UNCLASSIFIED



NATIONAL DEFENSE RESEARCH INSTITUTE

Posturing DoD for Mosaic Warfare: Final Briefing

Joel Predd, Jon Schmid, Ellie Bartels, Jeff Drezner, Bradley Wilson, Anna Jean Wirth

May 2021

With: Irv Blickstein, Scott Comes, Brad Martin, Chad Ohlandt



Project Overview

Motivation

DARPA has an ambitious vision of Mosaic warfare

The Mosaic vision

- is conceived by STO leadership as a
 - warfighting concept
 - means to accelerate capability development & fielding
- depends on DARPA advancing multiple technologies
- is inherently more challenging to "transition" than a program

Research Questions

- Are DoD's existing requirements, resourcing and acquisition systems compatible with fielding a Mosaic? Are those management systems compatible with envisioned increases in time-effectiveness?
- 2. If not, what are viable alternatives to the existing management systems?

Research Approach: Embrace Policy Gaming as Means to Experiment with Acquisition Models



How did we conceptualize Mosaic?

Heterogenous, fractionated capabilities, dynamically composed on tactical timelines



- Heterogenous: more diverse
- Fractionated: functionally simpler
- Composable: architecturally uncommitted to specific kill chains until mission execution

DevOps + Systems of Systems

time-effectiveness Mosaic 2 Mosaic 1 Mission effectiveness of Fielded Forces Legacy Time timestep: 0 r&d prototyping production awaiting fielding platforms sensors munitions c2 node fielded capabilities software attritable platforms killed

A means to dramatically increase

Concept: Gain insight by requiring DoD reps to make decisions within, live with consequences of a Mosaic world

Players inhabit the roles of DoD decision-makers **OSD** Components DoD R&D USD(A&S) USD(R&E) Community USD(P) CAPE Not played: DepSecDef Congress Industry Services CJCJS/ COCOMs USN USMC Joint Staff **USAF USA**

A three half-day virtual event

	Half Day 1: Mosaic in Today's System	Half Days 2&3: Mosaic in an Alternative Model				
Goal of exercise	Identify conditions under which today's requirements, resourcing & acquisition systems support a Mosaic model	Exercise an alternative to today's management systems to assess viability & identify improvements				
Role of participa nts	Experienced professionals and analysts	Role playing DoD stakeholders				

Force Planning Scenario w/in an Acquisition Scenario

Acquisition Scenario

- 2028 to 2032
- Strategic Continuity (DoD committed to priorities of 2018 NDS)
- Overall military competition between U.S. & China is contested
- U.S. has advanced new JWC but remains committed to a post-Cold War force structure
- DARPA in collaboration w/ USAF & USN R&D demo initial ASuW Mosaic
- Force Planning Scenario -2035 Chinese invasion of Taiwan Mission: ASuW
- SecDef and Congress note success, move to institutionalize a Mosaic

Players' Backgrounds Reflect Assigned Roles

Players in RAND Play-test I and II

Former DoD officials on RAND staff, e.g.

- Retired O6, Navy rep for JCIDS
- Retired Acting Director CAPE
- Former USD(ATL) Staff member
- Former Navy Dir for Analysis, NAVAIR

Players in DARPA Game

- DARPA STO Leadership & Staff
- Retired OPNAV N81
- Former USD(ATL) Staff member
- Senior Advisor to USD(A&S)

JMO Model Addressed Some Challenge, Surfaced Other Issues, and Raised Questions for Further Exploration (1/3)

Requirements

- Presumption that a requirement must precede resourcing
- Presumption of a static requirement that must be satisfied prior to fielding
- Can Mosaic build support w/o a requirement to serve as an agreed-upon benchmark for progress?

Resourcing

- 2-year budgeting cycle requires clairvoyance on needs, limits flexibility to adapt
- Reprogramming takes time, expends political capital

Technology Transition

Difficulty in maintaining enterprise-view of tech pipeline

Addressed by JMO pipeline (portfolio) management function; players note implementation challenges

Acquisition Oversight

- Program-centric paradigm predisposes focus on program cost, schedule, performance outcomes ← Addressed
- Ten ACAT-III tiles may add up to an ACAT-I Mosaic
- Need for a compelling measure of merit to guide Mosaic oversight
- How to measure Mosaic value prop of adaptability to the unknown?

← Players discuss multiple

by JMO mission orientation, pipeline mgmt function

- Issue w/ Existing System Addressed by JMO Model
- Issue w/ Existing System Unaddressed or Reinforced by JMO Model
- New Issue or Question

← Addressed by JMO flexible funding model; players note Congress has finite patience

metrics; RAND work suggests time-effectiveness, or throughput



← Addressed by JMO role in defining needs; not explored explicitly in game

JMO Model Addressed Some Challenge, Surfaced Others (2/3)

Source selection & contracting

- Quick decisions risk protests from losing bidders, adding delay
- Contract negotiations take time
- Seemingly increasing throughput in contract actions
- Risk in managing industrial base dominated by small players, changing demand signals
- Players saw value in an explicit "keep warm" contracting option
- Intellectual property

System Engineering & Integration

- Seamless mission integration (interoperability) does not resolve platform (physical) integration

Test & Evaluation

- Mosaic would compete with regular programs for scarce T&E infrastructure
- ✓ Programs pay for T&E → T&E competes for resources w/ upgrades, procurement...
- Static threats would preclude testing one of Mosaic's value proposition
- □ What is the baseline for T&E, given myriad potential kill chains?
- □ How to square legal requirement and timelines for OT&E with Mosaic timelines?
- Does T&E need to merge with training and TTP development? And with requirements?

✓ Issue w/ Existing System Addressed by JMO Model

- X Issue w/ Existing System Unaddressed or Reinforced by JMO Model
- □ New Issue or Question

← Addressed by pre-approved vendor pool, contracting vehicle; players see virtue and risks

> ← Addressed by JMO stewardship of dedicated T&E infrastructure

> > -6-

Fielding & Sustainment ("Ilities")

- X Limited capacity of Service & COCOM to uptake new capabilities
- X Sequential nature of requirements, T&E and TTP development
- □ Services, COCOMs and JMO were able to reach consensus on fielding
- Action Mosaic elevates the importance of near-continuous reveal-conceal decision-making
- Risk that heterogeneity at the mission-level scales unsustainably to chaos at the global-level

Governance

- ✓ The Institution Will Fight Back: Need to protect enduring DoD equities & interests
- ✓ Mosaic value proposition is greatest in a Joint context; but Joint context is hardest
- Peace-time vs. Wartime Modes of Governance
- □ Will Al play politics? Service reps to appeal to their own competing Al
- JMO introduce seams b/w Service and JMO responsibilities (e.g., enablers vs. platforms)
- Transitioning to Mosaic may be as hard if not harder than maintaining one in steady state
- □ What is the end-game for JMO; should the JMO sunset?

New functions: Pipeline Management and Continuous Mosaic Testing

- ✓ Issue w/ Existing System Addressed by JMO Model
- X Issue w/ Existing System Unaddressed or Reinforced by JMO Model
- □ New Issue or Question

← Not resolved by JMO; players emphasize potential for Service backlash

← the JMO & Institution resolved tensions; Services saw JMO as a bill-payer; natural value alignment with COCOM

Summary and Next Steps: DARPA and Mosaic

Summary

- Nothing inherent to DoD's existing requirements, resourcing or acquisition system inhibits development & fielding of fractionated, heterogenous & composable forces
- Yet existing governance model and management systems likely do not align with the Mosaic vision of fielding capability on operational time scales
- Proposed JMO concept addressed key challenges, but introduces new challenges
- Vast space of potential alternative governance models and management systems, subject to trade-offs, not optimality
- Risk: Mosaic becomes an end, not a means

Next Steps

- Continue to experiment w/ alternative governance systems & management systems using table-top exercises for low-cost prototyping
- When considering governance alternatives
 - Acknowledge enduring DoD needs for management controls for risk management & resource allocation,
 - Acknowledge Service and COCOM equities via Title 10
 - Embrace mission-centrality in requirements, resourcing and acquisition
 - Embrace throughput (time-effectiveness) as a Mosaic measure of merit
 - Define measure of merit that embrace uncertainty, Mosaic value proposition of adaptability
- Develop a simulation of the Mosaic pipeline, and use it to identify policy levers and bottlenecks that will inhibit realization of a Mosaic





Five Assumptions Guided Focus on Acquisition Implications

- 1. Technical interoperability between and within Mosaic elements is seamless
- 2. A Mission Capability Compiler has been advanced and demonstrated to a degree that its recommendations are viewed as credible by DoD leadership, staff & USGOV stakeholders
- 3. OSD, the Joint Staff, the Services, and COCOMs will maintain authorities, interests, missions & top-level priorities as derived from Title 10
- 4. DoD has embraced the Mosaic concept & successfully transitioned to an initial Mosaic force
- 5. The scope of Mosaic acquisition is limited to enablers (sensors, munitions, C2 nodes, attritable/expendable platforms, etc.) leaving major platform acquisition to Services.

Game Explores A Set of "Vignettes" That Instantiate Mosaic Acquisition

	Capabil	ity Thread	" A "	Сар	pability Thread "B"		' Co	Capability Thread			
1. ELINT sensor demoed at White Sands	1. ELINT sensor demoed at White Sands4. Integration into aerostat funded7. Capability demoed in live exercise		y ve fire	10. Aerosta upgrades	ats mainta	iined/sustai	ned by US	N, sensor develop	oer provide	s continual	
2. Analysis indicates senso increases M.E.	2. Analysis5. Firm put on contract to produce 48 units8. Final aerost fielded to ass forces in PACe			Il aerosta d to assig in PACO	stats signed IOC early			s 5. Firms demo swarm tech			
3. F finc sub	3. Pipeline analysis finds no suitable substitutes			9. s by pro	Sensors sustained 2 y USN aerostat d rogram ii		2. M&S → XLUUV + swarms → increase M.E.		6. Integration of sUUV swarm tech funded	8. Cap mainta by USN	ability ined /sustained N
3. Analysis finds new EW + UAS restores M.E.		ds 6. R S term integ	6. R&D initiative terminated to fund integration		9. Fielding progresses		3. Pipeline analysis7.shows no suitableXLIsubstitutesPa		7. Live fire t XLUUV + sw Pacific	est of /arm in	
1. Intel: new lor Chinese	1. Intel: advent of new long-range Chinese UAS4. USAF fur to mature E payload		funds firms 7.20 E re EW equipp fielded		EW- 10 ped UAS cor d to PACOM upp		. Vendor 4. R&I ntinually pushes spun u grades sUUV		D initiative p to develop swarms		
2. M&S indicates 5 threat degrades in M.E. c		tes 5. F les inte cha	5. Field tests reveal integration challenges		8. Performance in field less than 11 analyzed		11. UAS mo	1. UAS maintained/sustained by USN			
Year 1				Year 2		Y	Year 3				
*Placement of steps along t information is conveyed in v	ime axis for graph width or precise p	nical purposes o lacement of in	only. No dividual ste	eps.	Time)					

"Why not, let's try it": The logic of Mosaic may promote faster, cheaper, more responsive acquisition at the tile-level, regardless of the model



Thus, enabling various virtuous cycles

Faster schedules \rightarrow more responsive to threat \rightarrow less requirements creep

Faster adaptation \rightarrow shorter services lives \rightarrow less cost, time to design & build-in sustainability

Lower risks (cost) \rightarrow less onerous oversight by OSD & Congress \rightarrow faster schedules

Simpler requirements \rightarrow expanded performer base \rightarrow increased competition, innovation

In game(s), players tended to translate simpler requirements, lower costs into willingness to experiment, take risks

We Experimented with an Alternative Model

Consolidate authority for requirements, resourcing & acquisition in Joint Mission Office (JMO)

Reports to SecDef

Embraces mission-centricity in all things, elevating parallel development philosophy to the mission-level

- Publish an annual prioritized list of ASuW capability needs
- Assesses all Service investments in ASuW capabilities in the Western Pacific
- Advise SecDef annually on programmatic changes to support Mosaic Warfare.
- Manage and competitively allocate funds for Services or Agencies to develop, produce, or sustain ASuW enablers
- Resource and manage a Joint ASuW test & evaluation (T&E) range and virtual ASuW T&E environment
- Establish, promulgate and ensure Service compliance with Mosaic compatibility policy
- Establish, manage and administrate contracts of a pre-approved vendor pool
- By exception, initiate and oversee new R&D programs for ASuW Mosaic enablers

Promote oversight & protect institutional equities

•	limit IMO responsibility:	Mission:	Theater:	Capability:	Forces:
		ASuW	INDOPACOM	Enablers	Assigned Forces

- Sustain Service and COCOM responsibilities under Title 10 for major platforms, execution, operations...
- Require Service, COCOMs and JMO concurrence before fielding new capability (each have veto-power)

Allocate fully fungible funding to JMO (Congress)

We Create a Faux-DoD Instruction to Instantiate the JMO



Faux-DoD Instruction - Page 1 ASuW Joint Mission Office (JMO)

Mission: The ASuW JMO shall ensure the Joint Force's continual ability to execute the ASuW mission set given a dynamic threat environment and evolving capability space.

The ASuW JMO shall, inter alia:

- Publish an annual prioritized list of ASuW capability needs
- Assesses all Service investments in ASuW capabilities in the Western Pacific with regard to Mosaic readiness.
- Advise the Secretary of Defense annually on programmatic changes to support Mosaic Warfare.
- Manage and allocate, via a competitive process, a fund to support the Services or Defense Agencies to develop, produce, operate or sustain ASuW enablers
- Resource and manage a Joint ASuW test & evaluation (T&E) range and virtual ASuW T&E environment
- Establish, promulgate and ensure Service compliance with Mosaic compatibility policy
- Establish, manage and administrate contracts of a preapproved vendor pool
- By exception, initiate and oversee new R&D programs for ASuW Mosaic enablers
- Initiate, set terms, and select winners of competitions in Mosaic prize competitions



Faux-DoD Instruction - Page 2

The Institution: Services, COCOMs, etc

The Services shall, inter alia:

- Retain full responsibility (under Title 10) for development, production, operation and sustainment of non-enablers.
- By default, retain responsibility to execute development, production, operation and sustainment of enablers.
- Retain responsibility for defining "ility" requirements for all programs.
- Jointly with JMO and INDOPACOM, , annually approve new ASuW capabilities for fielding to assigned forces.

INDOPACOM shall:

- Create, in conjunction with the ASuW JMO, concepts of operation (CONOPS), concepts of employment (CONEMPs), and tactics, techniques and procedures (TTPs) for capabilities acquired by JMO.
- Jointly with JMO and Services, approve new ASuW capabilities for fielding to assigned forces.

The Secretary of Defense shall:

- Determine, in conjunction with the Deputy Secretary of Defense and the Vice Chairman of the Joint Chiefs of Staff, the high-level mission set of the ASuW JMO.
- Appoint Directors of JMO based on CJCS nominations.

Choice of Acquisition Model Subject to Trade-offs

2					?							
	, Facilitator Model				Embrace Middle Tier							
						Develop tiles through the		ugh the	New Joint Mission Office			
	Model	ModelJMO serves as a change agent, connecting developers, operators, etc.ProsMinimal Cost to Implement		e agent, connecting etc.	Model Mid pat ⁱ		Middle Tier of Acquisition pathway			Consolidate authority for requirements, resourcing and		
	Pros			ent	Pros	Minimal Cost to Implement		plement	Model	acquisition in new Joint Mission Office; limit responsibility to a specific mission theater		
		Does not ad		dress identified functional		Middle tier not envisioned to handle end-to-end acquisition, including lifecycle sustain.			capability (enablers) and forces to permit effective oversight			
	Cons	challenges r contracting,	hallenges requirements, resourcing, contracting, T&E, etc. challenges					ng	Pros	JMO likely empowered to make Mosaic successful		
	2					MT largely untested, future uncertain		ed, future	Cons	Unclear whether institutional equities can be protected, if compatible with Title 10		
	Today'	Today's Model Sustainment			Nodel 🤈					Most costly to implement		
	Treat Mosaic tiles as distinct programs			Field an initial Mosaic as an ACAT- 2/3 program under existing JCIDS Model requirement; subsequent tiles/upgrades managed under sustainment program			JMO	as Funder wi	th Dedica	ted T&E Infrastructure		
	subject PPBE, a	to JCIDS, Model				Model		JMO allocated R&D budget to fund Services to develop, produce or sustain Mosaic acquisition tile;				
	හ Cos Implem	3 No Cost to Implement						establish indigenous T&E infrast		infrastructure for rapid testing		
	Appears inherently		Pros	Uses existing acquisition apparatu		Pros Some prece		Some precede	ecedent			
	Mosaic	saic Cons		likely limiting scope		Cons		JMO primary means of influence is indirect – i.e.,		fluence is indirect – i.e.,		
			Needs to broaden co "program" to system		oncept of a of systems			level changes	level changes			

Cost and Risks of Implementation ("Institutional china Broken")