A Method for Estimating the Cost of Joint Open Air Range (OAR) Test & Evaluation Programs

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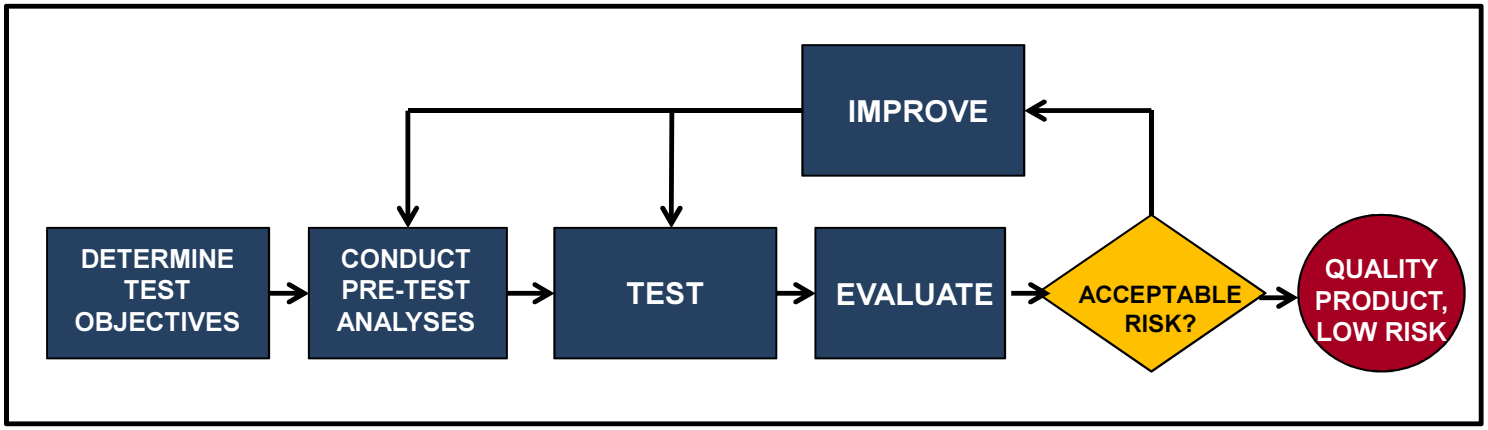
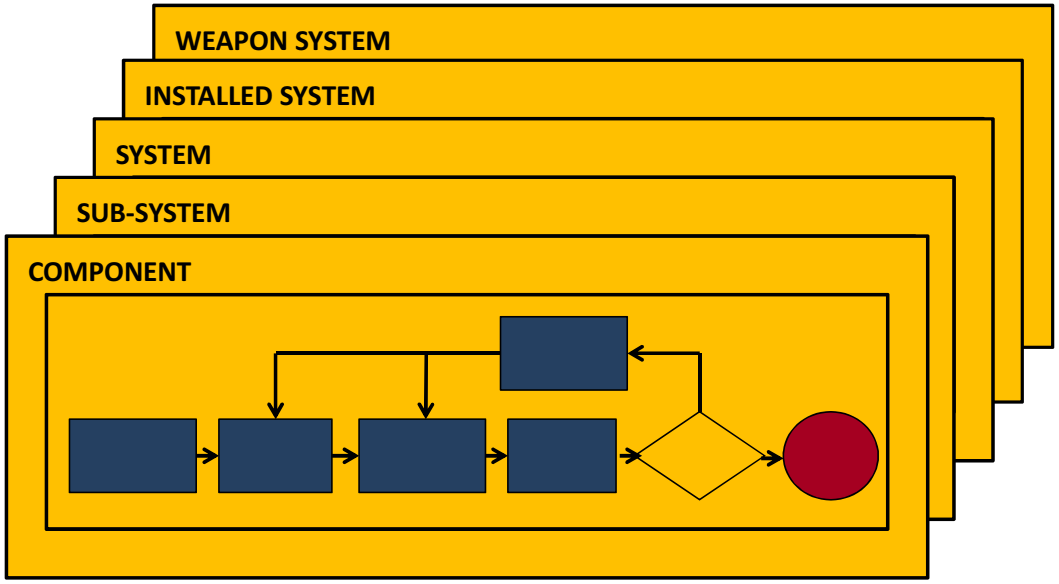
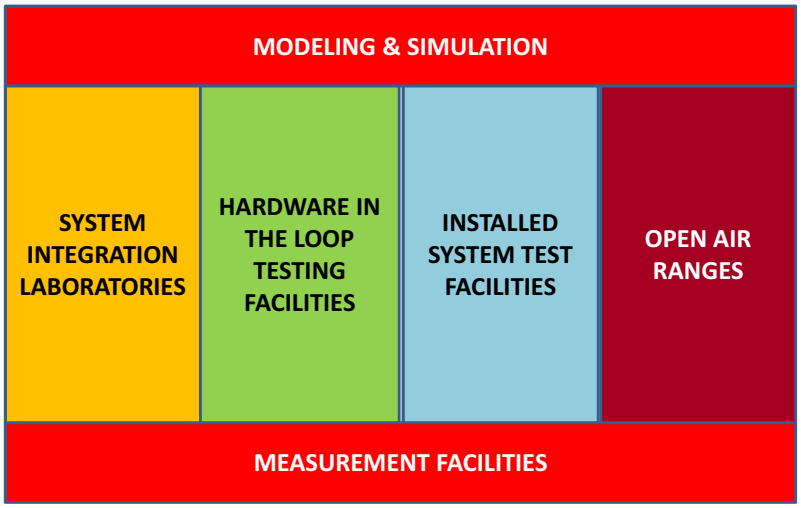
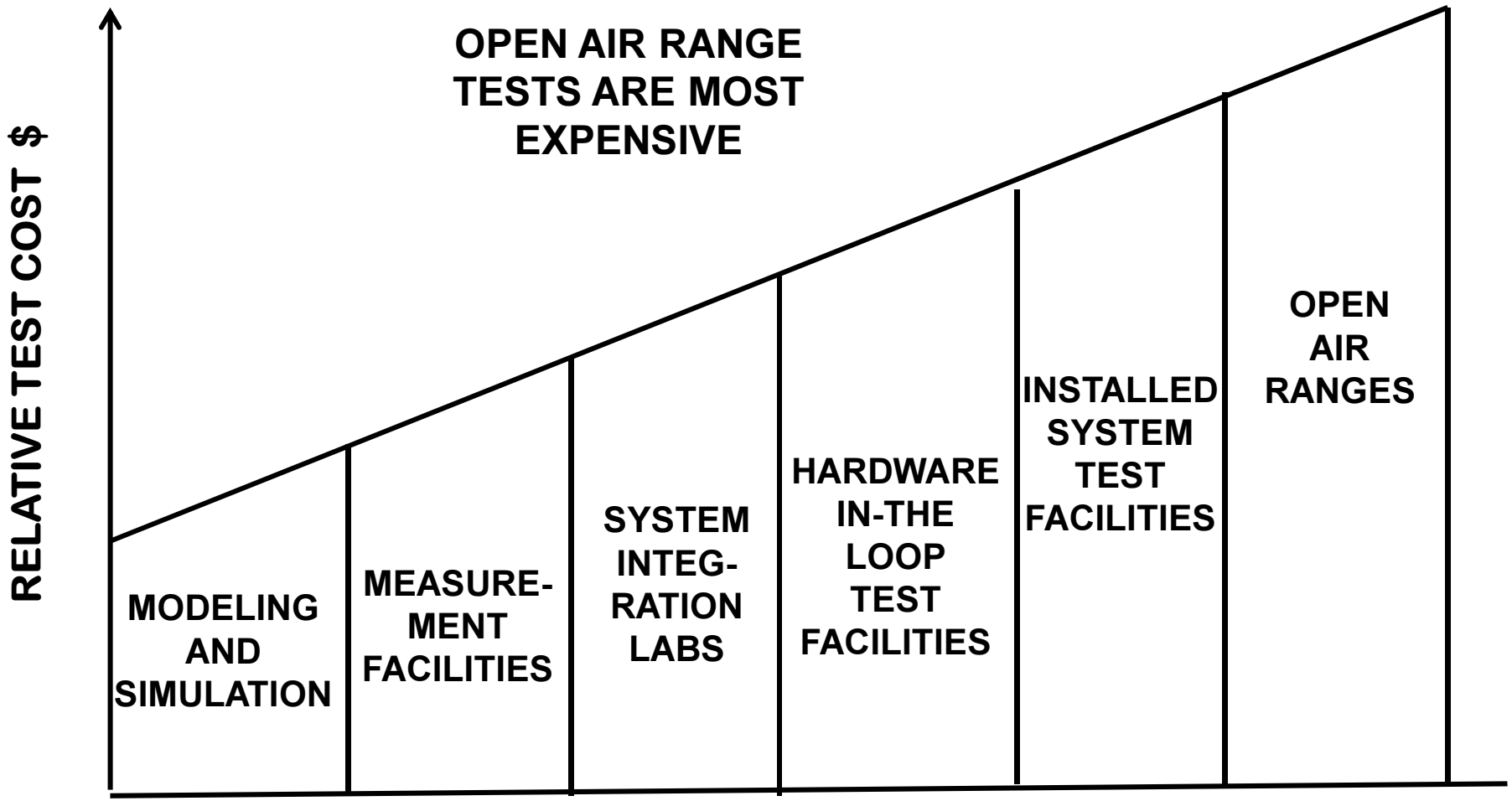
Conceptual Framework for Test & Evaluation







Conceptual Framework for Test & Evaluation



DoD Open Air Test Facilities and Ranges

Joint OAR Tests - Overview

Joint OAR tests are often conducted to evaluate a new system under development (SUD), but they are also conducted to explore how existing systems can be operated together in new ways to provide new capabilities and extend mission effectiveness and performance.

<u>Test Range Effort:</u> Joint OAR Test typically take place using one or more Government owned test ranges. Although range infrastructure is supported by service level appropriations, OAR tests must contribute funding for specific test efforts and expenses. Such expenses frequently include Government labor, contractor labor, specific material investments, and other direct costs.

<u>Instruments and Sensors:</u> The Joint OAR Test may require specific outlays for instruments or sensor equipment, or may require the temporary use of contractor owned instruments or sensor systems. Existing range ground, airborne, or space based sensors are also employed.

Joint OAR Tests - Overview

Platforms: *are vehicles used in performance of the OAR tests. These can include aircraft, ships, submarines, ground vehicles, and other systems. Platforms may support the tests as sensor carriers, weapon launch platforms, communications relay systems, or to perform other functions, as required.*

Weapons or Interceptors: *Often, Joint OAR tests involve use of expendable weapons or interceptors, launched from platforms using targeting data from a network of sensors.*

Targets: *Joint OAR tests may also involve use of expendable targets launched from range sites or platforms.*

FFRDC Support: *Technical support for Large Scale Joint Tests is often provided by FFRDCs such as JHU-APL, MITRE, MIT-Lincoln Labs, Georgia Tech Research Institute, Battelle, and others. These efforts typically include test planning, development of special simulations, and test support and data reduction.*

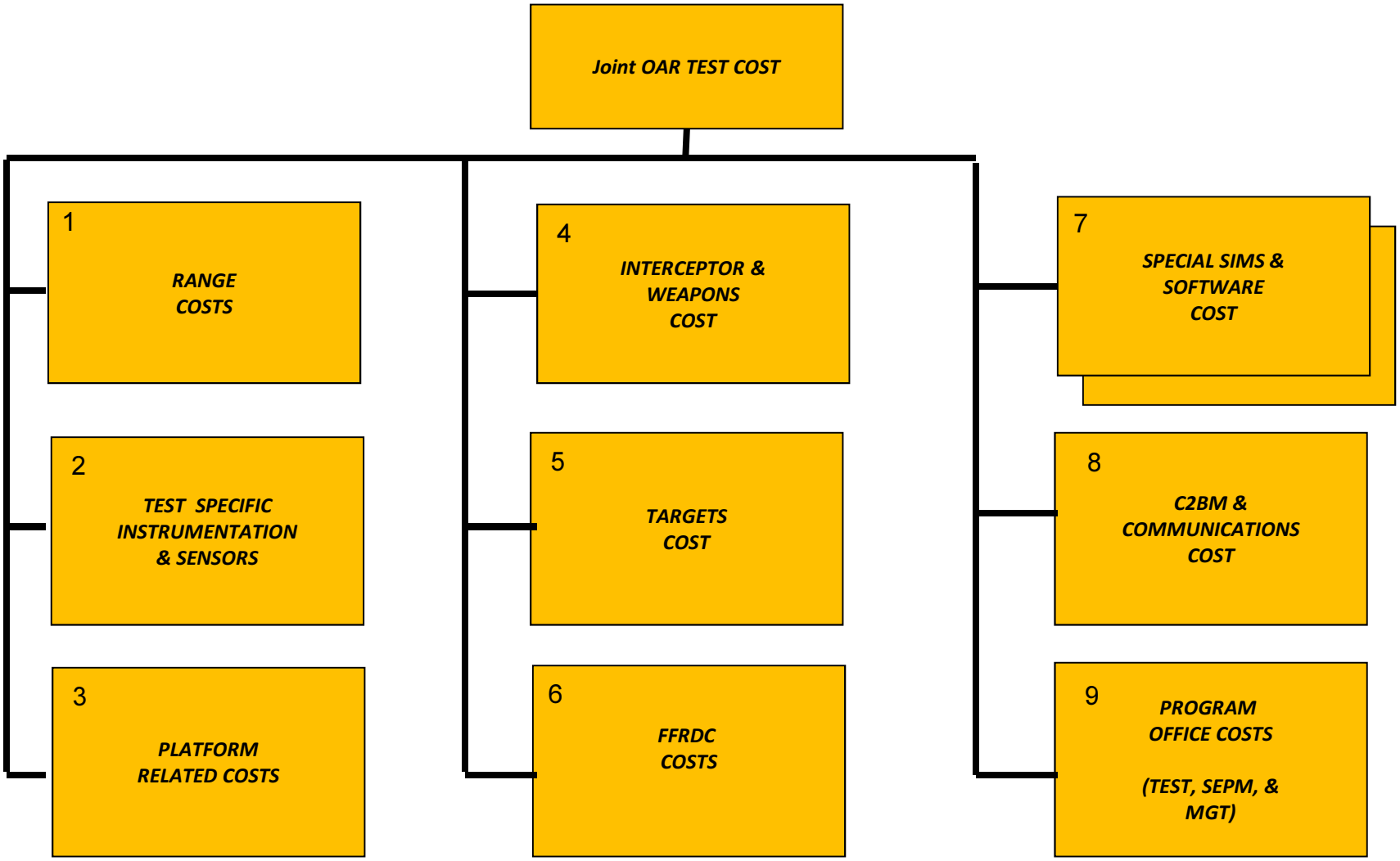
Joint OAR Tests - Overview

Simulation Codes and Software Patches: ***When Joint OAR tests are conducted to explore how existing systems can be operated together in new ways, prototypical software changes (patches) may be required to demonstrate new capabilities or performance. Such software developments are not suitable for fielding, but could serve as a starting point for further development.***

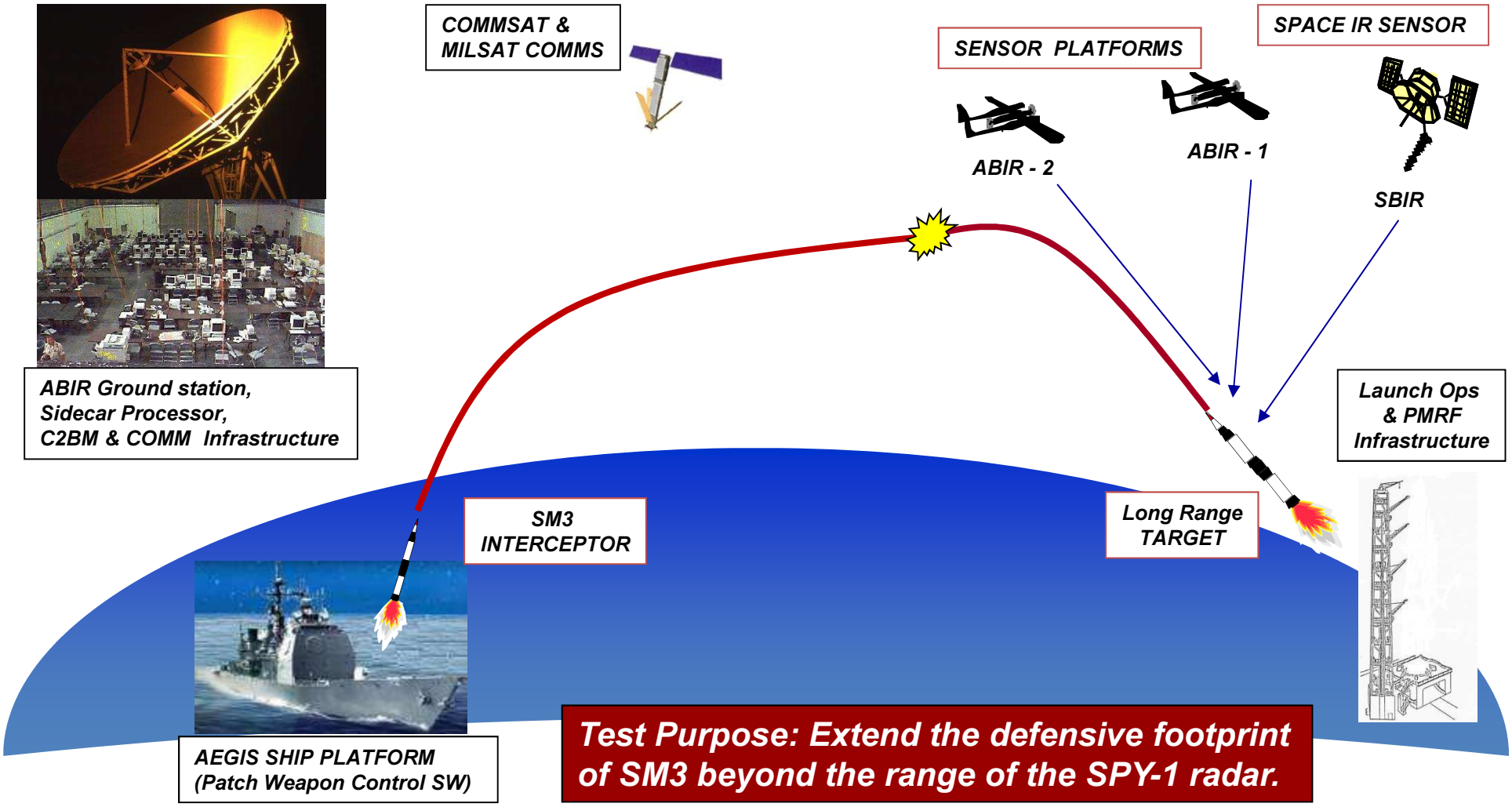
C2BM and Communications Systems: ***A group of Command, Control, and Battle Management systems may play a critical role in the test using specialized software and communications links. The sensors, C2BM, Platforms, weapons, and targets can all be connected via communications links using line of sight (LOS) radio, high frequency radio, or satellite communications systems.***

Program Office Management, Planning & Support: ***Joint OAR tests, whether related to a specific SUD or conducted as a joint forces exercise require a managing organization. The Program Office will serve as the center for over all planning and test management.***

WBS for Joint OAR Tests

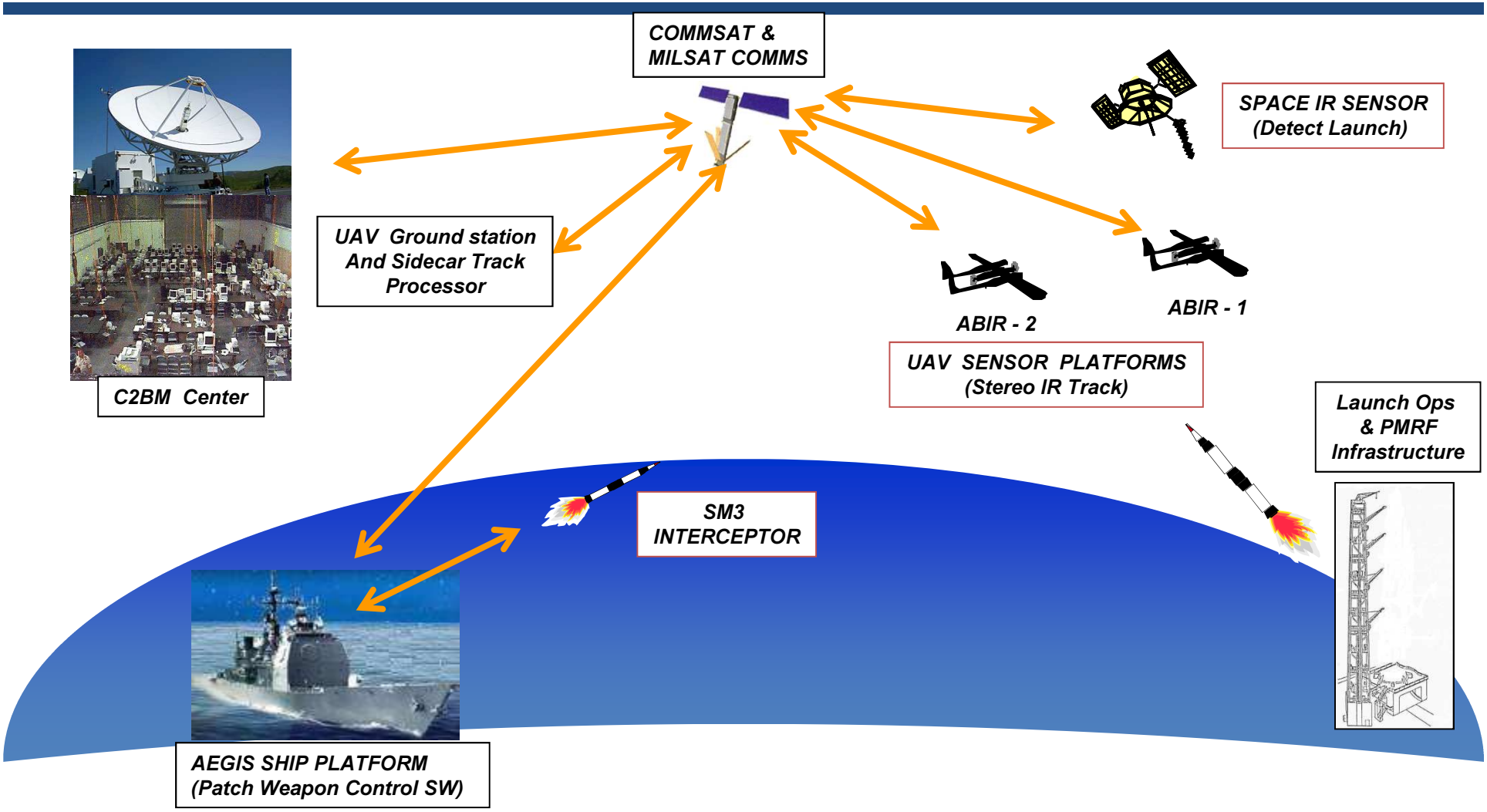


Notional Joint OAR Test



Test Purpose: Extend the defensive footprint of SM3 beyond the range of the SPY-1 radar.

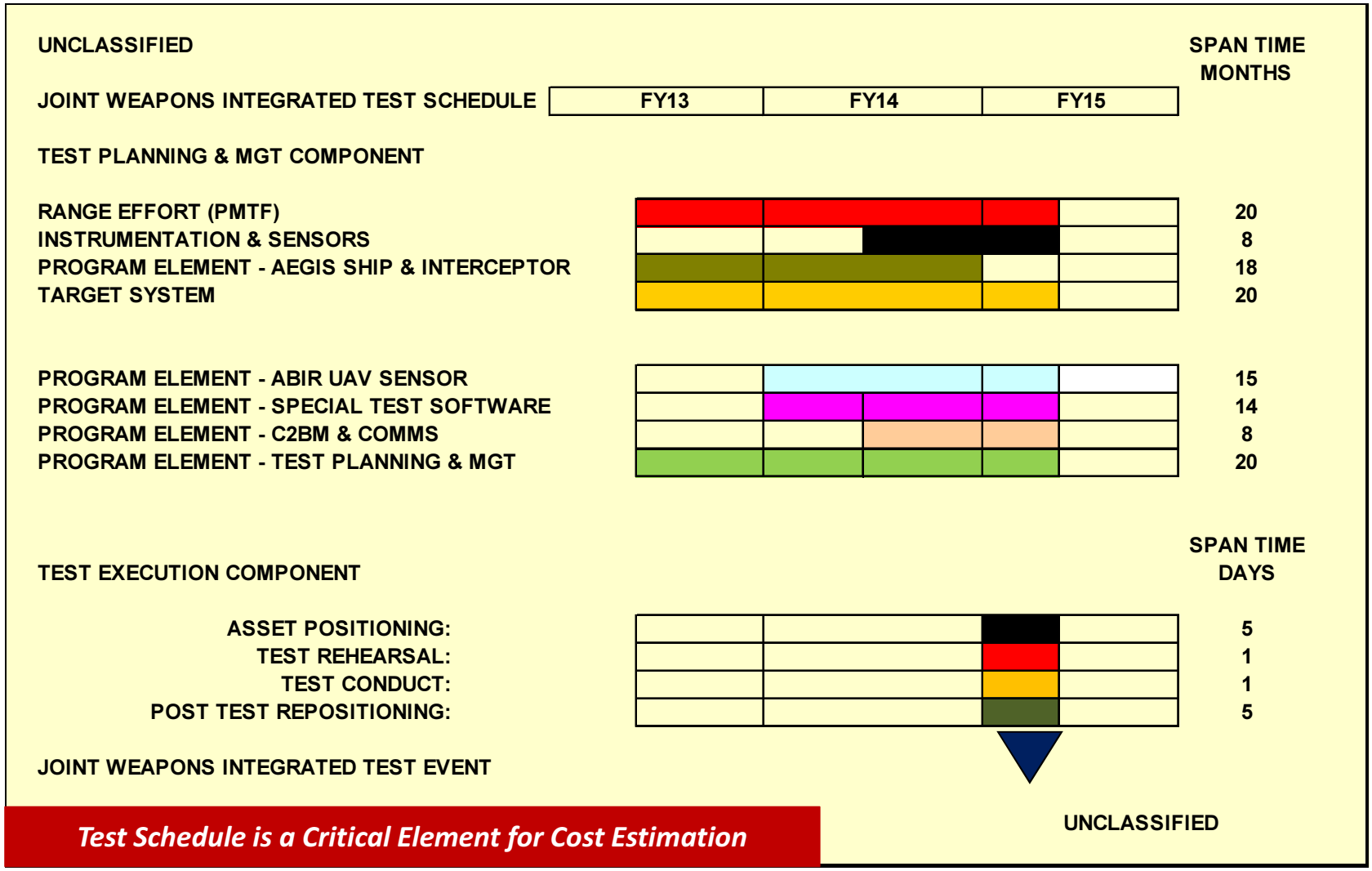
Joint OAR Test – Network Connectivity



Joint OAR Test – Assets Employed

DISA - COMMSAT & MILSAT COMM Links	*Cost based on Connectivity Fees Per Month (DISA Circular)*
Command , Control and Battle Management (C2BM) Center	*Existing DoD Organization, Capture Labor Cost for Tests*
Long Range Target	*Existing Design, Catalog-Type Procurement Cost*
PMTF-VAFB – Target Launch Ops & Range Infrastructure	*Existing Organization, Capture Labor Cost and Some Special Material Outlays (Instruments & Sensors)*
Space Based IR Sensor	*Existing System, Detection of Target Launch Event*
UAV Ground stations Sidecar Processor (USAF Site)	*Hardware Exists and Personnel are in Place. Peculiar Stereo Track Software Requires Development.*
UAVs with EOIR Sensors (USAF Site)	*Existing System, Develop Early Track in Boost Phase*
USN - AEGIS SHIP PLATFORM (Patch Weapon Control SW)	*Existing System, Launch & Guide SM III Interceptor Software "Patch" Required.*
USN – STANDARD III MISSILE	*Existing Design, Recent Procurement Cost*

Joint OAR Test – Notional Schedule



Joint OAR Test – Cost Summary (FY12 M$)

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JOINT WEAPONS TEST

TEST COST COMPONENT	RANGE SERVICES COST (FY12 M$)	DOWN RANGE SERVICES COST (FY12 M$)	RANGE SEPM COST (FY12 M$)	MISSION PLANNING COST (FY12 M$)	TOTAL TEST COST (FY12 M$)
1.0 VARIABLE RANGE COSTS					$1.871
PROGRAM MANAGEMENT			$0.263		$0.263
RANGE DOCUMENTATION				$0.231	$0.231
ADMINISTRATION & SECURITY			$0.231		$0.231
SAFETY			$0.231		$0.231
OTHER SUPPORT				$0.231	$0.231
PREOPERATIONS SUPPORT	$0.023				$0.023
OPERATIONS	$0.029	$0.029			$0.058
POST MISSION SUPPORT	$0.012				$0.012
GOV TECHNICAL SUPPORT			$0.069		$0.069
HARDWARE PURCHASE (MISC)	$0.050				$0.050
CONTRACT EFFORTS	$0.354	$0.118			$0.472
2.0 TEST SPECIFIC INSTRUMENTATION & SUPPORT COSTS					$5.663
3.0 PLATFORM RELATED COSTS					$2.972
ASSET POSITIONING					$1.149
TEST REHEARSAL					$0.337
TEST CONDUCT					$0.337
POST TEST ASSET REPOSITIONING					$1.149
4.0 INTERCEPTOR COST					$14.592
5.0 TARGET COST					$18.335

Joint OAR Test – Cost Summary (FY12 M$)

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JOINT WEAPONS TEST

TEST COST COMPONENT	RANGE SERVICES COST (FY12 M$)	DOWN RANGE SERVICES COST (FY12 M$)	RANGE SEPM COST (FY12 M$)	MISSION PLANNING COST (FY12 M$)	TOTAL TEST COST (FY12 M$)
6.0 FFRDC & OTHER AGENCIES					$2.501
REQUIREMENTS DEFINITION					$0.192
SIMULATION OPERATIONS					$0.736
TEST OPERATIONS					$1.247
TRAVEL & MISCELLANEOUS					$0.326
7.0 SIMULATIONS & SOFTWARE		UAV IR SW	AEGIS SW		$35.927
REQUIREMENTS DEFINITION		$2.544	$2.544		$5.087
SOFTWARE DEVELOPMENT		$4.555	$21.284		$25.839
TEST OPERATIONS		$2.500	$2.500		$5.000
8.0 C2BM & COMMUNICATIONS COST					$1.699
REQUIREMENTS DEFINITION & PLANNING					$0.148
SIMULATION & HWIL TESTING					$0.640
TEST PERFORMANCE					$0.615
SATCOMM NETWORK FEES					$0.075
C2BM & COMMS TRAVEL & MISCELLANEOUS					$0.222
9.0 PROGRAM OFFICE COSTS					$2.348
TEST PLANNING					$0.570
TEST MANAGEMENT					$0.332
TEST FINANCIAL MANAGEMENT					$0.498
TEST OTHER					$0.641
TEST TRAVEL & MISCELLANEOUS					$0.306
		TOTAL TEST COST (FY12 M$)			$85.908

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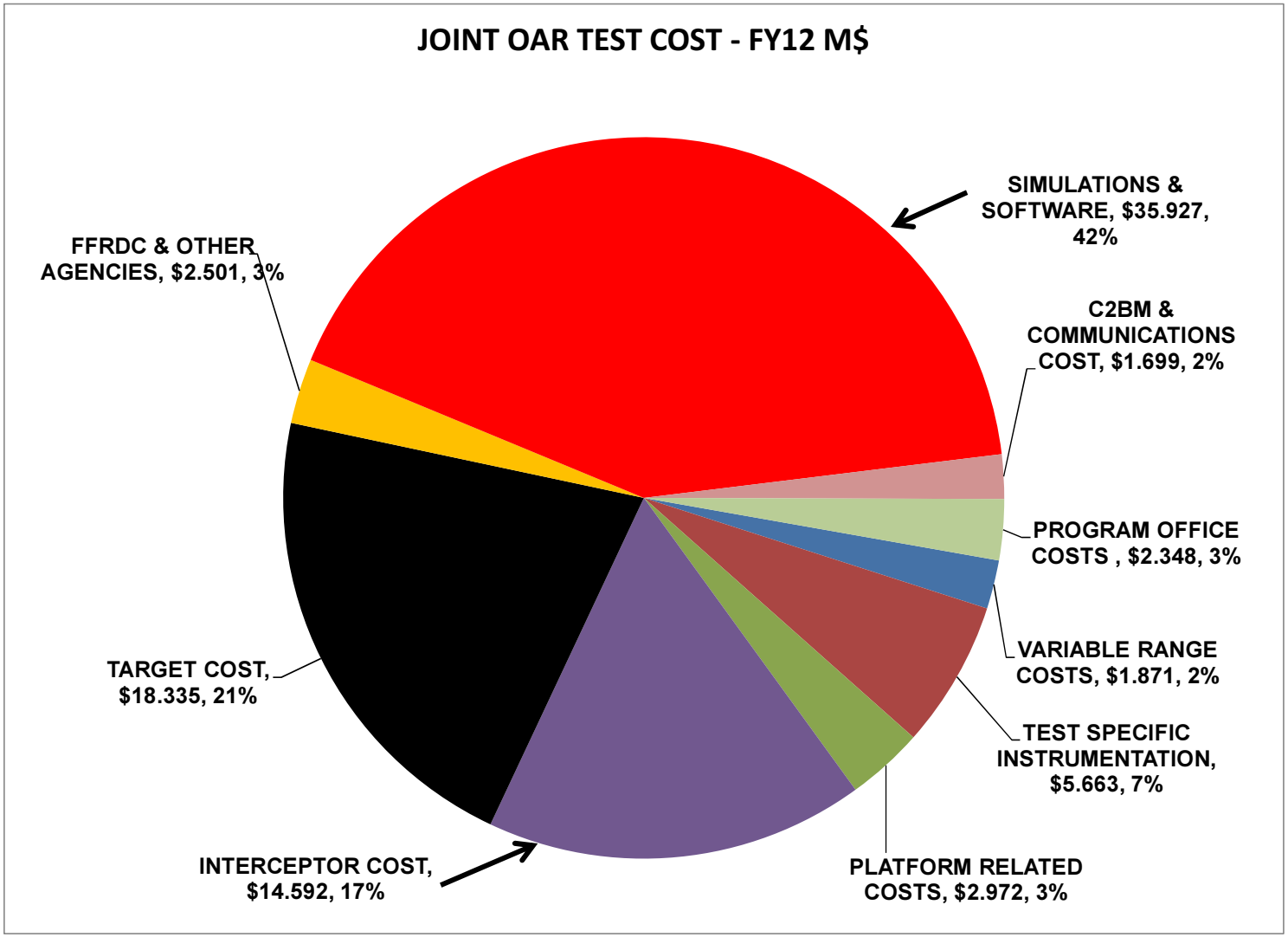
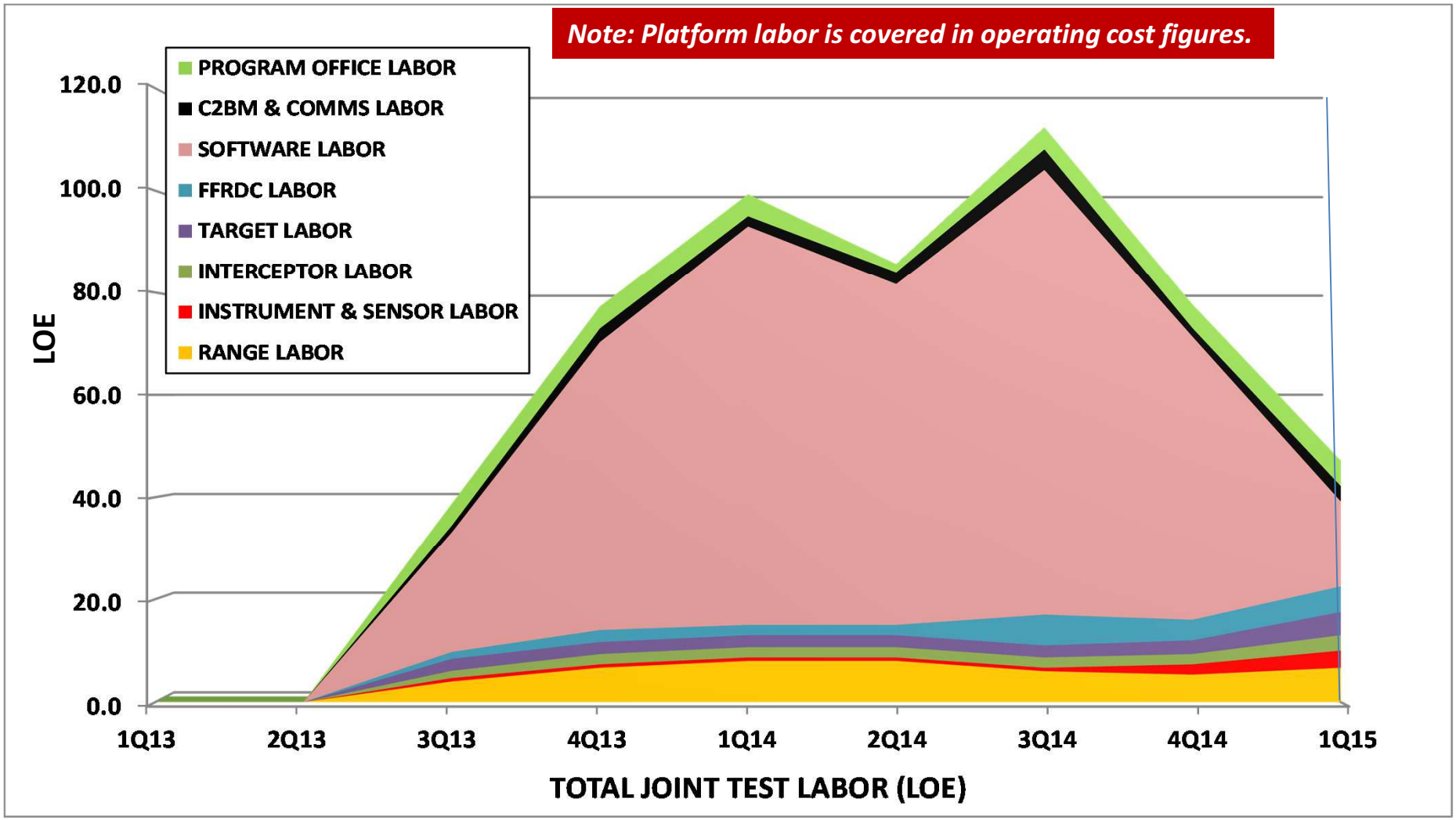
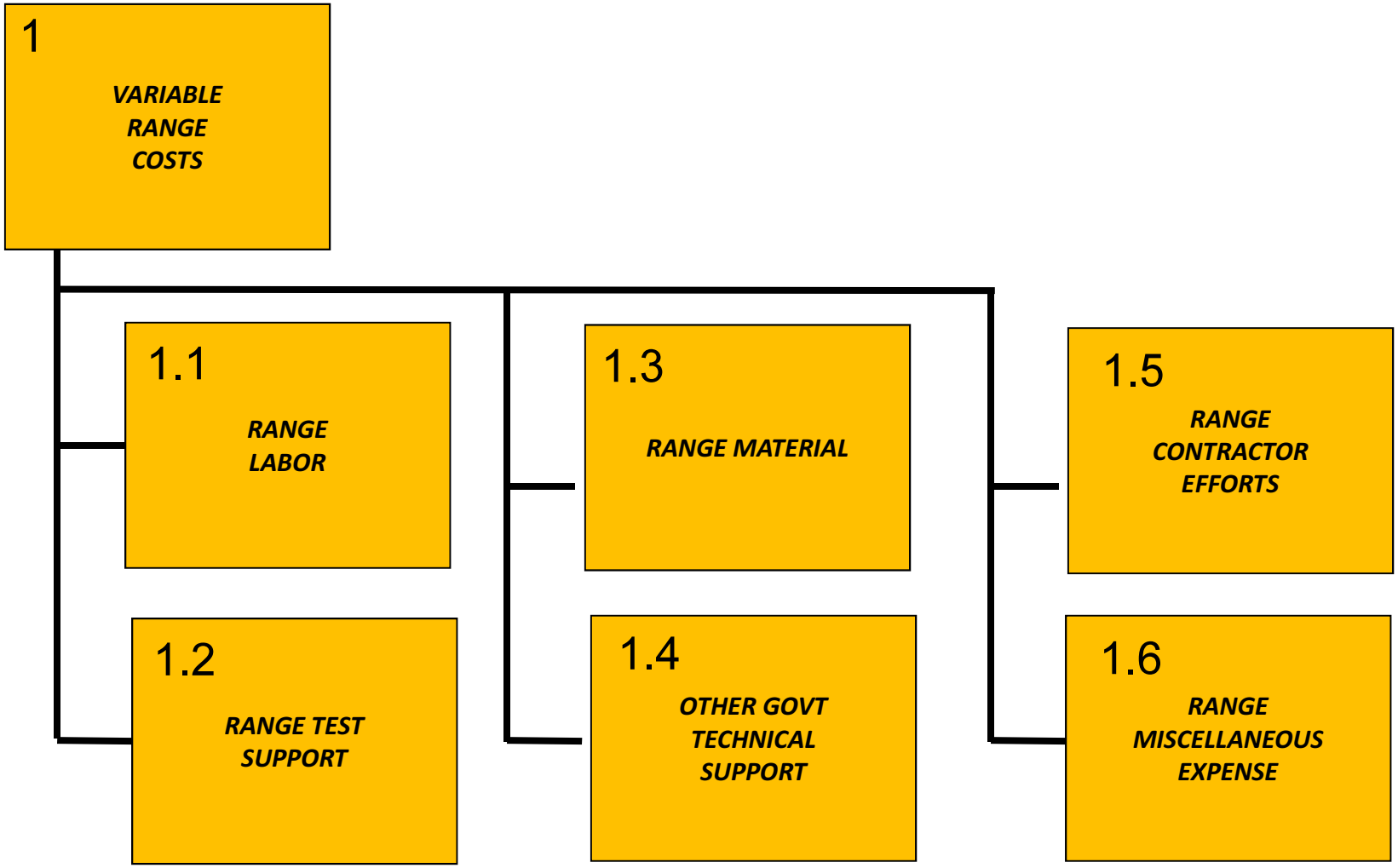
Joint OAR Test – Cost Summary (FY12 M$)



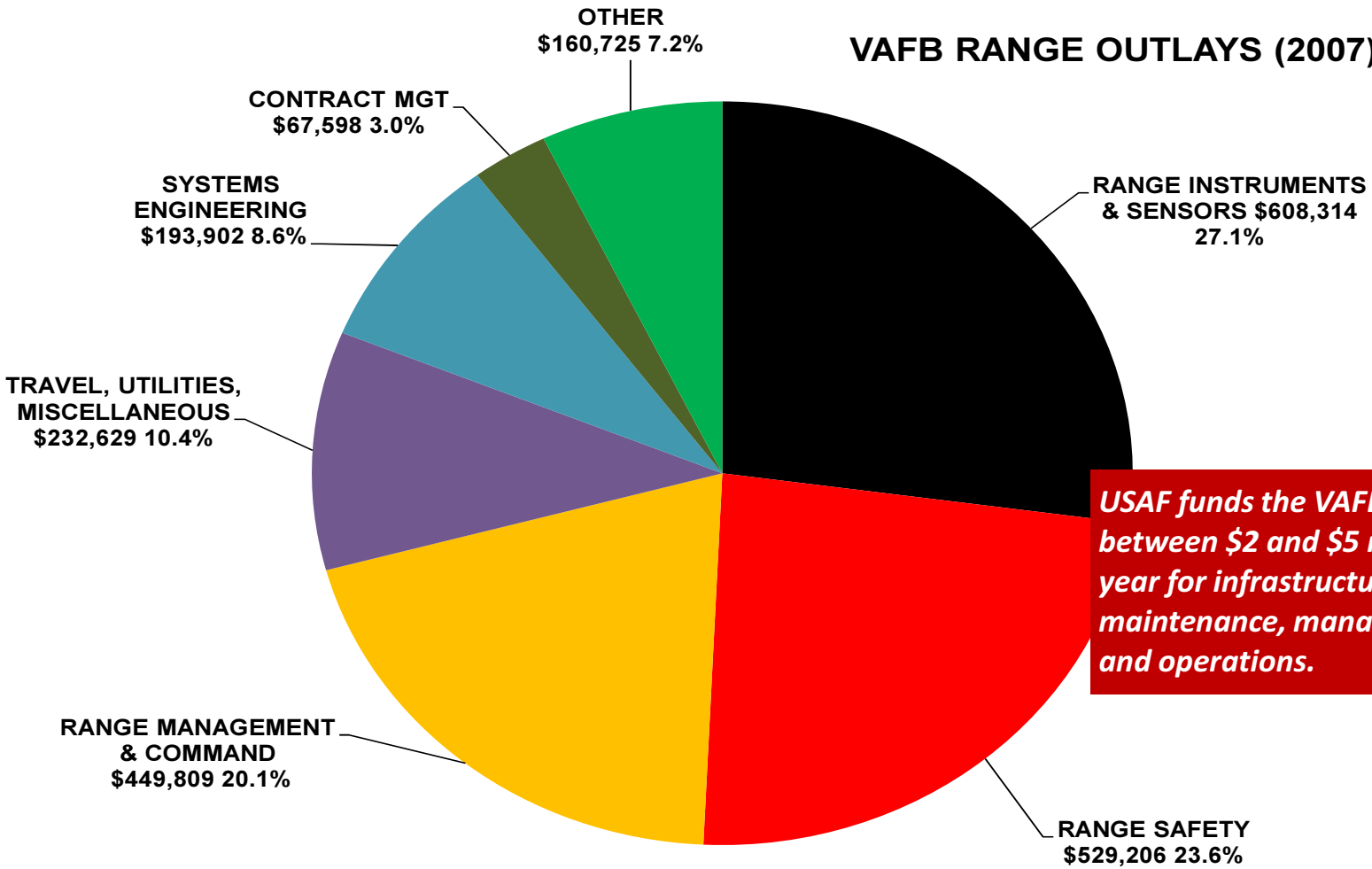
Joint OAR Test – Labor Summary – Level of Effort



1 – Variable Range Costs



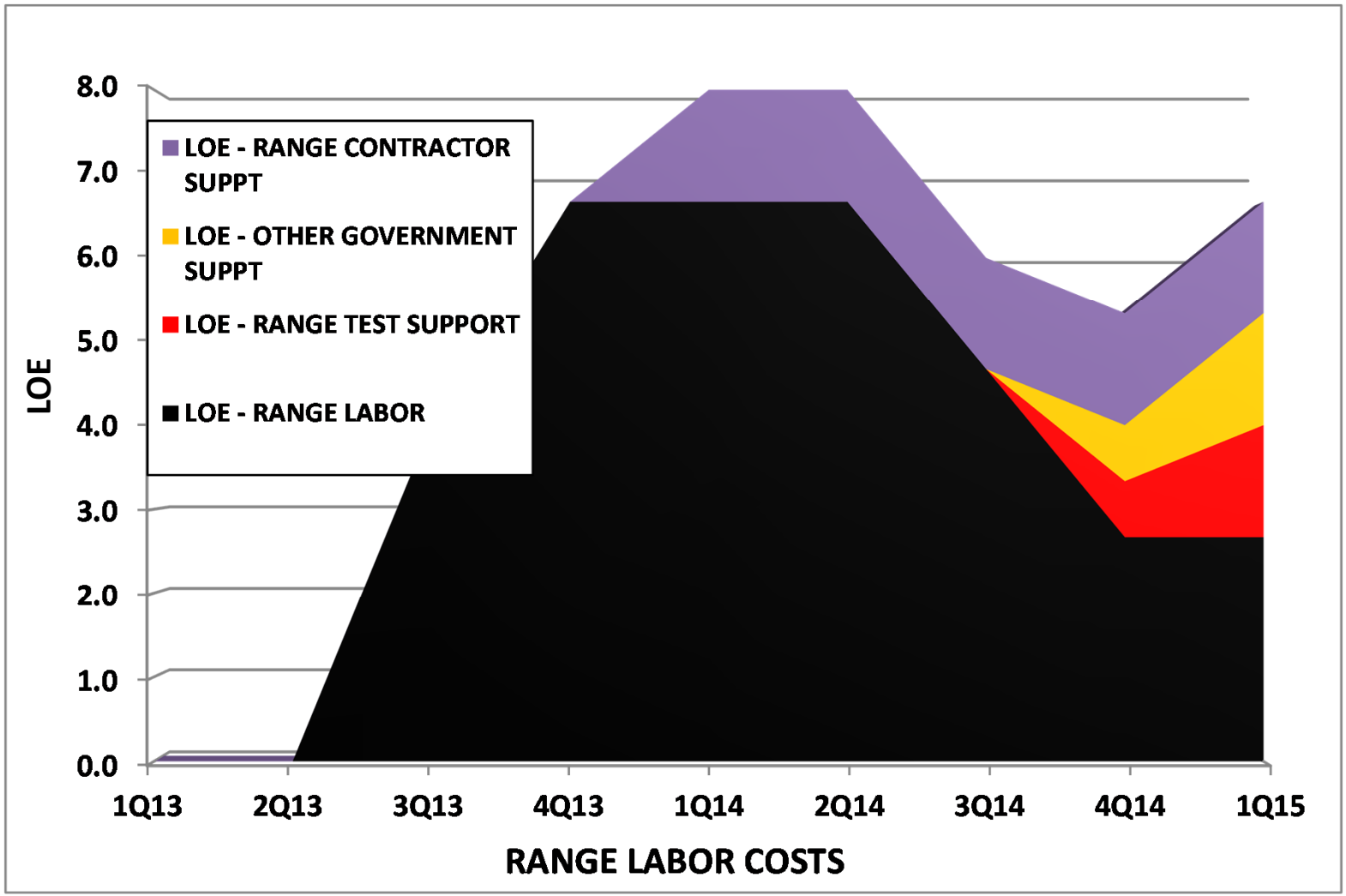
Typical Range Annual Budget – Fixed Costs



USAF funds the VAFB Range between $2 and $5 million per year for infrastructure, maintenance, management, and operations.

RANGE FIXED COSTS – NOT INCLUDED IN TEST ESTIMATE

1 – Variable Range Cost – Labor – Level of Effort



1 – Variable Range Cost (FY12 M$)

JOINT WEAPONS TEST UNCLASSIFIED

SPAN TIME (MONTHS) 20

1.0 VARIABLE RANGE COSTS	LOE	MONTHS SPAN	ESTIMATED M/M	LABOR RATE FY12 $	ESTIMATED COST (FY12 M$)	COMPLEXITY ADJUSTMENT FACTOR	ESTIMATED COST (FY12 M$)	REMARKS
1.1 RANGE EXPENSES (LABOR)					$1.210		$1.210	
PROGRAM MANAGEMENT (GOV)	1.0	20.0	20.0	$82.12	$0.263	1.00	$0.263	GOVT
RANGE DOCUMENTATION (GOV)	1.0	20.0	20.0	$72.23	$0.231	1.00	$0.231	GOVT
ADMINISTRATION & SECURITY (GOV)	1.0	20.0	20.0	$72.23	$0.231	1.00	$0.231	GOVT
SAFETY (GOV)	1.0	20.0	20.0	$72.23	$0.231	1.00	$0.231	GOVT
OTHER SUPPORT (GOV)	1.0	20.0	20.0	$72.23	$0.231	1.00	$0.231	GOVT
PREOPERATIONS SUPPORT (GOV)	1.0	2.0	2.0	$72.23	$0.023	1.00	$0.023	GOVT
1.2 RANGE TEST OPERATION SUPPORT					$0.069		$0.069	
POSITIONING (GOV)	0.5	2.0	1.0	$72.23	$0.012	1.00	$0.012	GOVT
REHEARSAL (GOV)	0.0	2.0	0.0	$72.23	$0.000	1.00	$0.000	GOVT
MISSION OPS (GOV)	0.0	2.0	0.0	$72.23	$0.000	1.00	$0.000	GOVT
SECURITY (GOV)	2.0	2.0	4.0	$72.23	$0.046	1.00	$0.046	GOVT
OTHER SUPPORT (GOV)	0.0	2.0	0.0	$72.23	$0.000	1.00	$0.000	GOVT
POST TEST MISSION SUPPORT	0.5	2.0	1.0	$72.23	$0.012	1.00	$0.012	GOVT
1.3 RANGE MATERIAL					$0.050		$0.050	
TEST HARDWARE PURCHASE (MISC)					$0.050	1.00	$0.050	GOVT

Mixed LOE Estimates and Material Costs

1 – Variable Range Cost (FY12 M$)

JOINT WEAPONS TEST

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SPAN TIME (MONTHS) 20

1.0 VARIABLE RANGE COSTS	LOE	MONTHS SPAN	ESTIMATED M/M	LABOR RATE FY12 $	ESTIMATED COST (FY12 M$)	COMPLEXITY ADJUSTMENT FACTOR	ESTIMATED COST (FY12 M$)	REMARKS
1.4 OTHER GOVERNMENT TECHNICAL SUPPORT					$0.069		$0.069	
NSWC CARDEROCK	0.0	2.0	0.0	$72.23	$0.000	1.00	$0.000	GOVT
NSWC DAHLGREN	1.0	2.0	2.0	$72.23	$0.023	1.00	$0.023	GOVT
NSWC CORONA	1.0	2.0	2.0	$72.23	$0.023	1.00	$0.023	GOVT
NAVSEA GRPS	1.0	2.0	2.0	$72.23	$0.023	1.00	$0.023	GOVT
NAVAIR GRPS	0.0	2.0	0.0	$72.23	$0.000	1.00	$0.000	GOVT
USAF GRPS	0.0	2.0	0.0	$72.23	$0.000	1.00	$0.000	GOVT
USAF GRPS	0.0	2.0	0.0	$72.23	$0.000	1.00	$0.000	GOVT
USAF GRPS	0.0	2.0	0.0	$72.23	$0.000	1.00	$0.000	GOVT
1.5 RANGE CONTRACTOR EFFORTS					$0.472		$0.472	
ASHORE SUPPORT (CTR)	2.0	2.0	4.0	$147.44	$0.094	1.00	$0.094	CTR
SURFACE CRAFT OPS (CTR)	0.0	2.0	0.0	$147.44	$0.000	1.00	$0.000	CTR
AIRCRAFT OPS (CTR)	4.0	2.0	8.0	$147.44	$0.189	1.00	$0.189	CTR
CAMERA SUPPORT (CTR)	4.0	2.0	8.0	$147.44	$0.189	1.00	$0.189	CTR
OTHER SUPPORT (CTR)	0.0	2.0	0.0	$147.44	$0.000	1.00	$0.000	CTR
1.6 TEST TRAVEL & MISC EXPENSES		15.0%			$0.000	0.00	$0.000	
TOTAL COST - TEST RANGE					$1.871		$1.871	

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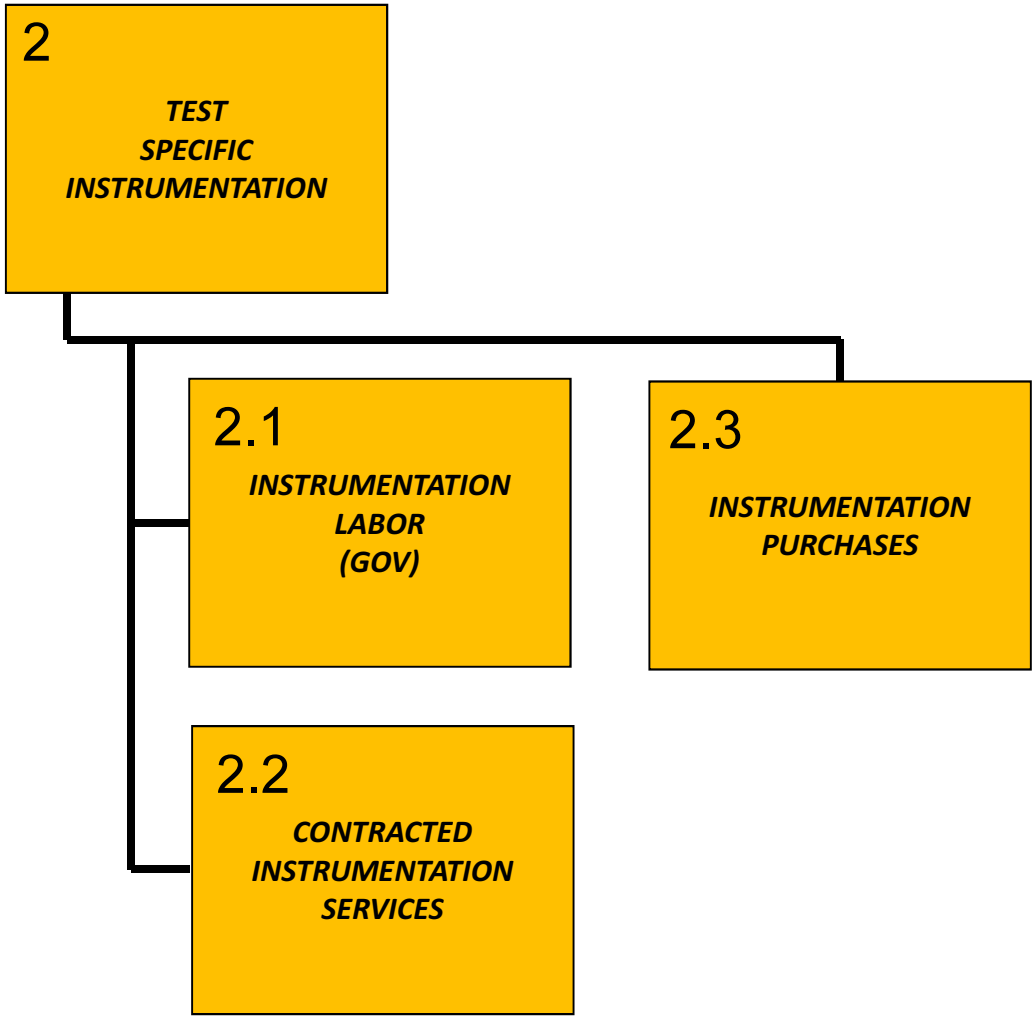
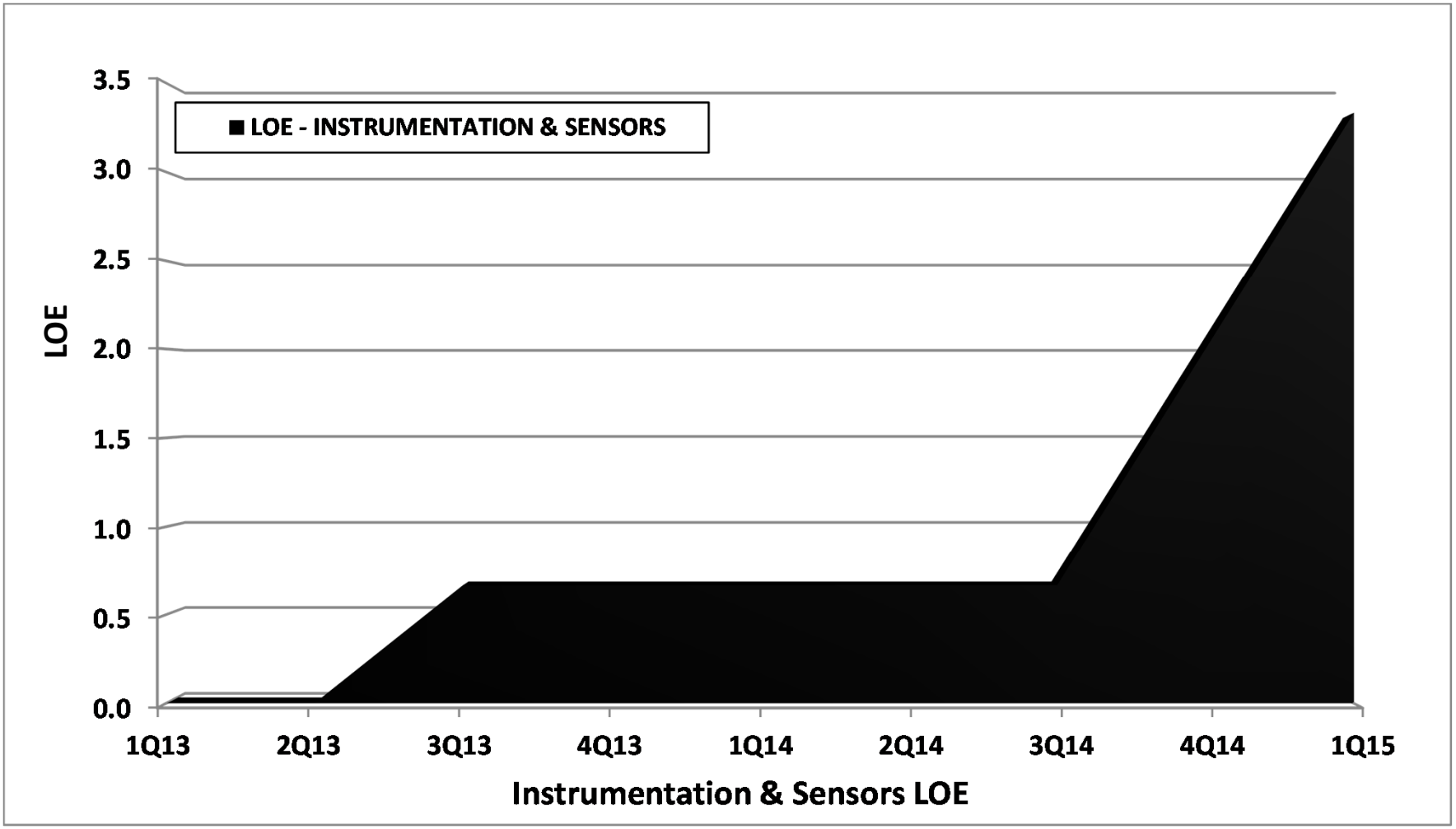
Mixed LOE Estimates and Material Costs

2 – Test Specific Instrumentation & Sensors



2 – Test Specific Instrumentation & Sensors - Labor



2 – Test Specific Instrumentation & Sensor Costs (FY12 M$)

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JOINT WEAPONS TEST

SPAN TIME (MONTHS) 8

	LOE	MONTHS SPAN	ESTIMATED M/M	LABOR RATE FY12 $	ESTIMATED TEST COST (FY12 M$)	COMPLEXITY ADJUSTMENT FACTOR	ESTIMATED COST (FY12 M$)	REMARKS
2.0 INSTRUMENTATION & SENSOR COST								
2.1 INSTRUMENTATION & SENSOR LABOR EXPENSES					$0.313		$0.313	
INSTRUMENTATION ENGINEERING (GOV)	1.00	8.0	8.0	$82.12	$0.105	1.00	$0.105	GOVT
INSTRUMENTATION CONTRACTING (GOV)	0.25	8.0	2.0	$72.23	$0.023	1.00	$0.023	GOVT
ADMINISTRATION & SECURITY (GOV)	0.50	8.0	4.0	$72.23	$0.046	1.00	$0.046	GOVT
INSTRUMENTATION INSTALLATION (GOV)	6.00	2.0	12.0	$72.23	$0.139	1.00	$0.139	GOVT
2.2 CONTRACT INSTRUMENTATION & SENSOR SERVICES			CONTRACT VALUE (M$)		$4.350		$4.350	
GROUND INSTRUMENTS (CTR)			$0.100		$0.100	1.00	$0.100	CNTR COST
DATA LINKS & TELEMETRY SUPPORT (CTR)			$0.250		$0.250	1.00	$0.250	CNTR COST
AIRCRAFT/HELICOPTER OPS			$2.000		$2.000	1.00	$2.000	CNTR COST
SPECIAL CAMERA SUPPORT			$2.000		$2.000	1.00	$2.000	CNTR COST
OTHER SENSOR SUPPORT			$0.000		$0.000	1.00	$0.000	CNTR COST
OTHER CONTRACTOR INSTRU SUPPORT			$0.000		$0.000	1.00	$0.000	CNTR COST
2.3 INSTRUMENTATION & SENSOR PURCHASES			CONTRACT VALUE (M$)		$1.000		$1.000	
GROUND INSTRUMENTS			$0.000		$0.000	1.00	$0.000	GOVT MATERIAL
DATA LINKS & TELEMETRY EQUIP			$0.000		$0.000	1.00	$0.000	GOVT MATERIAL
AIRCRAFT/HELICOPTER MODIFICATIONS			$0.000		$0.000	1.00	$0.000	GOVT MATERIAL
SPECIAL CAMERAS			$0.000		$0.000	1.00	$0.000	GOVT MATERIAL
SPECIAL SENSORS			$0.500		$0.500	1.00	$0.500	GOVT MATERIAL
OTHER INSTRUMENTS			$0.500		$0.500	1.00	$0.500	GOVT MATERIAL
TOTAL COST - INSTRUMENTATION & SENSORS					$5.663		$5.663	

Mixed LOE Estimates and Material Costs

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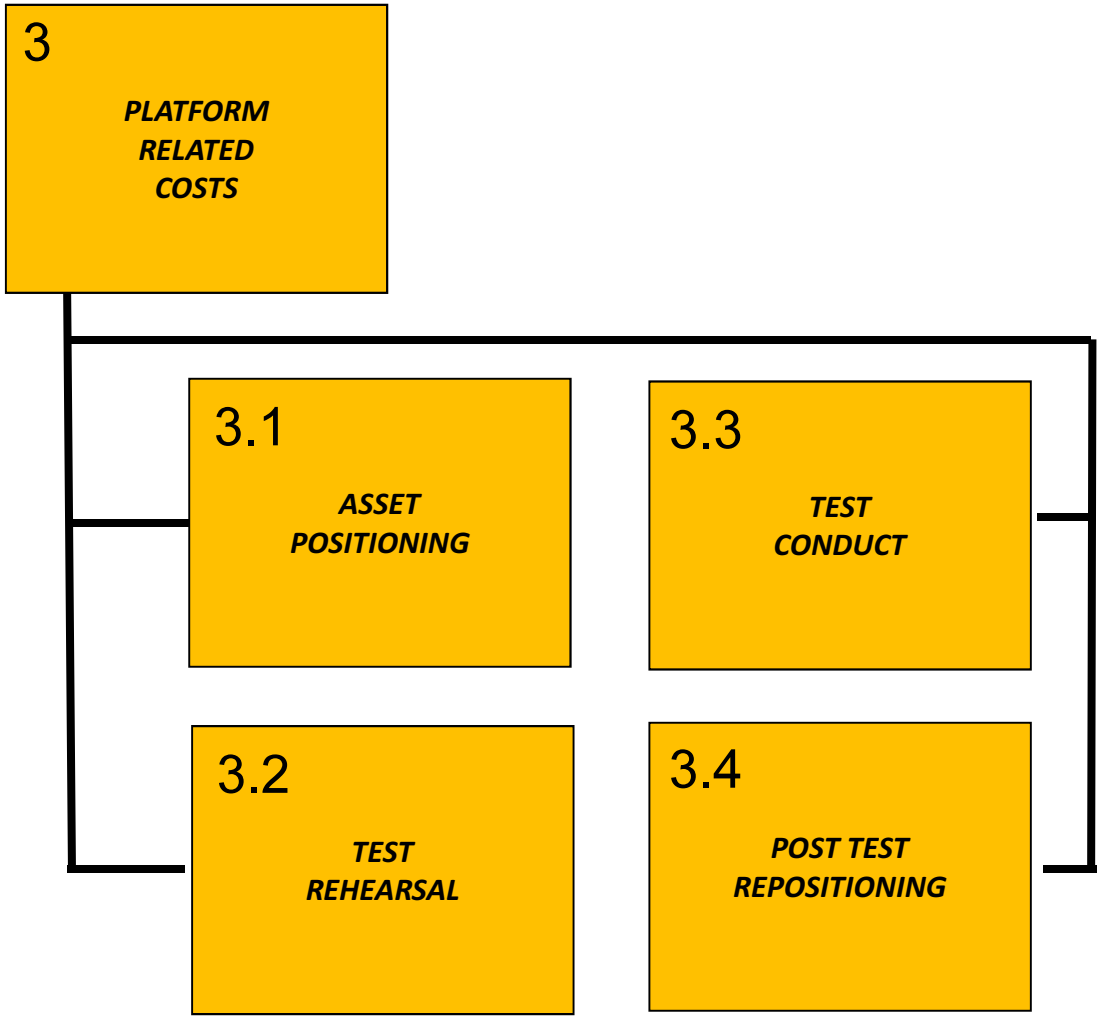
3 – Platform Related Costs



3 – Platform Related Costs – AEGIS Class Ship (1 ea)

Cost per Steaming Day:
$203K (FY12 $)
Source: VAMOSC Database

3 – Platform Related Costs – MQ-9 UAV (2 ea)

Cost per Flight Hour:
$ 6.7K (FY12 $)
Source: AFI 65-503 Database
Includes Ground Segment Costs

3 – Platform Related Costs per Utilization Unit (FH, Days)

ASSET POSITIONING:	5 DAYS	TEST CONDUCT:	1 DAYS
TEST REHURSAL:	1 DAYS	POST TEST REPOSITIONING:	5 DAYS

PLATFORM SYSTEM (COST - UTILIZATION HOURS)	HOURLY OP COST	HOURS PER TEST DAY	FY12 M$ COST PER PLATFORM DAY (M$)
ABIR 1 UAV COST PER FH	$6,750	10	$0.068
ABIR 2 UAV COST PER FH	$6,750	10	$0.068
OTHER PLATFORM COST PER OP HR	$0		$0.000
OTHER PLATFORM COST PER OP HR	$0		$0.000

PLATFORM SYSTEM (COST - PER OP DAY)	DAILY OP COST	TOTAL COST PER PLATFORM DAY (M$)
DDG AEGIS COST PER DAY	$203,038	$0.203
OTHER PLATFORM COST PER OP DAY	$0	$0.000
OTHER PLATFORM COST PER OP DAY	$0	$0.000

Platform Operating Costs per Interval of Time – Note; Airborne platform utilization times are different from surface (sea) platform times because of basing and speed differences.

3 – Platform Related Costs (FY12 M$)

3.0 PLATFORM RELATED COSTS

3.1 ASSET POSITIONING	UNITS	UTE	TOTAL UTE	COST PER UNIT (FY12 M$)	TEST COST (FY12 M$)
ABIR 1 UAV	1	10 FH/DAY	10	$0.007	$0.067
ABIR 2 UAV	1	10 FH/DAY	10	$0.007	$0.067
OTHER PLATFORM					
OTHER PLATFORM					
DDG AEGIS	1	5 DAYS	5	$0.203	$1.015
OTHER PLATFORM					
OTHER PLATFORM					
					$1.149

3.2 TEST REHEARSAL	UNITS	UTE	TOTAL UTE	COST PER UNIT (FY12 M$)	TEST COST (FY12 M$)
ABIR 1 UAV	1	10 FH/DAY	10	$0.007	$0.067
ABIR 2 UAV	1	10 FH/DAY	10	$0.007	$0.067
OTHER PLATFORM					
OTHER PLATFORM					
DDG AEGIS	1	1 DAY	1	$0.203	$0.203
OTHER PLATFORM					
OTHER PLATFORM					
					$0.337

3.3 TEST CONDUCT	UNITS	UTE	TOTAL UTE	COST PER UNIT (FY12 M$)	TEST COST (FY12 M$)
ABIR 1 UAV	1	10 FH/DAY	10	$0.007	$0.067
ABIR 2 UAV	1	10 FH/DAY	10	$0.007	$0.067
OTHER PLATFORM					
OTHER PLATFORM					
DDG AEGIS	1	1 DAYS	1	$0.203	$0.203
OTHER PLATFORM					
OTHER PLATFORM					
					$0.337

3.4 POST TEST ASSET REPOSITIONING	UNITS	UTE	TOTAL UTE	COST PER UNIT (FY12 M$)	TEST COST (FY12 M$)
ABIR 1 UAV	1	10 FH/DAY	10	$0.007	$0.067
ABIR 2 UAV	1	10 FH/DAY	10	$0.007	$0.067
OTHER PLATFORM					
OTHER PLATFORM					
DDG AEGIS	1	5 DAYS	5	$0.203	$1.015
OTHER PLATFORM					
OTHER PLATFORM					
					$1.149

GRAND TOTAL - PLATFORM OPERATIONS	$2.972

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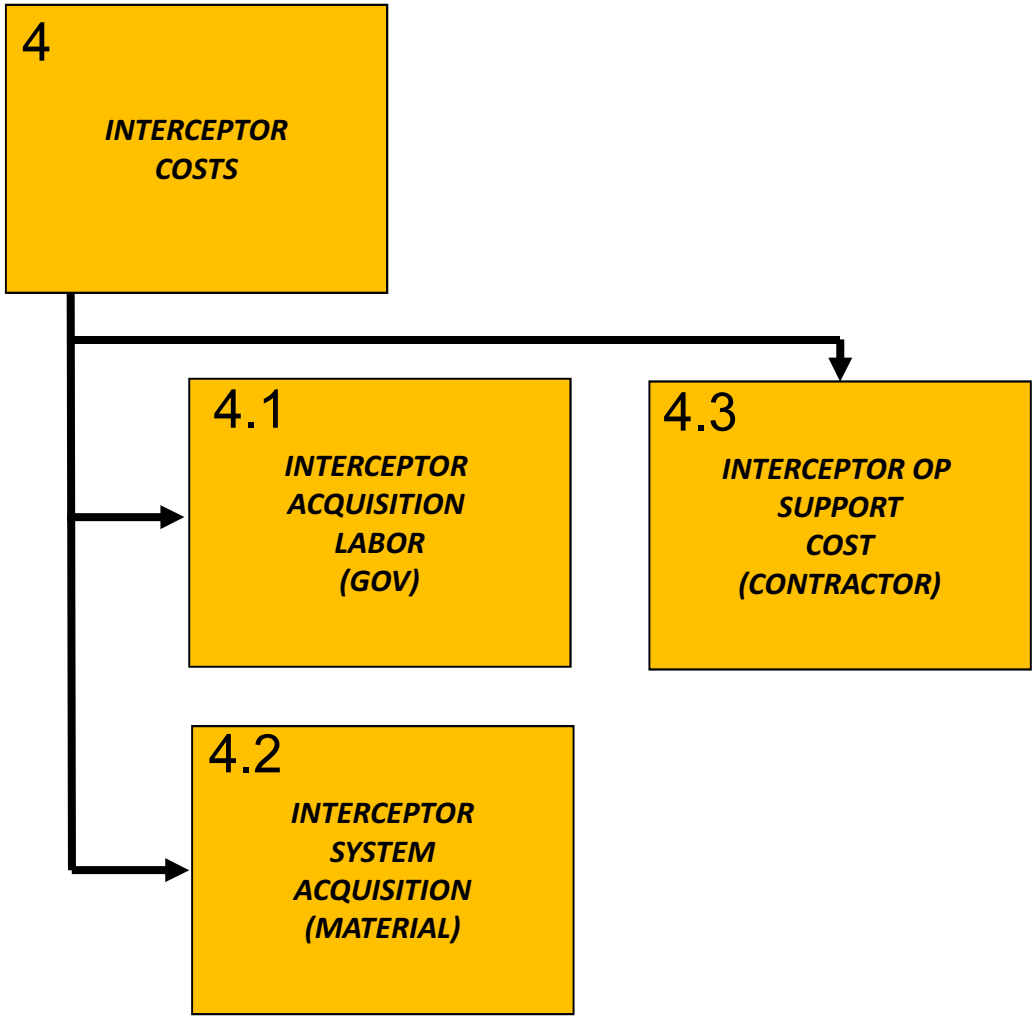
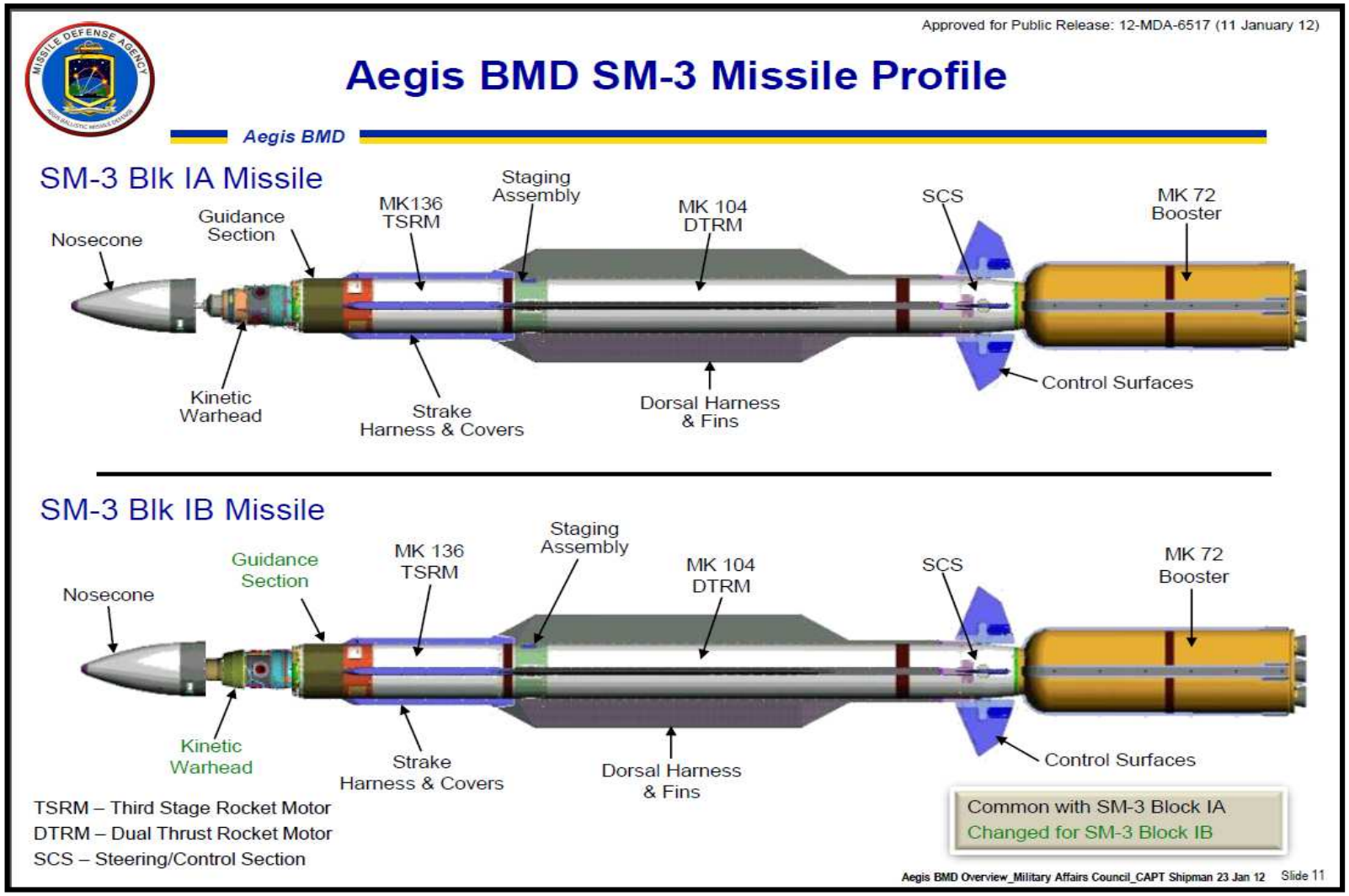
Platform Operating Costs per Interval of Time

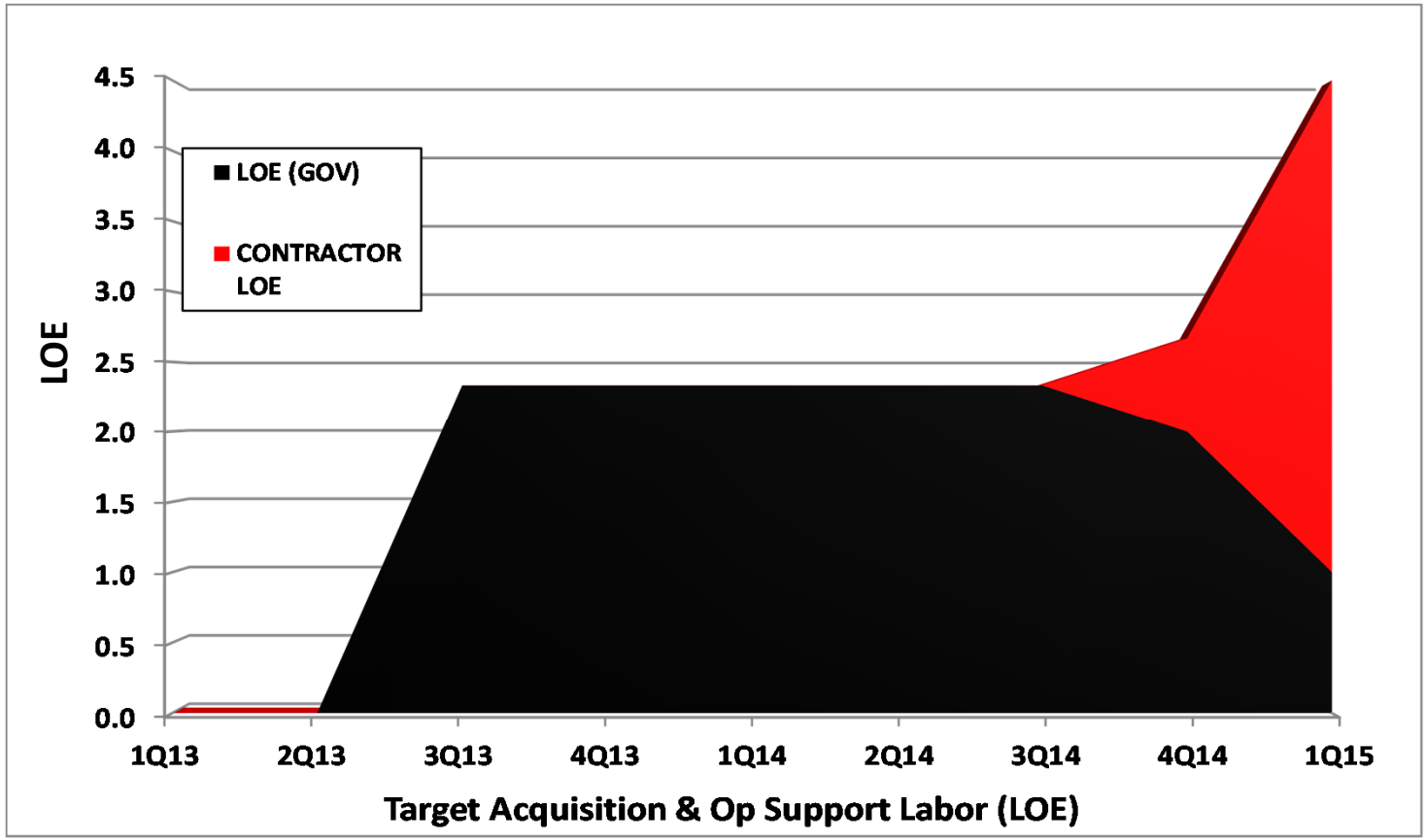
4 – Interceptor Costs



4 – Interceptor Costs



4 – Interceptor Costs – Labor (Acquisition and Op Support)



<u>Interceptor</u> The Standard Missile III cost is an important component of the cost estimate. Government labor (LOE) is required to acquire the interceptor and manage the supplier. Contractor labor (LOE) is needed to support interceptor launch from the AEGIS ship.

4 – Interceptor Costs (FY12 M$)

JOINT WEAPONS TEST

UNCLASSIFIED

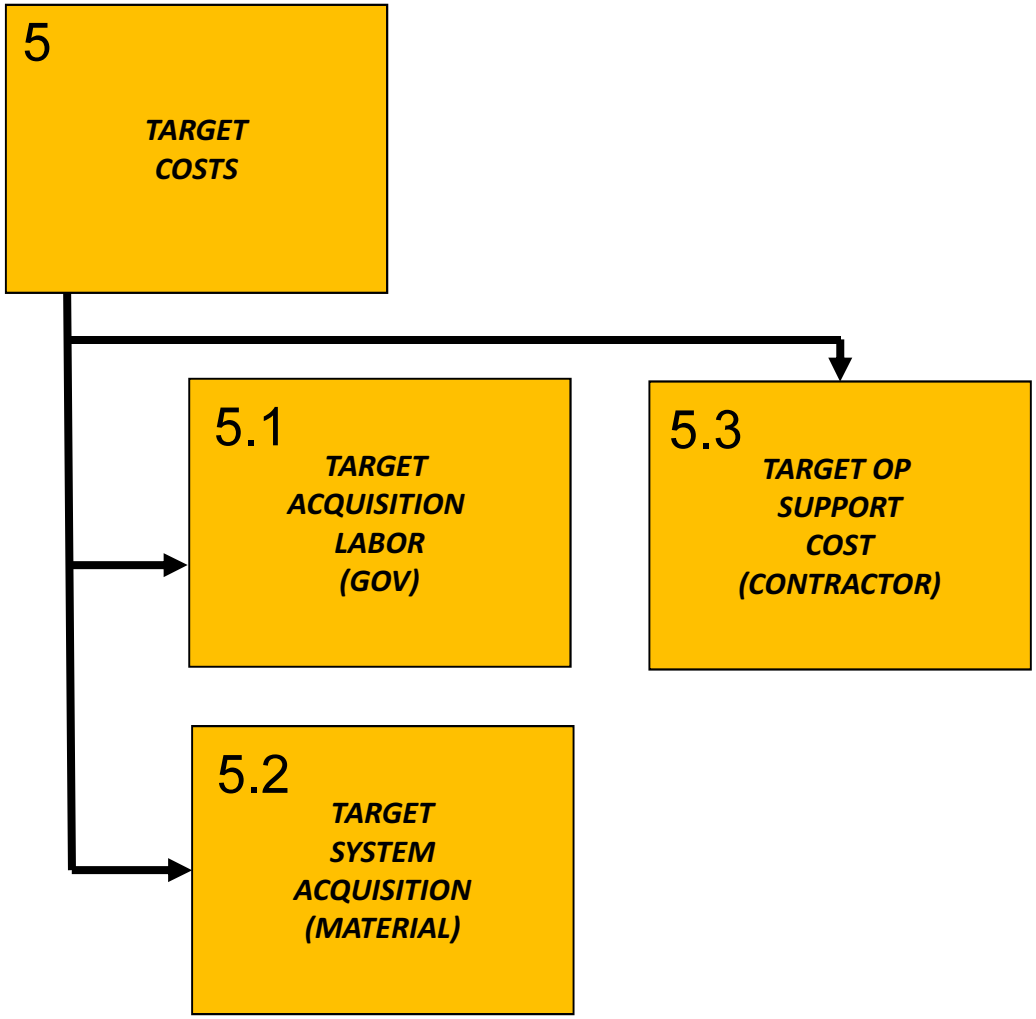
SPAN TIME (MONTHS) 18

	LOE	MONTHS SPAN	ESTIMATED M/M	LABOR RATE FY12 $	ESTIMATED COST (FY12 M$)	COMPLEXITY ADJUSTMENT FACTOR	INTERCEPTOR COST (FY12 M$)	REMARKS
4.0 INTERCEPTOR RELATED COSTS								
4.1 INTERCEPTOR ACQUISITION LABOR (GOVERNMENT)					$0.435		$0.435	
INTERCEPTOR ENGINEERING (GOV)	1	18.0	18.0	$82.12	$0.237	1.00	$0.237	
INTERCEPTOR CONTRACTING (GOV)	0.2	18.0	3.6	$72.23	$0.042	1.00	$0.042	
ADMINISTRATION & SECURITY (GOV)	0.2	18.0	3.6	$72.23	$0.042	1.00	$0.042	
INTERCEPTOR RCVG & HANDLING (GOV	5	2.0	10.0	$72.23	$0.116	1.00	$0.116	
4.2 INTERCEPTOR SYSTEM ACQUISITION (MATERIAL)			CONTRACT VALUE (M$)		$13.968		$13.968	
INTERCEPTOR ACQUISITION			$12.600		$12.600	1.00	$12.600	SM-3
INTERCEPTOR LOGISTICS & SUPPORT SERVICES			$1.000		$1.000	1.00	$1.000	SM-3
INTERCEPTOR CANNISTER			$0.318		$0.318	1.00	$0.318	MK-41 VLS
INTERCEPTOR LOGISTICS & SUPPORT SERVICES			$0.000		$0.000	1.00	$0.000	
PROPELLANTS, GASES, FLUIDS			$0.050		$0.050	1.00	$0.050	
CRANE RENTAL			$0.000		$0.000	1.00	$0.000	
OTHER INTERCEPTOR SUPPORT			$0.000		$0.000	1.00	$0.000	
4.3 INTERCEPTOR OP SUPPORT (CONTRACTOR)	LOE	MONTHS SPAN	ESTIMATED M/M		$0.189		$0.189	
INTERCEPTOR HNDLG	0.0	1.0	0.0	$147.44	$0.000	1.00	$0.000	
INTERCEPTOR BUILD-UP	0.0	1.0	0.0	$147.44	$0.000	1.00	$0.000	
SECURITY	1.0	1.0	1.0	$147.44	$0.024	1.00	$0.024	
VERTICAL CHECK-OUT	2.0	1.0	2.0	$147.44	$0.047	1.00	$0.047	
IRT/EMI/EMC TEST	1.0	1.0	1.0	$147.44	$0.024	1.00	$0.024	
DRY RUN	2.0	1.0	2.0	$147.44	$0.047	1.00	$0.047	
UPRANGE SECURITY	2.0	1.0	2.0	$147.44	$0.047	1.00	$0.047	
OTHER SUPPORT	0.0	1.0	0.0	$147.44	$0.000	1.00	$0.000	
TOTAL COST - INTERCEPTOR RELATED COST					$14.592		$14.592	

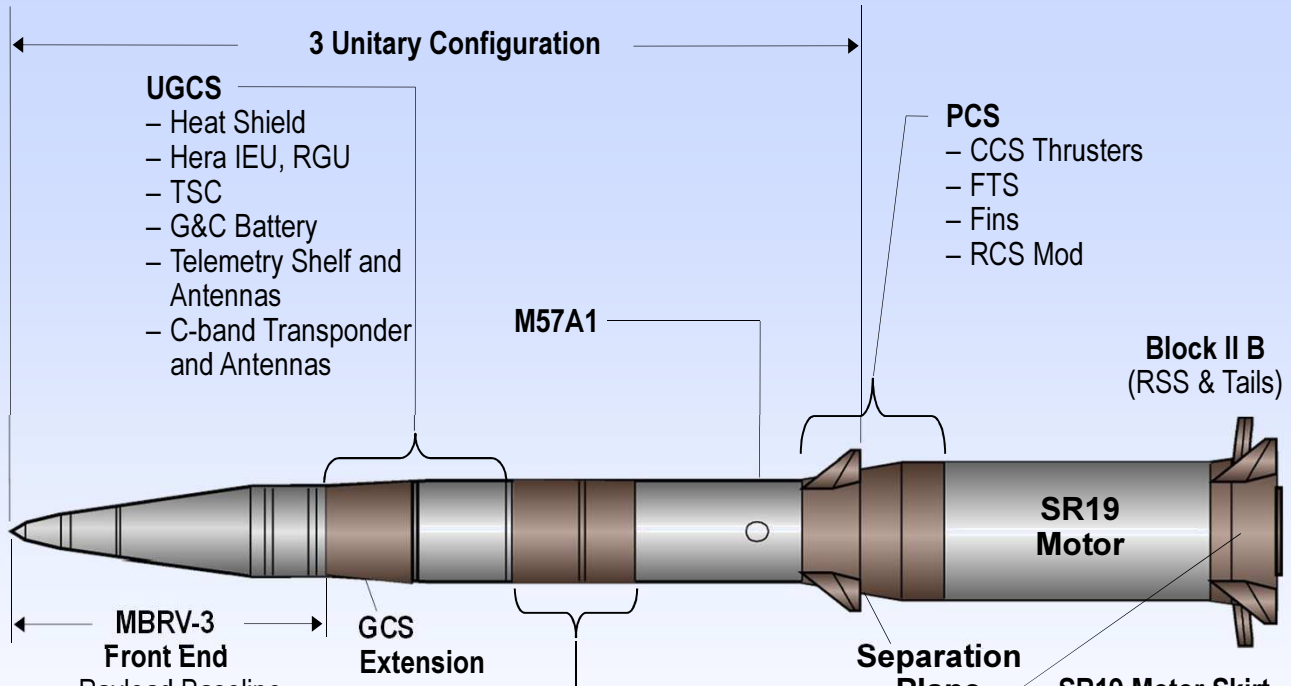
Mixed LOE Estimates and Material Costs

UNCLASSIFIED

5 – Target Costs

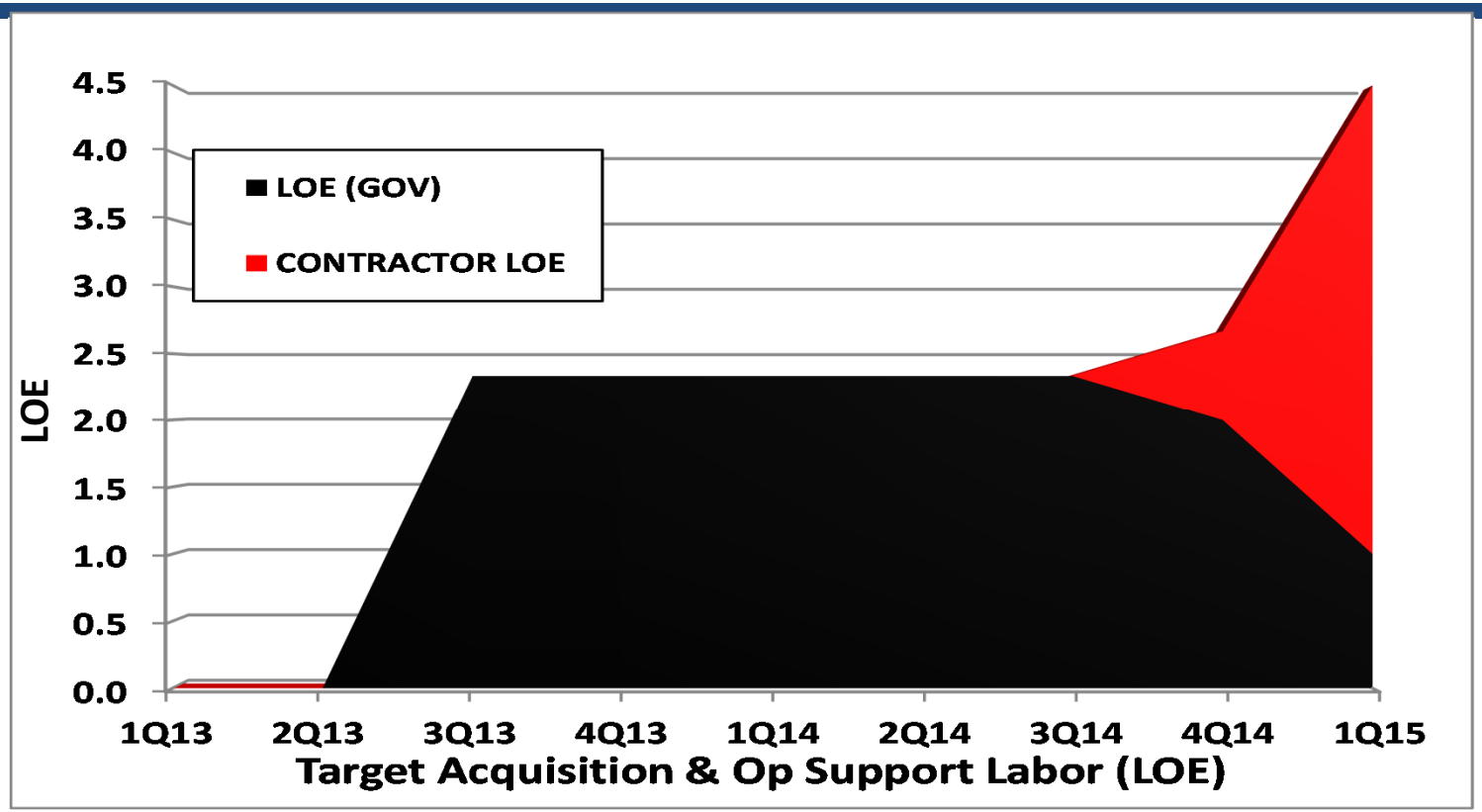


Notional Target Configuration



Target Unit Cost:
$ 16 M (FY12 $)
Source: Target Catalog

5 – Target Costs – Labor (Acquisition and Op Support)



Target: ***The L-RALT target cost is an important component of the cost estimate. Government labor (LOE) is required to acquire the target and manage the supplier. Contractor labor (LOE) is needed to handle, set up, and launch the target from the PMRF range site.***

5 – Target Cost - $ 18.3 Million (FY12 M$)

JOINT WEAPONS TEST

UNCLASSIFIED

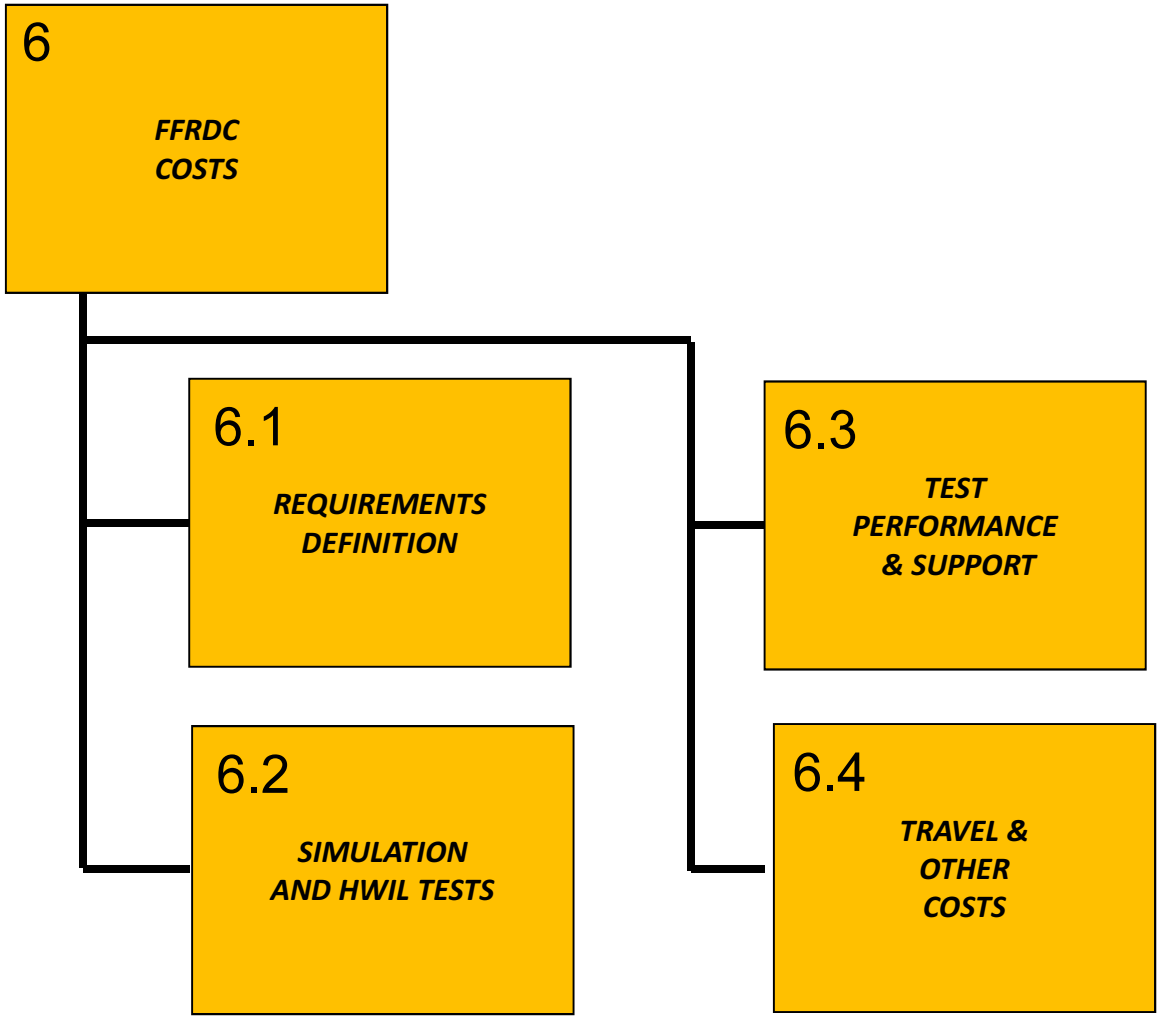
SPAN TIME (MONTHS) 20

	LOE	MONTHS SPAN	ESTIMATED M/M	LABOR RATE FY12 $	ESTIMATED COST (FY12 M$)	COMPLEXITY ADJUSTMENT FACTOR	TARGET COST (FY12 M$)	REMARKS
5.0 TARGET RELATED COSTS								
5.1 TARGET ACQUISITION LABOR (GOVERNMENT)					$0.540		$0.540	
TARGET ENGINEERING (GOV)	1	20.0	20.0	$82.12	$0.263	1.00	$0.263	
TARGET CONTRACTING (GOV)	0.5	20.0	10.0	$72.23	$0.116	1.00	$0.116	
ADMINISTRATION & SECURITY (GOV)	0.2	20.0	4.0	$72.23	$0.046	1.00	$0.046	
TARGET RCVG & HANDLING (GOV)	5	2.0	10.0	$72.23	$0.116	1.00	$0.116	
5.2 TARGET SYSTEM ACQUISITION (MATERIAL)			CONTRACT VALUE (M$)		$17.500		$17.500	
TARGET ACQUISITION			$15.000		$15.000	1.00	$15.000	LRALT
TARGET LOGISTICS & SUPPORT SERVICES			$2.500		$2.500	1.00	$2.500	LRALT
TARGET ACQUISITION			$0.000		$0.000	1.00	$0.000	
TARGET LOGISTICS & SUPPORT SERVICES			$0.000		$0.000	1.00	$0.000	
PROPELLANTS, GASES, FLUIDS			$0.000		$0.000	1.00	$0.000	
CRANE RENTAL			$0.000		$0.000	1.00	$0.000	
OTHER TARGET SUPPORT			$0.000		$0.000	1.00	$0.000	
5.3 TARGET OP SUPPORT (CONTRACTOR)	LOE	MONTHS SPAN	ESTIMATED M/M		$0.295		$0.295	
TARGET HNDLG	5.0	0.5	2.5	$147.44	$0.059	1.00	$0.059	
TARGET BUILD-UP	5.0	0.5	2.5	$147.44	$0.059	1.00	$0.059	
SECURITY	0.0	0.5	0.0	$147.44	$0.000	1.00	$0.000	
VERTICAL CHECK-OUT	3.0	0.5	1.5	$147.44	$0.035	1.00	$0.035	
IRT/EMI/EMC TEST	3.0	0.5	1.5	$147.44	$0.035	1.00	$0.035	
DRY RUN	3.0	0.5	1.5	$147.44	$0.035	1.00	$0.035	
UPRANGE SECURITY	1.0	1.0	1.0	$147.44	$0.024	1.00	$0.024	
OTHER SUPPORT	2.0	1.0	2.0	$147.44	$0.047	1.00	$0.047	
TOTAL COST - TARGET RELATED COST					$18.335		$18.335	

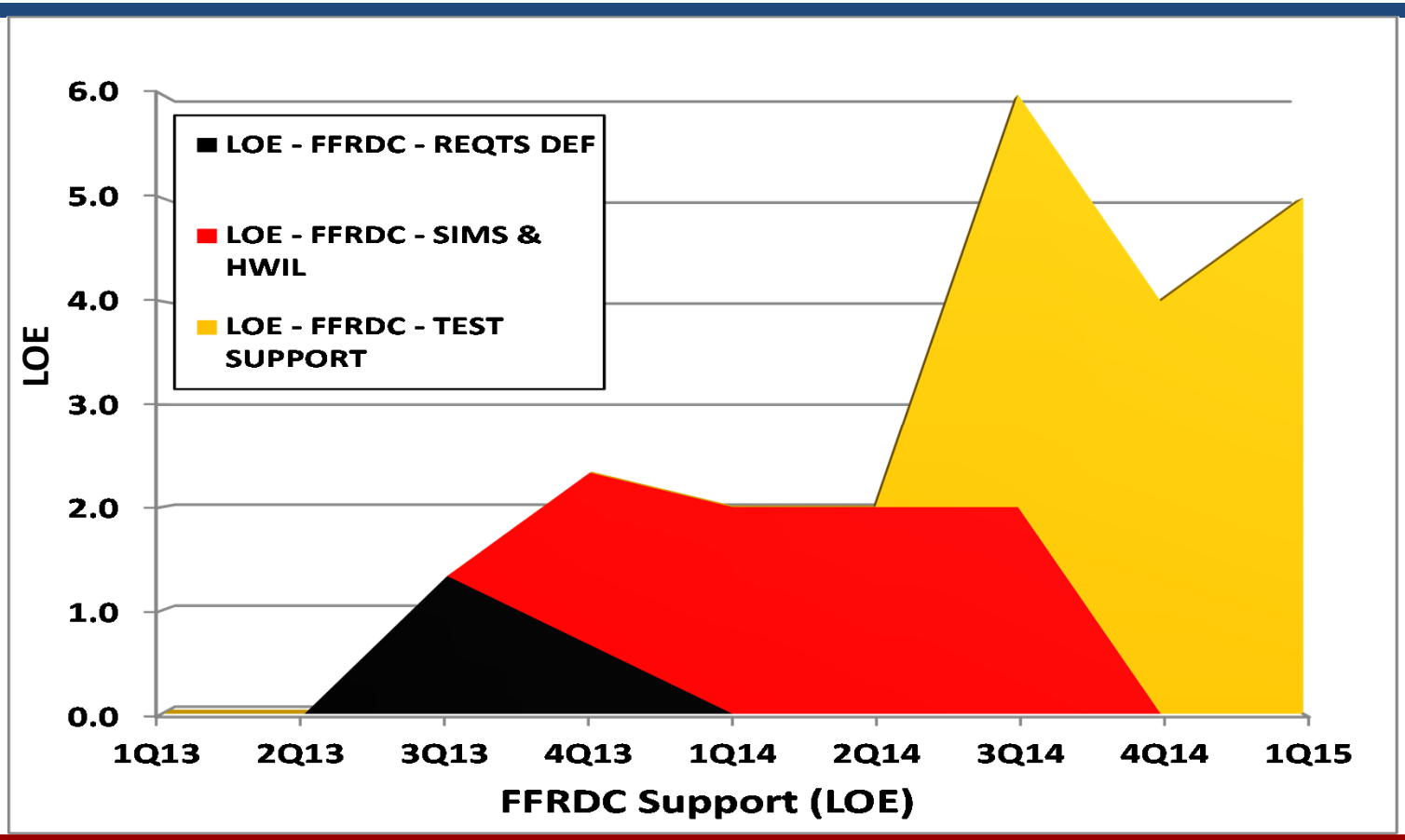
Mixed LOE Estimates and Material Costs

UNCLASSIFIED

6 – FFRDC Costs



6 – FFRDC Costs - Labor



FFRDC Cost: ***The FFRDC effort includes three components based upon level of effort (LOE) estimates. The initial effort covers requirements definition. The following effort includes simulations, analyses, and Hardware in the Loop testing. The final effort covers test support, data collection, and interpretation.***

6 – FFRDC Costs - (FY12 M$)

FFRDC & OTHER AGENCY COSTS UNCLASSIFIED

JOINT WEAPONS TEST

SPAN TIME (MONTHS) 20 (FY12 M$)

	MAN-MONTHS	MAN-HOURS	$/MHR	COST
6.0 FFRDC & OTHER AGENCY EFFORTS				
6.1 REQUIREMENTS DEFINITION & PLANNING	6.0	966	$198.68	$0.192
6.2 SIMULATION & HWIL TESTING	23.0	3703	$198.68	$0.736
6.3 TEST PERFORMANCE	39.0	6279	$198.68	$1.247
TOTAL FFRDC & OTHER AGENCY LABOR	68.0	10948		$2.175
	COST FACTOR			
6.4 TEST TRAVEL & MISC EXPENSES	15.0%			$0.326
TOTAL FFRDC & OTHER AGENCY COST				$2.501

Mixed LOE Estimates and ODC

UNCLASSIFIED

6 – FFRDC Costs - (FY12 M$)

6.1 Requirements Definition

Characterization of the message content, format, communication requirements for concept definition, expected performance, timing

Includes engagement characterization, support to concept definintion, and performance evaluations

	EFFORT	MHRS	LABOR RATE FY12 $	(FY12 M$) Estimated Cost
LEVEL OF EFFORT (PERSONS):	1.5			
DURATION (MONTHS):	4			
TOTAL MM:	6	966	$198.68	$0.192

6.2 HWIL / Interoperability Testing

Assess & verify C2BM system level performance

Includes planning, execution, and post test

	EFFORT	MHRS	LABOR RATE FY12 $	(FY12 M$) Estimated Cost
EVENT PLANNING				
LEVEL OF EFFORT (PERSONS):	3			
DURATION (MONTHS):	4			
TOTAL MM:	12	1932	$198.68	$0.384
HWIL EVENT EXECUTION				
LEVEL OF EFFORT (PERSONS):	3			
DURATION (MONTHS):	1			
TOTAL MM:	3	483	$198.68	$0.096
POST HWIL EVENT ANALYSES				
LEVEL OF EFFORT (PERSONS):	4			
DURATION (MONTHS):	2			
TOTAL MM:	8	1288	$198.68	$0.256
TOTAL PHASE II HWIL/INTEROPERABILITY TESTS				$0.736

LOE Estimates

6 – FFRDC Costs - (FY12 M$)

6.3 TEST PERFORMANCE
Integrated System Capability Demo

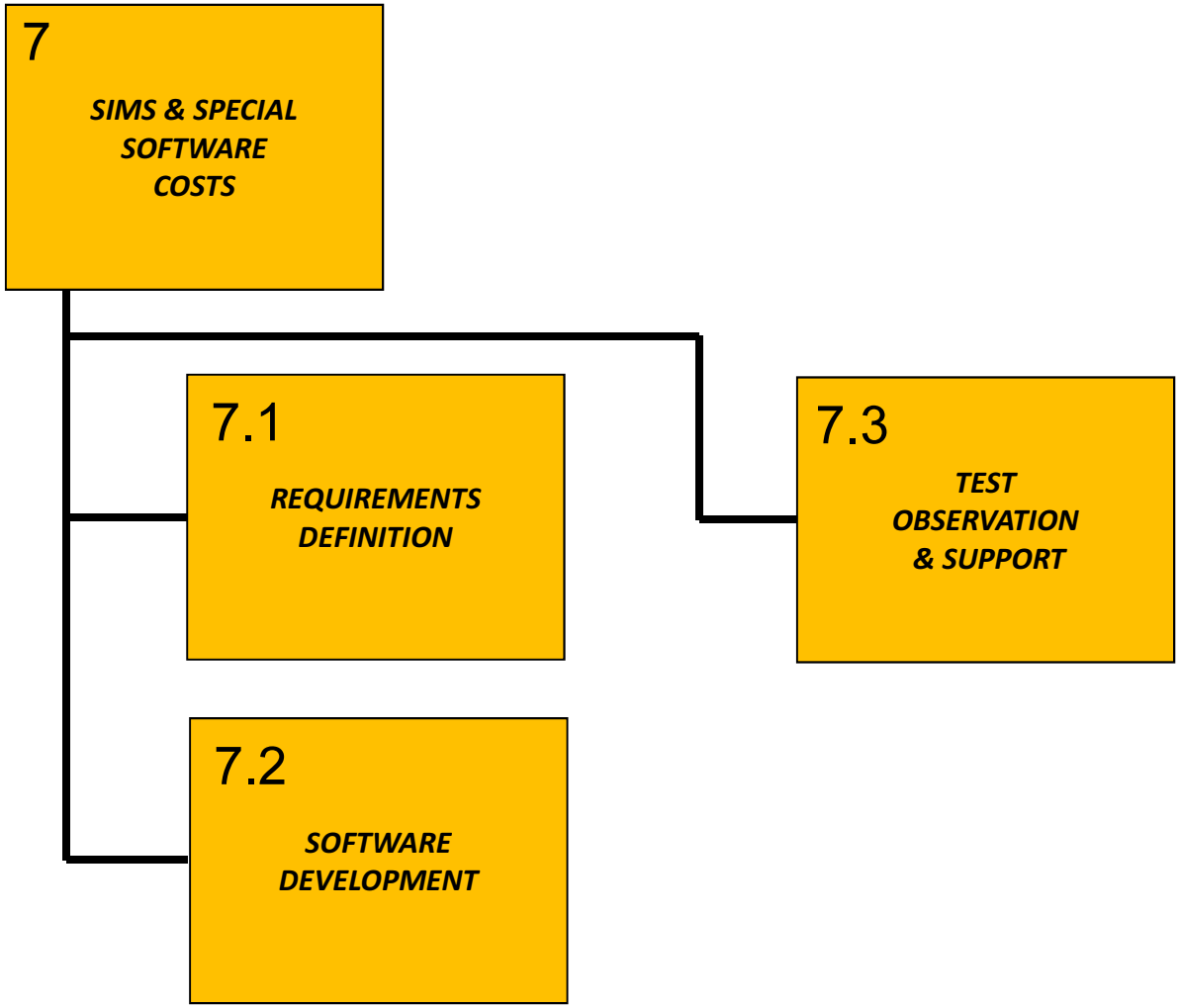
PRE AND POST EVENT ANALYSIS	EFFORT	MHRS	LABOR RATE FY12 $	(FY12 M$) Estimated Cost
LEVEL OF EFFORT (PERSONS):	3			
DURATION (MONTHS):	4			
TOTAL MM:	12	1932	$198.68	$0.384
REHEARSAL				
LEVEL OF EFFORT (PERSONS):	3			
DURATION (MONTHS):	1			
TOTAL MM:	3	483	$198.68	$0.096
SECURITY				
LEVEL OF EFFORT (PERSONS):	4			
DURATION (MONTHS):	2			
TOTAL MM:	8	1288	$198.68	$0.256
MISSION OPERATIONS TEST CONDUCT				
LEVEL OF EFFORT (PERSONS):	4			
DURATION (MONTHS):	2			
TOTAL MM:	8	1288	$198.68	$0.256
OTHER SUPPORT				
LEVEL OF EFFORT (PERSONS):	4			
DURATION (MONTHS):	2			
TOTAL MM:	8	1288	$198.68	$0.256
TOTAL PHASE III TEST PERFORMANCE				$1.247

LOE Estimates

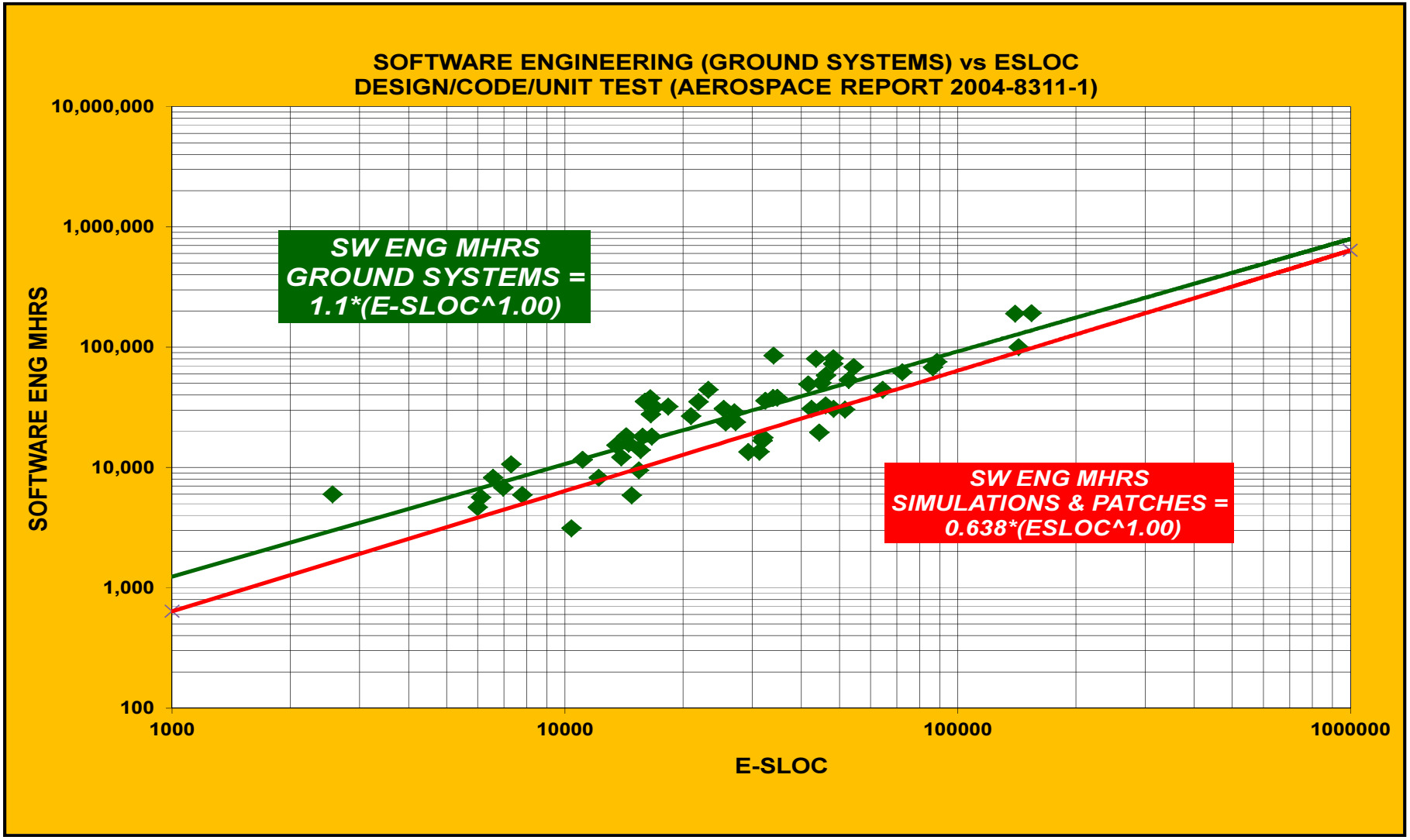
6.4 TRAVEL AND OTHER EXPENSE

COST FACTOR	
15.0%	$0.326

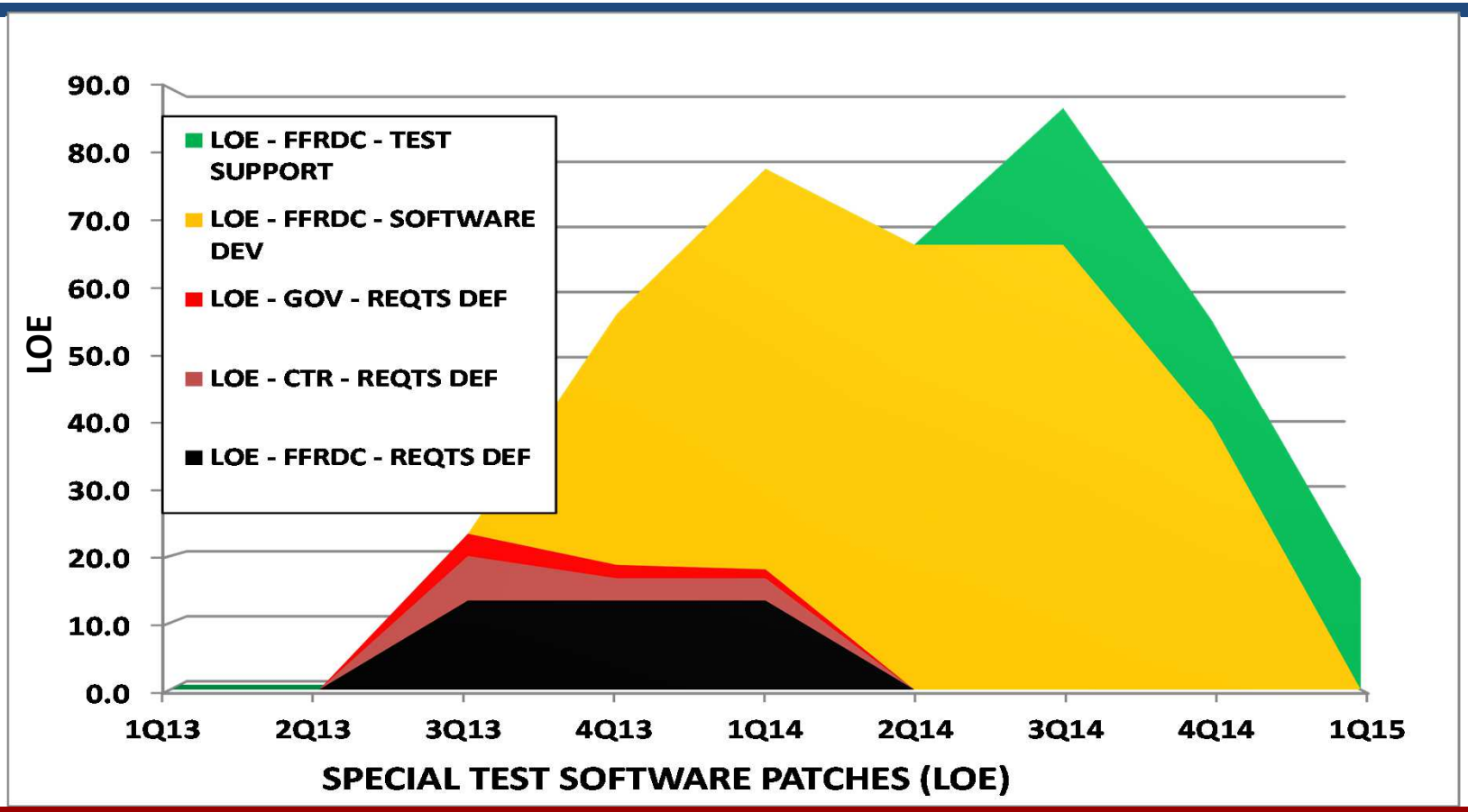
7 – Simulations & Special Software Costs



7 – Simulations & Special Software Costs



7 – Simulations & Special Software Costs



<u>FFRDC Cost:</u> The FFRDC effort includes two components based upon level of effort (LOE) estimates (Requirements Definition and Test Support). The largest effort covers development of special software (Simulations and patches) for IR stereo track and AEGIS launch on off-board queue and off-board sensor tracks.

7 – Simulations & Special Software Costs (FY12 M$)

JOINT WEAPONS TEST

UNCLASSIFIED

	UAV IR SW	AEGIS SW	COST (FY12 M$)
7.0 SIMULATIONS & SOFTWARE			$35.927
REQUIREMENTS DEFINITION	$2.544	$2.544	$5.087
SOFTWARE DEVELOPMENT	$4.555	$21.284	$25.839
TEST OPERATIONS	$2.500	$2.500	$5.000

UNCLASSIFIED

7 – Simulations & Special Software Costs - Requirements (FY12 M$)

REQUIREMENTS DEVELOPMENT	MAN-MONTHS	MAN-HOURS	(FY12 M$) COST
UAV-IR INTERFACE REQTS STUDY (FFRDC)	60.0	9660	$1.919
UAV-IR INTERFACE REQTS STUDY (CONTRACTOR)	20.0	3220	$0.492
UAV-IR INTERFACE REQTS STUDY (GOV)	10.0	1610	$0.132
OTHER TECHNOLOGY STUDY	0.0	0	$0.000
OTHER TECHNOLOGY STUDY	0.0	0	$0.000
TOTAL REQUIREMENTS EFFORT	90.0	14490	$2.544

UNCLASSIFIED

REQUIREMENTS DEVELOPMENT	MAN-MONTHS	MAN-HOURS	(FY12 M$) COST
AEGIS INTERFACE REQTS STUDY (FFRDC)	60.0	9660	$1.919
AEGIS INTERFACE REQTS STUDY (CONTRACTOR)	20.0	3220	$0.492
AEGIS INTERFACE REQTS STUDY (GOV)	10.0	1610	$0.132
OTHER TECHNOLOGY STUDY	0.0	0	$0.000
OTHER TECHNOLOGY STUDY	0.0	0	$0.000
TOTAL REQUIREMENTS EFFORT	90.0	14490	$2.544

UNCLASSIFIED

LOE Estimates

7 – Simulations & Special Software Costs – IR Stereo Track (FY12 M$)

UNCLASSIFIED

SPECIAL TEST SOFTWARE & SIMULATIONS
STEREO IR TRACK SOFTWARE
BASIS OF ESTIMATE

	REMARKS		
TOTAL EXISTING SOFTWARE (SLOC)	12,500	SLOC	PRIOR GOVT DEVELOPMENT
MODIFICATION TO EXISTING SOFTWARE (SLOC)	8,000	SLOC	MODS (FFRDC)
NEW SOFTWARE - TEST FUNDED (SLOC)	7,000	SLOC	FFRDC

REUSED SOFTWARE	12,500
MODIFIED SOFTWARE	8,000
NEW SOFTWARE	7,000
TOTAL DEMOVAL ESLOC	11450

*New SLOC+.4*Modified SLOC+.1*REUSED SLOC FROM SEER MODEL*

TOTAL SLOC DEVELOPED	11450
SIMULATION & PATCH CODE	11450
GROUND SPEC	0
AIRBORNE SPEC	0
SPACE SPEC	0

	(FY12 M$) COST	
SW DEVELOPMENT PRICE	$4.555	
SIMULATION CODE	$3.124	$273 PER SLOC
GROUND SPEC	$0.000	$476 PER SLOC
AIRBORNE SPEC	$0.000	$823 PER SLOC
SPACE SPEC	$0.000	$1,343 PER SLOC
INTEGRATION & TEST	$0.781	25% OF SW DEV COST
DOCUMENTATION & QA	$0.312	10% OF SW DEV COST
PROGRAM MGT	$0.337	8% OF SUBTOTAL COSTS

TO BE PERFORMED BY JHU-APL

22,927.7	TOTAL MHRS
143.3	TOTAL MAN-MONTHS

UNCLASSIFIED

7 – Simulations & Special Software Costs – AEGIS Launch (FY12 M$)

UNCLASSIFIED

SPECIAL TEST SOFTWARE & SIMULATIONS
AEGIS LAUNCH ON QUE SOFTWARE
BASIS OF ESTIMATE

	REMARKS		
TOTAL AEGIS WEAPON CONTROL SYSTEM SLOC	360000	SLOC	PRIOR GOVT DEVELOPMENT
TOTAL AEGIS SIM CODE AVAILABLE AT APL (SLOC)	125000	SLOC	MODS (FFRDC)
NEW SOFTWARE - TEST FUNDED (SLOC)	5,000	SLOC	FFRDC

REUSED SOFTWARE	485,000
MODIFIED SOFTWARE	0
NEW SOFTWARE	5,000
TOTAL DEMOVAL ESLOC	53500

*New SLOC+.4*Modified SLOC+.1*REUSED SLOC FROM SEER MODEL*

TOTAL SLOC DEVELOPED	53500
SIMULATION CODE	53500
GROUND SPEC	0
AIRBORNE SPEC	0
SPACE SPEC	0

	(FY12 M$) COST	
SW DEVELOPMENT PRICE	$21.284	
SIMULATION CODE	$14.598	$273 PER SLOC
GROUND SPEC	$0.000	$476 PER SLOC
AIRBORNE SPEC	$0.000	$823 PER SLOC
SPACE SPEC	$0.000	$1,343 PER SLOC
INTEGRATION & TEST	$3.650	25% OF SW DEV COST
DOCUMENTATION & QA	$1.460	10% OF SW DEV COST
PROGRAM MGT	$1.577	8% OF SUBTOTAL COSTS

TO BE PERFORMED BY JHU-APL

107,129.3	TOTAL MHRS
669.6	TOTAL MAN-MONTHS

UNCLASSIFIED

7 – Simulations & Special Software Costs – Test Support (FY12 M$)

STEREO IR TRACK SOFTWARE	(FY12 M$)		
ATTEND/OBSERVE TEST EVENTS	$0.750		
OBSERVE QUEUE MESSAGE GENERATION AND C2BM ACTIONS	$0.250	12,583.2	TOTAL MHRS
		78.6	TOTAL MAN-MONTHS
MEASURE UAV-IR QUEUE MESSAGE LATENCIES	$1.500		
TOTAL UAV-IR TEST OPS	$2.500		

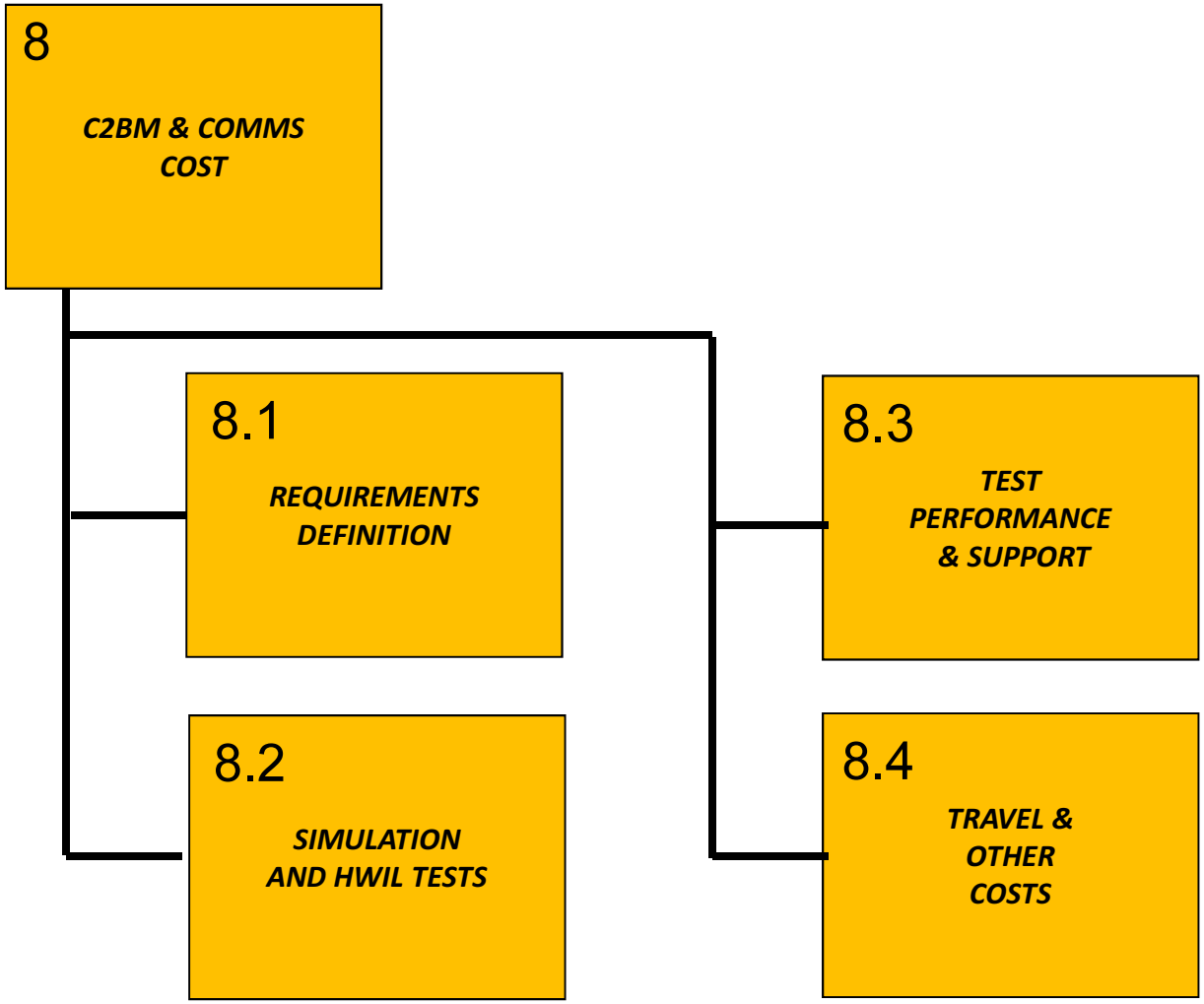
UNCLASSIFIED

AEGIS LAUNCH ON QUE SOFTWARE	(FY12 M$)		
ATTEND/OBSERVE TEST EVENTS	$0.750		
OBSERVE QUEUE MESSAGE GENERATION AND C2BM ACTIONS	$0.250	12,583.2	TOTAL MHRS
		78.6	TOTAL MAN-MONTHS
MEASURE AEGIS QUEUE MESSAGE LATENCIES	$1.500		
TOTAL AEGIS TEST OPS	$2.500		

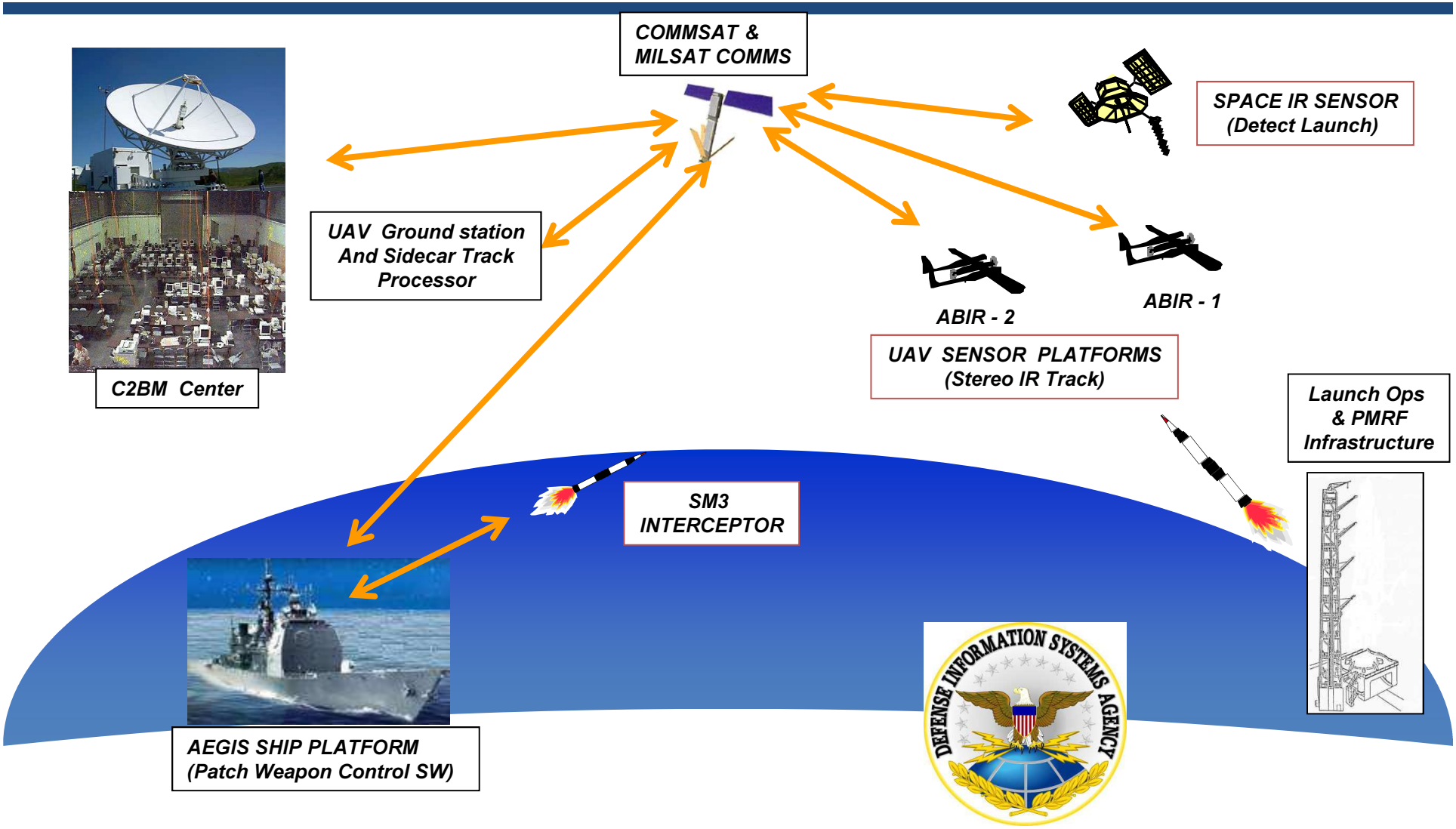
LOE Estimates

UNCLASSIFIED

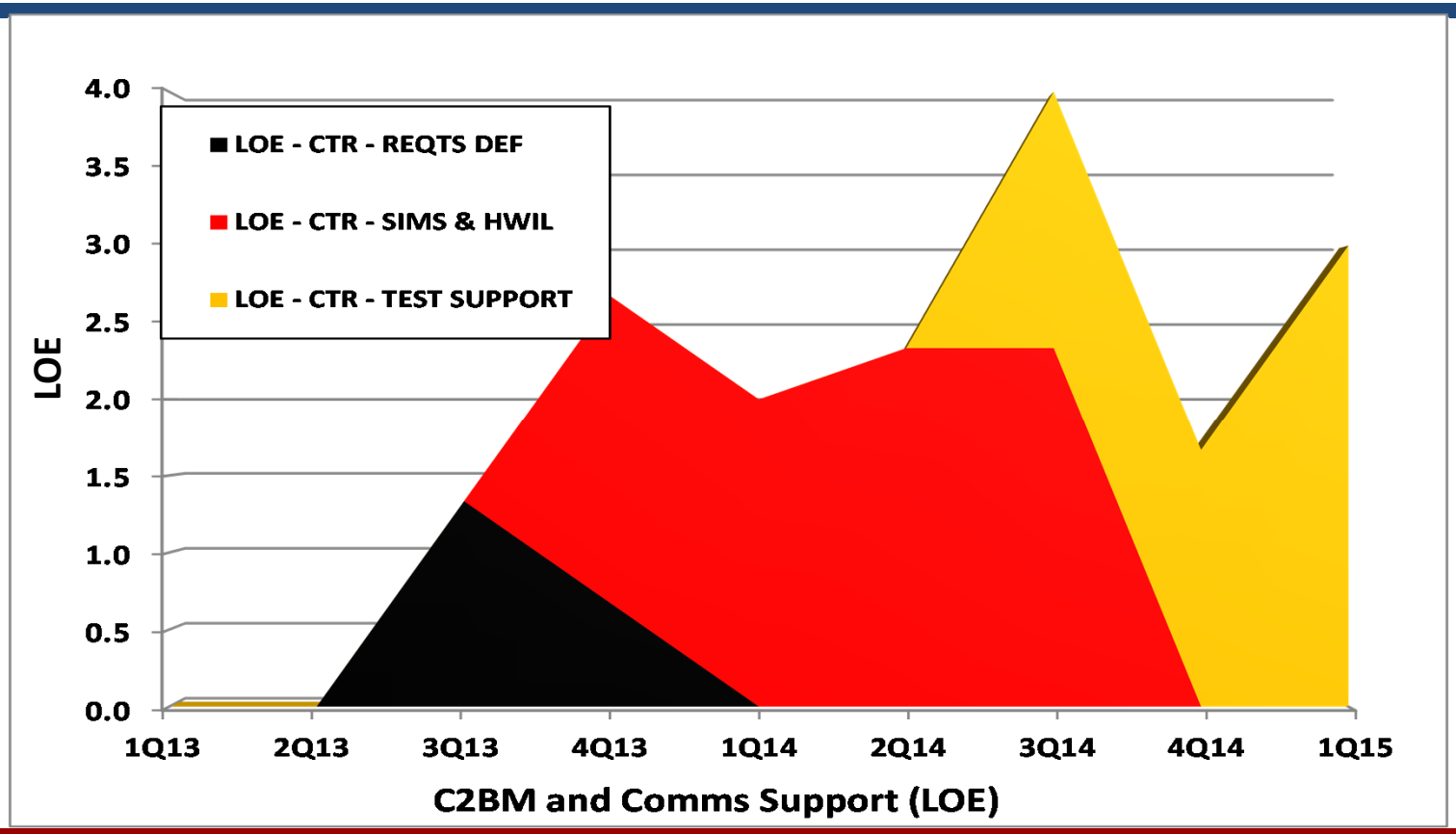
8 – C2BM & Communications System Costs



8 – C2BM & Communications System Costs



8 – C2BM & Communications System - Labor



C2BM & Comms Cost: *The C2BM effort includes three components based upon level of effort (LOE) estimates. The initial effort covers requirements definition. The following effort includes simulations, analyses, and Hardware in the Loop testing. The final effort covers test support, data collection, and interpretation. In addition to LOE labor costs, network fees are also included, based upon the DISA Circular cost per month for SATCOM connectivity.*

8 – C2BM & Communications System Costs (FY12 M$)

C2BM & COMMUNICATIONS EFFORTS UNCLASSIFIED
JOINT WEAPONS TEST

SPAN TIME (MONTHS) 8 (FY12 M$)

	MAN-MONTHS	MAN-HOURS	$/MHR	COST
8.0 C2BM & COMMUNICATION EFFORTS				
8.1 REQUIREMENTS DEFINITION & PLANNING	6.0	966	$152.83	$0.148
8.2 SIMULATION & HWIL TESTING	26.0	4186	$152.83	$0.640
8.3 TEST PERFORMANCE	25.0	4025	$152.83	$0.615
8.4 SATCOMM NETWORK FEES				$0.075
TOTAL C2BM & COMMUNICATIONS LABOR	57.0	9177		$1.478
	COST FACTOR			
8.5 TEST TRAVEL & MISC EXPENSES	15.0%			$0.222
C2BM & COMMUNICATIONS EXPENSE				$1.699

UNCLASSIFIED

Mixed LOE Estimates and ODC

8 – C2BM & Communications System Costs (FY12 M$)

8.1 REQUIREMENTS DEFINITION

Characterization of the message content, format, communication requirements for concept definition,

Includes engagement characterization, support to concept definintion, and performance evaluations

	EFFORT	MHRS	LABOR RATE	(FY12 M$) Estimated Cost
LEVEL OF EFFORT (PERSONS):	1.5		FY12 $	
DURATION (MONTHS):	4			
TOTAL MM:	6	966	$152.83	$0.148

8.2 SIMULATION & HWIL TESTING

Assess & verify C2BM system level performance with Test Platforms and Command elements. Conduct HWIL

Includes planning, execution, and post test analyses.

	EFFORT	MHRS	LABOR RATE	(FY12 M$)
EVENT PLANNING				
LEVEL OF EFFORT (PERSONS):	3		FY12 $	Estimated Cost
DURATION (MONTHS):	4			
TOTAL MM:	12	1932	$152.83	$0.295
HWIL EVENT EXECUTION				
LEVEL OF EFFORT (PERSONS):	3			
DURATION (MONTHS):	2			
TOTAL MM:	6	966	$152.83	$0.148
POST HWIL EVENT ANALYSES				
LEVEL OF EFFORT (PERSONS):	4			
DURATION (MONTHS):	2			
TOTAL MM:	8	1288	$152.83	$0.197
TOTAL PHASE II HWIL/INTEROPERABILITY				$0.640

LOE Estimates

8 – C2BM & Communications System Costs

8.3 TEST PERFORMANCE

	EFFORT	MHRS	LABOR RATE FY12 $	(FY12 M$) Estimated Cost
PRE AND POST EVENT ANALYSIS				
LEVEL OF EFFORT (PERSONS):	3			
DURATION (MONTHS):	2			
TOTAL MM:	6	966	$152.83	$0.148
REHEARSAL				
LEVEL OF EFFORT (PERSONS):	3			
DURATION (MONTHS):	1			
TOTAL MM:	3	483	$152.83	$0.074
SECURITY				
LEVEL OF EFFORT (PERSONS):	4			
DURATION (MONTHS):	2			
TOTAL MM:	8	1288	$152.83	$0.197
MISSION OPERATIONS TEST CONDUCT				
LEVEL OF EFFORT (PERSONS):	4			
DURATION (MONTHS):	1			
TOTAL MM:	4	644	$152.83	$0.098
OTHER SUPPORT				
LEVEL OF EFFORT (PERSONS):	4			
DURATION (MONTHS):	1			
TOTAL MM:	4	644	$152.83	$0.098
TOTAL PHASE III TEST PERFORMANCE				$0.615

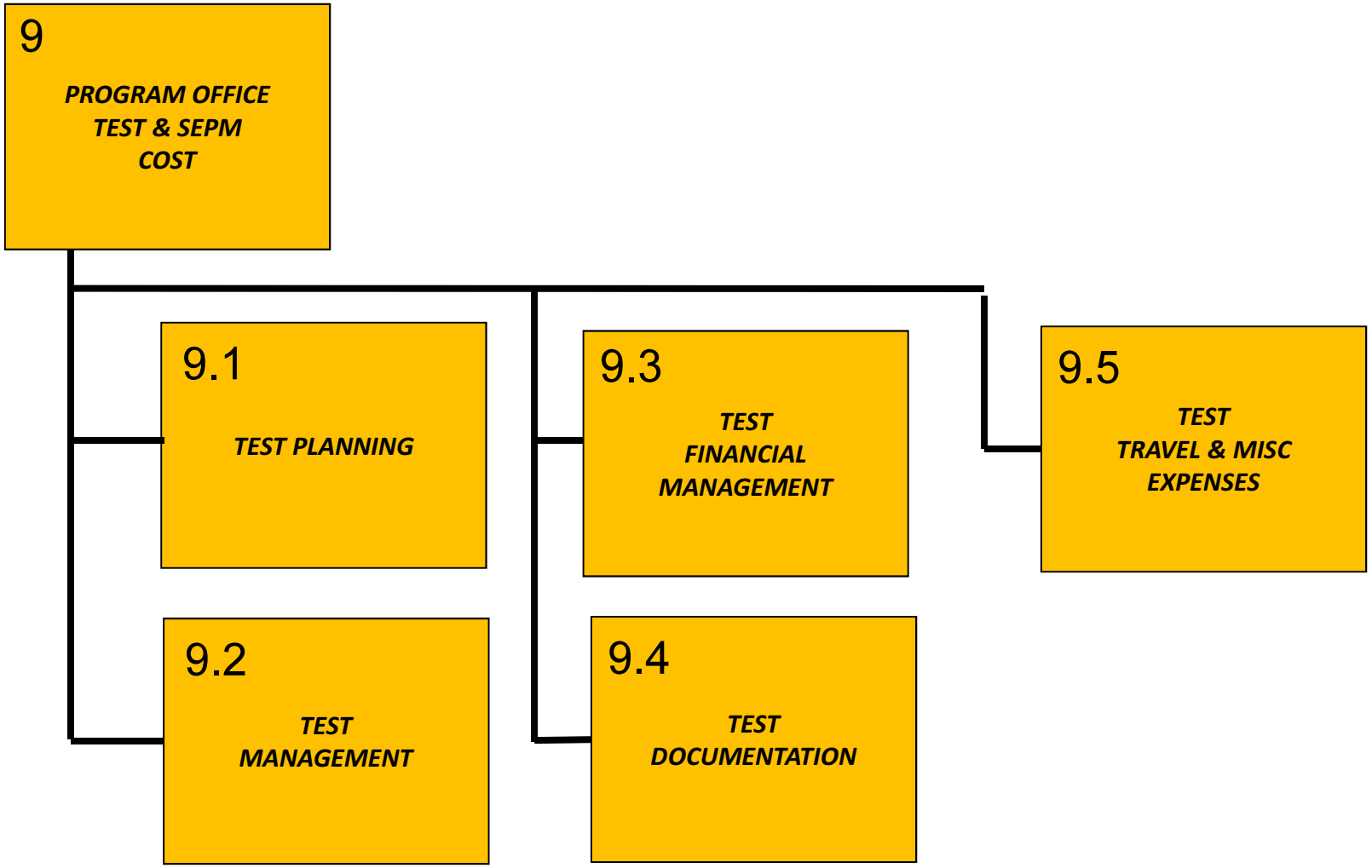
LOE Estimates

8.4 COMMUNICATIONS - NETWORK FEES

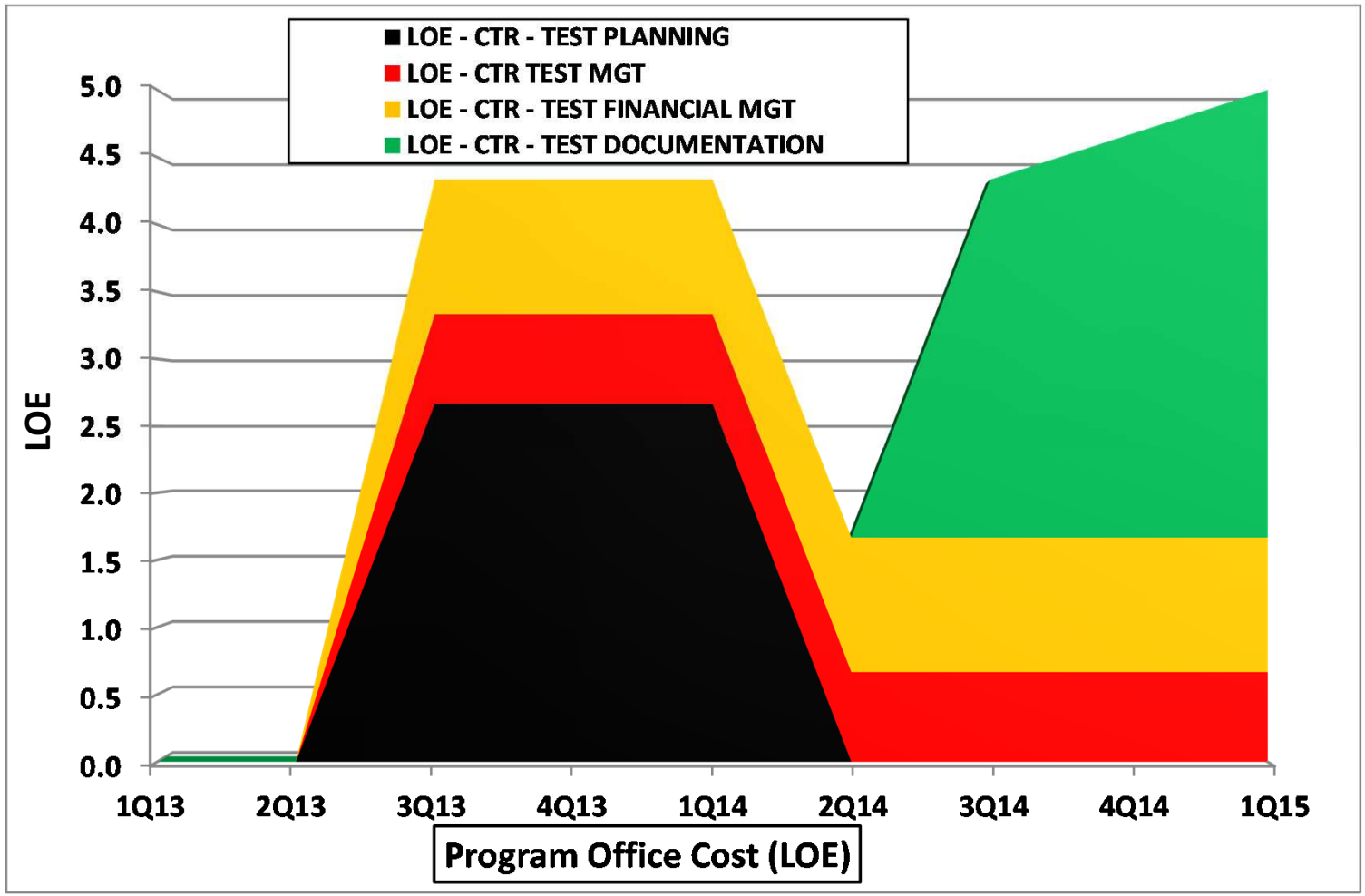
From DISA Circular

	EVENT DURATION (DAYS)	NETWORK FEES	
REHEARSAL	8	$66,667	
TEST CONDUCT	1	$8,333	$0.075

9 – Program Office Costs (SEPM & Other)



9 – Program Office Costs (SEPM & Other)



9 – Program Office Costs (SEPM & Other)

	MAN-MONTHS	MAN-HOURS	$/MHR	(FY12 M$) COST
9.0 PROGRAM OFFICE MANAGEMENT EFFORTS				
9.1 TEST PLANNING	24.0	3864	$147.44	$0.570
9.2 TEST MANAGEMENT	14.0	2254	$147.44	$0.332
9.3 TEST FINANCIAL MANAGEMENT	21.0	3381	$147.44	$0.498
9.4 TEST DOCUMENTATION & OTHER	27.0	4347	$147.44	$0.641
TOTAL PROGRAM OFFICE TEST EFFORT	86.0	13846		$2.041
	COST FACTOR			
8.5 TEST TRAVEL & MISC EXPENSES	15.0%			$0.306
PROGRAM OFFICE TOTAL TEST EXPENSE				$2.348

LOE Estimates and ODC

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9 – Program Office Costs (SEPM & Other)

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REMARKS

9.0 PROGRAM OFFICE TEST EFFORTS
JOINT WEAPONS TEST

9.1 TEST PLANNING (SYSTEM ENGINEERING & DATA EFFORTS)	PROGRAM OFFICE TEST PLANNING & SCHEDULING EFFORT			
	LEVEL OF EFFORT:	1.5	PERSONS	TOTAL M/M
	DURATION:	16	MONTHS	24
9.2 TEST MANAGEMENT	PROGRAM OFFICE TEST MANAGEMENT EFFORT			
	LEVEL OF EFFORT:	1	PERSONS	TOTAL M/M
	DURATION:	14	MONTHS	14
9.3 TEST FINANCIAL MANAGEMENT	PROGRAM OFFICE TEST MANAGEMENT EFFORT			
	LEVEL OF EFFORT:	1.5	PERSONS	TOTAL M/M
	DURATION:	14	MONTHS	21
9.4 TEST DOCUMENTATION & OTHER	PROGRAM OFFICE TEST OTHER - DOCUMENTATION & POST TEST EFFORTS			
	LEVEL OF EFFORT:	1.5	PERSONS	TOTAL M/M
	DURATION:	18	MONTHS	27

LOE Estimates

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Joint OAR Test Estimates - Conclusions

Joint tests can involve systems under development (SUD) or can involve demonstration of new capabilities using existing systems. Such tests vary greatly from case to case and many of them are unique in scope and purpose.

As the case study illustrates, joint OAR tests can be expensive, and their costs are not covered within normal annual range funding for infrastructure and sustaining operations.

Programs that use the ranges for Joint Tests need to provide funding for range services, specific instrumentation and sensor services. Platform operations and expendable weapons and targets also require planning, acquisition management, and support.

The cost estimate provided here includes a great deal of "Level of Effort" labor, determined by the test plan and schedule. But important cost contributions are related to software patches, acquisition of expendable targets and interceptors, and platform costs.