

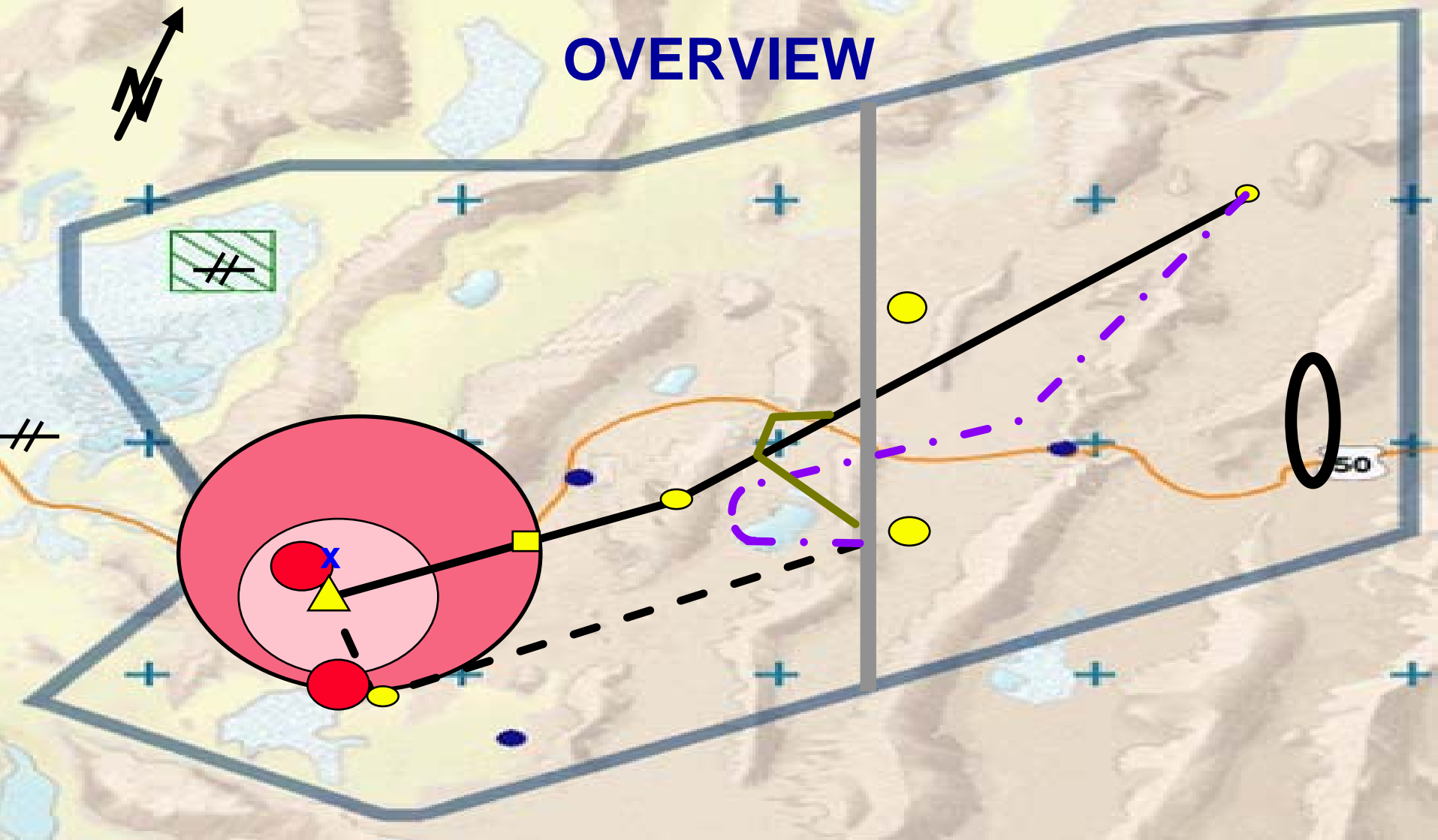


**High Reliability Weapons System**

**CDR Tom "Corn" Hole**

**PMA-201**

# OVERVIEW





# STRIKE COMPOSITION

(Desert Storm)



CALL SIGN	AIRCRAFT	MISSION	ORDNANCE	
HAMMER	01	FA-18	STK/FTR	8xMK83
"	02	FA-18	"	"
"	03	FA-18	"	"
"	04	FA-18	"	"
"	05	FA-18	"	"
"	06	FA-18	"	"
"	07	FA-18	"	"
"	08	FA-18	"	"
NAIL	41	FA-18	STK/FTR	"
"	42	FA-18	"	"
"	43	FA-18	"	"
"	44	FA-18	"	"
"	45	FA-18	"	"
"	46	FA-18	"	"
"	47	FA-18	"	"
"	48	FA-18	"	"
SWEEP	11	FA-18	CL. ESCORT	1/2/3
"	12	FA-18	"	"
"	13	F-14	"	2/2/2
"	14	F-14	"	"
"	15	FA-18	"	1/2/3
"	16	FA-18	"	"
"	17	FA-18	"	"
"	18	FA-18	"	"
TRON	07	EA-6B	JAM	1xAGM88
"	17	EA-6B	"	"
TRON	20	FA-18	HVAAP	1/2/3
"	21	FA-18	"	1/2/3
ZAP	22	FA-18	HARM	3xAGM88
"	23	FA-18	"	"
"	24	FA-18	"	"
"	25	FA-18	"	"
SNOOP	26	S-3	ES	
RAVEN	27	ES-3	ES	
DOME	01	E-2	C2	
DOME	02	E-2	C2	

**To prosecute 16 DMPs requires:**

**128 GP weapons**

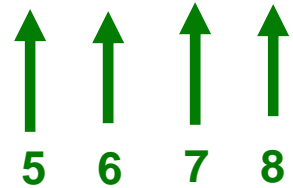
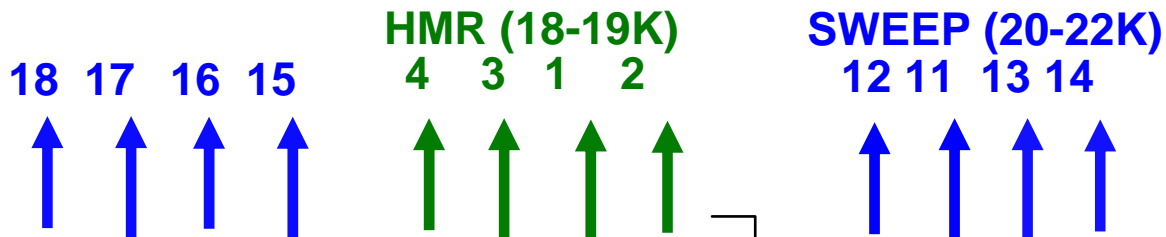
**16 Strike Aircraft**

**20 Support Aircraft**

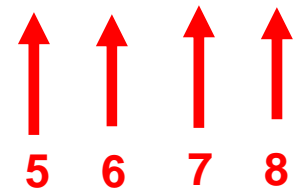
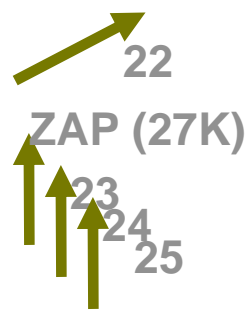
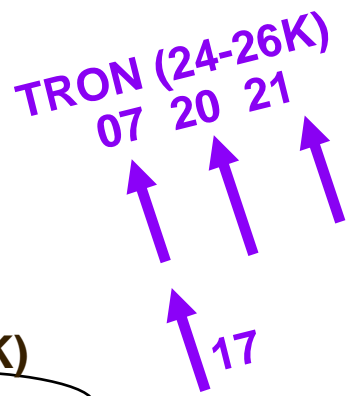
**36 Total Aircraft**



# FORM SNAPSHOT



2 nm



SNOOP 24 (22K)

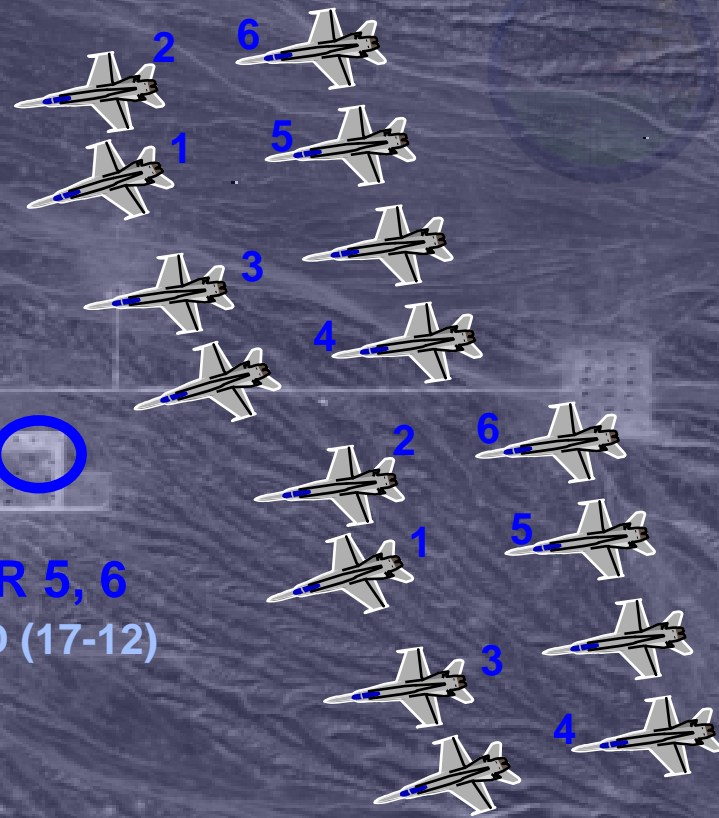
RAVEN 25 (23K)

# AIMPOINTS

HAMMER 1, 2  
W. FLAP LID (17-7)

HAMMER 5, 6  
E. FLAP LID (17-12)

HAMMER 3, 4  
SCUD (17-17)





# STRIKE COMPOSITION



CALL SIGN	AIRCRAFT	MISSION	ORDNANCE	
HAMMER	01	FA-18	STK/FTR	4 x JDAM
"	02	FA-18	"	"
"	03	FA-18	"	"
"	04	FA-18	"	"
SWEEP	11	FA-18	CL. ESCORT	1/2/3
"	12	FA-18	"	"
"	13	F-14	"	2/2/2
"	14	F-14	"	"
TRON	07	EA-6B	JAM	1xAGM88
TRON	20	FA-18	HVAAP	1/2/3
"	21	FA-18	"	1/2/3
ZAP	22	FA-18	HARM	3xAGM88
"	23	FA-18	"	"
RAVEN	27	ES-3	ES	
DOVE	01	E-2	C2	

To prosecute 16 DMPs requires:

16 PGMs

4 Strike Aircraft

11 Support Aircraft

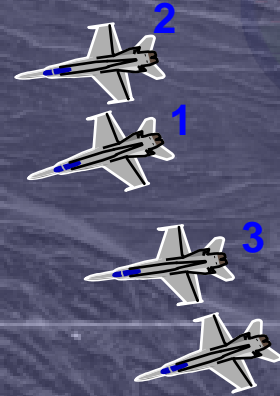
15 Total Aircraft

# AIMPOINTS

HAMMER  
W. FLAP LID (17-7)

HAMMER  
E. FLAP LID (17-12)

HAMMER  
SCUD (17-17)





*Click box to run video.*





# Precision Revolution



- **Desert Storm**

- Approximately 100,000 weapons delivered by TACAIR assets
- 93% were unguided
- 7% were precision guided

- **OEF / OIF**

- Approximately 25,000 weapons delivered by TACAIR to date
- 85% were precision guided
- 15% were unguided

**One bomb, One DMPI**



# How Does This Apply to Fuzes?

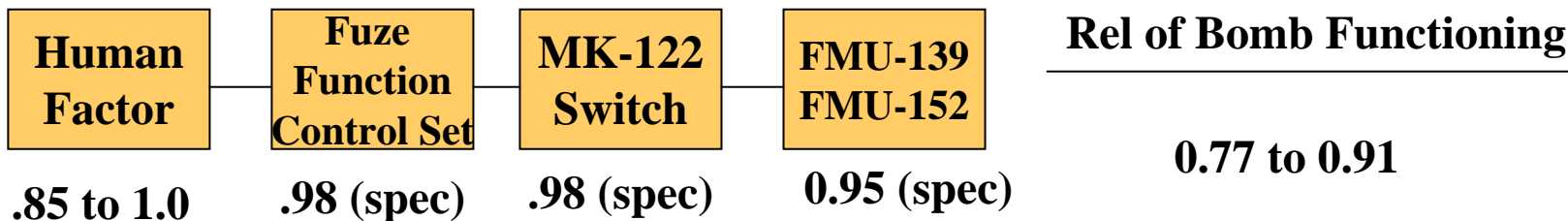


- **Duds are bad**
  - Target not destroyed
  - Troops in contact remain in contact (threat not destroyed)
  - Bad guys send the dud back to us as an IED
  - EOD must safe / remove dud

**None of these results are good**



# Theoretical Fuze Reliability



- Current MATHEMATICAL RELIABILITY, according to spec, best case:
  - **93% reliable (FFCS mode)**
  - **90% reliable (FZU mode)**
    - FZU-48 spec reliability is 95% vs FFCS spec reliability of 98%

**This is what DoN paid for: 93% best case reliability**



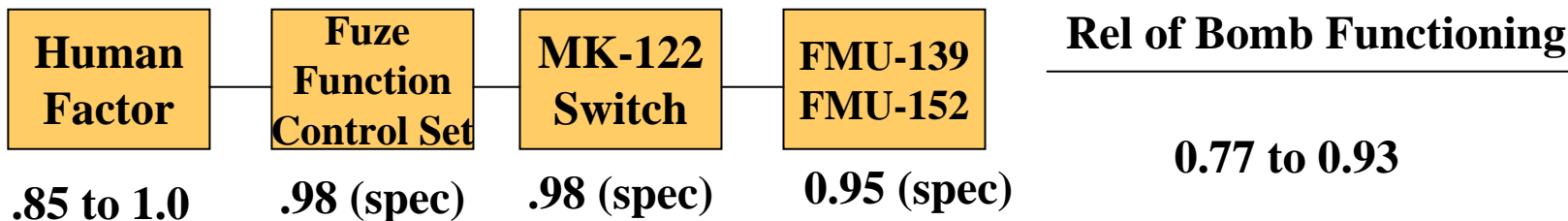
# Fuze Improvement Status



- **FMU-139C/B**
  - Adds 4 minute life with FFCS
  - Retains electro-mechanical safe arm device
  - No improvement in reliability
- **FMU-152 (JPF)**
  - Adds serial data interface to electro-mechanical safe arm device
    - Allows cockpit selectable arm/delay times
  - No improvement in reliability vs FMU-139
- **FMU-139D/B**
  - Electronic Safe Arm Device
  - Improves fuze reliability to near 100%
  - Allows further improvement in overall system reliability not possible with current fuzes



# Theoretical Fuze Reliability



- Current MATHEMATICAL RELIABILITY, according to spec, best case:
  - **93% reliable (FFCS mode)**
  - **90% reliable (FZU mode)**
    - FZU-48 spec reliability is 95% vs FFCS spec reliability of 98%

**This is what DoN paid for: 93% best case reliability**



# Hi-Rel Program



- **The first time you know if an FMU-139 or FMU-152 is going to work is when it hits the ground**
- **Goal of HiRel is to provide high reliability weapons SYSTEM**
  - Computers talking to computers
    - Eliminates current electro-mechanical fuze designs
  - 1760 interface allows system to identify failures BEFORE the bomb is released
  - Improves / Eliminates points of failure
    - FZU
    - MK-122
    - Cables
    - Connectors
  - Greatly simplifies assembly and load process

**Improve OVERALL Fuze System Reliability to near 100%**



# Hi-Rel Program



- DoD can't afford 100% inherent reliability
- BIT and status monitoring can be just as effective
- Example:
  - 100 bombs dropped, 5 duds = bad
  - 95 bombs dropped, 0 duds = good
- If we can achieve 85% reliability measured before the weapon is dropped but every weapon works 100% of the time when viewed by the bad guys, this is a good thing

**Reliability is measured at the target**



# Words from the War



***“My concern is that this war has reached a point where a tactical error can have strategic implications so everything in our arsenal needs to work first time, every time. We have also become the victim of our own success in that the ground troops “know” we can shack the target every time and pretty much control collateral damage. As such, we only drop one at a time so when one doesn’t work as advertised it becomes obvious.”***

***- Lt Gen Walter Buchanan  
Commander of 9<sup>th</sup> Air Force***

**Current Weapons Reliability Requirement = 100%**





# Summary



- **One bomb, one target**
- **100% is the requirement**
- **System of Systems approach**

A large, powerful explosion is taking place in a flat, open field. A massive plume of dark grey smoke and dust rises from the center, with several rectangular objects, possibly debris or components, being ejected upwards. The ground is dry and covered with sparse, low-lying vegetation. In the background, there are a few scattered trees and a clear, light blue sky. The word "Questions?" is written in a bold, yellow, sans-serif font across the middle of the image, centered over the explosion.

**Questions?**



# Abstract



Abstract: The FMU-139 and FMU-152 (JPF) are currently used in USN and USAF general purpose bomb based weapons to include JDAM, Laser Guided Bombs (LGB) and Dual Mode Laser Guided bombs (DMLGB). The demonstrated reliability of the FMU-139/152 in combat operations has been at or near 95%. The operational commanders have expressed that this is not acceptable and they require a weapons system that is 100% reliable. Any duds result in coalition forces being held at additional risk or the dud bomb being utilized as an IED by enemy forces. Just as the GPS weapon transformed our concept of one weapon, one kill, this same transformation has led to the requirement for 100% reliability. To be more precise, every weapon that is released must detonate. In order to achieve this level of performance, the current GP bomb fuzes must be transitioned to electronic safe arm devices. In addition, a system of systems approach to reliability and safety must be implemented. This is the approach that is being utilized in the High Reliability Weapons programs. This brief will cover the history, requirement and program the US Navy has implemented.