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Projectile Kinetic Energy Reduction System Development by Rapid Prototyping

Presented

At the

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Symposium & Exhibition

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Thomas C. Welty

United Defense LP

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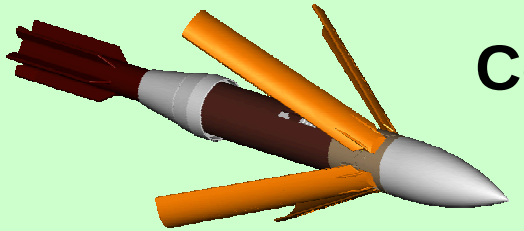
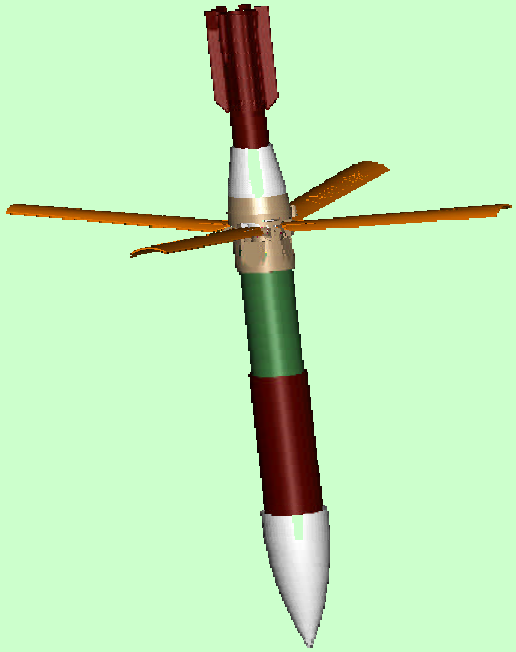
PROJECTILE KINETIC ENERGY REDUCTION SYSTEM



Contents:

- **-Design Attributes**
- **-Applications**
- **-Missions**
- **-Test Data**
- **-Rapid Prototyping**



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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

- PKERS IS A METHOD OF RAPID KINETIC ENERGY REDUCTION.

- RAPID PROTOTYPING ALLOWED DEVELOPMENT OF, MULTIPLE METHODS AND MODELS OF DEPLOYMENT.

- RAPID PROTOTYPING ALLOWS THE ENGINEER TO TAKE A SYSTEMS MANAGEMENT APPROACH .

- MODULAR DESIGN

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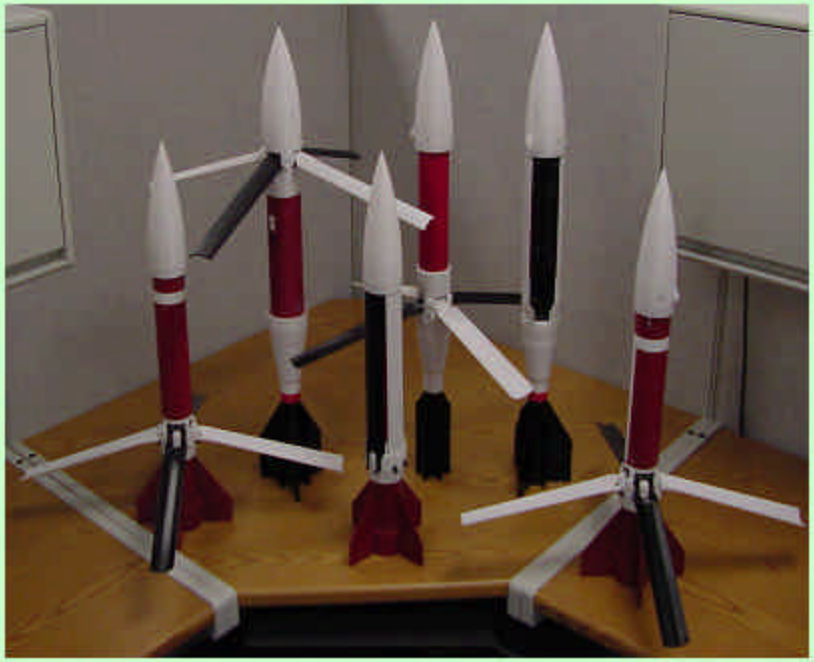
PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

KEY TO SUCCESS:

HOW TO MITIGATE FORCES ON THE WING HINGE POINTS AT DEPLOYMENT FOR SUPERSONIC AND SUBSONIC FLOWS?



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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

- WINGS ARE ALLOWED TO TRAVEL TO 120 DEGREES
- AIR LOADS ON HINGE POINTS ARE REDUCED
- CENTRIFUGAL FORCE AND SPIN RATE COMBINE TO SELF LOAD THE SYSTEM.
- CENTER OF PRESSURE AND CENTER OF GRAVITY MANAGEMENT

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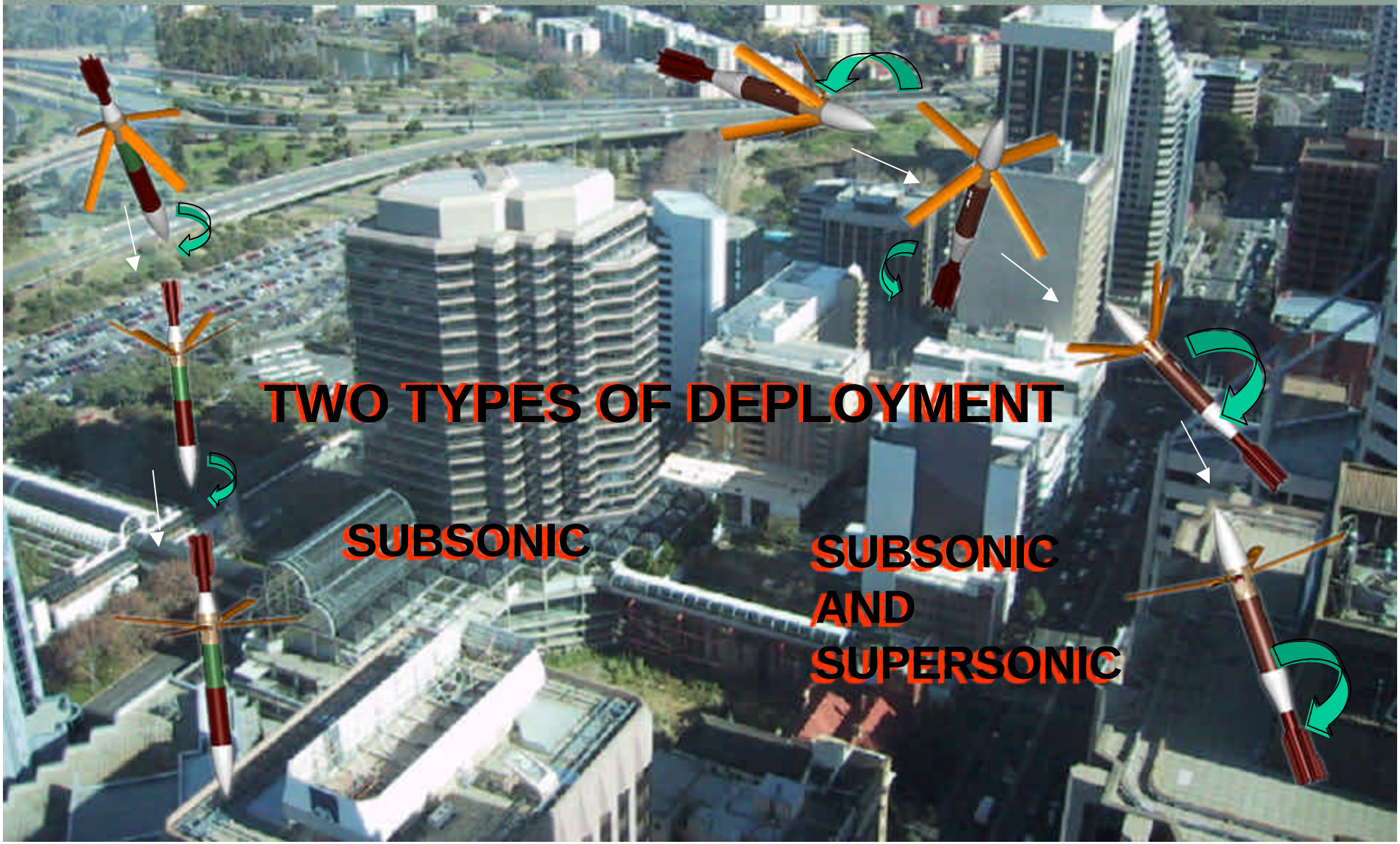
PROJECTILE KINETIC ENERGY REDUCTION SYSTEM



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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

- **NON-LETHAL 81 AND 120 mm MORTARS AND PROJECTILES**

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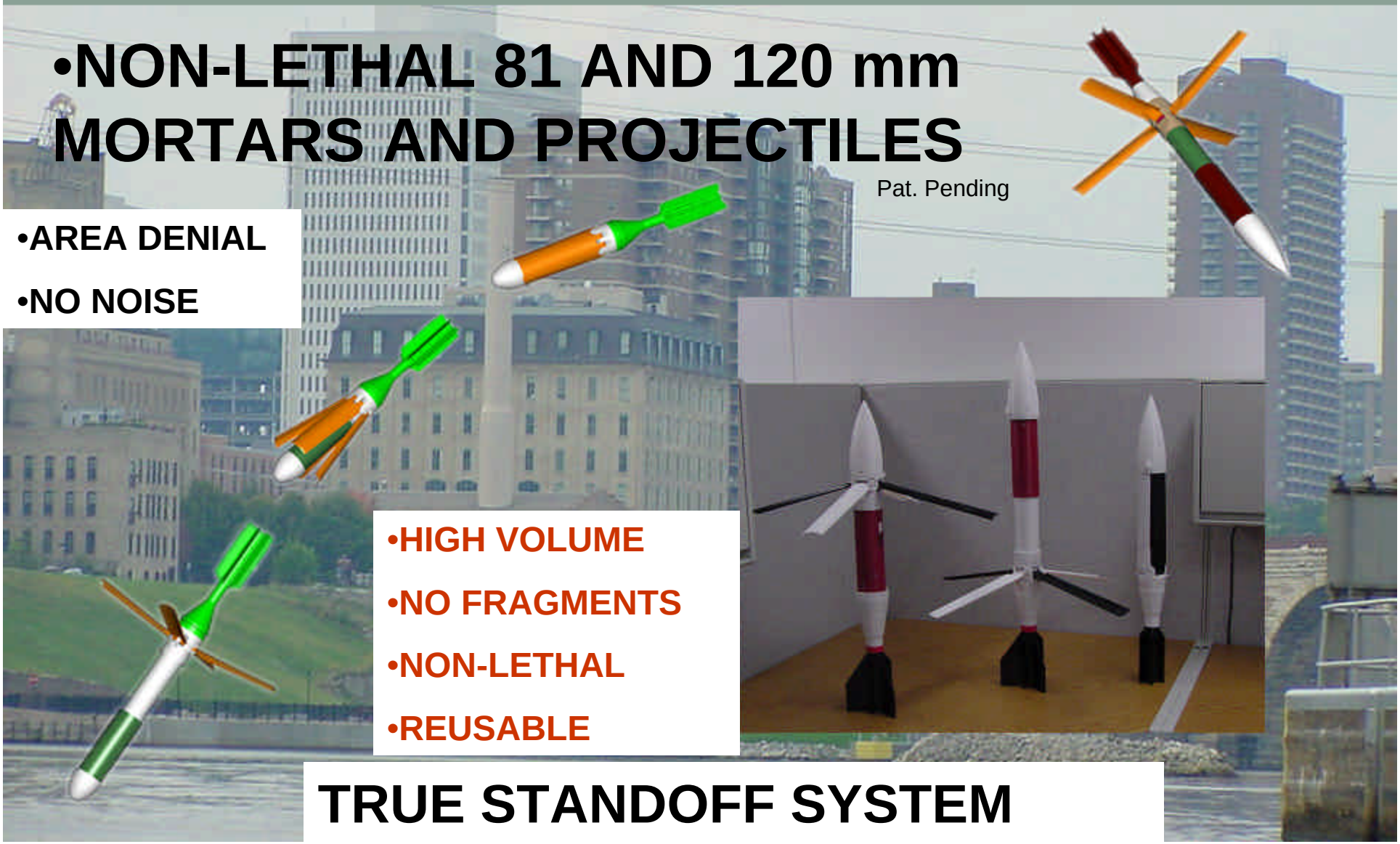

- **AREA DENIAL**
- **NO NOISE**

- **HIGH VOLUME**
- **NO FRAGMENTS**
- **NON-LETHAL**
- **REUSABLE**

TRUE STANDOFF SYSTEM

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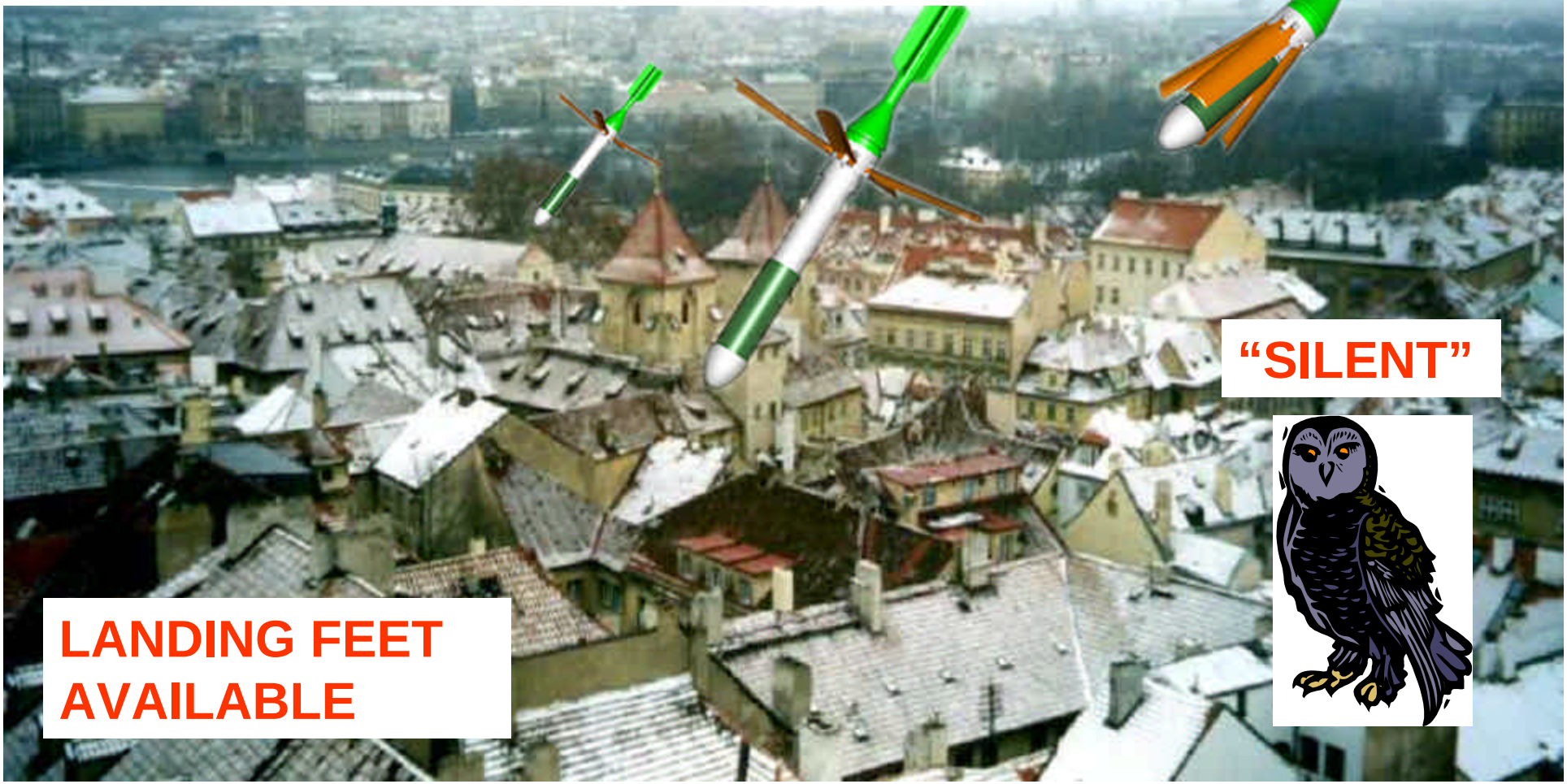
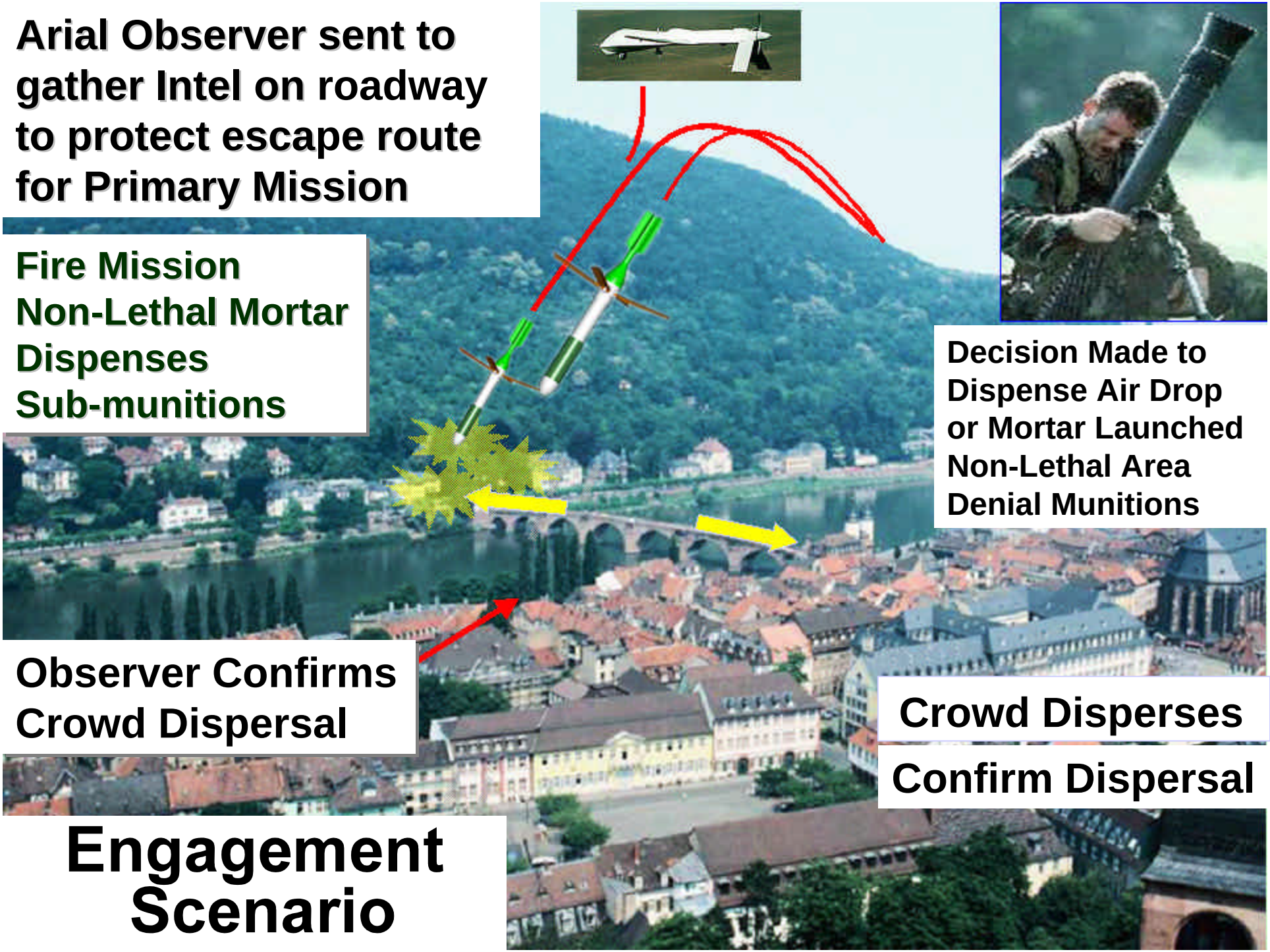
- **SOFT LANDED, PERSONNEL AND BUILDING, SENSORS**





Engagement Scenario

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EXTENDED RANGE:

- VEHICLE AND PERSONNEL SENSORS
- UAV REPEATER STATIONS

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"SILENT"

AIRFORCE HIGH ALTITUDE AIR DROP SENSORS

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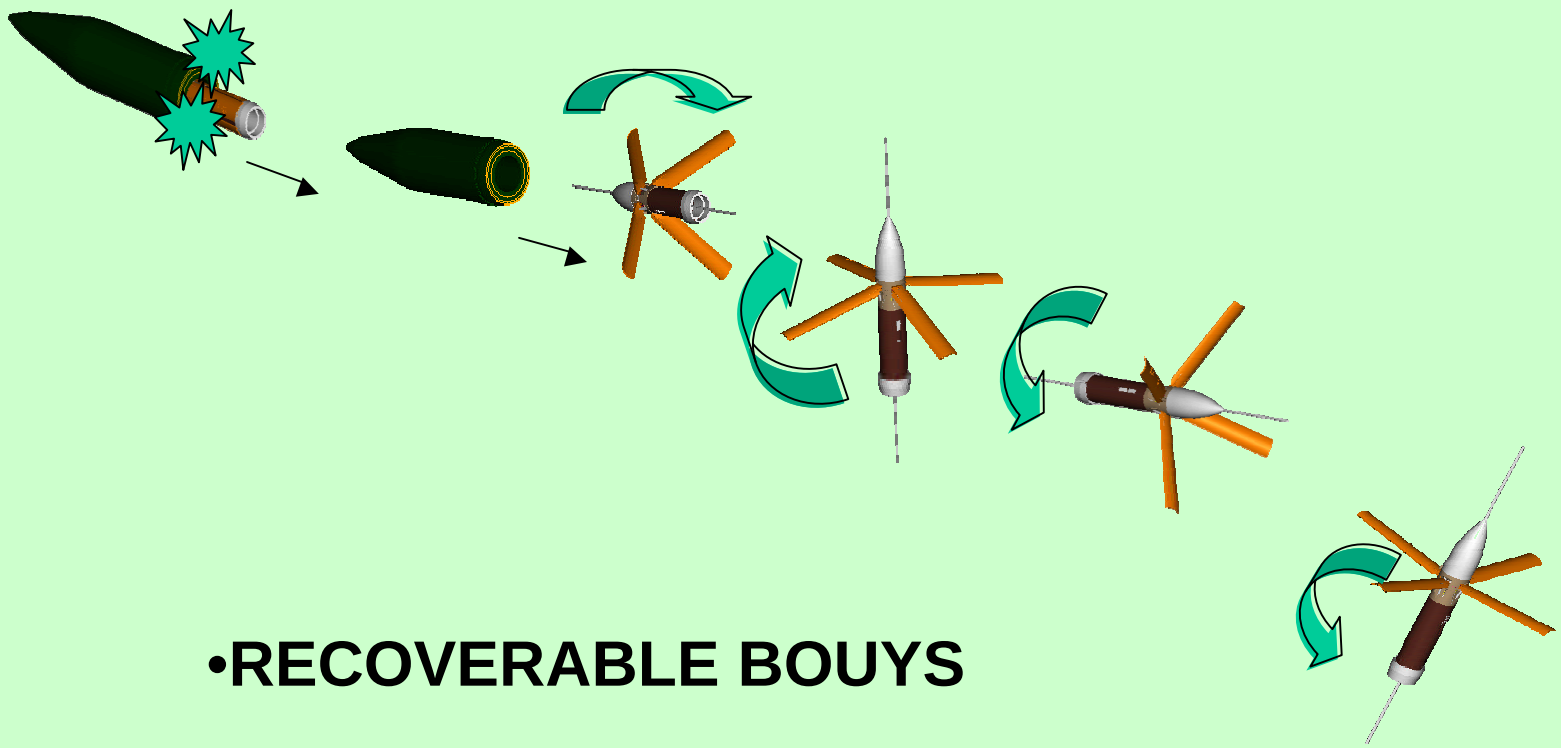
PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

5” AND 155 MM PROJECTILE CARRIERS



- **RECOVERABLE BOUYS**
- **SEA AND LAND SENSORS**

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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

- BATTLE FIELD SOFT LANDED GROUND SENSORS
- REDUCED RISK TO PERSONNEL AND EQUIPMENT
- SPECIAL OPERATIONS DEVICES

"SILENT"

- A TRUE STAND OFF SYSTEM OF DELIVERY

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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

- **WHITE AND IR ILLUMINATION ROUNDS**
- **INCREASED HANG TIME BY APPROXIMATELY 100%**

  (From ~1 min to ~2 min) FOR A GIVEN MASS
- **INCREASED SAFETY FOR OUR TROOPS**

  (NO FRAGMENTS)
- **RECOVERABLE / REUSABLE**
- **COST EFFECTIVE**
- **MODULAR DESIGN**

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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

•LAND, AIR AND SEA USE

MULTIPLE METHODS AND USES:

- ILLUMINATION (White and Infrared)
- AREA DENIAL (Land and Sea)
- HYDROPHONE (Advanced Warning)
- AIRBORNE AND SURFACE WEATHER CONDITIONS
- POTENTIAL GUIDED DECENT
- AIR DROP SENSORS AND SNIFFERS
- UAV SIGNAL REPEATER
- SONAR BUOYS (Advanced Warning)
- NASA INSTRUMENT LANDER
- POTENTIAL ARMOR AND PERSONNEL DEFENSE
- POTENTIAL POWERED FLIGHT (STATION KEEPING OBSERVER)

RECOVERABLE "SILENT"

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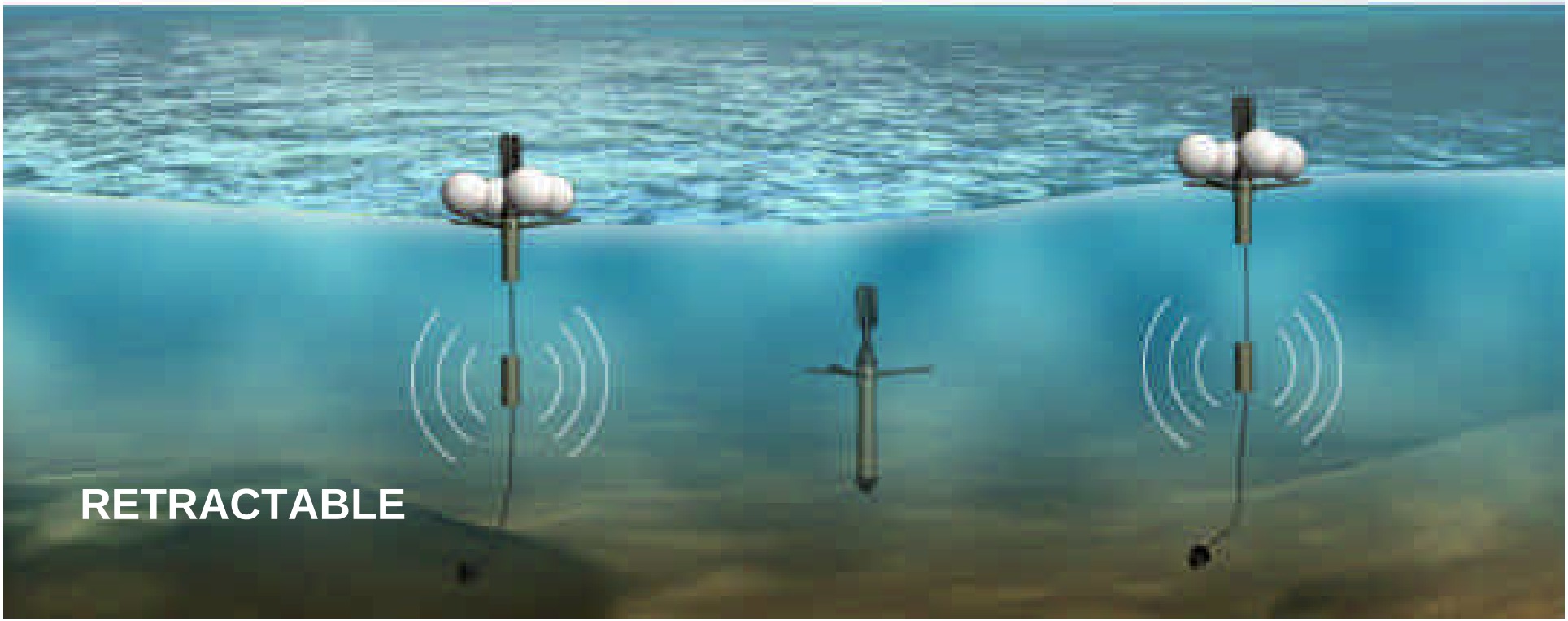
PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

THREAT COMMUNICATION AND NAVIGATION AIDS

RECOVERABLE
ENVIRONMENTALLY
FRIENDLY



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SEA USE: THEATER THREAT INFORMATION

- SOFT LANDED
- SONAR BUOYS
- HYDROPHONES
- ABILITY TO REDUCE LOSSES FROM IMPACT AND INCREASE TREAT AWARENESS.
- REDUCED RISK TO PERSONNEL
- RECOVERABLE

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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

TESTING (Wright Patterson AFB)

- Terminal Velocity Shown is in ft/sec.
- 23 ft/sec = 7 m/sec or 15.7 miles/hr Terminal Velocity
- Wind tunnel data available.
- Exceeds Government Non-Lethal Requirement

DOUBLE CLICK PICTURE

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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

Double Click

Design For Manufacturing

Stratasys
Titan

POLYCARBONATE

3 DIMENSIONAL PLASTIC

MODELER

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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

Chamber Build Envelope Dimensions

14 Inches Deep

16 Inches Wide

14 Inches Height

WHY MAKE MODELS?

- **FORM, FIT, FUNCTION**
- **COST EFFECTIVE METHOD OF DEVELOPEMENT**
- **MODELS ALLOW YOU TO ACTUALLY TOUCH AND HOLD A PART FOR FORM**
- **ALLOWS TESTING FOR FUNCTION WITHOUT HARD TOOLING**
- **DIMENSIONALLY STABLE PARTS**
- **REPEATABLE UNIFORM PARTS**

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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

CASE STUDY: NONLETHAL MORTAR

USE OF THE STRATASYS TITAN 3 DIMENSIONAL MODELER

PRODUCT DEVELOPMENT COST

- ENABLED DEVELOPMENT OF, MULTIPLE MODELS AND METHODS OF DEPLOYMENT WITHOUT EXPENSIVE TOOLING.
- DRASTIC REDUCTION IN DEVELOPMENT COST
- CONVENTIONAL INJECTION MOLD TOOLING COST WOULD HAVE BEEN APPROXIMATELY 50 TO 125K PER PART. (7 TO 13 PARTS PER MODEL)
- PLASTIC COST IS $7.00 PER CUBIC INCH OF MATERIAL PLUS LABOR

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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

Pro-E → Titan → Low Level Flight Testing

NO HARD TOOLING USED

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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

PARTS THAT HAVE JUST COME FROM THE TITAN MACHINE

FLIGHT TESTED MODELS

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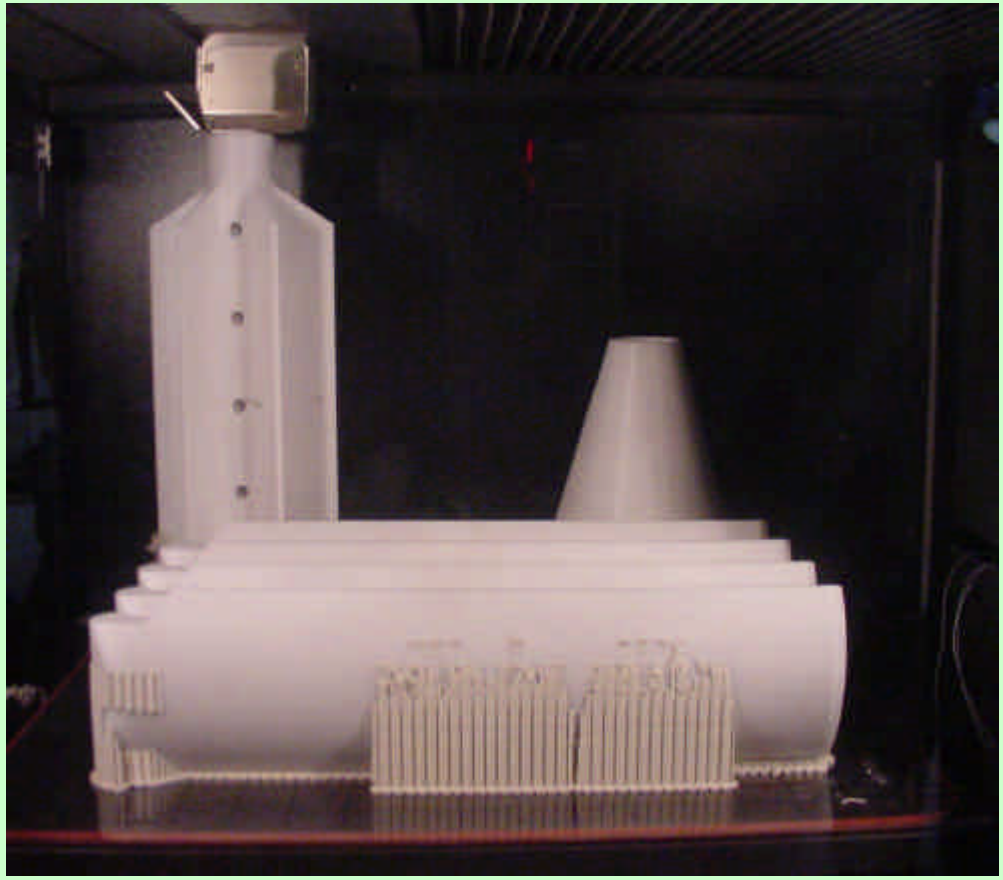
ACTUAL PARTS FOR THE 120 MM MORTAR IN PROCESS



CAN BE SEEN AT THE UNITED DEFENSE BOOTH

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PROJECTILE KINETIC ENERGY REDUCTION SYSTEM

Summary:

-PKERS is a viable design for Nonlethal weapons and can be integrated to carry soft landed payloads of many types.

-This design has been developed to address reliable deployment and soft landing issues associated with parachutes.

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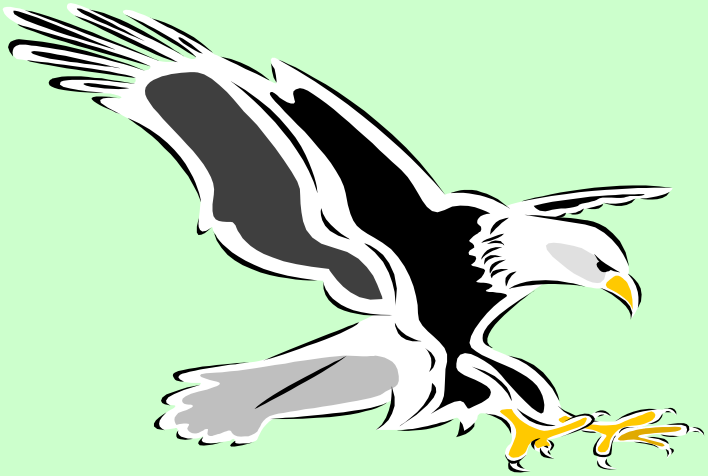
PROJECTILE KINETIC ENERGY REDUCTION SYSTEM



QUESTIONS?