Joint SuperSonic Cruise Missile (JSSCM) ACTD Breakfast Club Brief

Capt James Hart N780C/D

Capt Carl Reiber PMA 258

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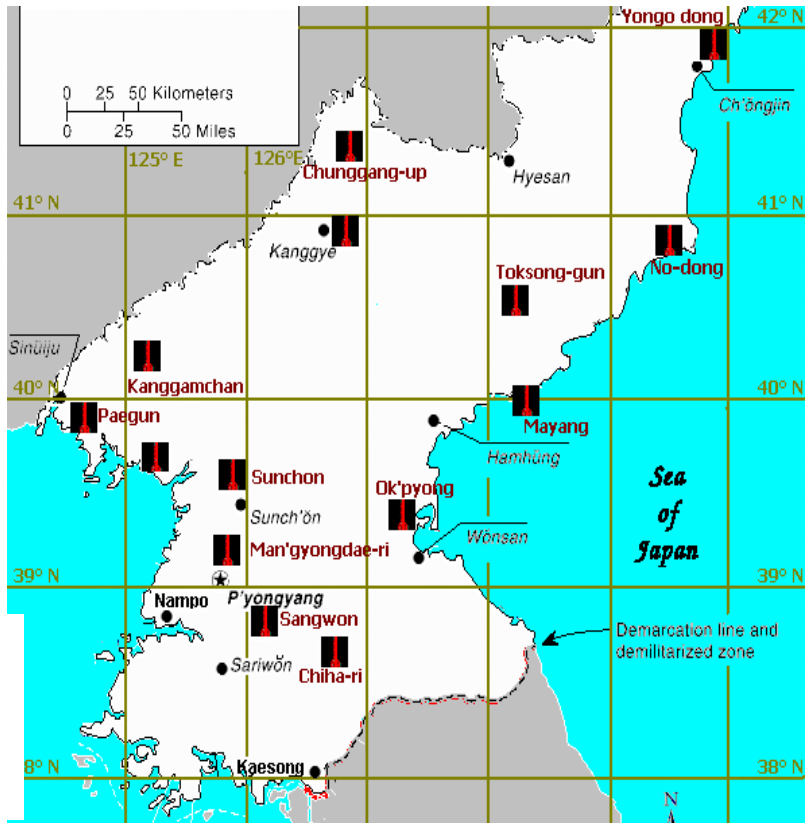
Agenda (U)

- **Mission Need**
  - **N88 Vision Initiated 1998**
  - **ACTD Mission**
- **JSSCM Technology**
- **Proposed JSSCM ACTD**
- **Growth Missions**
- **Summary**

MPEG of N88 High Speed Strike Vision

ACTD Mission Need
USFK HARTS/ CBW Sites

CINC CFC Pacific: "NK 240mm MRL posed a significant Psychological and political Threat to South Korea and the CFC".

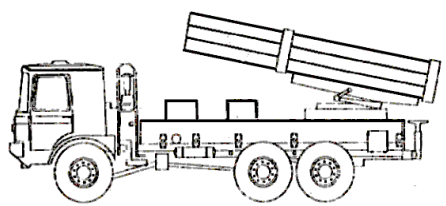


Provided by Federation of American Scientists website

Special Weapons Facilities - 50

Air Bases - 67

C&C - 30



Documents:

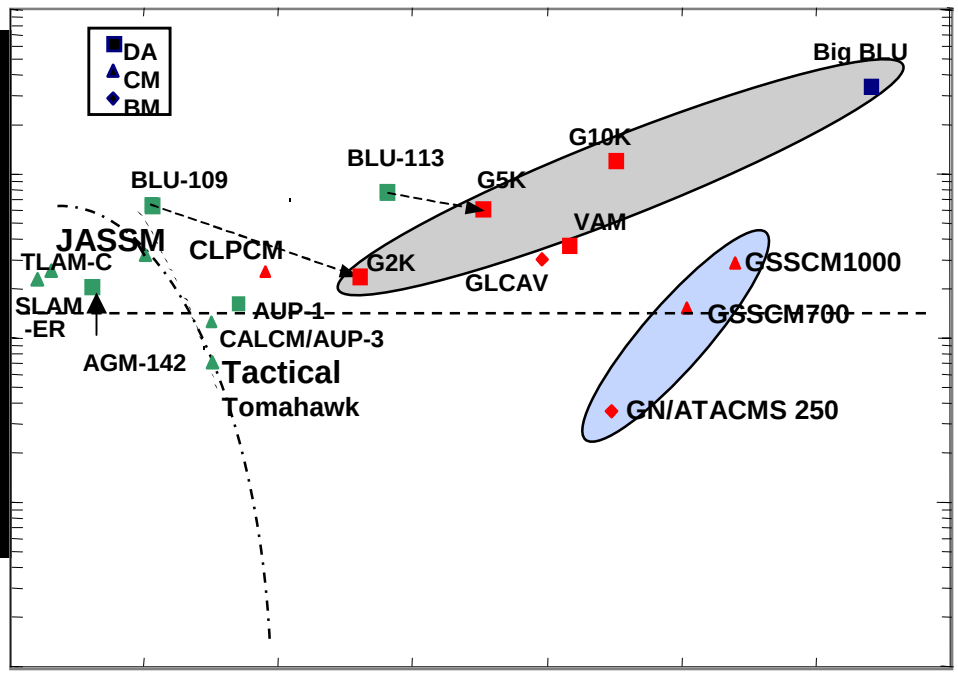
- **MNS 01C011-CS00164-SX-00 Hard and Deeply buried Targets Defeat Capability**
- **CINCPAC FY 01 Integrated Priority List (IPL) Preferred/Precision Munitions, Counterfire**
- **CINCUSNAVEUR FY01 IPL Precision Strike Munitions, All Weather, High Precision, Stationary & Moving Targets**

JSSCM Effectiveness

#1 Standoff Weapon Concept for OSD Hard and Deeply Buried Targets (HDBTDC) AoA

ref: HDBTDC AOA Report and Appendices 30 Sept 2000 01A756-SB00229-SX-00

- Most Lethal Standoff Weapon
- Most Effective and Affordable in Small Scale Contingencies (SSC)
- Wpn of Choice when Attrition could not be managed or Time Urgent



SSC	SUCCESS/COST AVERAG	
CONCEPT	SUCCESS	COST AVERAG
		$K
GSSCM	89%	$ 44,392.80
CLPCM	81%	$ 49,125.78
VAM	70%	$108,636.86
G5K	70%	$107,973.53
G10K	70%	$ 99,437.54
G2K	59%	$ 98,711.80
CAV	58%	$ 28,920.67
BIG BLU	56%	$ 99,737.90
LEGACY SET	50%	$ 95,276.62
GN/ATACMS	11%	$ 6,280.00

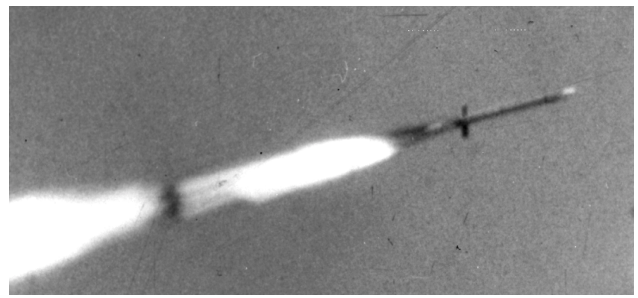
JSSCM ACTD Warfighting Capabilities

- **MOE#1** - Weapon System effective against Urgent Time Critical N Korea Hard Targets (HARTs, WMD, Missiles sites)
- **MOE#2** – Provides sufficient Range from Sea of Japan or Yellow sea:
  - –MOP#1:Threshold >300 nmi, Goal > 400nmi
- **MOE#3** - Minimizes response time.
  - –MOP#2: Threshold < 8min, Goal: 6 minute response time to 300 nm
- **MOE#4** - Accurate delivery of payload to optimize W/H Lethality
  - – MOP#3:CEP 2.7 Meters unjammed: < 3.4 meters jammed
  - –MOP#4: Orientation appropriate with target
- **MOE#5** - Integrated with TLN Fire Contro3 System
- **MOE#6** - VLS launched (initially)
- **MOE#7** - Complies with Start, SALT Treaties
  - –Cruise Missile, VLS or Air Launched

JSSCM System Overview

Legacy

- CROW (Creative Ramjet Ordnance Weapon)
  - Nose Inlet Ramjet with 6 flights in 1962 - 64
  - Small Scale: 8x127 in, 327 lbs
  - Mach 3 @ 50,000 ft > 97 nmi
- RARE surfaced launched in 1970's
- PIP funded by ONR & others during 1983 - 1995
  - Efficient Inlet
  - Short Length to Diameter (L/D) Propulsion
  - COTS Turbopump
  - Universal Autopilot W/ global data link for DGPS, BDA, TM, Real time target updates

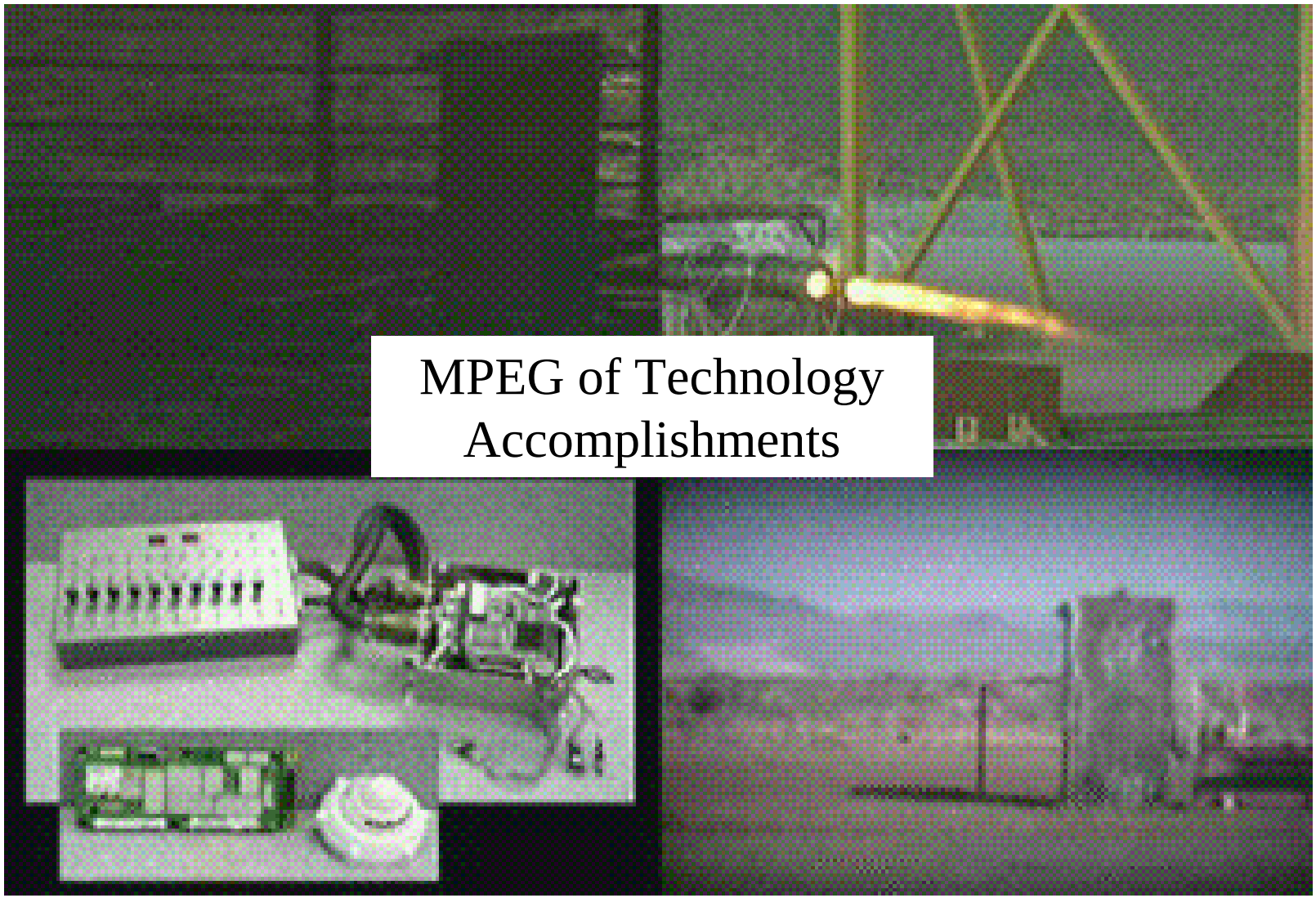


Characteristics

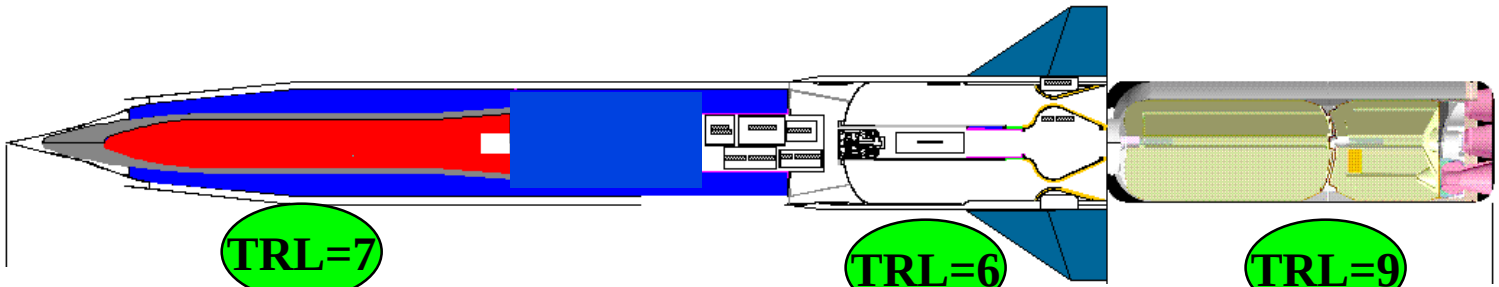
	ACTD	Growth
Cruise Missile		
Velocity	Mach 4.	Mach 6+
Payload	HDBT	Tomahawk WDU-36/Submunitions
Range nmi	300 -400	1200 - 1500
Launcher	VLS	Sub/F15,F18,B52,B2
Diameter (in) 21.2 dia		
Length (in)	233.4	256
Weight (lbs -Air)	2280	
Weight (lbs Surface)	3400	
Cost $K	<400	(unit buy 5000 per Naval Center for Cost Analysis, Validated by USAF CAG)

- **Multi-Service**
- **Multi-Mission**
- **Low Cost**

JSSCM Technology



ACTD
System Components &TRL



TRL=7

TRL=6

TRL=9

Nose Inlet Ramjet Airframe (CROW)

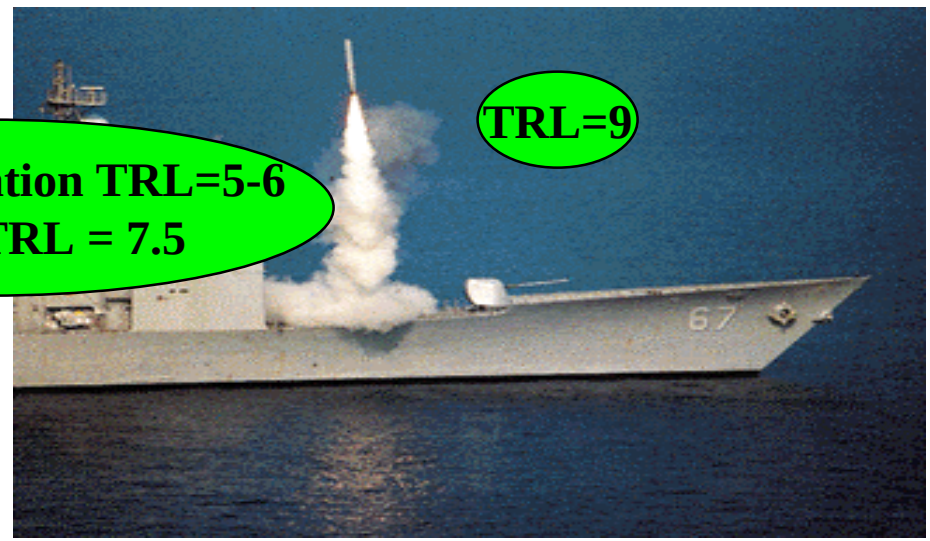
Standard Missile MK72 Booster

JASSM or M4 High energy Penetrator

TRL=9

TRL=5

System Integration TRL=5-6
Average TRL = 7.5



TRL=9

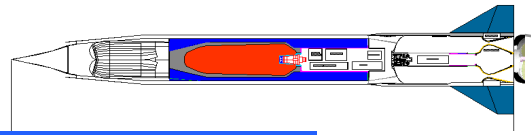
TLN = TTWCS + LAM FC + NFCS Phase I+

TRL=8

TRL=NASA Test Readiness Level

JSSCM Operational Concept

Objective: Close HARTS Tunnels ASAP after start of conflict



5 **Angle of Attack Maneuver**

1 **Start of Conflict**

Boost to ramiet transition 4

2 **Pre-Launch**

- **Pre-Planned Mission**
  - **Known Target GPS Coordinates**
- **Msl Powered up**
- **INS/GPS Initiated <1min**
- **Status Checks**

6 Ramjet throttle back

7 Controlled impact on Target

3 **Launch**

ACTD Participants

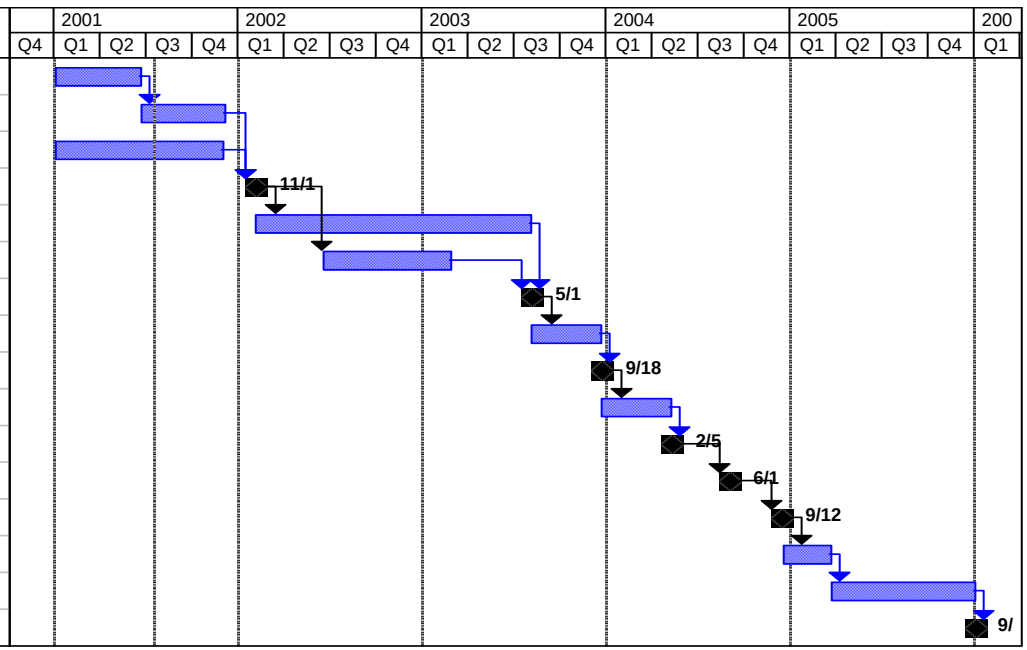
- Lead Service - USN
- User Sponsor-
  - CINCPAC - Mike Reilley
  - Technical Manager S. Lyda NAVAIR
- Operational Manager
  - USFK / LCol. Liberatore
  - 3RD Fleet – ADM Bucchi / Tim Wise
- Transition PEO
  - PEO (W) - RADM Chenevey

•Team Members
- NAWCWD - TDA
- NSWC-PH - VLS Launcher, FCS
- NSWC-DD – TLN
- Wright Patterson AFB – Propulsion Flow Path
- UK-MOD - Ramjet
- Orbital Science Corp - Flight Vehicle Systems
- Lockheed Martin - Systems Integrator
- Chemtronics - Airframe
- M-Dot - FMS
- DTRA - Targets, Lethality ??
- Parallel Efforts
  - •AFRL - Eglin UL/MOD - Penetrating Payload
  - •UK/MOD PMA 258 Air Launched IRRJ

JSSCM ACTD Schedule

- **FY02 ACTD with two phases in 3 years w 4th year LRIP**
  - **Phase 1: Vehicle Integration & demonstration, Payload Sizing, DT w/ Launcher**
    - **Vehicle Testing @ White Sands Missile Range**
    - **Flight Tests w/High Velocity D-GPS / CERPA Guidance, Low CEP capability**
  - **Phase 2: Operational Assessment**
    - **Weapon Lethality against Hard Targets @ White Sands**
    - **Integrate with TLN**
    - **MUA Demonstration from Aegis**
  - **LRIP & Deploy residual assets on Aegis ships**

ID	Task Name	Duration	Start
1	Airframe Risk Reduction Design	121 days	Mon 10/2/00
2	System Analysis Trades	121 days	Tue 3/20/01
3	Contracting	240 days	Mon 10/2/00
4	OSD ACTD Approval/Start	0 days	Thu 11/1/01
5	Vehicle DT&E	391 days	Thu 11/1/01
6	TLN Integration	180 days	Tue 3/19/02
7	VLS-Flight Test Vehicle 1 (PP Flight)	0 days	Thu 5/1/03
8	Avionics Integration	100 days	Fri 5/2/03
9	VLS-FTV 2 (Guided)	0 days	Thu 9/18/03
10	Payload Integration	100 days	Fri 9/19/03
11	VLS-FTV 3 (HT test)	0 days	Thu 2/5/04
12	VLS-FTV 4 (Ship Integration)	0 days	Tue 6/1/04
13	VLS-FTV 5 (Extended Range)	0 days	Sun 9/12/04
14	Military Utility Assessment	70 days	Mon 9/13/04
15	Residual Production	203 days	Mon 12/20/04
16	Final Delivery USFK	0 days	Wed 9/28/05



JSSCM
Military Utility Assessment

DEVELOPMENT | ASSESSMENT | TRANS

FY/02	05/03	02/04	02/04	06/04	09/04	01/05
	WHITE SANDS FLIGHT TEST	WHITE SANDS FLIGHT TEST	WHITE SANDS FLIGHT TEST Hard Target	LAKE EARLE FLIGHT TEST	TBD BARKING SANDS	MUA

TRANSISTION

MU ASSESSMENT

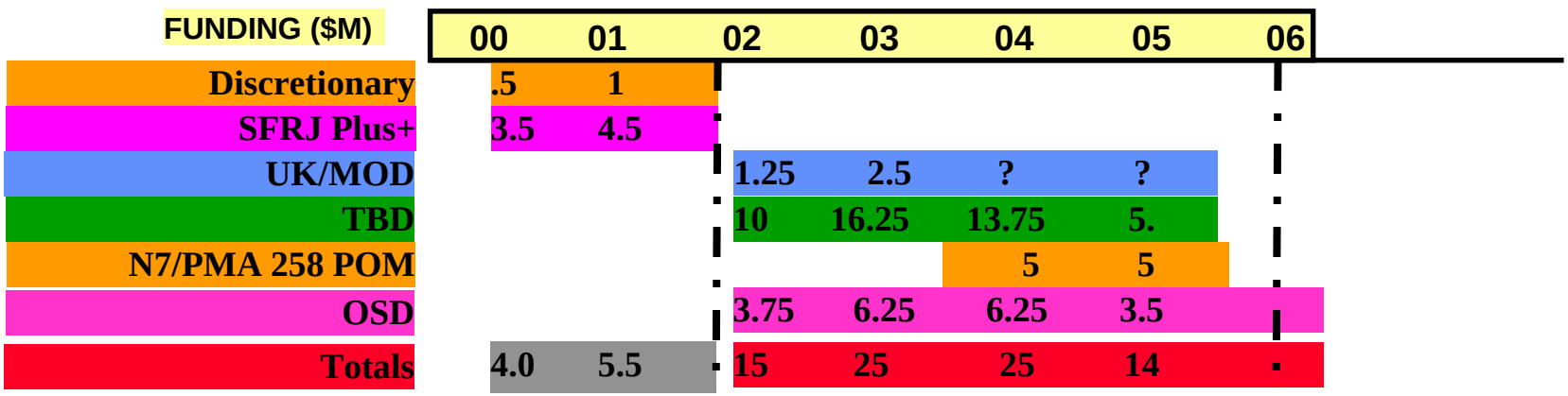
IMPLEMENTATION
"illities" Assessment
Training

CONOPS
Doctrinal / TT&P issues
Assessment Plan Development
ORD Initiation – POM for Transition

JSSCM
ACTD Cost / Funding/Contracting

Cost Item	Cost $M		
	Baseline VLS	Growth Cost	Issue
• JSSCM DT&E	17	- 2	Multiple agencies
• JASSM Warhead Acq&Int	3	0	
• Mk-72 Boosters	11	-4	MK72 Avail.
• Platform Integration	20	-6	TLN Integration
• AUR Tests (7)	15	0	
• Training/ MUA/ ILS/Spares	7	-3	
• AUR Residuals	10 (10)	0	
Total	$79M		

Contracting Approach: Full and open competitive announcement under the authority of 10 USC 2519 "Federal Defense Laboratory Diversification Program to pursue the national security objectives of 10 USC 2501. COMMERCE BUSINESS DAILY 25 JANUARY 2000. SOL N68936-00-R-0034



JSSCM ACTD Team

COMMANDER IN CHIEF, U.S. PACIFIC COMMAND (USCINCPAC)
CAMP H.M. SMITH, HAWAII 968614028

JOGS
3882
24 Jan 01

To:Office of the Under Secretary of Defense 3000 Defense Pentagon,

Washington, DC 20301

Subj: USCINCPAC ACTD PROPOSAL SUBMISSION FOR FY 02

Ref (a) Deputy Under Secretary of Defense (Advanced Systems & Concepts) letter,
Subject: Fiscal Year 2002 Advanced Concept Technology Demonstration (ACTD) Proposals

End: (1) Joint Supersonic Cruise Missile ACTD Proposal
(2) Joint Supersonic Cruise Missile ACTD Quad Chart
(3) Time Critical Counter Targeting ACTD Proposal
(4) Time Critical Counter Targeting ACTD Quad Chart
(5) Overwatch ACTD Proposal
(6) Overwatch ACTO Quad Chart

1. In response to Ref (a) request for submission of FY 02 Advanced Concept Technology Demonstration (ACTD) proposals I am pleased to forward three candidates for consideration. These proposals have been developed with the Army Space and Missile Defense Command and the Naval Air Warfare Center, Weapons Division with substantial input from the USPACOM staff and components. USCINCPAC is prepared to sponsor these candidates should they survive the selection process.

2. We believe that these proposals represent cutting edge technologies ii~~ their respective areas and provide significant technological and operational improvements for Precision Strike and Full Dimension Protection.
   - The Joint Supersonic Cruise Missile ACTD candidate provides a M4+ capability to deliver penetrator and brilliant munitions from ships and aircraft against fixed and mobile targets.
   - The Time Critical Counter Targeting ACTD candidate provides precision counter targeting information to strike aircraft and artillery to engage surface-to-air missile launchers, transporter-erector-launchers, artillery

DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45423

6 April 2001

MEMORANDUM FOR STEPHEN F. LYDA
NAVAL AIR WARFARE CENTER
WEAPONS DIVISION
CODE 4.7.H.G.OODD
CHINA LAKE, CA *93555-6001*

FROM: AFRL/PRA

SUBJECT: Participation in the Proposed Joint Supersonic Cruise Missile ACTD

1. As a result of our discussion on 5 April 2001, the Aerospace Propulsion Office of the AFRL Propulsion Directorate is very interested in participating in the proposed Joint Supersonic Cruise Missile (355CM) Advanced Concept Technology Demonstration (ACTD). We believe that there are several areas where our expertise and knowledge can help bring the proposed effort to fruition:

   a. Airframe and propulsion trade studies and concept assessment.

   b. Ramjet flowpath analysis, including 3D unsteady computational fluid dynamics.

   c. Experimental analysis, including direct-connect high-Mach combustor tests.

2. For the foreseeable future, we are committed to developing scramjet propulsion technologies. In order to participate in the ACTD, we will require additional funding to enable us to focus the relevant personnel on the JSSCM project. We will work with you to determine an appropriate balance of effort versus available funding and will need to formalize our intent via a Memorandum of Understanding.

3. Please continue to work with Glenn Liston (DSN 785-2175) on this matter.

PARKER L. BUCKLEY, Chief
Aerospace Propulsion Office

JSSCM Transition Ltrs

From: Program Executive Officer, Cruise Missiles and Joint Unmanned Aerial Vehicles (PMA-258)

To: Chief of Naval Operations (N8)

Subj: OSD SUPPORT OF GENERIC SUPERSONIC CRUISE MISSILE (GSSCM) DEMONSTRATION PROGRAM

1. PMA 258 strongly supports the concepts and technical capabilities purported by Generic Supersonic Cruise Missile (GSSCM). The GSSCM program would enter the production phase immediately subsequent to the end of the presently proposed production schedule of the SLAM ER, ATACMS, and JASSM. …...

Steve,

Following the review meeting with our DEC(DS), MOD Customer yesterday it has been agreed that the UK will support the programme. The UK contribution would be broken down into stages, at which breakpoints/reviews would be used to commit the UK to the next stage. As you well know getting large funds released is going to take some more time and this staged approach will ensure that the UK can be on board from the start.

This agreement was only reached on the basis that the UK has a full involvement in the programme. This means that we have involvement at the "total systems level" and not just the IRR technology level. It is important that we make this clear as this is the only basis on which the UK MOD will continue to support the programme.

... the UK may be interested in taking the ACTD into an integration (E&MD) phase.

Best Regards, Peter Doidge MOD Advance Concepts (received 12/21/2000)

JSSCM ACTD Parallel Efforts

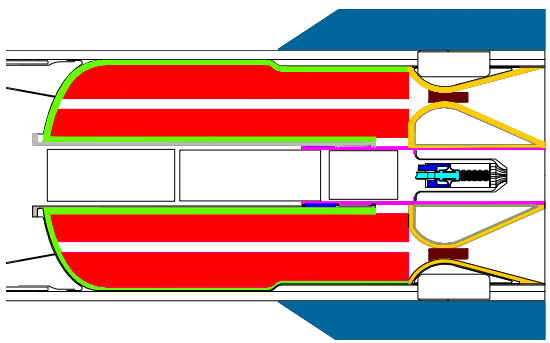
1) Light Weight -Low Cost Booster

Partners: Standard Missile, IMAD Office

2) M4 Thermo baric Penetrating Warhead

Partners: AFRL-Eglin, UK/ MOD, OSD

3) Integral Rocket Ramjet

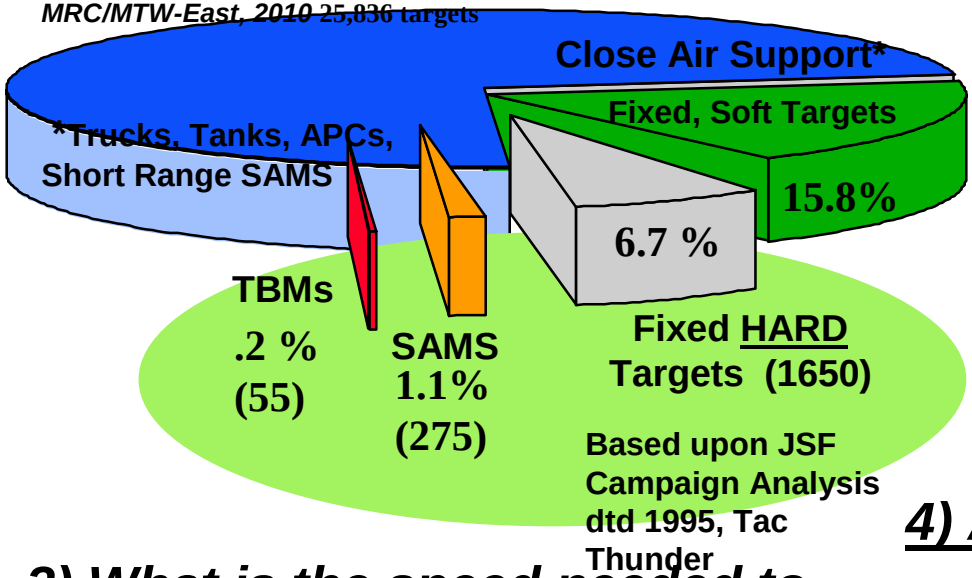


Partners: UK/ MOD, PMA 258

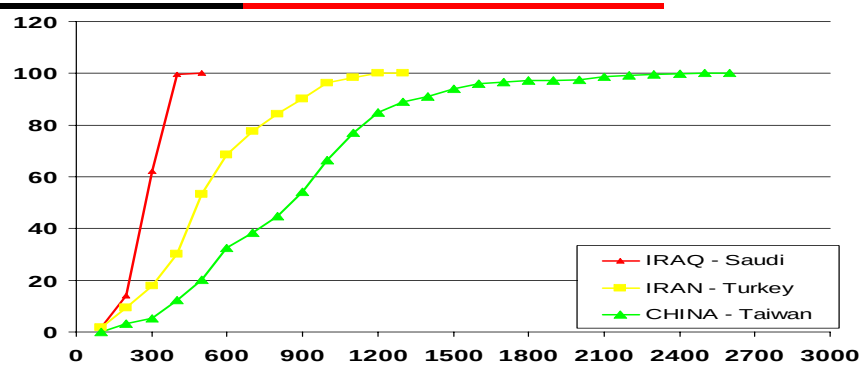
- Decreased AUPC
- Increased Range
- Improved Lethality
- Additional Launch Platforms

JSSCM Future Missions: Need Summary

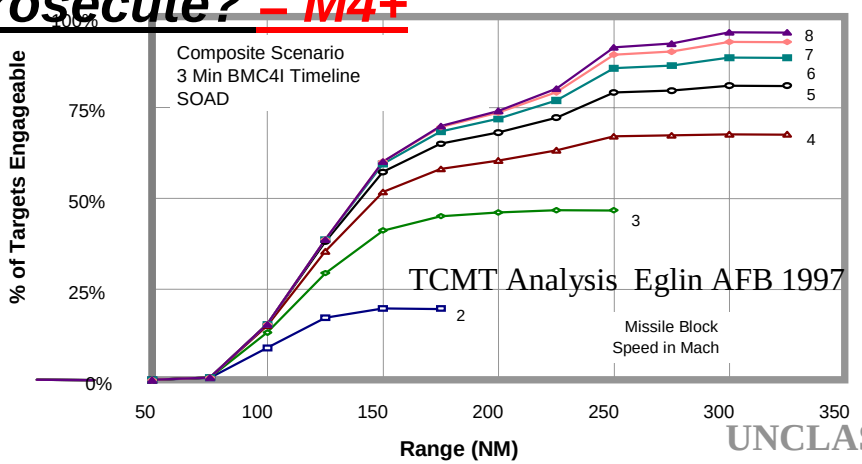
1) HOW MANY ARE NEEDED SWA/NEA ? = 6,841



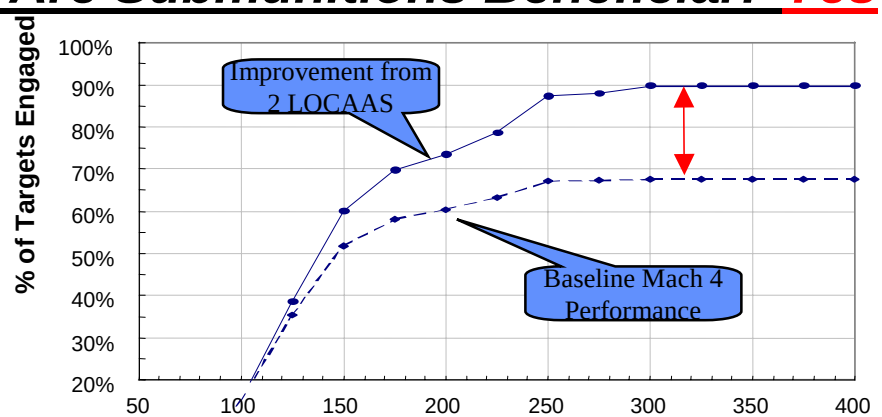
2) What are the distance these targets are located ?=1000 mi for 95%



3) What is the speed needed to prosecute? = M4+



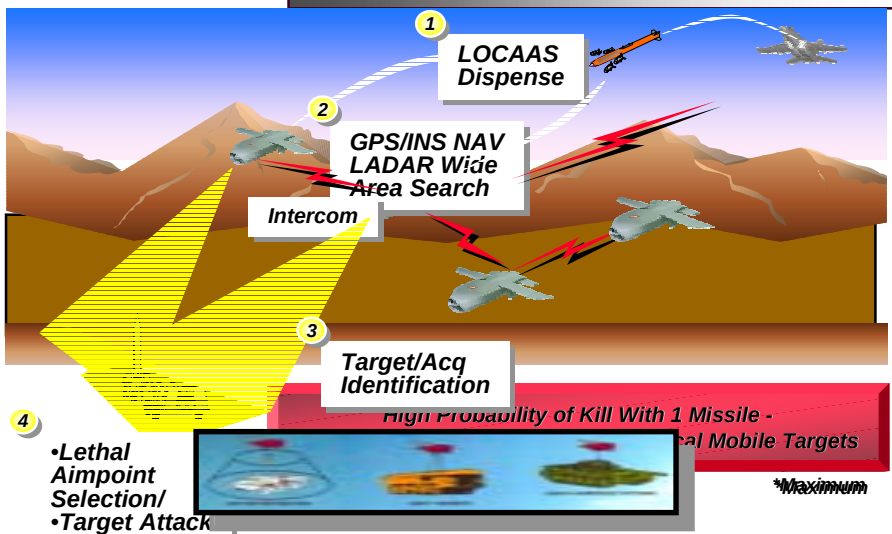
4) Are Submunitions Beneficial? Yes



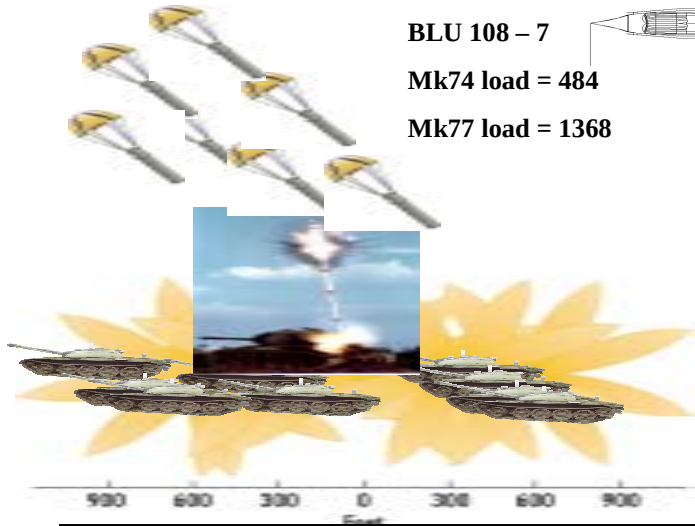
- Fixed TCT < 14 min @ 20 (nmi)+ Range (NM)
- Attack TCMT w/LOCAAS < 400 nmi…

High Speed Weapons Utility Study, CNA 7/2000

JSSCM
Mission Growth Areas



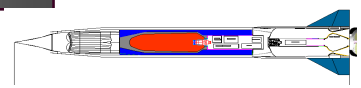
Lockheed Martin Missiles and Fire Control - Dallas Proprietary

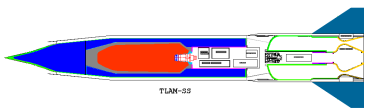


BLU 108 – 7

Mk74 load = 484

Mk77 load = 1368





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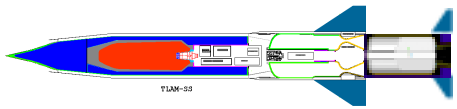
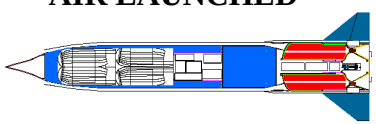
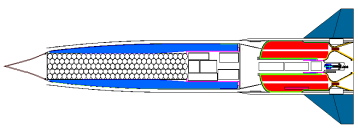


SURFACE LAUNCHED

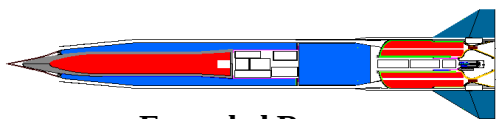


TIME CRITICAL AND MOBIL TARGETS

HARDEN DEEPLY BURIED TARGETS



Submunitions



Extended Range

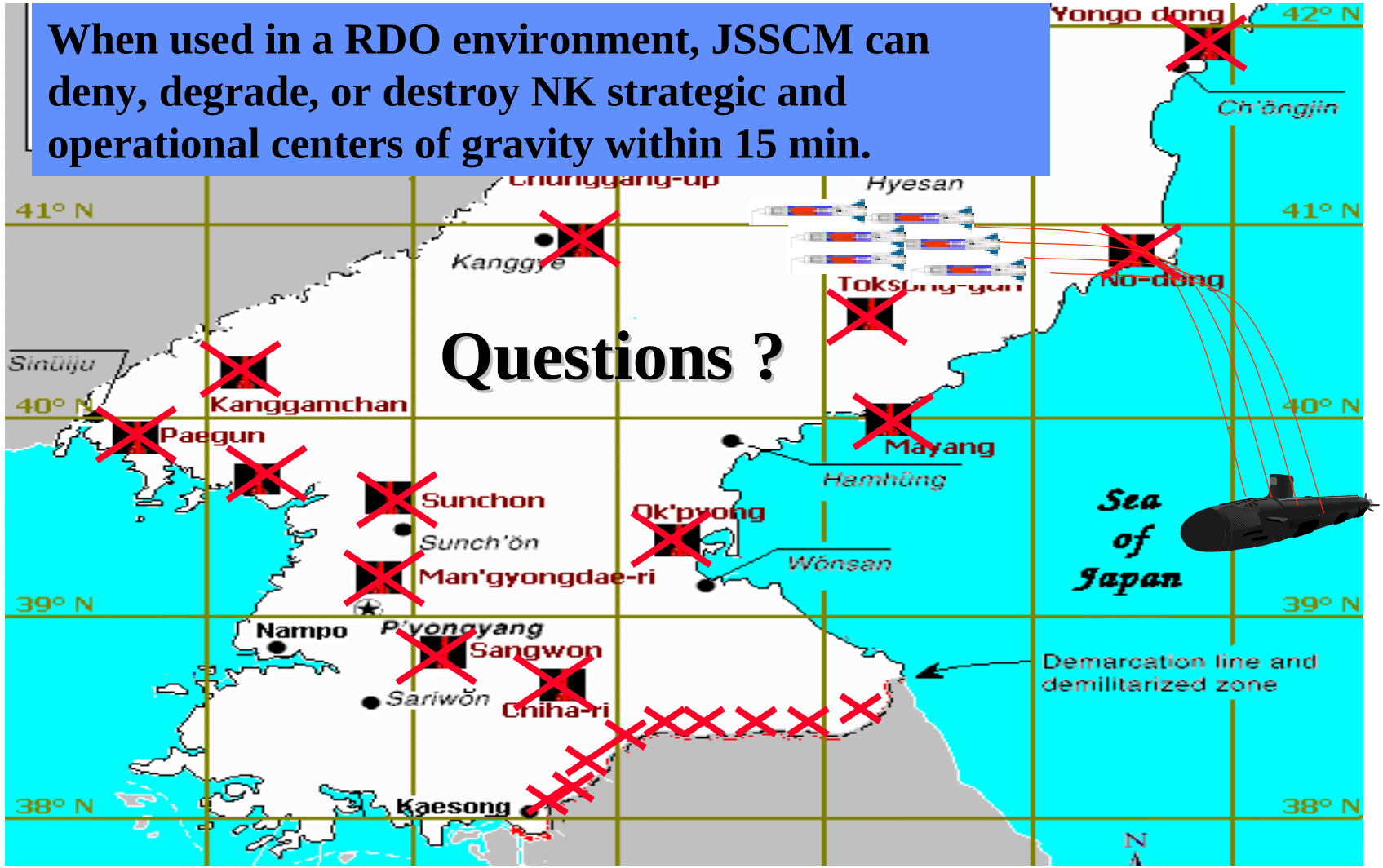
Conclusions

- **JSSCM ACTD Provides IMMEDIATE DEFEAT of Time Urgent Hard Targets in N. Korea (and World Wide) which can not be held at risk by other weapons**
  - **Based upon Technology which can be fielded with Test Readiness Level = 7.5**
  - **Is supported by PACOM, CENTCOM, USJFCOM, EUCOM, USAFE**
  - **Has Coalition partner interest (UK/ROK)**
  - **Is Joint Service with WPAFB and Eglin AFB (AMCOM pending)**
  - **Transitions to PEO(W) / USFK/ UK**
  - **Has N7 direction to proceed**
  - **Has potential funding @ OSD, N7 & Congressional Interest**
  - **Transition to Milestone B/II affordability improvements, additional missions, & platforms for next generation weapon family**

- **JSSCM Provides a "Leap Ahead" Cruise Missile Weapon**
  - **Unique in the combination of Range, Speed, Payloads, Infrastructure, & Cost**
  - **Increased "Non-Nuclear" Lethality against**
    - » **World Wide Hard Targets & Time Critical & Mobile Targets**
  - **In conjunction with Rapid Decisive Operations can deny, degrade, or destroy strategic and operational centers of gravity without having to conduct extensive buildup of forces in the theater of operations.**

JSSCM
NK Effectiveness

When used in a RDO environment, JSSCM can deny, degrade, or destroy NK strategic and operational centers of gravity within 15 min.



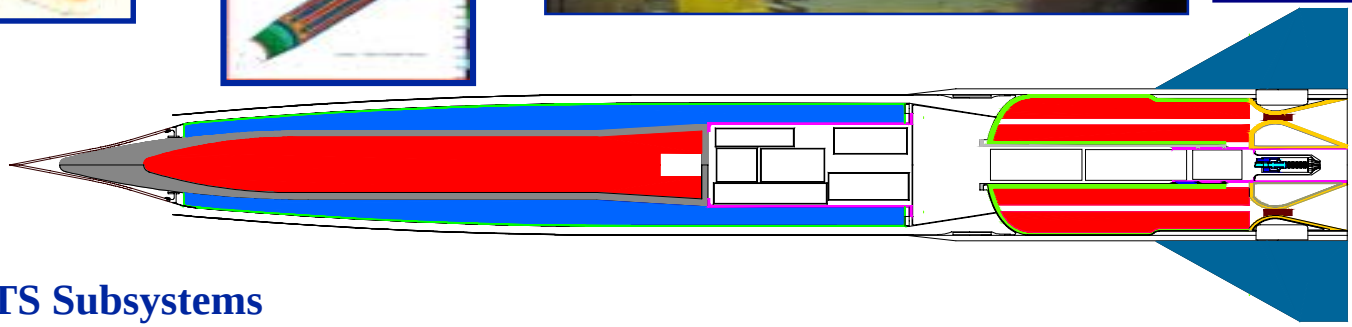
Questions ?

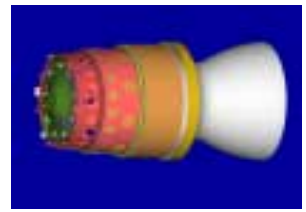
Joint SuperSonic Cruise Missile (JSSCM) ACTD

End of Presentation

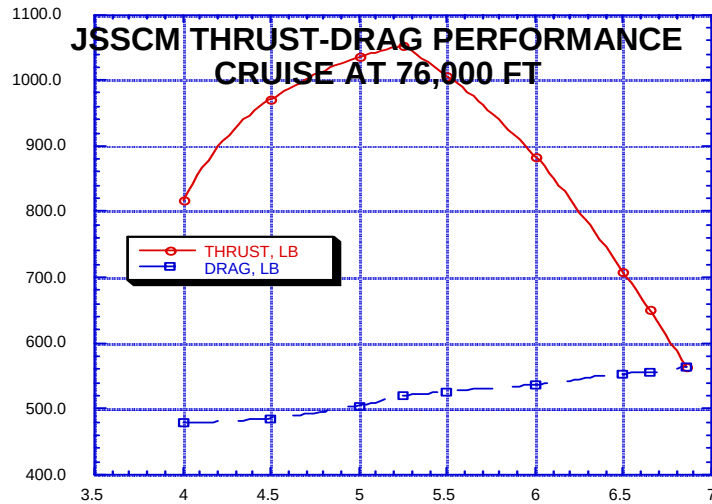
JSSCM
Flight Vehicle Subsystems

Inlet CFD Model





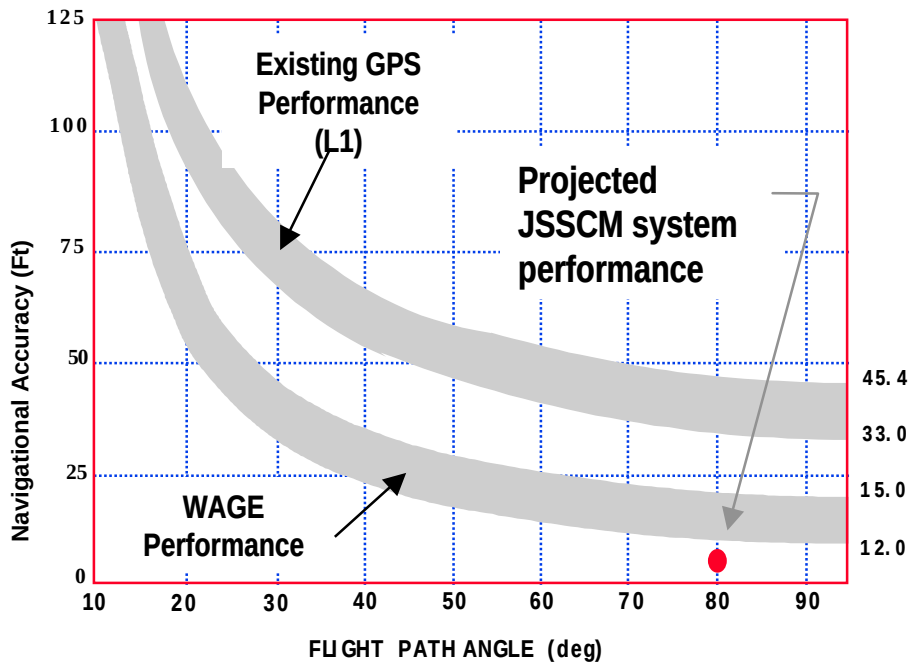
COTS Subsystems



CEP/ Jamming

JSSCM has low CEP & is GPS Jamming Immune

- **URAP Guidance System**
  - Navigation Module – 80 way points
  - Control Module – pre-programmed maneuvers
  - Telemetry Module ->128 data streams
  - 67 units procured @ $37K/unit
  - 34 flight tests -4 at supersonic speeds MA 31
- **CERPA Antenna by Ball Aerospace**
  - Conformal Array
  - Body Shielding
  - Altitude Attenuation
  - Missile Speed flies through en-route jamming
- **Trajectory Shaping eliminates vertical uncertainty errors**
- **Accurate**
  - 2.7m CEP, 3.4m Jammed per HDBTDC AOA FY 2000
- **USAF/ Orbital flights ~ 1 M accuracy**



Affordability

JSSCM has a low AUP cost

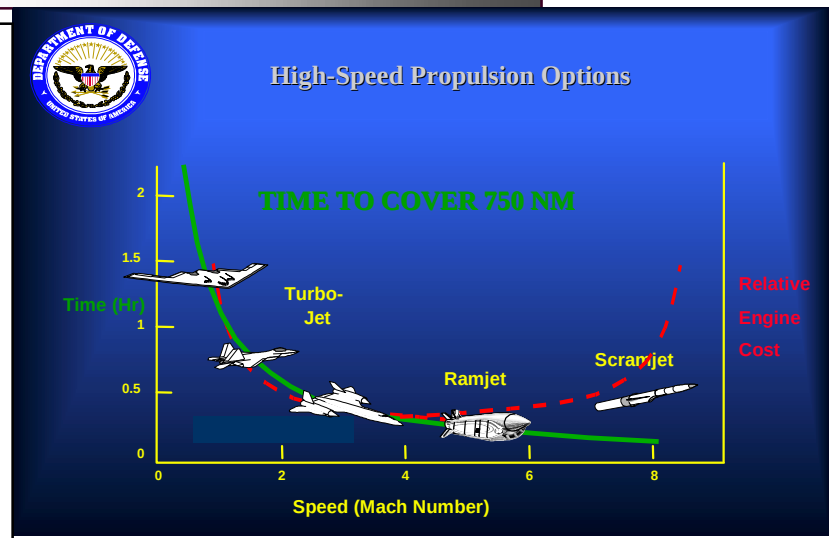
1) No Terminal Guidance (DSMAC, TERCOM)

2) Propulsion cost reduction for turbine (80K) vs ramjet (17K)

3) COTS: Automotive turbopumps ~ $7k
Chemtronics Airframe ~ $40K

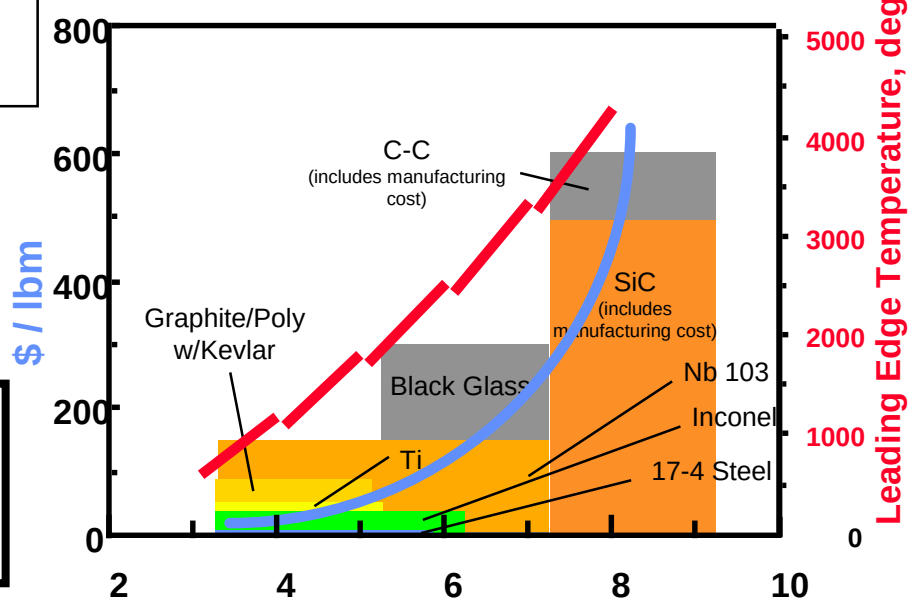
4) Existing subsystems: URAP guidance @37K ea, Mk-72, payload

5) Cruise speed complies with existing materials



- Cost Analysis for GSSCM provided by Naval Center for Cost Analysis (NCCA)
- Costs Validated by Air Force CAG HDBTDC AoA

	GSSCM	JASSM	TacTom
units	5000	5000	5000
Fly Away	$394K	$400K	$529



High Energy Penetrating Warhead

Objectives:

- Demonstrate a Mach 4+, penetrating payload w/ 300 lbs eq. Thermo baric fill
- Build upon ongoing AFRL/DTRA penetrating efforts
- Team with DTRA , AFRL, UK/MOD
- Utilize as alternative payload if successful for JSSCM LRIP
- ROM Delta Cost $9.8M w/10 residuals
- POC Dr. Mike Cramer – Eglin, M Swett NAWCWD

Technology Drivers

- Case Survivability @ impacts of 3000 to 4000 fps (Risk Med)
  - 250 & 660 lb penetrator Warheads tested by OSC under contract to AFRL with Sandia, LANL, and others at velocities up to Mach 4.
- Fuze survivability & operability (Med Risk)
  - The Hard Target Smart Fuze is under development by the Air Force is prime subsystem
  - Multi event fuze an Hard Target fuze are alternatives
- Energetic Fill Insensitivity (High Risk)
- Thermo Baric energy coupling for lethality (Med Risk)

AFRL – Orbital Sciences (OSC) Demonstrated 2000

Impact Conditions	Guidance	Flight Angle	Angle of Attack	Impact Velocity	Penetration Depth
MTD-1	3.2m	-89.9de	<0.2 deg	3,300 fps	31 ft
MTD-3	1.0m	-90.0deg	0.1 deg	4,063 fps	45 ft

M4 Thermo baric Penetrating Warhead

JSSCM ACTD Status Summary

- ACTD 1st on PACOM FY02 ACTD list – Supported by CENTCOM
- ACTD Selected by ONR (7/32) Mr. Ben Riley
- PEO(W) Transition Organization
  - PMA258/282 – SLAM Office POM Wedge in FY04, Poised to initiate ACTD
- UK/MOD has agreed to join ACTD effort. Initial funds 2.1M lbs
- Government industry Team forming
  - Lockheed Martin-Prime, Orbital, Chemtronics, NAWCWD, NSWD, WPAFB
  - USAF (stated they will join for KE warhead, interest in Air Launched version) 5/5/01
  - MICOM (Interested in future generation of supersonic missiles)
- Socializing ACTD
  - ADUS-AT Dr Daly – various meetings
  - N7 ADM McGinn – 1/10/01 directed that ACTD proceed
  - Briefing to DSN (TSC) ADM Altweg (ret) 1/12/01 & 4/24/01 - endorsed ACTD
  - Briefing provided to Tomahawk Leadership Team N764
    - » Capt Hoffman assigned Capt Wise, Cdr Heiss as AO
  - Briefed Counterproliferation and FTO 2/26/01
  - N76 ADM Kelly –2/26/01 Support contingent upon LASM penetrator comparison
  - DDUSD-Strategic & Tactical Systems (Air Warfare) Dr Mutzelburg endorsing ACTD
    - » Jointly w/ Dr Ullrich OSD(S&T)/WS submitted $90M FY02 proposal for JSSCM
  - DTRA Dr Vayl Oxford & Dr Chuck McKinnon 3/1/01 Interested but not committed to date
  - Briefed SubTech N77 4/24/01 Initiating High Speed Weapon program for boomers
  - Briefed RADM Balisle 5/3/01 – Endorsed concept w/ concerns on transition planning

JSSCM ACTD Technical Risks

- **Mk 72 Booster – Off the Shelf**
  - Booster takeover margins - Low Risk
  - Total impulse from MK-72 booster is of concern for cold conditions
  - Alternative to open inlet for lower takeover speed & cruise velocity or Lower payload weight
- **Ramjet Propulsion – Ramjets flying, specific design tested – Low Risk**
- **Airframe Design - Low Risk**
  - Weight growth is driver for ACTD performance
    - ACTD range is 300 / 400nmi allows for weight growth
  - Design Trades being conducted by NAWCWD, Lockheed, & Chemtronics in FY01
    - DCT estimate of $40K/unit
  - Based upon missiles with similar design: Soviet Yakhont , CROW and RARE (seen in MPEG)
- **Avionics – Based on existing URAP design - Low Risk**
- **Actuator - Low Risk**
  - Based upon existing designs
  - 1st order heat analysis indicates satisfactory cooling & performance margins
- **Payload – Risk dependent upon OSD approach**
  - M4 Penetrator – based on on-going NTACMP, AF efforts –Moderate risk
  - JASSM / SLAM – Low risk
- **Integration - Moderate Risk**