Annual Programs Review

April 19-20, 2005

Annual Program Review Agenda

Tuesday, 19 April 2005

Open Remarks: "Interdependency Across the Services", by Rear Admiral Timothy L. Heely, USN, PEO for Strike Weapons and Unmanned Aviation

Keynote Address by Major General Joseph F. Peterson, USA, Vice Director for Operations (J-3), The Joint Staff (Presentation not approved for distribution)

Precision Attack to Ensure Dominant Maneuvers:
- EXCALIBUR XM982, by LTC Bill Cole, Product Manager for Excalibur
- Non-Line-of-Sight Launch System - Program Update, by Mr. Rod Summers, Director, NLOS-LS Task Force
- Guided MLRS - Full Spectrum Precision with Scalable Effects, by LTC Stephen Lee, Product Manager GMLRS, Precision Fires Rocket & Missile Systems (PFRMS)
- Viper Strike - Fielded and Ready! by LTC John Oxford, USA, PM Submunitions

Precision Weapons Capability from an Operator, by Lt Col West “Elvis” Anderson, USAF, Student, National War College

Wednesday, 20 April 2005

Laying the Geospatial-Intelligence Foundation for Future Warfare, by Mr. Jon D. Estridge, Chief, Air Warfare/Targeting Division, NGA Future Warfare Systems (IW), InnoVision Directorate

Joint Deep Strike Systems:
- JASSM, by Colonel James Geurts, Commander, Long Range Missile Systems Group
- NETWORKING WEAPONS: Weapons Data Link Network Advanced Concept Technology Demonstration, by Ms. Lynda Rutledge, AAC/XR

Capabilities Based Planning: An AT&L Perspective on FCB Interactions, by Mr. James “Raleigh” Durham, Deputy Director for Joint Force Application, OUSD(AT&L) Defense Systems

LUNCHEON ADDRESS: Improving the Kill Chain, by Lieutenant General Michael A. Hough, USMC Deputy Commandant for Aviation United States Marine Corps Headquarters

Precision Strike Acquisition Panel:
- Army Perspective: “US Army Precision Fires”, by BG(P) Jeff Sorenson, USA
- Air Force Perspective: Armament for the Battlefield, by Ms. Judy A. Stokley, Deputy for Acquisitions, Air Armament Center
TUESDAY, 19 APRIL
OPENING REMARKS: Rear Admiral Timothy L. Heely, USN
PEO for Strike Weapons and Unmanned Aviation

KEYNOTE ADDRESS: Major General Joseph F. Peterson, USA
(Presentation not approved for distribution)
Vice Director for Operations (J-3), The Joint Staff

PRECISION ATTACK TO ENSURE DOMINANT MANEUVERS:

- EXCALIBUR: LTC Bill Cole, USA
  Deputy PM, Combat Ammo System
- NLOS Launch System & NLOS Cannon: Rod Summers—PM, NLOS-LS
- Guided MLRS: LTC Steve Lee
  PM, Guided MLRS Unitary
- VIPER STRIKE: LTC John Oxford, USA
  PM

TESTING OF PRECISION STRIKE WEAPONS: David W. Duma
Acting Director, Operational Test and Evaluation, OSD

THE B-1 & PRECISION STRIKE WEAPONS: Lt Col West Anderson, USAF
Student, National War College

WARFIGHTERS’ STRATEGY PANEL—POLICY IMPLICATIONS FOR THE FUTURE OF PRECISION STRIKE WEAPONS: (No Presentations)

- Army Perspective: BG (P) Robert E. Durbin, USA
  Director, Army QDR
- **Navy Perspective:** RADM Patrick M. Walsh, USN  
  Director, Navy QDR Support Office
- **Marine Corps Perspective:** MajGen Emerson N. Gardner, USMC  
  Director, USMC QDR
- **Air Force Perspective:** Brig Gen Taco Gilbert, USAF  
  Deputy Director, Air Force Strategic Planning Directorate

**WEDNESDAY, APRIL 20**

**IMPROVING TARGET LOCATION ERROR THROUGH CONVERGENCE OF GEOSPATIAL & TACTICAL INFORMATION:** Jon Estridge  
InnoVision Directorate, Targeting & C4ISR Division Chief, National Geospatial-Intelligence Agency (NGA)

**JOINT DEEP STRIKE SYSTEMS:**
- **JASSM:** Colonel James Geurts, USAF  
  JASSM PM
- **ATACMS:** Colonel Earnest Harris, USA  
  PM, Precision Fires Rockets & Missiles, PEO Space and Missiles Command
- **TOMAHAWK:** CAPT Bob Novak, USN *(Presentation not approved for distribution)*  
  PMA-280
- **Network Weapon ACTD:** Linda Rutledge  
  NCW PM

**SEA STRIKE SYSTEMS:** Weapons in the GiG (FORCENET): "It's all about the kill chain" or “getting targeting information to the proper lethal mechanism” *(No Presentations)*
- **Strategic/Operational Perspective:** CAPT Bob Novak, USN  
  PMA-280
• Operational/Tactical (Fixed Wing Strike) Perspective: CAPT David Dunaway, USN
  PMA-201
• Tactical (Direct Attack) Perspective: CAPT Mark Converse, USN
  PMA-242
• Requirements Perspective: LtCol Chris St. George, USMC
  N78

**LUNCHEON ADDRESS:** Lieutenant General Michael A. Hough, USMC
Deputy Commandant for Aviation United States Marine Corps Headquarters

**FUNCTIONAL CAPABILITIES BOARD PROCESS—FORCE APPLICATION:**
Raleigh Durham
Deputy Director for Joint Force Application, OUSD(AT&L)/DS

**KEYNOTE ADDRESS:** General Benjamin S. Griffin, USA *(Presentation not approved for distribution)*
Commanding General, U.S. Army Material Command

**PRECISION STRIKE ACQUISITION PANEL:**
• Army Perspective: BG(P) Jeffrey Sorenson, USA
  Director, Systems Management & Horizontal Technology Integration
• Naval Perspective: RADM (S) Rick Wren, USN *(No Presentation)*
  Aviation & Aircraft Carrier Plans & Programs N-780
• Air Force Perspective: Judy Stokley
  Deputy for Acquisition, Air Armament Center, Eglin Air Force
• OSD Perspective: Diane Wright *(No Presentation)*
  OUSD (AT&L) Defense Systems, Air Warfare Director
• National Agency Perspective: Scott Robertson
  Director, Future Warfare Systems Office, National Geospatial-Intelligence Agency (NGA)
The Bone
Precision Weapons Capability
from an Operator

Lt Col West “Elvis” Anderson
National War College
Overview

• Precision and “Block D”
  – *OEF & OIF results*

• Precision and “Block E”
  – *Capabilities & Proposals*

• B-1 Weapons Roadmap

• Thoughts on Optimal Design Capabilities
B-1 General Description

Crew
2 Pilots & 2 WSOs

Performance Data
Cruise Speed: 0.65 - 1.2M
Altitudes: 200 ft - FL 350
Range: Unlimited with Air Refueling
All Weather
Day/Night Terrain Following

"THE BONE"

The B-1 currently holds 100 world records for aircraft speed - payload - distance and time to climb.

50 just set in October 2003
Defensive Avionics

- JAMMING & RECEIVING
- LEFT SECTOR
- RIGHT SECTOR
- AFT SECTOR
- TOWED DECOY SYSTEM (TDS)
- EXCM (CHAFF & FLARES)
- TAIL WARNING FUNCTION (TWF)
Aircraft Basing

ACC B-1 Bases

Key Contractors

Acq/Support

Boeing

AMARC

(17 A/C in storage)

Edwards AFB

419th Test

Hill AFB

Wright-Patt AFB

(SPD)

Ellsworth AFB

37th BS / 34th BS

Dyess AFB

9th BS / 28th BS

13th BS

Weapons School

Test Division

Robins AFB

Tinker AFB (SSM)

(PDM site)

Hanscom AFB

EDO

Northrop

AMARC

(17 A/C in storage)

Static Displays - 8
[OPR: AF Museum]

* B-1 force structure under review with congress
B-1 Mission Evolution

Cold War B-1

- Nuclear Deterrence
- Low-altitude, high speed
- Pre-planned, SIOP missions
- CONUS based, nuclear alert

Today’s (and Tomorrow’s) B-1

- Conventional Engagement
- High-altitude, loiter & strike
- In-flight mission planning / targeting
- CONUS based, rapid deployment
- Heavy strike platform with a new generation of conventional weapons

USAF Bomber Roadmap (June 1992)
**Block D**

*MilStd-1760 / GPS / JDAM / ARC-210 / TDS...*

- Integration of JDAM (24 per B-1)
  - GBU-31 (Mk-84) and GBU-34 (Blu-109)
- Mil Std 1760 bus interface / GPS
- ALE-50 Towed Decoy System (TDS)
- GMTI/GMTT mode (non-integrated to crosshairs)
- ARC-210 Radio

**STATUS**

- RAA declared Dec 98 - operational in OAF, OEF & OIF

**ALE-50**

Towed Decoy

- RF repeater
- Increases missile miss distance by decoying missile away from B-1
B-1 WEAPONS “Blk D”

- 84 Mk 82 / 62
- 30 CBUs
- 24 JDAM / Mk 84

CBM

CRL

84 - Mk 82, Mk 62
30 - CBU 87, 89, 97
24 - Mk 84, JDAM
Expeditionary Air Force

- 10 AEF “Buckets”
  - Full range of capabilities
- Global response
- CONUS to bare base to combat ops in min-time
- Deployment target length = 90 days
- Bombers were key in AEF
Operation ENDURING FREEDOM
The Nation Calls...

- Sept 11 Response - War on Terrorism
  – Oct 2001 – Ongoing / Afghanistan

- B-1s dropped 38% of all weapons dropped while flying only 5% of the overall sorties

- B-1s dropped twice as many JDAM as all the rest of military aircraft combined!
AOR

Long Range Airpower the Key...
Expeditionary Mindset

- Built base from scratch
- Start with some slabs of concrete
- Add equipment, combat CE and hard work
- Include services skills
- All the amenities of home
- Ready to fight
GBU-31 JDAM
*

the Big Stick...

• Joint Direct Attack Munition
  – GPS-Aided GP / Penetrator
  – Weight: ~ 2000 Pounds
    • Mk-84 or BLU-109 Bomb Body
  – Length: 12.7 Feet
  – Guidance: INS / GPS-Aided
  – Range: ~ 8 NM

• B-1 Carriage: 24
  – 8 JDAM per Bay
  – 3 versions (Impact, Air Burst, Penetrator
Weapons Expended (Tons)

- **Allied Force**: 0 tons Gravity bombs, 0 tons JDAMs
- **OEF**: 1500 tons Gravity bombs, 3500 tons JDAMs
- **OIF**: 2500 tons Gravity bombs, 2500 tons JDAMs
Combat Performance
B-1 operations from Oman

- Take-off fully loaded with 24 JDAM and climb to altitude
- 6 sortie surge with 3-4 sustained ops per ATO
- Enter into combat box
  - 2-5 hours on station
  - Usually one air refueling
- On-call for strategic attack, interdiction or CAS mission
- Also conducted PSYOPS!
B-1 Operations from Diego Garcia

**Average Crew Duty Day:**
- 22 Hours

**Load-Out**
- 16 JDAMs
- 1 Fwd Bay Tank

**Average Sortie Duration:**
- 16-18 Hours
  - 430k lbs. GW on Takeoff
  - 4-5 Hour Vul Coverage
  - 3 Midair Refuelings (90, 90, 65)
  - Longest B-1 Combat Sortie in History
    - 21.3 Hours, 11 Hour Vul Period
Mission Routing
Operation ENDURING FREEDOM & IRAQI FREEDOM...
A Very Long Way....
The BONE’s Contribution

Product of Precision and Payload...

Targets Destroyed

35%

All other aircraft

B-1

Sorties Flown

5%

Weapons Dropped

38%

“We’re not running out of targets, Afghanistan is.....”

- Secretary of Defense Rumsfeld
Operation ENDURING FREEDOM

CFACC’s Platform of Choice...

Weapons Dropped:

- JDAMs: 3660 and rising
- Mk-82s: 1,471
- Mk-84s: 135+
- CBU-87: 70

Tons Dropped

<table>
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<th>Aircraft</th>
<th>Tons Dropped</th>
<th>%</th>
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<tbody>
<tr>
<td>B-1</td>
<td>3,438</td>
<td>41%</td>
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<tr>
<td>B-52</td>
<td>3,089</td>
<td>32%</td>
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<tr>
<td>All Others</td>
<td>2,538</td>
<td>27%</td>
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Data through Feb 02
Adaptive Warfighting

- Transforming the B-1 during warfare
  - On Call CAS
  - Psyops
  - ISR
  - TST / Emerging Targets
    - Leadership, High Value, Strategic Effects
  - Strike Coordination and Reconnaissance (SCAR)

None of these missions were in the original concept of the B-1
Revolutionary Tactics

Success based on marriage of:

- Near-realtime updates with SATCOM
- Teaming with Special Forces
- GPS navigation and weapons delivery
- B-1 inherent capabilities (payload, range, speed & loiter)
On-Call CAS

Precision weapons gave the capability...

- Integration of High-Res Radar and GFAC
  
  - Can drop on coordinates only; however, non-optimal

- GFAC makes bomber CAS possible
  
  - Radar talk on by GFAC common

Key striker during sand storms

Laser-guided weapons unable to target during sand storms/inclement Wx
PSYOPS

A New Mission using a non-lethal weapon...
Combat Escort
Afghan President...
Combat Escort
22 MEU...
TST / Emerging Targets
*Leadership, High Value, Strategic Effects…*

- Search for SCUD Launchers
- Detect and track suspicious movers
- Support Ground Forces

![Map of Iraq with a marked area and a ZIL truck indicated.](image-url)
Scud Hunting

- B-1s assigned 2-hour search patterns
- Ground Moving Target Indicator (GMTI)
  - Detect vehicles moving between 5-75 MPH
- Monopulse Measurement (MM)
  - Derives coordinates of designated radar return
- Pass vehicle information to another aircraft with PID Capability
- B-1 limited to non-precision strike for moving Tgts (Blk D)
  - Impacted mission weapons load
Modern Mission Planning
7th OSS
Combat Mission Planning Experts...
Modern Mission Planning

Combat Track II

CAOC

B-52

B-1

B-52

Diego Garcia

CAOC

UNCLASSIFIED

UNCLASSIFIED
# Modern Mission Planning

## Area Target Pattern Management

<table>
<thead>
<tr>
<th>Pattern Shape</th>
<th>Coordinates</th>
<th>DMPI Coordinates</th>
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## Diagram

![Mission Planning Diagram](image)
OEF BDA
Zawar Kili
Aka “TORA BORA”...

- 3 Jan 02
- Largest PGM strike
  - 4 x B-1 (96 JDAM)
  - 4 x F-18 (8 JDAM)
  - 2 x Predator
  - 2 x AC-130

- Results:
  - 101 GBU-31s on 84 DMPIs in 17 minutes
  - Cave Complex Completely Destroyed
Operation ANACONDA

- Delivered 850+ JDAMs
- First-ever B-1B conventional alert; became CENTCOM’s top choice for emergency support
- Weapons troops loaded 24 JDAMs in 26 minutes—shattering old record of 35 minutes
Incredible Results
Incredible Results

HERAT AIRFIELD, AFGHANISTAN
PRE STRIKE

HERAT AIRFIELD, AFGHANISTAN
POST STRIKE
Incredible Results

GARMABAK GHR TERRORIST TRAINING CAMP

PRE STRIKE

GARMABAK GHR TERRORIST TRAINING CAMP, AFGHANISTAN

POST STRIKE
SHINDAND AIRFIELD IN WESTERN AFGHANISTAN SOUTH OF HERAT
POST-STRIKE
OEF BDA
We can move Mountains...
OEF BDA
We can move Mountains...

ZHAWAR KILI CAVE COMPLEX, AFGHANISTAN
POST STRIKE
Operation IRAQI FREEDOM
19 Mar-18 Apr 2003...

- Over 40,000 sorties flown
  - Total fighter and bomber sorties = 20,703
  - Bombers: 505; B-1: 197 sorties (0.95%) 

- All but one mission had changes post-step

- B-1 dropped 2,282 munitions
  - 2,214 Iraqi targets; 37 Afghani targets; 24 jettisoned
  - 11% of the total number of guided munitions
  - 43% of the GBU-31 JDAMs (from <1% of the missions!)
OIF Mission

- Deployed 10 aircraft to Thumrait AB, Oman
  - Flew an average of 8 sorties per day (surge level ops) for duration of deployment
  - First night - 10 sorties
    - Average sortie duration was 8 hours
    - Covered both Iraq and Afghanistan (OEF) missions
    - Provided 24-hour/day coverage over Iraq
    - Many types of taskings including INT, SAR, XINT, XCAS
    - 414 Total B-1 sorties during OIF
      - Includes flights prior to the start of OIF and after 18 Apr
Prevent the Iraqi forces from launching any SCUDS into Israel. The President’s second highest priority next to eliminating the Iraqi regime.
OIF Strike Operations

• Strategic Attack and Interdiction
  – Targets were passed from Combined Air Operations Center (CAOC)
    • Passed via secure voice or secure email (Combat Track II)
  – Target Array
    • Leadership Targets in Baghdad
    • Airfields
    • Fielded Forces
    • Infrastructure
    • GPS Jamming Towers
OIF SAFIRES on B-1

- **71 SAFIRES***
  - 62 Distant
  - 9 Close proximity (<2 miles)
  - 35 SAMs
  - 36 AAA

- **35 Launches**
  - 17 SAM Launches
    - 9 SA-2
    - 1 SA-6
    - 3 Roland
    - 4 Unknown SAMs
  - 10 Science Projects
    - 8 Ringback,
    - 2 Hookshot
  - 8 Unknown Launches

* These numbers reflect the CENTAF published and verified Surface to Air FIRES.
* Aircrews reported more in the MISREPS, but did not meet CENTAF criteria (RJ, Space, etc).
OIF BDA
*MORS AB ALTO...*

**MILITARY COMMAND AND CONTROL FACILITY, IRAQ**

*PRE STRIKE*

*POST STRIKE*
OIF BDA
MORS AB ALTO...
OIF BDA
MORS AB ALTO...
OIF BDA
MORS AB ALTO...
B-1 Future: Block E (it’s here!)

- Advanced Avionics Computers
- Advanced weapons capabilities
- Wind corrected munitions
  - 30 per B-1
- AGM-154 JSOW
  - 12 per B-1
- AGM-158 JASSM
  - 24 per B-1
- Enhanced situational awareness
Main Block E Upgrades

- Cockpit Operations Faster / Streamlined
- Interleaved Search and Track (ILST) Radar Mode
- Multi-bay / Weapon Release Capability
  - GBU-31, WCMD, Mk82, Mk84, CBUs and Mines
  - 2 JDAM  2 WCMD  2 Mk82
    (AFT BAY)  (MID BAY)  (FWD BAY)
The Block E B-1 in Global Strike

- Single Pass Multi-Weapon Attacks
  - Simultaneously Attack With JDAM / WCMD / Mk82
BLOCK “E” ADDITIONS
MIXED WEAPON LOADS...

• Result of ACC request to assess addition of Mixed Weapon Loads on a rotary launcher within a bay to the Block E JJI release versus waiting 2 - 4 years for a future sustainment upgrade

• Maximizes weapon load, JDAM & JASSM/JSOW combinations with non-station specific software

• Effort added to contract Jun 03
Substantial Avionics Upgrade

**Block D**
- Four 70s Era Avionics Computers
- 4 Software Loads Per Mission
- 5 DTUCs (Tape Drives) @ $10,000 Each
- Proprietary Code
- “Optimized” Launch Acceptability Regions (LARs) for Guided Weapons

**Block E**
- Two Pentium Computers
- 1 Software Load Per Mission
- 2 PC Cards @ $200 Each
- DoD Standard Code (ADA)
- Expanded Launch Acceptability Regions (LARs)

**Improved Reliability & Sustainability**
Improved LARs

- Block D Used Lookup Tables (Tab Data) and Linear Interpolation
- Block E Employs Real-Time Release Conditions and Target Parameters - Far Better in Changing Wind Conditions
- Block E Provides Much Greater Flexibility in Target Area
Avionics Improvements

- Increased Situational Awareness
  - Weapon and Navigation Data Improved
  - Digital Bullseye
  - “LAR Bars” ease Guided Munition Prosecution
- “Copy / Paste” DMPIs
- Wind Corrected Munitions Dispenser (WCMD)
Avionics Improvements

Yes Air-to-Air Rdr...

- ILST - Essentially the F-16 “SAM” Mode
- Search up to 64 Contacts, Track One
- Tracked Contact
  Also Updates
  Threat Situation Display
HI-RES UPGRADE

Precision Weapons need precision aiming...

Proposed 1’ to .5’ Resolution SAR
GMTI Operation

BUILDING
GMTI Operation

- Radar tracks moving target and computes weapon impact point
- Large plus displayed around target
- Qual value 0 – 9
  - 0 < 100’
  - 9 > 900’
The B-1 Block E in Global Strike

- Advanced Radar Targeting
- Automatically Target Stationary or Moving Targets With GBU-31 or WCMD
- Weapon Stick, Impact Point Displayed on Radar
  - WSO can direct WCMD lay-down axis
Interim Datalink (IDL)

- Adds Link 16 (Line of Sight) and Combat Track II/Airborne Quad Z (Beyond Line of Sight) datalinks
  - Color displays at each crew station
  - Falcon View
- Permanent modification – not integrated with A/C systems except for power, cooling, and A/C position data (1553 data bus)
- Modifies 8 jets
Targeting Pod (SNIPER)

- B-1 Time Sensitive Targeting (TST) experience during OEF / OIF:
  - 95% of B-1 OIF missions re-tasked in-flight
  - Off-board sources required for target Positive Identification (PID)
- EO/IR targeting pod provides autonomous, onboard PID
- Pod Status: Future upgrade program
Block E Weapons
It’s a whole new ballgame...

JDAM / MK-84

CBU

WCMD

MK-82 / MK-62

JASSM

JASSM Capable Now / Crews Fully Trained 3Q 05
A Range of Options

- **JASSM-ER:** 500+ NM
- **JASSM:** 200+ NM
- **WCMD-ER:** 40+ NM
- **JDAM:** ~ 8 NM
  - WCMD ~ 5 NM
  - Mk-82, Mk-84, CBU

*Single Sortie Global Strike Capability*
Comparisons
To the rest of the Fleet....
Block E Aircraft Beddown Plan
(120-day rotations start Sep)
JOINT AIR-TO-SURFACE STANDOFF MISSILE (JASSM)

- 24 weapons per B-1
- Use against high-value, heavily defended targets
- Low observable
- Launching aircraft remains outside enemy defenses
- B-1 only MDS to release with no problems
JASSM Flight Profile – Top View

- Release WP
- A/C Route
- IZ LAR (20°)

Release / transition to cruise
Mid-altitude cruise (Cruise altitude is different for throttle controlled & non-throttle controlled missions)

Terminal Ingress Azimuths
(Length and profile differ for Standard vs Alternate trajectories)

ATL Transition
(Descent point is variable)

Final Ingress
(Minimum ATL distance is different for throttle controlled & non-throttle controlled missions)

Leg length maximum limited by INS accuracy

May be only acceptable ingress

INS Maneuver

WP 1

Variable ingress point.
Sensor Fuzed Weapon (SFW)

- Wide-Area Cluster Munition
- 40 Projectiles per Bomb

24-Hour, All-Weather, Operational Capability
WIND-CORRECTED MUNITIONS DISPENSER (WCMD)

- Inertial guidance kit for existing cluster bombs
- All-weather capability
- Multiple targets in a single pass

Accuracy at High Altitudes
JOINT STANDOFF WEAPON (JSOW)

- Program terminated in favor of WCMD-ER
- Currently have some 400 weapons
- B-1 will remain capable throughout 2005
Small Diameter Bomb, WCMD-ER, 500 LB JDAM

16 500 lbs JDAM

30 WCMD-ER

32 SDB per bay
Design Considerations
If you are asking...

• Improved Data Link Capability
  – Post release data link
• Maximize in-flight data/mission modification capability
• Positive Identification Capability
• Long duration issues
  – Power on challenges
  – Captive Carry Issues (training & combat)
  – Sim vs. Real software—minimize differences
• Minimize parameter limitations (speed & Alt)
• Bomber delivery issues
  – Weapon battery duration, CRL/CBM fit, etc.
OK…That’s it
So What’s the Bottom Line?

• Block E transforms the B-1 into the Precision Supersonic “Mack Truck”
  – Explosive leap in capability
• Proven combat platform
• Meets Combatant Commander requirements

“The B-1 was the platform of choice during OEF & OIF!”
Lt Gen Moseley, CFACC

"The B-1, probably more than any other weapon system, gives us flexibility on the battlefield that no other airplane would with respect to time sensitive targeting.”
Gen Hal Hornburg, ACC/CC

“B-1 bombers…made their presence known in Baghdad, striking the dictator's regime until the regime was no more.”
President Bush
SIZE MATTERS!
Questions?
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<th>Location</th>
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<td><strong>Prime contractor</strong></td>
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<tr>
<td>Boeing</td>
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<td>Design; Engineering Datalink</td>
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<td><strong>Major component contractors</strong></td>
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<td>Radar &amp; test facility support</td>
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<td>Avionics control units</td>
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<td>Aeronautical Sys Center</td>
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<td>Sustainment, maintenance, repair</td>
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<td>AFOTEC</td>
<td>Kirtland AFB, NM</td>
<td>Testing</td>
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<tr>
<td>Warner Robins ALC</td>
<td>Robins AFB, GA</td>
<td>ALQ-161</td>
</tr>
<tr>
<td>AFFTC</td>
<td>Edwards AFB, CA</td>
<td>Flight Test</td>
</tr>
<tr>
<td>DCMA</td>
<td>Long Beach, CA</td>
<td>OA, Contract administration</td>
</tr>
</tbody>
</table>
BONE’s Greatest Hits

U.S. AIR FORCE

• Operation DESERT FOX (1998)
  – First combat sorties – Mk 82 drops
• Operation ALLIED FORCE (1999)
  – Delivered 2.5 M pounds of Mk 82s
  – ALE-50 decoy “proven performer”
  – First BLOS datalink experience
• Operation ENDURING FREEDOM (starting Oct 2001)
  – JDAM “truck” – nearly 4000 delivered
  – Nearly 9 M pounds of weapons delivered
  – Datalink critical – in flight replanning emerges
• Operation IRAQI FREEDOM (starting Mar 2003)
  – Primary JDAM platform – 2159 dropped
  – Struck 10% of total targets hit
  – Time critical targets – continuous, airborne, on-call, precision strike capability
  – Datalink now vital to mission
  – In flight planning the norm – few “classic” ATO sorties
  – “Strike platform of choice” – CAOC Commander
Strategy for Future

Keep the B-1 Lancer fleet flying – critical sustainment mods
- Radar R&M Upgrade
- Central Integrated Test System (CITS)
- Inertial Navigation System/Gyroscope Stabilization System (INS/GSS)
- Vertical Situation Displays (VSD)
- Defensive System (ALQ-161)

Continue to push B-1 combat capability to the field
- GBU-38 – 500 lb JDAM – lower collateral damage
- JASSM-ER – extended-range standoff precision

Modernize to address future requirements
- Improve aircrew Situational Awareness -- new displays

"The B-1, probably more than any other weapon system, gives us flexibility on the battlefield that no other airplane would with respect to time sensitive targeting."

Gen Hal Hornburg, ACC/CC
Block E1 ILST Display

Yes Air-to-Air Rdr...

- LT BRAA
- RA Radar Altimeter
- Range Scale
- LT Altitude Differential
- LT MC
- LT Vc Closing Velocity
- LT TAS
- LT Notch Indicator
- LT Decision Range Time
- Tanker Offset
- Interference Indicator

LT = Locked Target
Imagine if the machines could talk together. That's where we've got to go. … For the Air Force, go into the Combined Air Operations Center, and see the integration that's going on so we can do things like redirect that B-1 where it needs to be in near real time.

…shortening the timeline from sensor detection to weapons on target, we envision a future where network-centric warfare gives our nation an even greater asymmetric advantage in the war on global terrorism and in future combat operations.

Gen John P. Jumper, USAF Chief of Staff
**AGM-158 JASSM**

- **Joint Air-to-Surface Standoff Missile**
  - Long-Range Precision Standoff
  - Weight: 2250 Pounds
    - 1000-Pound Unitary Warhead
  - Length: 14 Feet
  - Guidance: INS / GPS-Aided
  - Range: 200+ NM
- **B-1 Carriage: 24**
  - 8 JASSM per Bay
• Mission Planning Less intensive than ALCMs
• LO/ GPS JAM Resistant

JASSM is a CALCM replacement!
JASSM Operational Concept

Mission Development
- Intelligence Support
- Missile Route Planning

Loading
- From container
- Existing equipment

Storage
- Wooden round
- In container BIT

Intel

DTD

Support

CMBRE

GPS

BIA Transmit

- All-up-round
- Simple mission planning
- Retargeting
- High and low altitude launch
- Long range for aircrew survivability

Missile Enroute
- Missile survivability
- Mid- or low-altitude ingress
- Anti-jam GPS (SAASM)
- Time-on-target control

Terminal Attack
- Automatic target correlation
- Highly accurate
- Adverse weather
- Lethal against hard, soft, and distributed targets
Mission Development

1. Specify targets and mission objectives
2. Produce 3-D models
3. Use 3-D model to adjust aimpoint and trajectory
4. Route missiles from impact to launch region
5. Select acceptable launch region within in-range circle
6. Evaluate route survivability
7. Link aircraft route to missile launch regions
Intuitive modeling tools are used to trace objects on image. Build general models or DPI specific models based on seeker FOV.
Viewing Wire Frame From Any Reference Point
• Close Air Support
  – Worked directly with ground forces to strike Iraqi Targets – within 200m of friendly forces
  – Aided Special Operation Forces with capitulating forces
  – Key striker during sand storms
    • Laser-guided weapons were unable to target during sand storms and inclement weather
1) Begin terminal maneuver
2) Begin BIA transmission
3) Seeker active
4) Start ATC algorithm (clear or adverse weather)
5) Null Angle of Attack

- Jam resistant both en route and in target area
- Robust ATC/seeker combination for precision terminal attack
- Capable in 1500 ft / 3 nm weather

Seeker field of view: 12°
Detector array: 256 x 256
9TH EXPEDITIONARY BOMB SQ

"Bats"

- 8 B-1 Aircraft, 200+ personnel and 16 Crews
- Full range of mission capabilities: Strategic Attack, Interdiction and Close Air Support
Wing Shear Bearing

Cordwood Modules

Intermediate Automatic Test Equipment

- Bearing showing signs of major wear
- A/C will ground if not complete
- Boeing developed repair
- Repairs at Dys/Ells going well
- 13 aircraft complete/6 wks per A/C

Sustainment Programs

- Drives #1 MICAP/Cann; flawed “stacked” electronic circuits used in flight control system
- B-1 uses 87 different modules
- SCAS Controller -- has 24 cordwood modules
- 15 modules redesigned — 75% improvement in MTBF
- SCAS Controller checkout 28 Jan
- Replaces obsolete 1980s vintage support equipment
- 900 LRU backlog
- MC rate – 50%
- Funded through two phases
  - Phase 1 – modernization of existing
  - Phase II – replacement (IOC) FY06
- 28 TPSs in FY06 with all 134 TPSs by FY10
The Bottom Line

- Precise
- Flexible
- Sustainable
B-1 “Good News” Stories

• B-1 CMUP has brought a new era in bomber employment
  – Flexibility -- Precision -- Persistence
  – Single-weapon-per-target capability with JDAM
  – Datalinks critical … in flight replanning now the norm … compressed timelines for targeting

• Operation IRAQI FREEDOM success story
  – Flew 1% of total sorties – delivered 42% of all JDAMs

CMUP has delivered war-winning capability to the theater commanders

• Set 50 new world records (while retaining 50 others)
Summary

• AF Vision for the conventional bomber force established in 1992
• The past decade has seen that vision realized
  – Precision weapons from bomber platforms
  – True Close Air Support missions by heavy bombers
  – Beginning of datalink impacts on air operations

"The B-1, probably more than any other weapon system, gives us flexibility on the battlefield that no other airplane would with respect to time sensitive targeting."

Gen Hal Hornburg, ACC/CC
Imagine if the machines could talk together. That's where we've got to go. We've got to let the concepts of operation lead the way.

... For the Air Force, go into the Combined Air Operations Center, and see the integration that's going on so we can do things like redirect that B-1 where it needs to be in near real time.

... As we experiment with machine-to-machine conversations across the global grid, shortening the timeline from sensor detection to weapons on target, we envision a future where network-centric warfare gives our nation an even greater asymmetric advantage in the war on global terrorism and in future combat operations.

Gen John P. Jumper, USAF Chief of Staff
LOCATION

Ultimate Application of Geography and Politics...
Fully Integrated Datalink (FIDL)

- Integrates Link 16 and Joint Range Extension (JRE) datalinks with aircraft systems
  - Incorporates expanded J-series messages over IDL

- Upgrades displays at OSO and DSO with color Multifunctional Displays (MFDs) to support display of datalink and weapons management info

- Software upgrades to include addition of automated retargeting capability to take new target data from datalinks and pass to the on-board weapons

- First fields in late CY08
IDL vs FIDL

- **IDL provides basic situational awareness**
  - 16 J-series messages total, including:
    - PPLI, Air & Ground Surveillance Tracks, Threat Warning, Free Text

- **FIDL provides the entire set of messages from Mil Std 6016C applicable to B-1 missions/roles, to include package or mission commander, or support roles to the package or mission commander**
  - 48 J-series messages total, including:
    - Electronic Warfare
    - Precise Participant Location & ID (PPLI)
    - Intelligence
    - Air & Ground Surveillance Tracks
    - Weather
    - Threat Warning
    - Control
    - Free Text
    - Platform & Systems Status
    - Weapons Coordination & Mgt
    - Voice (Objective)
    - Imagery
The BONE’s Contribution

Product of Precision and Payload...

- **Sorties Flown**
  - All other aircraft: 5%
  - B-1: 35%

- **Weapons Dropped**
  - 38%

- **Targets Destroyed**

"We’re not running out of targets, Afghanistan is…..”
- Secretary of Defense Rumsfeld
Operation ENDURING FREEDOM

• Ellsworth deployed 8 aircraft to Diego Garcia, BIOT in 2001
  – Flew an average of 6 sorties per day
  – Average sortie duration of 11-12 hours
  – Initially majority of sorties were INT, then transitioned to more XINT, XCAS
OEF

BONE Community Response...

- 28th BW generated 14 fully combat-loaded A/C from across the B-1 community in 5 Days

Aircraft/Personnel
- 4 x B-1s (28/28/10)
- 4 x B-1s (3 x CRL)
- All 8 B-1s
  - Combat Track II (Secure Satellite e-mail)
  - ALE-50 Towed Decoy System
- 16 Aircrews (2.0 crew ratio)
28th Bomb Wing
B-1 history Oct-mid Dec 2001...

- Rapid deployment to Diego Garcia
- Combat ops from day #1
- Long sorties with standard profiles and load-outs
7th Bomb Wing
Dyess Moves into Action...

- Notified on 14 Dec 01
- Deployed 36 hours later
- Stood-up 405th 5 days later
- Moved B-1s from Diego 1 week later
- Full-up combat ops in 10 days
In one wing, we conducted our own air to air refueling, reconnaissance, intelligence, command and control and strike missions. No other unit in the AOR can do that!
Operation DESERT FOX

- B-1 Combat Debut
- Iraq forces move south
- 4 B-1s Deploy
- 4 Days of Strikes in Dec 98
DESERT FOX

HI-RES RADAR DISPLAY...
Desert Fox

B-1 Combat Début...

- USAF/USN Joint Operation
- Dyess & Ellsworth Warfighters
- Targeted Republican Guard barracks
Operation ALLIED FORCE

- April – June 1999 / Serbia
- 19 Country NATO Operation
- 4 B-1’s delivered 20% of all weapons

- Launched first combat sorties within 14 hours of arrival at the forward operating location
- Flew 100 combat sorties and dropped 5,037 weapons amounting to 2,527,570 pounds
PRISTINA AIRFIELD, KOSOVO
POST STRIKE

MIG 21 Fishbed
Conclusion

• B-1 played a vital role during OIF
  – Reliable, Flexible, and Lethal
• Proven combat platform
• Combatant Commander requirement
Computer Upgrade

• 4 New ACUs
• New Data Transfer Device

Guided Weapons

JASSM
• Standoff Missile
• Precision Weapon

JSOW
• Standoff Glide Bomb
• Precision Weapon

WCMD
• TMD Tail-kit
• INS aided
• High Accuracy

SECBM
Situational Awareness
Beyond Line of Sight (BLOS) Data Link/Situational Awareness Enhancement (SAE) System

Temporary Mod of Fleet

- BLOS: Provides SATCOM data link for inflight mission updates: target changes, etc
- Enhanced SA: A/C power w/ PGPS to 3 PCs provide moving map, kill box, LAR displays to all crewmembers

OEF Combat Mission Need Statements

Moving Map w/ Weapon Launch Areas

Pilot’s Tablet PC

WSO’s Laptop w/ Moving Map Display

OIF Success Story
JOINT DIRECT ATTACK MUNITION (JDAM)

- Guidance kit for existing 1,000 & 2,000 lb bombs
- Global positioning & inertial guidance = 10 meter accuracy
- Will be carried on all USAF bombing platforms

All-Weather, Near-Precision Accuracy
JOINT DIRECT ATTACK MUNITION (JDAM)

- Guidance kit for existing 1,000 & 2,000 lb bombs
- Global positioning & inertial guidance = 10 meter accuracy
- Carried on all USAF bombing platforms
JOINT DIRECT ATTACK MUNITION (JDAM)

Accurate, Hard-Target Penetration

JDAM (BLU-109)
The Nature of...

Airpower

Advanced technology radar-evading supersonic fighter-bomber equipped with computerized laser-guided target-seeking smart bombs.

Bob
Statistics

• 414 Total B-1 sorties during OIF
  – Includes flights prior to the start of OIF and after 18 Apr
  – During this time B-1s supported
    • Horn of Africa Operations
    • Operation Southern Watch
    • Operation Enduring Freedom

• 34 EBS
  – 10 B-1s total
  – Averaged 8 sorties per day – OSW and OIF
    • First night - 10 sorties
    • Average duration = 10.8 hours
Excalibur Basics

- 155 mm Precision-Guided Extended Range Munition for Cannon Artillery
- Cooperative development
  - USA and Sweden
- Family of Munitions

Raytheon

Distribution A. Approved for public release; distribution is Unlimited.
Block I Variants and Requirements

- **Block Ia-1** Initial Capability
- **Block Ia-2** Improves on Ia-1 performance; more reliable, capable of higher charge level, tested anti-jam
- **Block Ib** Compact guidance section; more capable, more reliable, lower cost, could add SAL seeker

### Unitary Block

<table>
<thead>
<tr>
<th>Capability</th>
<th>Block Ia-1</th>
<th>Block Ia-2</th>
<th>Block Ib</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Delivery</strong></td>
<td>10-20m CEP(U)</td>
<td>10-20m CEP(U)*</td>
<td>10m CEP(U)*</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td></td>
<td>20-30m CEP(J)</td>
<td>20m CEP(J)*</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>30-35 km</td>
<td>39-cal: 30-40 km</td>
<td>39-cal: 35-40 km*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>52-cal: 50-60 km</td>
<td>52-cal: 50-60 km</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>&gt; 60%</td>
<td>85+%*</td>
<td>90+%*</td>
</tr>
<tr>
<td><strong>Effectiveness</strong></td>
<td>ORD Threshold (M107)</td>
<td>ORD Threshold* (M107)</td>
<td>ORD Threshold* (M107)</td>
</tr>
<tr>
<td><strong>Platform &amp; Charge</strong></td>
<td>LW155 (TAD) Paladin</td>
<td>LW155 (TAD) Paladin NLOS-C FH77BD MACS 3-5</td>
<td>LW155 (TAD) Paladin NLOS-C FH77BD MACS 3-5</td>
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<tr>
<td></td>
<td>MACS 3-4</td>
<td>MACS 3-5</td>
<td>MACS 3-5</td>
</tr>
</tbody>
</table>

*Denotes KPPs in addition to Interoperability-Top Level IERs. Block Ia-1 has no KPPs.*

Distribution A. Approved for public release; distribution is Unlimited.
Concept of Operations

- Gun Target Location
- Trajectory Information
- GPS Crypto Keys
- Precise Time
- Fuze Setting
- Power

System Initialization

Deploy Canards prior to Apogee (Ballistic prior to Apogee)

GPS Acquisition and Track

Impact Near Vertical for Max Lethality

Fragmenting Warhead

Structure Top Attack (Detonation after Penetration)

Top Attack, 3 Fuzing Modes:
- Height of Burst
- Point Detonating
- Delay/Penetration

Sensors:
- M707 Knight w/FS3
- Stryker FSV w/FS3
- M7 & M2A3 BFIST
- OH-58D

Mission Planning

Latitude / Longitude / Altitude

• Precision Delivery Regardless of Range
• Limits Collateral Damage
• Decreases Volume of Fire Per Engagement
• Enhances Soldier Survivability

Distribution A. Approved for public release; distribution is Unlimited.
Excalibur Operational Scenario
Excalibur is used in a complex target environment!

- ~10m CEP
- Same lethality as an 155 mm HE

Excalibur at any range
- M549 at 20Km
- M107 at 15Km

### Infantry Platoon
- Excalibur: 3 rounds
- M549: 25 rounds
- M107: 43 rounds

### Command Post
- Excalibur: 6 rounds
- M549: 54 rounds
- M107: 78 rounds

### Structures
- Excalibur: 3 rounds
- M549: 147 rounds
- M107: 110 rounds
Range and Gun Compatibility

- 155 mm, 39 caliber
  Range 30 – 40 km

- US Army
  155 JLW
  M109A6 Paladin
  FCS NLOS-C

- 155 mm, 52 caliber
  Range 50 – 60 km

- Swedish Army FH77BD

Distribution A. Approved for public release; distribution is Unlimited
Technical Progress Summary 1

- IMUs survived tests at MACS-5
- Continuing with 2 vendors
  - Honeywell
  - BAE

- EPIAFS
- Completing design of EPIAFS and Platform Integration Kit (PIK)

- Canard Actuator System (CAS)
- Survived Overstress Airgun Test, 17kGs and Gunfire at MACS 4
- Canards deployed & guided to target during GG-A

- GNU Electronics demonstrated gun-hardening gun firing tests (MACS-5)
  - Mission Computer
  - Power Conditioning Unit
  - GPS Receiver
  - AJ Boards

Distribution A. Approved for public release; distribution is Unlimited
Technical Progress Summary 2

- MKI.5 Base with Roll Control tested – will support upcoming tests
- Base Bleed tested
- MKI.5 Base with Roll Control tested – will support upcoming tests
- Base Bleed tested
- Successful Container Critical Design Review; Meets all Requirements
- Pallet Testing Underway
- 1st design iteration arena, penetration and IM tests completed
- Tactical design established
- Second Arming defined
- Accepted by US & SwedishFuze boards
- Unitary Payload
- Container
- Base with Fins
- Base Bleed
- Explosive
- FSA
- IMU
- 4-Axis CAS
- Base
- Payload
- GN&C
- Fuze Safe & Arm
- Distribution A. Approved for public release; distribution is Unlimited
Range to target: 20 Kilometers

Objectives
- Demonstrate that projectile de-rolls when commanded, correctly orients, acquires GPS, calculates a navigation solution and guides a non-ballistic trajectory to a point on the ground

Configuration
- 3 Projectiles fired at MACS-4 charge from LW155 & Paladin cannons
  - Guidance & Navigation Unit (GNU)
    - Tactical computer & flight software
    - C/A Code (civilian) GPS
  - Tactical Canard Actuator System (CAS)
  - Encrypted Telemetry System (in place of tactical HE warhead)

Results
- All objectives successfully met; 2 of 3 rounds impacted in target area
  - Demonstrated Accuracy: 3.4m & 6.9m
  - Full Functionality of Guidance and Navigation System
  - Guided to Programmed Target Location
  - Performed Terminal Tip over Maneuver over Target
  - Projectile #2 flew ballistic
    - Shortcoming of GPS C/A code caused large change in navigation solution; round went into fail-safe mode
    - All future guidance tests will use military Y-code GPS which will not have this problem

Distribution A. Approved for public release; distribution is Unlimited.
Guided Gunfire A Test

GG-A

Shot #3

18 Dec 2004

Distribution A. Approved for public release; distribution is Unlimited
Major Upcoming Test Events

- **Lethality Demo – June**
  - First Guided Flight with HE Warhead

- **Guided Gunfire B**
  - Demonstrate initialization, projectile flight performance and Fuse Mode functionality
  - Various ranges and charges
  - Exposure to environmental conditioning

- **Sequential Environmental Tests - Safety**
  - Extreme environmental conditioning
  - Loose cargo and drop testing
  - Fired at charges up to PIMP+5%

Distribution A. Approved for public release; distribution is Unlimited
Commanders in the CENTCOM AOR want a capability for a cannon fired precision munition
  ✓ Immediately responsive precision fires
  ✓ Munition with limited collateral damage

The Army Staff has asked PM Excalibur to accelerate testing and fielding

Value to Warfighter
  ✓ Allows destruction of high-payoff targets in urban & complex terrain
  ✓ Minimizes collateral damage
  ✓ Reduces risk to friendly forces in close fight
  ✓ Responsive; organic to UA Brigade
  ✓ All weather capability
  ✓ Fly to grid capability; no laser required
Questions?

Distribution A. Approved for public release; distribution is Unlimited
Capabilities Based Planning: An AT&L Perspective on FCB Interactions

Mr. James “Raleigh” Durham
OUSD(AT&L) Defense Systems
Overview

- Capabilities-Based Planning (CPB)
  - New Joint Capability Areas
  - Notional Mapping to Current Capability Areas
  - DoD End-to-End Process (old and new)
- Force Application Activities under CPB
- AT&L Perspective
Capabilities Based Planning (CBP) Objectives

CBP should be a top-down, competitive approach to weigh options vs. resource constraints across a spectrum of challenges

CBP should:

- Link DoD decision-making to the Defense Strategy
  > Encompass the full set of DoD challenges
- Inform risk tradespace -- identify joint capability gaps, redundancies and opportunities
  > Generate common framework for capability trades
  > Couple programmatic capability development to operational needs
- Facilitate the development of affordable capability portfolios
PPBS, the last major change in DoD resource management (1960s), was based on a decade of prior analytical development.
Overall Defense Capabilities Process:
- Senior Leadership Upfront
- Department-Level View of What’s Needed
- Linking Strategy to Planning to Programming

CBP Top-Down Process

- **Strategic Planning Council (SPC)**
  - Drives
    - Operational Planning
    - Enterprise Planning
    - Capabilities Planning
    - trades Across: Capabilities, Components, Warfighting & Enterprise

- **Assesses**
  - Program Execution & Performance Reporting
  - SecDef Chairs
  - SLRG Principals plus CoCom Commanders

Time
| Goal: | Dec | Jan | Apr | May | Oct | Nov |

- SecDef decision points
- Iterative SecDef engagement
CBP Integrates Across Processes

Planning, Programming, Budgeting & Execution System

Requirements

Strategic Planning

Acquisition

CBP integrates major DoD processes to facilitate strategic planning

CBP is enabled through a common set of joint capability definitions
DJCS(J-8) CBP Process

Defense Planning Scenarios

DoD Planning Construct and Stretch Goals

Irregular

Catastrophic

Traditional

Disruptive

OSD Policy Strategy

Warfighting Capabilities and Corresponding Force Structure

Operational Availability Assessments

DJCS (J-8)

Macro

Functional Capability Boards

Micro

Joint Integrating Concepts

Capabilities Based Assessments

Capabilities Gaps and Overlaps

JCIDS

For materiel and Non-materiel solutions
Proposed Definition Set: Joint Capability Areas (Tier 1)

- Battlespace Awareness
- Command and Control
- Network Operations
- Interagency Coordination
- Public Affairs Operations
- Information Operations
- Protection
- Logistics
- Force Generation
- Force Management
- Homeland Defense
- Strategic Deterrence
- Shaping & Security Cooperation
- Stability Operations
- Civil Support
- Non-Traditional Operations
- Access & Access Denial Operations
- Land Control Operations
- Maritime/Littoral Control Operations
- Air Control Operations
- Space Control Operations

Developing a common lexicon
### Notional Mapping of Joint Capability Areas to Current Joint Operating Concepts

<table>
<thead>
<tr>
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<th><strong>Major Combat Operations</strong></th>
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DoD End-to-End CBP Process

- Strategic Planning Guidance
- Defense Planning Scenarios
- Family of Concepts
- Transformation

**Capabilities Based Assessment**

- Capabilities
- Tasks
- Attributes
- Metrics
- Gaps
- Shortfalls
- Redundancies
- Non-materiel solutions
- Materiel solutions
- S+T initiatives
- Experimentation

- Concept Refinement
- Refined concept
- Analysis of Alternatives
- Technology Strategy
- Systems Engineering Plan

- Affordability
- Affordable military-useful increment
- Technology demonstrated
- Initial KPPs

- Technology Demonstrated
- System integration
- DT&E/IOT&E

- **MS “B”**
  - CDD
  - System Development
  - Production

- **MS “C”**
  - Evolutionary or Spiral Development

**Services**

- As is
- Roadmaps
- Task a
- Task b
- Task c

- "as is" Services and OSD (DOT&E) -- Joint Staff (JROC)

**Acquisition and Test**
Capabilities-Based Planning: Perspective from AT&L

- Acquisition has traditionally focused at the program level
- Under CBP, acquisition will widen its perspective
  - Infuse technology and programmatic reality into planning and decisions
  - Shape, engineer, and validate solutions to capability needs
  - Make decisions on systems within a capabilities context (systems perspective)
  - Engineer the relationships across the set of systems that together satisfy the need (systems of systems)
  - Synchronize the interaction among programs to satisfy multiple capabilities (roadmaps)
  - Provide a coherent logistics transformation strategy supporting distributed, adaptive operations
The FCBs -- “Hot, Sweaty Pile”

Joint Integrating Concept Development
- Missions
- Capabilities
- Tasks
- DPS-based vignettes

AT&L participates and advises

Capabilities-Based Assessment
- FAA
  - Capabilities
  - Tasks
  - Attributes
  - Metrics
- FNA
  - Gaps
  - Shortfalls
  - Redundancy
  - Risk Areas
- FSA
  - Non-materiel Alternatives
  - Materiel Alternatives
  - S&T Initiatives
  - Experimentation

SPONSOR
- COCOM or Service

FCB Co lead - OSD SES
Current ATL (DS/SMI/JFA) FCB Activities

- JCIDS Capabilities Based Assessments
  - Joint Undersea Superiority
  - Joint Forcible Entry Operations
  - Global Strike
  - Integrated Air and Missile Defense

- AT&L-led Capability Area Reviews and Roadmaps
  - Previous: Integrated Air and Missile Defense; Conventional Engagement Capability (Land Attack Weapons)
  - Future: Electronic Warfare; JBMC2

- Studies
  - Medium Range Bomber/Long Range Strike; Emerging Technologies for TACAIR; Aviation Capabilities; Cross-Capability Assessment and Risk Management Framework for Evaluating Major DoD Force Capability Options
Other Activities

- Study of JCIDS/5000 Transition
  - Examining the transition ("lead change") from requirements to acquisition; key point of intersection is the FSA through AoA.
  - Highlight success criteria, roles and responsibilities for critical decision points

- Study of Capability Area Reviews
  - Examining the structure and content of CARs
  - Identify key focus areas, process requirements, and analysis requirements

- DAB-level System "In context" Reviews
  - Expands the scope of individual program DAB reviews to include critical interrelationships between supported and supporting programs and systems within the capability / mission area
    - Example on next slide
Example: JSF Interrelationships with Complementary Systems

Supporting Platforms:
- C-17A
- KC-10/135
- Future Tanker
- KC-130J

Hosting Platforms:
- CVN-21
- CVN-68
- LHA
- LHA (R)
- LHD

Replacing:
- F-16
- A-10
- AV-8B
- F/A-18C/D

Complementary Platforms:
- F/A-22
- F/A-18E/F

ISR:
- JSTARS
- E-2C
- AWACS
- Rivet Joint
- EP-3/ACS
- IBS
- GPS
- E-10

C4:
- JTRS
- MIDS(Link-16)
- JMPS
- GATM
- JPALS
- VMF

Weapons:
- AIM-120
- JDAM
- JSOW

Other:
- Crew Protection Modeling & Simulation

Cost, Schedule, Performance & Integration Support Fielding

Cost, Schedule, Performance or Integration Issues

Cost, Schedule, Performance or Integration issues to be resolved

SOLID DENOTES CURRENT SYSTEM
DASH DENOTES FUTURE SYSTEM

OSD MDAP DAES Rating, (MDAP) OR SERVICE ASSESSMENT (ACAT 2/3)

Cost        Sched       Perf       Not Rated

16
Current Issue: Family-of-Systems System Engineering

• Problem Statement (IAMD CAR DAB):
  – Certain capabilities only appear in a Family of Systems context.
  – How do these FOS capabilities get engineered within the various individual systems
  – How do these FOS capabilities get tested

• Example
  – Capabilities such as Combat Identification must be implemented in numerous systems across all Services and Agencies to enable the joint warfighter to use that capability in combat
SE at a Capability Level*
How do we do this?

For each capability drop

Coordinate Development, Engineering Changes, and Test

Joint Warfighting Concepts
Capability Requirements Analysis
Architecture Development

Capability Area Manager and Lead Capability Systems Engineer?

Service/PEO/PM Program Systems Engineers

System Requirements Analysis
System Architecture Development
Synthesis
Implementation
Integration Test
Unit Test
System Test

*From MITRE report, Sep 04, JCIDS impacts on SE
Building a FOS Capability – One View

JROC / JCB
JCIDS process

CA DAB / OIPT
Acquisition process

FCB
O-7 BoD

Capability Set Manager (Service lead)

One Idea – others?

Analytical Support

Function
Activities & Scope
Specific Examples

Requirements
FoS Capabilities
POR & FoS Testables & “J” ISP

Roadmap
POR / FoS Synchroniz’n
Proposed CAPSET FoS Schedule

Stakeholder Coordination
Service/Agency Agreements

Resources
Budget, People, Facilities
Svcs/OSD resource proposals

SE / SI
8 SE Functions
FoS configuration management

Test
FoS T&E
Test coordination for CAPSET

External Inputs & Data Sources

Roadmap
Master POR List
APB Data
Service POMs
Etc.

FCB WG
Capability-based Assessment

Integrated Architecture
Example:
Capabilities Based Acquisition
Applied to JSEAD
JSEAD and Aircraft Survivability

Key: JSEAD roles

Deny, Delay Radar Acquisition/Tracking/Lock-On
- Radar Cross Section design
- On Board Radio Frequency/Infrared Countermeasures
- Off Board Countermeasures
  -- Towed Decoys/Chaff/Flares

SEAD capability interacts with Self Protection - synergistic effect
**Service Response to AEA AoA: AEA System of Systems Concept**

**AEA AoA Recommendation**

**Complete Capability**
Sensing capability to support reactive jamming
Full frequency coverage
Specialized high power jamming*
Stand-in jamming

*AEAS Radars, Advanced Waveforms, and High Power New Technology AEA Arrays collectively can provide Specialized High Power Jamming Capabilities.

**DoD AEA JSEAD Plan**

Briefed to OSD(AT&L) June 2002
Where Are They Now… Sample AEA/SEAD Programs

Today

AEA MNS Jul 99
EA-18G/ICAPIII
ORD Oct 03

MS B
Dec 03

CDR
Apr 05

MS C
Apr 07

IOC
Sep 09

EA-18G

MNS
ORD

B-52 SOJ

ICD

CDD

Joint Strike
Enabler
ICD

JROC

Aug 99 – Dec 01

AEA
AOA

MALD
ACTD

ACTD
Approved

Preliminary
Design
Review

Critical
Design
Review

Engineering
Development,
Manufacturing,
and Flight Testing
Completed
3rd Qtr FY99

Interim
Capability

End ACTD

1st Qtr FY96

4th Qtr FY96

1st Qtr FY97

2nd Qtr FY99

2nd Qtr FY01
Electronic Warfare (EW) Capabilities Analyses and EW Roadmap

EW GAP ANALYSIS

EW Capabilities

DOD EW ROADMAP

Objectives: Document a Joint EW Vision; Develop an EW Roadmap and Investment Strategy
Requirements-to-Acquisition: Some AT&L Observations

- Capabilities-Based Assessments help inform decision makers – not a decision-making tool in and of themselves
  - Still rely on Services to identify and attempt to resolve shortfalls
- JCIDS is still evolving - potential to impact acquisition
  - Joint Capability Areas, Streamlining JCIDS are latest initiatives
  - Sufficient data/analysis to support decisions?
- Process is still oriented towards Service-developed ICDs
  - Services are beginning to develop “joint” ICDs together (e.g., JSE)
- Need for process flexibility is recognized
  - Program migration from old to new acquisition framework (e.g., MNS/ORDs to ICDs/CDDs, MS I to MS A)
  - Application of single-program criteria to Family-of-Systems programs (e.g., Future Combat System)
Requirements-to-Acquisition: Some AT&L Observations

- Early involvement of AT&L is a plus
  - Allows for greatest leverage in preventing mistakes / misconceptions and understanding Service objectives
  - Engaging with subject matter experts (e.g., acquisition policy) can do a lot to avoid unnecessary delays
  - PA&E is our most useful partner in this phase

- NII is an increasingly important ally as programs attempt to translate the Net Ready KPP into an actual capability
Questions?
InnoVision
Future Warfare Systems Office

Laying the Geospatial-Intelligence Foundation for Future Warfare

Brief to Precision Strike Program Review

Jon D. Estridge
Chief, Air Warfare/Targeting Division
NGA Future Warfare Systems (IW)
InnoVision Directorate
What is NGA and What Do We Do?

Our vision…

**Know the Earth…Show the Way**

…D/NGA as the functional manager for GEOINT:

Department Of Defense Directive Number 5105.60 (dated 11 October 1996)

…Providing GEOINT in all its forms, and from whatever source imagery and geospatial– to ensure the knowledge foundation for planning, decision, and action.

…Affording easy access to GEOINT data, for all stakeholders.

…Creating tailored, customer-specific GEOINT; providing analytic services and solutions; and sharing insight.
Our Contribution to National Security
Geospatial Intelligence provides the knowledge basis for decision, planning, and action

**Geospatial Intelligence:** Who are its customers?
- National policymakers
- Combatant commanders
- Homeland Security agencies
- Intelligence Community analysts
- **Military Departments (Services)** - Title 10
What is NGA and What Do We Do?

National Geospatial-Intelligence Agency (NGA) is a National Intelligence and Combat Support Agency

Mission:
Provide Timely, Relevant, and Accurate GEOINT in support of National Security

Definition:
GEOINT is earth-referenced information about natural and man-made objects or events with National Security implications
Geospatial Intelligence (GEOINT)

- A 4-D framework of information for comprehending objects and events, planning and executing operations, and assessing effects

  - How are the enemy’s physical and virtual infrastructures constructed?…
  - How do they interrelate and operate?…
  - What are my COA options and COEs?…
  - Where am I?…
  - Where are the Friendlies?… Hostiles?… Non-Combatants?…
  - How do I move or navigate in the battlespace?…
  - What is the environment?…

GEOINT Provides the **Basic Foundation** for Effects-Based Operations
Key Elements of NGA Transformation

• All-digital Operating Environment – transition from a paper-centric to a layered, data-rich network-centric environment accessed via single portal

• Foundation Data – Specific information on essential features that change rarely or slowly (i.e., point positioning data, topographic features, elevation data, safety of navigation)

• Mission Specific Data – Intensified Foundation Data encompassing greater detail or additional features and/or attributes to meet specific mission requirements

• Geospatial-Intelligence Knowledge Base (GKB) – NGA data environment composed of two content layers: foundation layer and intelligence layer (weather, order of battle, intelligence reports, features, multi-intelligence, elevation)
The Transition
Geospatial Intelligence Knowledge Base (GKB)
Customer Self-Serve Portal

- Provides Stakeholders with One-Stop Access to All of NGA’s Holdings
- Means Through which Web-Based Collaboration Occurs
The Changing Challenge....

Above Surface

Static

Moving

12 - 24 Hours

4 - 12 Hours

0 - 4 Hours

Traditional NTM Coverage

Denial and Deception

Below Surface

Characterized

Uncharacterized
What is GEOINT and Why is it Important?

A short picture history of the impact of GEOINT

1943
- 1500 B-17 sorties
- 9000 x 250 lb. bombs
- One 60’ x 100’ target
- W.W. II

1970
- 30 F-4 sorties
- 176 x 500 lb. bombs
- One Target
- Vietnam

1991
- 1 F-117 sortie
- 2 x 2000 lb. bombs
- Two Targets per Sortie
- Desert Storm

2005
- 1 B-2 sortie
- 16 x 2000 lb. bombs
- 16 Targets per Pass
- Available Today

2010
- 1 FA-22 sortie
- 8 x Small Diameter Bombs
- Future Weapon Attacks
- Mobile Targets

ONE SHOT
ONE KILL
Weapon Performance: Precision & Accuracy

- It’s always a matter of precision **AND** accuracy:
  - Precision, Without Accuracy
  - Accuracy, Without Precision
  - Accuracy, With Precision

- Both matter if you’re shooting a weapon at a coordinate!
  - Latitude: 350342.791°N
  - Longitude: 1072256.017°E
  - Height above Ellipsoid: 529.38 m
  - Circular Error/Linear Error $90 = 4.1\text{m}/3.8\text{m}$

- In and of themselves, PGMs are **not** inherently any more accurate than any other type of weapon; but, their behaviors **are** more predictable and controllable

- The focus must be on our ability to achieve a delivery accuracy commensurate with our ability to achieve precision trajectory control
Future Warfare Systems Office

Future Combat Systems
Future Warfare Systems Office (IW)

Mission

- **Identify** and meet DoD and Military Service needs for Geospatial Intelligence for **emerging and future warfare systems** to ensure their desired effectiveness

- When necessary, facilitate **technical, operational, or programmatic solutions** to eliminate shortfalls
The Idea

• Introduced by General Clapper
  – **Warfare systems** of the future will increasingly depend on the information provided by NGA
  – NGA must be **part of the process and fully engaged from the inception** of acquisition programs
  – **GEOINT** cannot be an afterthought
NGA’s Focus on Future Warfare Systems

- **Interface early** in acquisition cycle
- **Participate as a special member to the DAB**
  - Attend IIPTs, OIPTs
- **Ensure NGA understands specific Geospatial Intelligence** needs of future warfare systems
- **Ensure Warfare Community understands NGA’s planned capabilities**
- **Ensure coherence** between Services’ future systems and NGA’s Geospatial Intelligence
NGA/IW’s Goals

- Understand Future Warfare System GEOINT Needs
- Educate Warfare System Stakeholders on NGA’s Transformation Goals and Initiatives
- Identify GEOINT Support “Disconnects” Early in Warfare System’s Development
- Inform NGA transformation

Potential Benefits – for Warfare Programs and NGA

- Lower technical and cost risk
  - For future MDAP systems
  - For the National System for Geospatial-Intelligence (NSG)
- Increased NGA Responsiveness
- Optimized Warfare System Performance
- Better Informed Budget Priorities and Decisions
- Better Technology Investments
- More Focused NGA Transformation
IW Program Alignment

Scott Robertson, A. Director
John Powers, A. Deputy
Amy Wandless, BX
Randy Anders, A. TX

OSD Liaisons
USD(I)
USD(AT&L)

Key Programs and Initiatives

AIR/SPACE/TGT
- F/A-22 & F-35
- JUCAS
- SDB
- AOC
- JMPS
- AMD
- PAC 3/MEADS
- CV-22

LAND/SpecOps
- FCS
- EFV
- NLOS
- Soldier System
- PRV
- Complex Terrain
- Special Ops Support
- Rotary Wing A/C

NAVAL
- LCS
- DD (X)
- JHSV
- ASDS
- ERGM
- VXX
- MMA
- ASW ConOps

C4ISR
- ACS
- JBMC2
- DJC2
- DCGS
- DCGS
- WIN-T
- JTRS
- JLENS
Air Warfare Future Systems

• **F/A-22, F-35 (Joint Strike Fighter)**
  - Next generation fighter aircraft
  - Extremely robust radar and sensor suite (direct targeting)
  - JSF developing “digital cockpit” with leap ahead technologies
  - **Non Traditional ISR** – IW authored early draft CONOPS, adopted by Air Combat Command (ACC) as baseline for USAF document
  - Early program spirals focused on air worthiness

• **Challenges**
  - JSF cockpit moving map (Defining digital map support)
  - Ensure JMPS integrated with future GEOINT
  - Limited on board space for NGA support data, partnering with programs to develop registration/data storage to support targeting
    - Unknown requirement for fidelity of high resolution elevation data, ongoing testing with Level II DTED (SRTM) and DPPDB
  - F/A-22 SAR standards
  - Accessing NTISR data to make available via National System for Geospatial Intelligence (NSG)
Future Munitions

- **Small Diameter Bomb (SDB)**
  - First in family of miniature munitions
  - Minimize collateral damage, engage multiple targets per sortie
  - DPPDB is source of precise coordinates (accuracy)
  - NGA teaming with OSD DOT&E to support live tests
  - USAF submitted SDB accuracy requirement Apr 05

- **Challenges**
  - Maintain or improve accuracy, currency, and coverage of DPPDB holdings supporting GPS/INS seeking wpns
    - Ensure programs understand capability & limitations
  - Target characterization (4m wpn vs 20m knowledge)
    - GEOINT foundation for target system analysis
  - Teaming with USAF to define future accuracy reqt
Takeaways

• GEOINT is critical to effectiveness of future DoD warfare systems
  – Targeting, navigation, mission planning, situational awareness
• NGA is committed to fully supporting Future Warfare Systems!
• Must continue to engage early in process
  – JCIDS (FCB), IIPTs, Service Labs, etc.
• Encouraging specified vs implied requirements
  – DRAFT JP 3312.01
NGA Organization

STAFF Offices

Director
Deputy Director
Executives

Military
Business
Technical
Western

LINE Directorates

Source Operations
Enterprise Operations
Analysis and Production
Acquisition

InnoVision

ENABLER Directorates

Human Development
Financial Management
Security & Installations
Supporting Transformation

- **DoD’s and NGA’s Transformations: Our Mutual Objectives**
  - Our Nation’s military is transforming how it fights - new threats, new capabilities, and new operational concepts
  - Those changes are driving NGA to change
  - We understand where the Department is going and are transforming to meet our Geospatial Intelligence needs

- **Discovering and understanding the needs of and future warfare systems is a full time job**
  - Evolving systems’ needs for geospatial intelligence are substantial and require DoD-wide scrutiny
  - NNGA’s role in supporting defense acquisition

- **The process is costly and requires:**
  - Close cooperation among Commands, Services, and Agencies
  - Recognition that this is a DoD-wide interest
What is GEOINT and Why is it Important?

Definition: Information about any object - natural or man-made - that can be observed or referenced to the earth, and has national security implications.

- Where am I?
- Where are the Friendlies?
- Where are the Enemies?
- Where are the Non-Combatants?
- How do I move or navigate among them?
- What is the Environment?
- What does it mean?
- What is the impact?
How is NGA Transforming?

Trends transforming NGA

**YESTERDAY**
- Maps and Pictures
- Mapping 2D and Text
- NTM and EO
- Government Only
- (Sampling) Reconnaissance
- Deliberate Targeting
- Separate Tactical and National Intelligence
- Limited Deployment
- Foreign Intelligence
- Single INT

**TODAY AND TOMORROW**
- GEOINT
- Visualization, COP, and 4D
- NTM, Commercial, Airborne, in all Forms in the Electromagnetic Spectrum
- Best Source
- (Persistent) Surveillance
- Time-sensitive Targeting
- Interactive Tactical and National Intelligence
- Robust Forward Deployment
- Domestic Applications
- Multi-INT Fusion

"Persistent TPED" Convergence
Colonel James Geurts, Commander
Long Range Missile Systems Group
Eglin, AFB
JASSM Topics

- Program Overview
- JASSM Capability Of Today
- JASSM Capability Of The Future
  - JASSM Extended Range (JASSM ER)
  - Electronic Safe and Arm (ESAF)
  - Weapons Data Link (WDL)
  - Maritime Interdiction
What Is JASSM?

- A joint Air Force and Navy Program to provide an autonomous, long range, conventional, air-to-ground, precision missile able to strike highly defended, high value targets

- It fills an urgent requirement for a system that will:
  - Cost less than $400K (FY95$) AUPP objective
  - Take out enemy command and control
  - Survive the advanced threat environment
  - Attack the target autonomously
  - Reduce risk to aircrew
  - Operate in adverse weather
  - Launch from both fighters and bombers
  - Reduce mission planning timelines
System Requirements

**Targets**
- Air defense sites
- Hardened bunkers
- Large reinforced buildings
- Distributed soft targets
- Bridges
- Other (small hard targets)

**Carrier Operable**
-Insensitive munitions
- Shipboard handling
-CATS & TRAPS
-Naval environment
-Compatible with “yellow gear”

**System Performance Specification**

- Range: >200 NM
- Missile mission effectiveness: Approximately 1 missile/target
- Time-on-target: ±5s
- Off-axis release: 180 deg
- Retargeting: In-flight GPS

**Mission Planning**

- AFMSS (MPS and JMPS)
- Uses existing intelligence infrastructure
- < 5 min per route plan
- < 15 min per target

**Aircraft Employment**

**Platform/Loadout**
- F-16C/D 2
- B-52H 12
- B-2 16
- B-1B 24
- F/A-18E/F 2
- F-117 2
- F-15E 3
- JSF 2

**Supportable**
- Complete 15-year warranty
- Wooden round
- Uses existing support equipment
- In-container built-in test
- Load from container
- Stack up to 5 high
Concept of Operation

Mission Planning
- Rear area planning
- Forward area planning

Loading
- From container
- Existing equipment

Storage
- Wooden round
- In container BIT

Intel
- Wooden round
- Simple mission planning
- Retargeting
- High and low altitude launch
- Long range for aircrew survivability

DTD
- Missile Enroute
  - Missile survivability
  - Mid- or low-altitude ingress
  - Jam resistant
  - Time-on-target control

Support
- Terminal Attack
  - Automatic target correlation
  - Highly accurate
  - Adverse weather
  - Lethal against hard, soft, and distributed targets

CMBRE
- GPS
- BIA Transmit
JASSM Topics

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• JASSM Capability Of The Future
  – JASSM Extended Range (JASSM ER)
  – Electronic Safe and Arm (ESAF)
  – Weapons Data Link (WDL)
  – Maritime Interdiction
McChord AFB
Minot AFB
Ellsworth AFB
Whiteman AFB
Dyess AFB
Barksdale AFB
Lackland AFB
PACAF

Total Delivered To Date = > 190
# Top Level JASSM Schedule

- **Research & Development**
  - MS2
  - LRIP
  - MS3

- **Production**
  - LRIP-LOT 1
  - LRIP-Lot 2
  - LRIP-Lot 3
  - FRP LOT 4

- **Block Release Cycle**
  - Block 1 – Lot 1
  - Block 1a – Lot 2
  - Block 2 – Lot 6

- **Data Link ESAF**

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- **Data Link Development**
- **ER Phase II Development**
JASSM Facility – Pike County Operations
- Producing JASSM missiles since 1999
- > 290 missiles have been delivered to date
- Facility supports required production rates
- Shingo Prize winner for manufacturing excellence

Production Line
- Hot Line through 2018
- Economies with USAF procurement
- Online depot capability
- Production and System Engineering teams in place
- Integrated logistics support program
VT-1 & 2 Test Results
Insensitive Munitions Certification

NATO Insensitive Munitions Information Centre (NIMIC) Insensitive Munitions Award Citing “...the most significant advance in Insensitive Munitions (IM) technology in the NIMIC nations over the past two years.” The award, named this year for Susan DeMay
JASSM Topics

• Program Overview

• JASSM Capability Of Today

• JASSM Capability Of The Future
  – JASSM Extended Range (JASSM ER)
  – Electronic Safe and Arm (ESAF)
  – Weapons Data Link (WDL)
  – Maritime Interdiction
What is JASSM-ER?

This Is A JASSM

• Block 2 upgrade to JASSM

• PROGRAM GOALS
  – Provide same capability as JASSM with >500 nm range
  – Begin production with JASSM Lot 6 (Jan 07)

This Is A JASSM-ER

RESULTING PHILOSOPHY

– SAME warhead, fuze, interfaces, outer mold line, coatings, mission planning architecture and model, etc. as JASSM

– Only changes are related to new engine, add’l fuel volume

JASSM-ER Will More Than Double JASSM Range
JASSM-ER Development Milestones

Design, qualification, and flight testing of JASSM-ER configuration in time to support Lot 6 insertion
Objective / Description

- Electronic In-Line Fuze – No movable parts
- Performance requirements same as FMU-156/B
- Compatible with Mk94/BLU-109 fuze well
- Vented externally to support IM compatibility

Product Upgrade Verification
ESAF Development Milestones

Design, qualification, and flight testing of ESAF in time to support Lot 5 insertion
JASSM Weapons Data Link (WDL)

• Modify JASSM’s baseline one way data link into 2 way transreceiver

• Enables retargeting enroute

• Goal is to incorporate into JASSM ER by Lot 8
JASSM Maritime Interdiction (MI)

- JASSM provides warfighter near-term opportunities to enhance MI capability
  - Tailored flight profile and seeker algorithms - can be inserted into inventory missiles
- Added synergy with data link
- ASuW studies completed FY04 through USN funded task
- Supporting continued studies and concept refinement with ACC

JASSM Is Critical Component Of A System-Of-Systems MI Solution
Summary

• JASSM is in the field and available for warfighter today
  – Multiple aircraft can shoot against high value, highly defended targets with unmatched effectiveness
  – Upgrades underway to increase already impressive baseline capabilities for JASSM of tomorrow
  – By Lot 8, will have 500 nm and range with retargeting inflight
Precision Strike Association
Annual Programs Review

“Interdependency Across the Services”

RDML Tim Heely
Program Executive Officer
Strike Weapons and Unmanned Aviation
19 April 2005
Weapons Roadmap

- **INVESTMENT STRATEGY to leverage:**
  - Fiscal Cooperation
  - Joint Development
  - Joint Employment
  - Capabilities-based investments; vice platform-centric

- **Capabilities-based acquisition planning**
  - From TARGETS back to platforms/Weapons
  - Capability Across the entire KILL CHAIN (F2T2EA)
Navy/Marine Corps weapons compatible with other services

- JSOW – USAF
- JDAM – USAF
- LGBs – USAF
- HARM – USAF
- Hellfire – ARMY & USAF
- 2.75 inch Rockets – ARMY & USAF
- Maverick – USAF
- 20MM Gun Systems – USAF
Cooperation for Tomorrow

- **APKWS**
  - Advanced Precision Kill Weapon System
  - Army
  - Interoperability with Coalition Forces
  - Off-Board Interoperability with National Assets

- **HARM**
  - High Speed Anti-Radiation Missile (AGM-88 B/C)
    - AGM-88 C: United Arab Emirates
    - AGM-88 B: Germany, Italy, Greece, Turkey, Spain, South Korea

- **AARGM**
  - Advanced Anti-Radiation Guided Missile (AGM-88 E)
  - Italy

- **JHSW**
  - Joint High Speed Weapon
  - Potential Program to fill Capabilities Gaps
  - In Joint Capabilities Integration & Development Process
“OSD identifies 50 goals for unmanned aviation in this Roadmap that support the Department’s larger goals of fielding transformational capabilities, establishing joint standards, and controlling costs.”

6.4.6 Standards Goals: Develop standards to maximize interoperability within each class of UAV and to maintain an appropriate degree of interoperability between classes of UAVs.

“To achieve UAV interoperability, standardization is required in the regimes of situational awareness, control, tasking, collection, processing and dissemination.”

“Interoperability among UAV systems is critical in order to reduce acquisition costs, share sensor data among disparate users, ....”
Moving Forward

- INTEROPERABILITY changes...
  - The way we fight
  - The way we approach the fight

- Sea Power 21
  - Critical Component of Joint Interdependence

- Integrated Networked force
  - Joint Services
  - Multi-national partners
  - Commercial assets

**CAPABILITIES-BASED approach; seeking solutions "BORN JOINT"**
Precision Strike Association

Annual Programs Review

20 April 2005

LtGen Michael A. Hough
Deputy Commandant for Aviation
Precision Strike: Improving the Kill Chain

**Precision Strike:** Kill Chain

FIND | FIX | TARGET | TRACK

Key enabler: *Command & Control*

- Situational Awareness
- Precision Targeting
- Standoff
- Response Time
- Precision Lethality

**Precision:** A Warhead on a Forehead
Precision Strike: Improving the Kill Chain

Yesterday: Where we were
Today: Where we are
Tomorrow: Where we need to go
Yesterday: Where we were

- Slow & limited intelligence & SA
- Limited precision
- Limited standoff
- Very slow response time

- Dumb bombs
- Dumb aircraft
- Inaccurate coordinates
- Operator skill & luck

Quantity versus Quality
Today: Where we are

- Intel & SA vastly improved
- Precision effects desired / required
- Major improvement in LETHALITY
  - Precise & Precision weapons
    - J DAM, Laser guided weapons
    - Precision aircraft
    - Precision coordinate generation – in work
- Response time decreased

Enhanced success on non-moving targets
Today: Where we are

**KILL CHAIN IMPROVEMENTS**

- **Digital Communications / Targeting Systems**
  - Accuracy, speed, coordinate pedigree
  - TLDHS *(Target Location Designation Handoff Sys)* → *Near-instant data transmission & processing*

- 3rd generation FLIR
- Real-time video downlinks
- UAVs
  - Real-time situational awareness
  - FACs: greater engagement range
  - Armed UAVs shorten kill chain

Significant progress – more needed
**Target Location Designation and Handoff System**

**TLDHS**

- USMC Today: Ground user to GPS weapons with NO human input
- Precision coordinate generation at the tactical level

Digital Map & BFSA Overlays

Precise targeting interface
Sensor downlink from aircraft – “Rover”

- Developed by USMC for Offensive Air Support
- Provides video from aircraft/ UAV sensor to ground user
- Pilot understands FAC – FAC understands pilot:

**SHARED SITUATIONAL AWARENESS**

Real-time Collaboration shortens kill chain
Today:

**NIGHTIME CAS AT 20 MILES AWAY**

- **Litening AT**
  - AV-8B
  - Expeditionary F/A-18
- **Shared Situational Awareness**
- **Night operations**

**RESULTS…**
- Near-precision effects
- Sortie efficiency!
Weapon TLE is NOT the limiting factor
We use precision weapons in an imprecise way
Coordinate Generation is KEY
  - Quality
  - Timing
  - Digital Transmission / Error avoidance
  - Employment
  - Processing time & effort
UAVs in the Kill Chain

Efficiency

- Sorties
- Risk: aircrew vs. machines
- Capability: persistence/duration
- Survivability
- Cost: AV-8B = $7K/hr, Tac UAV = $300/hr

IR pointer on Pioneer

We need a 3rd tier tactical UAV: Eagle Eye

Must be fully plugged into C2 Net

>>> Seamless Integration

>>> Operate within Kill Chain
Today: Where we are

What is our best PS weapon today?

- Real-time Targeting
- Target Discrimination
- Moving Targets
- Intelligent Response

Accuracy: ±1 INCH

Today’s model for precision strike
Today: Where we are

Today's model for precision strike

- Real-time Targeting
- Target Discrimination
- Moving Targets
- Intelligent Response

Accuracy: \( \pm 1 \text{ INCH} \)
Command & Control – SA & Intel

Sea Shield & FORCENet

Networked Architecture

Interoperability

Better Situational Awareness

- An “Internet-style” architecture for all players?
- All users, platforms, weapons linked – total visibility

Drive down Response Time

Compress the kill chain
Urban ops require increased precision

**Marine on the ground needs...**

- Sophisticated system to acquire precision coordinates
  - Image processing
  - Mensuration
- Microburst precision data to platform & operators
- Platform data transmitted back to man on the ground
  - Coordinates refined & transmitted

**USMC will field soon with TLDHS**
Marine on the ground needs...

- Sophisticated system to acquire precision coordinates
  - Image processing
  - Mensuration

- Microburst precision data to platform & operators

- Platform data transmitted back to man on the ground
  - Coordinates refined & transmitted

Instant weapon programming
- Air-launched bomb
- Missile
- Smart artillery/naval round

It should all happen in an INSTANT!

Simple user interfaces

No voice comm

USMC will field soon with TLDHS

Tomorrow: Kill Chain
Tomorrow

Moving/Mobile Targets
- Long range weapons – targets move
- Terminal guidance updates
- Sensor-fused weapons
- Guidance systems that can discriminate

Today: LGBs, Maverick, Hellfire

Joint Common Missile technology...

NETWORKS
- “Internet” for all players – weapons linked in
- Limiting factor becomes response time, not accuracy

Making the kill chain more effective

Need “tag” for mobile targets
Concerns

- Joint Policy
- Joint Training
- Joint Equipment
- Joint Architecture

This is not easy...

We need your help
Tomorrow

What we do today
Will determines the steps we take tomorrow

FUSION WITHIN THE KILL CHAIN
Advanced Technology

MARINES: Our best platform
How we will make this happen

Leadership
Questions

Marine Corps Vision: 2015

EXPEDITIONARY MANEUVER WARFARE
Precision Fires Rocket and Missile Systems

Guided MLRS

Full Spectrum Precision With Scalable Effects

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Product Manager GMLRS
Precision Fires Rocket & Missile Systems (PFRMS)
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ANY SOLDIER, ANYWHERE, ALL THE TIME
Agenda

- Program Overview
- What GMLRS Brings to the Warfighter
- GMLRS Urgent Need
- Conclusion
# GMLRS Evolution to Precision Strike

## User Requirements

<table>
<thead>
<tr>
<th>Year</th>
<th>Range</th>
<th>Precision / Accuracy</th>
<th>Flexibility</th>
<th>Payload</th>
<th>Maneuver Safety</th>
<th>Targets</th>
<th>Survivability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>32 Km</td>
<td>No Load Detent</td>
<td>Deeper Targets</td>
<td>Dual Purpose Improved Conventional Munition (DPICM)</td>
<td>5% Dud Rate</td>
<td>Soft</td>
<td>–</td>
</tr>
<tr>
<td>1998</td>
<td>45 Km</td>
<td>Inertial Measurement Unit (IMU) / Global Positioning System (GPS) Aided</td>
<td>Deeper Targets</td>
<td>DPICM</td>
<td>4% Dud Rate / &lt; 1% with M101</td>
<td>Soft</td>
<td>Set Back</td>
</tr>
<tr>
<td>2000+</td>
<td>70+ Km</td>
<td>GPS Aided / IMU</td>
<td>Deeper Targets</td>
<td>Unitary with Multi-Option Fuze</td>
<td>4% Dud Rate / &lt; 1% with M101</td>
<td>Soft</td>
<td>Set Back Dwell Time</td>
</tr>
</tbody>
</table>

## Area

**Full Spectrum With Scalable Effects & Range**

*Any Soldier, Anywhere, All The Time*
GMLRS Variants

Spiral Development for Full Spectrum Precision Capability

In Production

GMLRS DPICM

Produce 450 by 30 Sep 06

Unitary Phase I

Develop In FY05-06
Start Production In FY07

Unitary Phase II

STO In FY08-11
Start Development In FY11

GMLRS P3I
GMLRS DPICM / GMLRS Unitary Comparisons

**GMLRS DPICM**
- Fuze: Electronic Safe & Arm Device (ESAD)
- Motor (Non-IM)
- Warhead
- Polyurethane Foam Support
- DPICM (404 M101 Grenades)
- Guidance & Control
- Canards (4)

**GMLRS Unitary**
- Initial Warhead
  - Hardened Case, Non Dispensed with IM Explosive Fill
- Initial Motor
- Point Detonating & Delay & Proximity
- Follow-On Motor
- IM Design

**Common Design Items Between GMLRS DPICM & Unitary**
- Guidance & Control
- Canards
- Motor = Non - IM
- Spinning Tail Fins
- Pod
- Common SW
- Maintainability
- Supportability

**Design Items for Initial**
- Warhead with IM Design
- Multi Mode Fuze: DPICM ESAD Modified to Unitary ESAF with PD, Proximity & Delay Capabilities
- Unique Unitary SW

**Design Items for Follow-On**
- Motor = IM Design
- CAIV Initiatives
- Rocket Pods
- Other Technology Opportunities (OTO)
  - Pit Stop

**POTENTIAL GMLRS Unitary Spiral Design Improvements For Future Increments and / or Blocks**

Any Soldier, Anywhere, All The Time
GMLRS DPICM is the Foundation of Future Precision (Unitary) and Smart Munitions

- Increased Range, Accuracy, and Effectiveness
- Decreased Logistics Throughput Per Target (Average 6 to 1 Advantage in the Number of Rockets Over M26)
- Basis for Transition to Precision / Smart Rocket Munitions
- HIMARS + GMLRS: Key Systems in Fires Brigade
- Mitigates the M26 Shelf Life Issue
- Reduction of Unexploded Ordnance (UXO)

Provides Spiral Development Improvements that Support Fires Unit of Action Munitions Capabilities (ATR, Loiter, BDA, Intel . . .)
## Assumptions:

All Rounds Fired at Their Max Range, 30% Expected Fractional Damage, 50m Target Location Error, Against a Given Target

### MUNITION | ROCKETS | COMMITMENT
--- | --- | ---
M26 (32km) | 75 rockets | 6 launchers – 19 min, 1 M270A1 Reload = 1 Battery
M26A2 (45km) | 122 rockets | 6 launchers – 19 min, 5 M270A1 Reloads = 1 Battery
M30 (70+km) GMLRS | 15 rockets | 2 launchers – 2 min, No M270A1 Reloads = 1 Platoon (-)
M30 (70+km) GMLRS | 15 rockets | 3 launchers – 2 min, No HIMARS Reloads = 1 Platoon

**GMLRS Allows the Other Launchers Within the Battery to Service Several Targets Simultaneously**
Decreased Logistics Throughput

Basic Rocket

Guided Unitary

36 Rounds

6 or less Rounds

Effectiveness Comparison

Infrastructures

Guided Unitary Target Elements

Bunkers

Personnel / Materials

Multiplicative Effect of Reducing the Logistics Throughput = Decreased Fuel, Transports, Transporters, Maintainers, Medics, Cooks, Etc.
Bottom Line

- GMLRS is a Vast Improvement Over Our Current Free-Flight Rockets
- Increased Effectiveness with Fewer Rockets
- Allows for More Targets to be Serviced in the Same Time Frame
- Reduces the Hazardous Area for Maneuver Forces
- Provides Planners the Ability to Select Maneuver Routes with Confidence

Significantly Improved Maneuver Safety – 95% Reduction In Duds and a 99.6% Reduction In Hazardous Area
KDI Design

- Critical Failure in M915, Sister Program
- “Late Riser” Issue
- Will Still Conduct PQT Although Results are Questionable
- KDI is Working on Get Well Plan

Bulova Design

- Will Deliver SDFs For Two-Rocket Design Verification Test
- Given a Successful DVT Will Move Immediately to PQT
- Pyro-Technical Design Based on Current M101

Junghans–Giat and ATK

- Strategic Decisions To Withdraw From Consideration
**SDF Path Forward for GMLRS**

<table>
<thead>
<tr>
<th>FY05</th>
<th>FY06</th>
<th>FY07</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LINE QUALIFICATION</strong></td>
<td><strong>PRODUCTION QUALIFICATION FLIGHT TEST</strong></td>
<td><strong>LEADER</strong></td>
</tr>
<tr>
<td>(Inert Fuzes &amp; Inert Grenade Bodies)</td>
<td>0 Rocket Payload - 3,636 Live Fuzes / Inert Grenades</td>
<td>If Affordable and Effective…..</td>
</tr>
<tr>
<td>1,000 for Lone Star Army Ammo Plant</td>
<td>• Incorporate Partial Stockpile - To - Target Sequence and Accelerated Shelf-Life Testing</td>
<td>.....Procure No More Than 1 Million SDFs</td>
</tr>
<tr>
<td>6,000 Inert Fuzes / Inert Grenade Bodies for Lockheed Martin in Camden, Arkansas</td>
<td>• 2 Rockets Each Hot-Long, Hot-Short, Cold-Long, Cold-Short, &amp; 1 Rocket Ambient</td>
<td>Procure No More Than 2.8 Million SDFs From Either Source</td>
</tr>
</tbody>
</table>

**FOLLOWER CANDIDATES**

- JUNGHANS - GIAT ATK, or Bulova Second Source in SDF Production

**DESIGN VERIFICATION TEST**

- Production Verification Test

**FOLLOWER**

- Production Qualification Testing

- Down Select “Second Source”

**Two Qualified SDF Sources by FY05**

- Two Rockets

- Dec 06, Deliver First Rockets with SDFs to the UK

Any Soldier, Anywhere, All The Time
GMLRS Unitary Warhead
Collateral Damage Reduction

Point Target in Restrictive Environment

Target emplaced in hospital parking lot

Engagement with randomly generated impacts at 40km range, TLE = 50m

GMLRS UNITARY CEP$_{90}$

GMLRS DPICM CEP$_{90}$
Approximation of GMLRS Unitary and DPICM Warhead Scalable Effects

GMLRS Unitary Effects Are Concentrated About Point of Detonation and Quickly Taper Off

- GMLRS DPICM Submunition
- GMLRS Unitary Air Burst
- GMLRS Unitary Ground Burst
- GMLRS Unitary Delay

Less Than 200 Meters
Scalable Effects

**DPICM**

**Proximity Fuze**

**Point Detonating Fuze**

**Delay Fuze**

**Military Equipment Shielded by Civilian Buildings**

**Iraqi Bunker**
Scalable Area of Influence

Legend

XM30

Scale

0 km | 100 km | 200 km | 300 km

Any Soldier, Anywhere, All The Time

UNCLASSIFIED
Scalable Response Time

RADAR ➔ Launcher w/Enhanced C2 ➔ Guided Unitary Rocket
Auto processing turned on at Radar
Stay Hot Shoot Fast

Optimal Timeline Achieved!

Effects Timelines Reduced to Less Than 2 Minutes
GMLRS Unitary Urgent Need

UMR Facts

• Begin Deliveries of Accelerated GMLRS Unitary Rockets As Soon As Possible, but NLT Jun 05
• Expedite Deliveries to CENTCOM Theater
• Field 75% of a Battery Basic Load (486 Rockets)
• Field A Dual Mode Fuze Capability (Point Detonate and Delay)
• Priority is M270A1 First and HIMARS Second - Both By Jun 05
• Qualify the Rocket as Safe and Suitable - AEC Assessment will Include Effectiveness
• Achieve a Limited Safety Release
• Obtain Urgent Material Release
• Upgrade Additional Launchers to a GMLRS Capability
• Spiral GMLRS Unitary Initial Capability to Full ORD Requirements

Path Forward

• Urgent Need Statement (UNS)
  - “This is What I Want” (LTG Metz, 12 Oct 04)
• Validated Urgent Need Statement (UNS) by G-3/5/7
  - “We Agree You Need It” (LTG Lovelace, 06 Jan 05)
• IM Waiver Request
  - “JCB Recommends Waiver Approval and Paper JROC”
• Safety Assessment (AMCOM)
  - “It Will Work with Manageable Risk”
• Acceptance of Conditions by Gaining Command
  - “We will Take It” (LTG Metz)
• Urgent Material Release Approval
  - “Send It” (MG Pillsbury)
## GMLRS Unitary Schedule

### GMLRS (DPICM)
- GMLRS Production Contracts

### GMLRS Unitary
- **UMR Configuration**
  - Point Detonate & Delay Fuze Capabilities
  - (Safe and Suitable)
- **Initial Configuration**
  - Phase I (HE)
  - Point Detonate, Delay, Air Burst Fuze Capabilities
- **Follow-On**
  - Phase II: “Initial” Plus IM, Trajectory Shaping, Cargo Studies & New Pod
  - (ORD Requirements)

### Risk Reduction Activities
- LRIP I
- LRIP II
- LRIP III
- SDD KA
- IPR/CDR (IC)
- CDR (FO)
- MS C (FO)
- LRIP (FO)
- LRIP (UNS)
- IOC (UNS)
- IOC
- PVT (FO)
- PVT (UNS)
- FRP
- FRP I
- FRP II
- FRP III

### spiral Development
- GMLRS Unitary SDD
  - EDT 1 (IC)
    - M270A1 / HIMARS
  - EDT 2 (FO)
    - HIMARS & M270A1
  - PQT 1 (IC)
  - PQT 2 (FO)
  - Limited Production from LRIP II to satisfy UNS
  - Other Technology Opportunities (OTO)
    - Pit Stop
    - Modular Pod
  - LRIP (FO)
  - Other Technology (OTO)
Conclusions

• GMLRS is a Significant Capability Available Today

• Together with HIMARS Creates Unprecedented Capabilities at an Affordable Cost

• Is Needed by the Warfighter TODAY!

Bottom Line: GMLRS Provides Unprecedented Full Spectrum and Scalable Effects
Back-Up

DPICM

UNITARY
## GMLRS DPICM Schedule

### Contract Award, Event, and Deliveries

<table>
<thead>
<tr>
<th>GMLRS DPICM Rocket</th>
<th>FY03</th>
<th>FY04</th>
<th>FY05</th>
<th>FY06</th>
<th>FY07</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SDD KA</strong></td>
<td><strong>MS C</strong></td>
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<tr>
<td>Fac IPR</td>
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<tr>
<td>Tooling KA</td>
<td></td>
<td></td>
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<tr>
<td>LRIP 1 Award (108)</td>
<td></td>
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<tr>
<td>LRIP 2 Award (786)</td>
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<tr>
<td>LRIP 1 Deliveries</td>
<td></td>
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<tr>
<td>LRIP 2 Deliveries</td>
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<tr>
<td>LRIP 3 Deliveries</td>
<td></td>
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<tr>
<td>FRP Deliveries</td>
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</tbody>
</table>

### GMLRS Test Events

<table>
<thead>
<tr>
<th>Event</th>
<th>Phase 1</th>
<th>Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flt Test</td>
<td>M270A1 SIT</td>
<td>HIMARS DTLE</td>
</tr>
<tr>
<td>Ground Test</td>
<td>HIMARS SIT &amp; SDF Fly-Off</td>
<td>CRTTC Testing</td>
</tr>
<tr>
<td>Nuclear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step Stress Drop Test</td>
<td>Technical Pubs &amp; V&amp;V</td>
<td></td>
</tr>
<tr>
<td>Rail Impact</td>
<td>MCTD and MCTD Trainer P&amp;V</td>
<td></td>
</tr>
<tr>
<td>Software FQT</td>
<td>Log / M Demo</td>
<td></td>
</tr>
</tbody>
</table>

**As of Jan 05**

- **Major Milestones**
  - EDT Event
  - Payload DCA
  - IM Grenade
  - PQT Event
  - PVT / FPVT Event
  - OT Event

**Trade Studies, Testing**

- Tooling, Analysis, Design

---

**Any Soldier, Anywhere, All The Time**

UNCLASSIFIED
GMLRS DPICM

System Description

• Integrated Guidance & Control (G&C) Package
• Achieves Greater Range & Precision Accuracy
• Improved Accuracy Reduces the Number of Rockets Required to Defeat Targets
• 5 Nation Cooperative Development Program

Accomplishments Last Six Months/Status

• Log and Maintainability Demo
• Successful Operational Test (OT)
  - Ground Phase Conducted 20 Sep-1 Oct
  - Flight Phase Conducted 13 Oct-3 Nov
• LRIP III Contract Awarded 31 Jan 05
• On track for FRP Decision

Key Performance Parameters (KPPs)

• Range: 60 km (max) / 15 km (min)
• Effectiveness: 30% Expected Fractional Damage
• Rocket Reliability: Threshold: 92%; Objective: 95%
• Safety and Health: <2% Hazardous Dud Rate (<4% Less than 20 & Greater than 60 km)

Next Six Months

• Stockpile-to-Target Sequence (4 x HIMARS)
• PVT-2/PQT of KDI SDF, 25 Mar 05
• FRP IPR, Jun 05
• Multi-Year Procurement Decision Package
# GMLRS Unitary

## System Description

- Provides Complimentary Capability to DPICM (where use of submunitions are not effective or desirable)
- Single 200 lb High Explosive Warhead
- Effective Against Critical Area & Point Targets Located in Restrictive Terrain

## Key Performance Parameters (KPPs)

- Min / Max Range: 15 / 60 km
- Effectiveness: Functional Kill with Point Detonating & Delay Fuzes
- Effectiveness: 30% EFD with Proximity Fuze
- Rocket Reliability: Threshold: 92% Objective: 95%

## Accomplishments Last 6 Months / Status

- EDT-1, 1a & 2 Flight Test in PD Mode
- GMLRS Unitary HE Warhead Arena Tests
- Converted to 3 - Inch Standard Fuze Design
- EDT-4 and 8 in Delay Mode
- EDT-7 in Proximity Mode

## Next Six Months

- Field Contingency Quantity of Rocket to OIF / OEF
- EDT Ground Tests
- Complete EDT Flight Tests
- LIT/SIT With HIMARS & M270A1
- Start Production Qualification Testing
Target Sets
Guided Rocket Family of Munitions

Target Categories
1. Personnel
2. Materiel
3. Structures

Payloads
1. DPICM
2. Unitary
3. Smart

Venn diagram intended to describe target set. Size does not indicate target density.
GMLRS Provides Significant Capability

The Complementary Nature of GMLRS with Unitary and DPICM Warheads Make GMLRS a Formidable Weapon in All Future Contingency Operations

Demonstrated Accuracy - Demonstrated Lethality
GMLRS Unitary
Operational Effectiveness Example

GMLRS is more effective than Unguided Rockets against all targets

Basic Rocket 36 Rounds => 1 Target
Guided Unitary 36 Rounds => 6 or more Targets

30% Damage Level

Effectiveness Comparison

GMLRS Unitary Target Elements

Infrastructures

Bunkers

Personnel / Materials

Any Soldier, Anywhere, All The Time
IM Waiver & Compliance Summary

System Description

- GMLRS Rockets have an Integrated Guidance and Control (G&C) Package & are Used by M270A1 & HIMARS Launch Platforms
- GMLRS Rockets Achieve Greater Range & Precision Accuracy
- GMLRS Rockets Reduce UXO
- Replaces Current Inventory of Aging M26 Basic Unguided Rockets
- Two Variants-GMLRS DPICM & GMLRS Unitary

Waiver Request

- GMLRS DPICM & the Unitary Urgent Need (UNS from MNC-I) Quantities are not IM Compliant
- GMLRS DPICM will have IM Motor Improvement Production Cut-in FY07; RDT&E Effort in Place for Warhead Improvement
- GMLRS Unitary SDD Includes System Level IM Compliant Design; UNS Precludes IM Motor Availability & Warhead is Initial IM Design
- Request Waiver for Limited Production Army & USMC GMLRS Rockets Through FY06 (~4,662 of Total 100,000-140,042 or <5 % of Total Quantity)

Correction of Deficiencies

- Replacement of Non-Compliant Explosive M101 Grenade Fill with Compliant Fill for GMLRS DPICM
- IM Motor Being Developed under GMLRS Unitary SDD to be Cut Into GMLRS DPICM Production After Qualification
- Trade Studies of Alternate Launch Pod Container Materials for Improved IM Response with Follow-on Redesign Activity...Accelerated
- Payload Dispensing Core Assembly IM Characterization Test to Determine Vulnerability to IM Stimuli; Trade Studies and Potential Redesign Effort to Follow...Accelerated
- GMLRS Unitary SDD Contains Requirement for System Level Compliance
Viper Strike
Fielded and Ready!

Precision Strike
Annual Programs Review
Arlington, VA

19-20 April 2005

LTC John Oxford
PM Submunitions
Viper Strike
Major Components

- 48lb Precision Munition
  - Semi-Active Laser Seeker
  - Near Zero CEP
  - Small size/weight warhead
  - Nearly impossible to countermeasure
- Munition, Airframe, & Seeker being produced or recently in production
- Successful Validated Demos
  - Mar ’03 – 6 of 7 engagements
  - Jul ’03 – 9 of 9 engagements
- Quick Reaction Capability fielded to MNC-I
Viper Strike Lineage

ATACMS Delivered Base BATs

Eagle Eyes Multi-Mode Seeker Proof of Principle

Viper Strike SAL Seeker Proof of Principle Demos I & II

Hunter - Base BAT Demo

Viper Strike Quick Reaction Capability Fielded

Convert Block II Base BAT to Viper Strike

AC-130-Viper Strike ACTD

New Production Viper Strike Munition Requirements

AC-130 - Viper Strike Operational Use

Hunter-Viper Strike CSTF & CRAM Capability

Hunter - Viper Strike C/RAMS Operational Use

Predator - Viper Strike Operational Use

Eagle Eyes Multi-Mode Seeker Proof of Principle

Operational Capability

Proof of Principle
Quick Reaction Capability

Operational Needs Statement:
- Provide Training, Crew Certification, and Tactical Viper Strike Munitions to MNC-I in support of Operation Iraqi Freedom
- 2 Army Hunter Viper Strike Equipped UAVs
- 8 Training/Crew Certification Munitions
- 25 Tactical Viper Strike Munitions
- 2 Contractor Logistical Support Munition Handlers

$3.6M FY05 Supplemental funds provides 45 additional Viper Strike Munitions to OIF for CSTF/CRAM Efforts
Current Capabilities

- **“Golden Shots”**
  - Pinpoint a moving armored car in a motorcade

- **Restricted (Minimal Collateral Damage) Urban Targets**
  - Reach down into cordoned urban canyons
  - Near vertical angle of attack projects warhead shrapnel into the target and ground minimizing collateral damage

- **Convoy & TOC ISR & Security**
  - At 10k’ AGL, UAVs relatively unseen, unheard, and undetectable
  - Allows observation of enemy preparations and ambush points

- **Key Infrastructure ISR & Armed Response**
  - Refineries, pipelines, politically sensitive locations, etc.

- **Monitor critical situations with timely response**
  - Undetected observation without ground troops in harm’s way

- **Army asset under Army control**
Future Carriers

Hunter 2 Munitions

Fire Scout 4-6 Munitions

Many Munitions on the AC-130

MQ-1 Predator 4-6 Munitions, MQ-9 Predator B 12-24 Munitions

7 Armed Carriers, 14-28 Munitions, in the UEx, Fires Brigade, UAV Company

Other Carriers
Future Capabilities

Future Capabilities include:

- 6km sniper for "Golden Shots"
- Reach into cordoned urban canyons
- Precise room attack; minimal collateral damage
- Pinpoint & confine damage to a single moving armored vehicle in motorcade

Designators:

- Self Designator
- Buddy Designator
- Standoff Carrier

Ground Designators

6km sniper for "Golden Shots"
Several Concurrent Efforts . . .

Requirements, TTPs, and CONOPS
Operational Missions in theater
Various user demonstrations being planned
Follow-on munition production and sustainment issues
Viper Strike’s Greatest Hits
July 2003
“US Army Precision Fires”

BG(P) Jeff Sorenson
AGENDA

- Precision Fires – Why and Why Not?
- Misconceptions
- Target Acquisition
- Equipment Programs
- Key Planning Studies Underway
- Challenges
- Road Ahead
PRECISION MUNITIONS -- WHY?

- All-weather, terrain, and operational environment engagement capability that reduces operational risk by providing immediate responsive fires and scalable effects

- Minimize collateral damage, especially in urban settings; allows for discriminating use of force

- Reduce number of rounds needed to defeat targets at all ranges (same CEP at any range)

- Reduce logistics footprint and force burden

- Essential to fulfill objectives of Transformation and Joint opns

- Compliment -- *not replace* – unguided or ‘dumb’ munitions
• Not every target needs to be destroyed – suppression, masking, or harassing fire is often needed to shape the battle

• Unaffordable – if chasing too many programs with limited resources

• Insufficient numbers – if they become the weapon of choice

• Dependent on sensor system data, rapidly passed networked information, especially when addressing fleeting targets

• PGM technology is developing ahead of doctrine and infrastructure – modernizing weapons without modernizing doctrine may lead to ineffective use of PGMs
MISCONCEPTIONS

• A replacement for unguided munitions – but “dumb” is still good

• A leap-ahead advantage – but temporary since eventually precision will proliferate and put our own forces at risk

• Leads to quick victory – but the enemy does not always behave the way we think we would

• Technology Will Save Us…
  -- PGMs are not a replacement for sound tactics or strategy (do not confuse the ways and means of war with its end)
  -- PGMs as the ‘silver bullet’ – but weapons break; human error; enemy countermeasures; not a replacement for doctrine, tactics, or the human element (leadership; will to win; luck)
Circular Error Probable (CEP) - the radius of a circle within which 50% of the projectiles fired will impact.
JOINT FIRES CAPABILITIES

Long Range Precision Strike

Shaping Fires

Destructive Fires at Depth

Fires to Isolate

Fires to Protect

Close Support Fires

Variety of:
- Targets
- Dwell Times
- Effects

Responsiveness for Close Fight

Range

- >300km
- 300km
- 150-180km
- 100km (LAM)
- 70km
- 40-50km (PAM)
- 30-40km
- 7-12km

Air Interdiction

TLAM

ATACMS

Air Gunfire

UCAV

Naval Gunfire

Attack AVN

GMLRS

FCS Cannon W/Excalibur

PAM/LAM

Close Air Support

FCS Mortar

FCS
FIELDED PRODUCTION SYSTEMS:

TOW 2B
JAVELIN
HELLFIRE variants -- SAL (K, M, or N) and LONGBOW (L)
ATACMS Block IV – Quick Reaction Unitary (QRU)

SYSTEMS IN DEVELOPMENT OR S&T:

PEO AMMO:  
 Excalibur  LOSAT  Viper Strike
 PGMM  CKEM  NLOS LS -- PAM
 MRM  APKWS  NLOS LS -- LAM
 CCF  JCM  MTHEL
 GMLRS

PEO MISSILES and SPACE:


Air Armament Center (AAC)

ARMAMENT FOR THE BATTLEFIELD

Judy A. Stokley
Deputy for Acquisition
Air Armament Center (AAC)

• Provides Weapons And Combat Support Systems To AF, Navy, Army, And More Than 30 Countries

• Strategic Advantage: Laboratory, Acquisition Offices, Developmental And Operational Test Organizations Are Co-located At The AAC

AFMC/ AAC Mission

Deliver War-winning Technology, Acquisition Support, Sustainment, And Expeditionary Capabilities To The Warfighter
Air-to-Ground Munitions Systems Wing (AGMSW)

Joint Direct Attack Munition (JDAM)

Sensor Fuzed Weapon (SFW)

Joint Air Surface Standoff Missile (JASSM)

Small Diameter Bomb (SDB)
Air-to-Air Missile System Wing (AAMSW)

- Advanced Medium-Range, Air-to-Air Missile (AMRAAM)
- QF-4 Full Scale Target
- Sidewinder AIM –9X
- Air Force Sub-Scale Aerial Target (AFSAT)
- Harm Targeting System (HTS)
- Miniature Air Launched Decoy (MALD)
Air Combat Support Systems Group (ACSSG)

- All Purpose Remote Transport System (ARTS)
- Universal Munitions Trailer (UMT)
- Large Shelter System (LSS)
- Munitions Assembly Conveyor (MAC)
JDAM For OEF And OIF
The Future?

• Prior to 11 Sept 01 Attacks
  – 700 Units Per Month
  – Aircraft

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<th>MK 84 (2000 lb)</th>
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<td>F-16 Blk 50</td>
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• Today
  – 2800 Units Per Month
  – More Aircraft Integrations - Smaller Bombs

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* Quick Reaction Capability

Precision + Low Collateral Damage + Platform Flexibility in Months Vice Years
Preparing For The Future

• Small Diameter Bomb
  – Field More Precise, 250 lb Bomb In FY06

• Universal Armament Interface
  – Develop Plug-and-Play Aircraft/Weapon Interfaces

• Net-Ready Weapons
  – Establish Interface Standard For Weapon Data Links
    • ACTD FOR SDB, JASSM, JSOW-C, MALD-J

• Directed Energy Application – Are We Ready?
  – 8-10 Feb 05 Workshop Focused On Transition

• Armament Symposium – 4-5 Oct 05
  – Focus Areas: CBRNE, CAS, Long Range Strike
Non-Line-of-Sight Launch System

Program Update

19 April 2005

Rod Summers
Director
NLOS-LS Task Force
256-313-1049
rod.summers@msl.army.mil

ANY SOLDIER - ANYWHERE - ALL THE TIME
Briefing Summary

- **Overview Information**
- **Program Restructure**
- **Selected Program Accomplishments**
  - PAM
  - LAM
  - CLU
  - Networking and Communications
- **Supportability Concept**
- **S&T Strategy**
- **Take-Aways**

**BLUF:** NLOS-LS Program On Track Supporting FCS Spiral 1
FCS System-of-Systems

Manned Systems
- Infantry Carrier Vehicle
- Command and Control Vehicle
- Recon and Surveillance Vehicle
- Mounted Combat System
- Non-Line of Sight Cannon
- Non-Line of Sight Mortar
- FCS Recovery and Maintenance Vehicle
- Medical Treatment and Evacuation

Unmanned Air Vehicles
- Class I
- Class II
- Class III
- Class IV

Unmanned Ground Vehicles
- ARV RSTA
- ARV Aslt
- ARV A (L)
- MULE (Transport)
- Small (Manpackable) UGV
- Unattended Ground Sensors
- Unattended Munitions
- Intelligent Munitions Systems
- NLOS LS

Unattended Munitions

Network

NL-0011 NLOS-LS to PSA (Apr 05)
Main FCS Program (PM UA)

- Unattended Ground Sensors
- NLOS-Launch System
- Intelligent Munitions System
- SOSCOE

Modular Brigade Combat Teams
BCT(UA) (43 - 48 AC & 34 RC)
77 - 82 total

Brigade color key
- BCT(UA)
- Evaluation Unit
- BCT not modular
- BCT(UA) w/partial FCS capabilities
- FCS UA (18 +1 Systems)
- Pending FY 06 Decision (option To buy 5 more)

LEGEND
EBCT – Evaluation Brigade Combat Team
SOSCOE – System of Systems
Common Operating Environment
UA – Unit of Action
NLOS – Non-Line of Site

* NLOS-Cannon (Prototype & Block 0) to EBCT ONLY
NL-0011 NLOS-LS to PSA (Apr 05)

FCS SPIRAL STRATEGY

System Development and Demonstration

- EBCT Test and Evaluation Spiral 1
- EBCT Test and Evaluation Spiral 2
- EBCT Test and Evaluation Spiral 3

1st UA Fielding FY 14-16 (18 of 18)
• Provide Responsive, **Networked, Extended-Range Targeting** and **Precision Attack** of Armored, Lightly Armored and Other Stationary and Moving Targets During Day/Night and Near All-Weather Conditions
• Be Highly **Deployable** and **Platform Independent**
Why is NLOS-LS in Spiral 1?

- **Fills Capability Gaps in Brigade Combat Team Forces**
  - Has ability to overcome large TLEs, precisely kill hard and soft targets that are moving or stationary by target designation or autonomous means from stand-off ranges.

- **Operational Flexibility**
  - Offers joint forces tremendous flexibility across a spectrum of conflicts with efficient logistics, ease of transportability, and greatly reduced collateral damage.

- **Maturity of the System**
  - Program has been under contract since 1998 and had numerous successes.

- **Building Block for the UA**
  - Gives current forces a major piece of the FCS lethality capability now.

**NLOS-LS Brings the Future to Today's Joint Forces**
**NLOS-LS Draft**

**Restructured Program Plan**

## FCS SPIRAL 1

<table>
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<tr>
<th>FY05</th>
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<td>Detailed Design</td>
<td>Pilot Line Setup</td>
<td>CLU/CDR Pre-Production</td>
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<td>Flight Tests</td>
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<td>LRIP</td>
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* ASSUMES FY05 REPROGRAMMING REQUEST APPROVED

---

**Spiral 1 Proc Qtys**

- 6
- 12
- 30

**NLOS-LS PROCUREMENT PART OF UA**

---

**Scaled down SDD**

- LAM SDD FUNDING REMOVED

---

**Costs**

- $122.3M*
- $231.6M
- POM POM POM POM POM POM

**Notes**

- * ASSUMES FY05 REPROGRAMMING REQUEST APPROVED
Precision Attack Missile (PAM) Technical Requirements

GPS/INS Navigation System

Data Link
- JTRS Cluster V
- 2-Way – Op in loop
- Software Programmable

Multi-Mode Seeker
- Semi-Active Laser (SAL)
- Un-Cooled Imaging Infra Red (UCIIR)

Automatic Target Acquisition (ATA)

Requirement
- Maximum Range 40 km
- Minimum Range 500m
- Target Set
- Updates in Flight

ORDER Threshold
- 40 km
- 500m
- High Value Targets (Armor)
- Two-Way Comms w/ FCS Network

PAM Provides A 40km Precision Kill Capability Against Hard and Soft Targets Using Laser Guidance or Automatic Target Acquisition
**PAM Accomplishments**

- **Warhead Bunker Test**
  - Armor Entrance Hole
  - Armor Exit Hole
  - Warhead Armor Test
  - Pre IM Frag Test
  - Post IM Frag Test
- **End to End Flight Test Successes**
  - IR Seeker Images from Captive Flight Tests Against Land/Sea Targets
- **Accomplishments**
  - Armor Entrance Hole
  - Armor Exit Hole
  - Pre IM Frag Test
  - Post IM Frag Test
  - End to End Flight Test Successes
  - IR Seeker Images from Captive Flight Tests Against Land/Sea Targets
Loiter Attack Missile (LAM) Technical Requirements

Data Link
- JTRS Cluster V
- 2-Way – Op in loop
- Software Programmable

Jet Engine
- Low Cost Turbojet

Requirement

- Maximum Range (INF Treaty)
- Minimum Range
- Typical Range with Loiter (km)
- Target Set
- Updates in Flight

ORD Threshold

- < 480 km
- 500m
- 70km w/ 30 min loiter
- High Value Targets (TEL/MRL)
- Two-Way Comms w/ FCS Network

LAM Provides A Dedicated, Loitering Long Range Recon and Discriminating Point Kill Capability
LAM Accomplishments

- Square Body Wind Tunnel Test
- Hot Engine Wind Tunnel Test
- Engine Static Tests
- Carbon Fiber Wing
- Seeker Section
- Prototype Processor Board
- Captive Flight Test
- LADAR ATR
Loitering Attack Missile (LAM)

What is the Status of LAM?
LAM Funding Removed from SDD Beginning in FY05 Due to Army Affordability Issues and Effort Shifted to Army S&T; Operational Requirement Still Valid

What is the Focus of LAM S&T Efforts?

- Higher Maneuverability
- Efficient Searches
- Fly Through Stalls

- More Beams and Resolution for Greater Coverage
- Lower Cost, Higher Performance Laser by Shift of Components

- Continuous View of Targets
- Wide Field of Regard Cueing
**SDD CLU Baseline Concept**

**Computer and Communications System (CCS):**
- Communications
- Navigation/GPS
- Power
- Man Interface
- I/O to AURs in Base

**Container Launch Unit (CLU):**
- Removable Forklift Structure (RFS)
- Removable Base Assembly (RBA)

**Walls**

**All Up Round (AUR):**
- LAM or PAM
- Transportation
- Storage
- Launch
- I/O in base to CCS
HIMARS Resupply Vehicle Chosen as NLOS-LS Platform for EBCT

Roll Off: Immediate Mission

Roll Off: Have 30 minutes prep time before mission

Helo Transport

Platform Independence
But What is the NLOS-LS Traffic Load?
First, we had to establish a baseline for the NLOS-LS traffic load:

**AMRDEC/Ft. Sill Simulation Experiments**

- TRADOC-Approved:
  - FCS Scenarios
  - Force Structures
  - CONOPS
- ITT and Raytheon NLOS-LS Missile Subnets Explicitly Modeled
- NLOS-LS Mission Planners & Imagery Display Explicitly Played
- LAM & PAM Detailed Flight Models (Speed, Altitude, Turns, etc)
- LADAR and UCIR Seekers Explicitly Modeled
- IDEEAS & FIRESIM XXI Force-on-Force Models

Unit of Action Supported by Unit of Employment Assets

2500 Entities Played
NLOS-LS Captive Carry Communications Test

- 7 SUVs (Surrogate Terminal Phase PAMs)
- 2 SUVs (Surrogate FOs/C2)
- 2 Cessnas (Surrogate Planned Relays)
- 2 Cessnas (Surrogate Planned Relays)
- NLOS - LS Captive Carry
- Communications Test

- 6 Cessnas (Surrogate LAMs)
- 7 SUVs (Surrogate Terminal Phase PAMs)
- 2 Cessnas (Surrogate Planned Relays)

- Xcom (C2)

- 80 km East to West
- 30 km North to South
- Highest Terrain Feature at 2000 ft ASL
**Purpose:**
Develop and Test Communications Networking for NLOS-LS Missiles

**Products:**
- Soldier Radio Waveform (SRW) Modified to Support NLOS-LS Missile Requirements
- Two Form-Factored, Prototype Missile Radios and a Missile Antenna
- Radio and Comms Software

**Results:**
- NLOS-LS Bandwidth Requirements Established and Proven for UA Operation
- Air-Ground Dynamic Network Tested and Proven
- Imagery can be Transferred Over Wireless Network Sufficiently for Operational Use

**Control Node Located at Fayetteville, TN Airport**
- Monitors all Comms Traffic in the 20-node Test
- Performs Analysis of Network Performance

**Test Area (30 x 75 km)**
Extends Up and Over the Cumberland Ridge

**20-Node, Beyond Line-of-Sight Comms Test**
Successful Demonstration for PEO-TM with PM UA Networks, LSI and PEO C3T Participation

**M577**
AFATDS
Cluster 5
Surrogate*

Free Text
Via CLU

Fire Orders
Status
MFR

* Cluster V surrogate = ITT SFF radios used in NLOS-LS Comms STO effort

**SOF/FO**
RPDA
Prototype SW
Cluster 5
Surrogate*

**CLU**
RPDA
Prototype SW
Cluster 5
Surrogate*

Soldier Radio Waveform (Today)

Soldier Radio Waveform (Missiles Comms Demo – Aug 04)
• MBCT/UA’s Logistics Support and O/S Costs Minimized
  – Soldier and Depot Level Maintenance Only
  – Line Replaceable Units (LRUs)
  – Common FCS Rechargeable Battery
  – Standard NATO Slave Connection
  – Limited Tools Required to Replace LRUs

• Fully Integrated Interactive Electronic Technical Manuals (IETM)
  – Embedded RPDA on CLU
  – Enables Training and Maintenance Without Additional TMDE or Manuals

• Predictive Logistics Increases Cdr’s Flexibility
  – Embedded Platform Soldier Readiness System (PSMRS) Software feeds the FCS Network’s Logistics Decision Support System (LDSS)
  – Provide Predictive Prognostics, Diagnostics, and Planning at All Levels of Command
**NLOS-LS S&T Roadmap**

**Capability Upgrades - Spiral Development**

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**NLOS-LS Schedule**

- **Pre-SDD**
  - PDR
  - CDR
  - LRIP

**NLOS-LS PAM/CLU SDD**

- Transition to PAM SDD
- Transition Mature Technology
  - PAM Enhanced Propulsion*
  - PAM Warhead Integration (Development-ARDEC)**

**NLOS-LS Spiral SDD**

- Future System Improvements: Capability Upgrades
  - Increased ATR Processing
  - Aiming Algorithms
  - Extended Ranges/Loiter Time
  - Urban Environment Operations
  - Increased FOV for Seekers
  - NLOS Communications
  - Simulations
  - Bandwidth Utilization
  - Signature Reduction and IM
  - Adverse Weather Performance
  - Reduced TOF
  - ADA Variant
  - IMU Accuracy/Affordability
  - Extended Power

**Threshold+ Capability**

- IOC

**NLOS-LS LRIP/Production**

- Integ Flight Tests

**S&T Efforts for Enhanced LAM Capabilities – Transition to LAM SDD**

- ELAM Trades
- ELAM Airframe: Improved Agility
- ELAM Seeker: Cost Reduction
- Adv. Turbo Fan Propulsion

---

* Proposed Joint Program with Navy
** Proposed Joint STO with ARDEC
“Take-Aways” on NLOS-LS

• **NLOS-LS is on Track for Spiral 1**
  – PAM: Component Level Risks Have Been Addressed
  – CLU: Prototyping has Provided Great Insights into Power and Interoperability Activities

• **LAM Efforts Underway in S&T to Reduce Cost and Enhance Performance**

• **Joint Efforts Continue and Will Expand**
  – Current Navy Funding on NLOS-LS Contract for Putting PAM on Littoral Combat Ships
  – Special Operations Forces have High Interest

• **NLOS-LS Task Force Director Objectives:**
  – Provide PAM Lethality to Current Forces ASAP
  – Get LAM Back on Track to Support Future Forces

**NLOS-LS Brings the Future to Today’s Joint Forces**