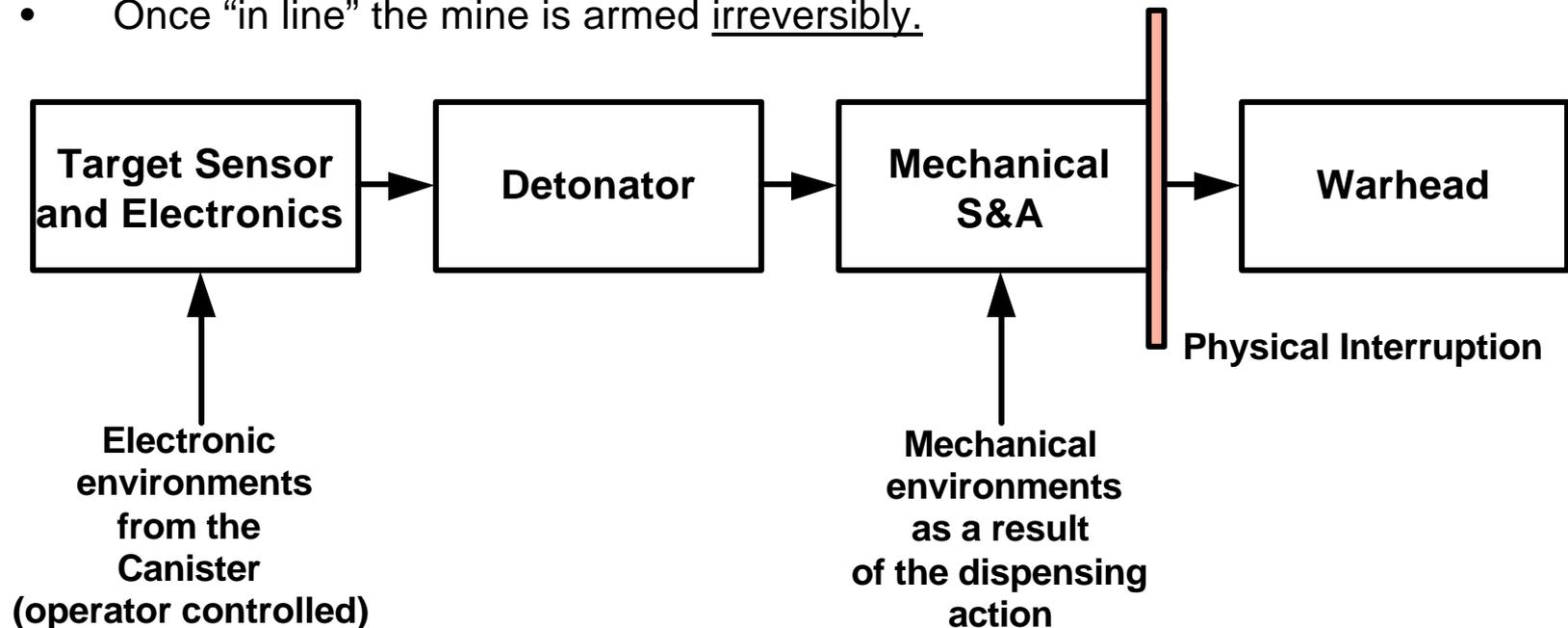
3) Power Source



The Volcano Mine Safety and Arming Subsystem

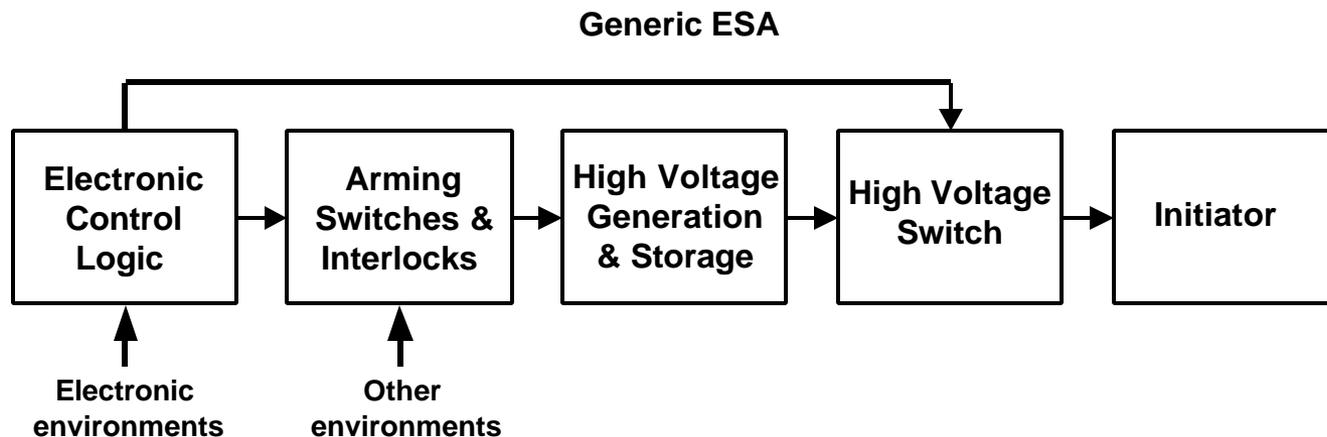


- The S&A mechanism in the Volcano Mine ensures that the mine cannot arm until all proper dispensing sequences have been completed, and a satisfactory safe separation has been achieved.
- Safety is defined and approved according to MIL-STD 1316E.
- The current mechanical S&A uses a physical interruption between the detonator and the warhead (“out-of –line”), moved “into line” only by proper mechanical environments.
- Once “in line” the mine is armed irreversibly.



The Electronic Safety and Arming Approach

- An Electronic S&A (ESA) approach is commonly referred to as “always-in-Line”.
- The safety is achieved by the electronic control and generation of a unique discharge shock pulse into special insensitive explosive formulations.
- The discharge pulse can only be created with uncommon high voltage generated by the specialized electronics.
- The electronics uses the same arming environment verifications as the “out-of-line” approach for safety, but without moving parts.
- An ESA offers higher reliability and improved safety over mechanical S&A fuzes (no moving parts and no sensitive explosive formulations).
- AND the ESA arming function is reversible, thereby enabling new functionality such as “off-on-off”, “on-off-on” and potential mine recovery and reuse.



Electronic Safety and Arming Technology

- Incorporation of the Electronic S&A (ESA) into products has been hindered in the past by component technology.
- Required critical components like high voltage transformers, capacitors and switches were large and expensive.
- Recent new technology has revolutionized the component technology.



High Voltage transformer
Less than 1" square



Technology progression in firing capacitors—Dual dielectric (left) to ceramic (center and right)

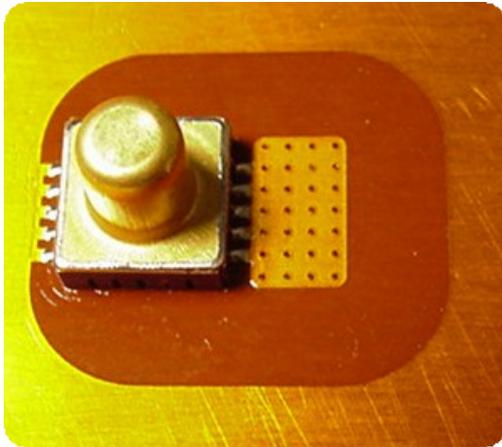


Technology progression in high energy discharge control—Tube switch (left) to MOS-Controlled Thyristors (MCT).

Electronic Safety and Arming Technology (cont)



- The remaining critical component, the initiator, commonly called a LEEFI or Low Energy Exploding Foil Initiator, is also quickly advancing to a low cost highly reliable component.



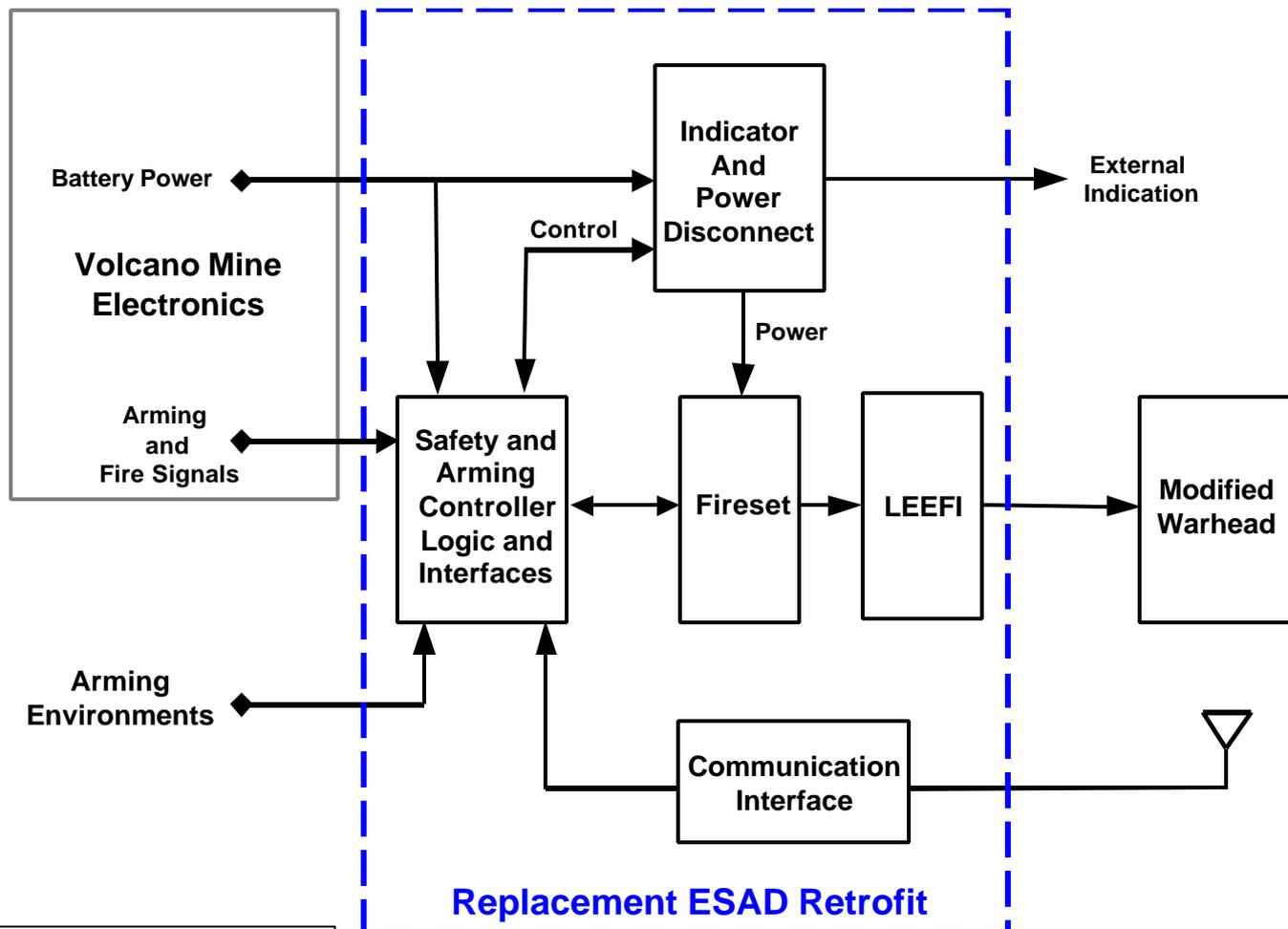
**Mounted LEEFI
(Reynolds Systems, Inc.)**



Full Firing Module 3/4" Long

The Volcano Mine ESA Approach

- The Volcano mine will be upgraded with a Mechanical S&A to ESA retrofit.
- The resulting new munition has more functionality and improved lethality.



Questions ?

Points of Contact

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