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INITIAL CAPABILITIES DOCUMENT

for

Unmanned Systems (Air, Ground, and Maritime)

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1. **Concept of Operations Summary.** Unmanned Systems can provide persistent relief from dull, repetitive tasks or physically challenging,tasks, while providing providing standoff from dirty or dangerous missions. Unmanned Systems have proven their value and saved Soldiers lives in multiple combat theaters. Recognizing this, the U.S. Congress directed in the 2007 National Defense Authorization Act that:

> *"The Secretary of Defense shall develop a policy, to be applicable throughout the department of defense, on research, development, test and evaluation, procurement, and operation of unmanned systems.*
>
> *- An identification of mission and mission requirements, including mission requirements for the military departments and joint mission requirements, for which unmanned systems may replace manned systems.*
>
> *- A preference for unmanned systems in acquisition programs for new systems, including a requirement under any such program for the development of a manned system for a certification that an unmanned system is incapable of meeting program requirements…"*

a. This ICD supports that directive by identifying required capabilities across the Warfighting Functions. For the scope of this document, an Unmanned System consists of a powered physical system, with no human operator aboard the principal platform, which acts to accomplish assigned tasks. It may be mobile or stationary, and it can be smart, learning, and self-adaptive. It can include all associated supporting components such as Operator Control Units (OCU). Examples include unmanned aircraft systems (UAS), unmanned ground systems (UGS), unmanned maritime systems (UMS), and unattended munitions and sensors. The Unmanned System, operated remotely or with some degree of autonomy, can carry human passengers, and remain categorized as an unmanned system. Currently deployed Unmanned Systems are remotely operated or semi-autonomous, thus requiring a human to be an integral component for mission success.

b. Capability Contributions: The complexity and uncertainty of the current and future Operational Environment (OE) (2009-2034) requires the Joint Force Commander (JFC) to extend the reach of his situational understanding to continuously adapt to a changing environment across the full spectrum of conflict, while facing hybrid threats. This extended battlespace awareness requires the collection of information into the integrated battle command systems network to enable informed decision-making. Unmanned Systems can support future forces and expanded battlespace concepts by serving as economy of force assets and enhancing force protection by providing standoff operational capabilities for many warfighter functions. Interoperable with Joint, Interagency, Intergovernmental, and Multi-national (JIIM) forces, Unmanned Systems must be expeditionary with lethal and non-lethal capabilities that are versatile, agile, sustainable, survivable, and capable to transition across the spectrum of operations. Unmanned Systems with improved persistence, endurance, and autonomy will provide efficiencies in Force Structure through manned and unmanned teaming.

c. Unmanned Systems conduct persistent surveillance for situational awareness. They can provide force application, including targeting, lethal fires, and non-lethal effects, while protecting the force through standoff from threat capabilities. Unmanned Systems also enable sustainment and force support operations through the automation of critical missions, including: assured mobility, transportation, distribution, maintenance, explosive ordinance disposal, communications, and health services. Integrated teams of air, ground, and maritime (surface and subsurface) manned and unmanned systems will enable all warfighter function capabilities to defeat the enemy, under any conditions in the current and future OE.

d. Operational Outcomes. The JFC will employ Unmanned Systems to conduct joint interdependent operations across the spectrum of conflict. Unmanned Systems will be able to conduct focused operations for high-risk missions or selected missions that best satisfy the requirement without the limitations and vulnerabilities of manned systems. Autonomous behavior and the elimination of life support systems will decrease size and weight of an unmanned system. Unmanned Systems allow JFCs to make more informed decisions and plans, to use their forces more effectively and efficiently to produce desired outcomes. JFC desire the capability to provide a level of persistency that is not normally attainable by manned systems.

e. Effects. Unmanned Systems will provide the JFC the ability to persistently monitor their OE, conduct lethal and non-lethal Engagement, and enable continuous command and control (C2), while while protecting and sustaining the force at standoff distances from the threat.

f. How it complements the joint warfighting force. Unmanned Systems provide joint forces greater flexibility when other manned assets are task saturated. Unmanned Systems complement and are fully interoperable with national, strategic, operational, and tactical capabilities found at all echelons, providing for synergistic effects within a complex, net-centric environment.

g. Enabling capabilities required to achieve the desired operational outcomes. Unmanned Systems are dependent upon the integrated battle command applications and supporting communications architecture. For remotely operated systems, a loss of communications to the OCU can be fatal to the system. For all Unmanned Systems, including autonomous systems, the loss of connectivity prevents the shared situational awareness from the sensor to the commander and risks mission failure.

2. **Joint Capability Area.**

a. Unmanned Systems primarily support the Joint Capability Areas (JCAs): Joint Battlespace Awareness, Force Application, and Protection. Unmanned Systems also support Command and Control, Force Support, Net-Centric, Building Partnerships, and Focused Logistics.

b. Range of Military Operations (ROMO). Unmanned Systems capabilities are applicable for the full spectrum operations in all operational themes.

c. Timeframe under consideration for initial operation capability (IOC). Unmanned Systems capabilities are critical to current (2009) operations and are projected to be needed beyond 2034 in alignment with the Office of the Secretary of Defense (OSD) Unmanned Systems Integrated Roadmap. IOC for specific capabilities will vary and be identified in follow-on Capability Development Documents (CDD) and Capability Production Documents (CPD)

d. Relevant Defense Planning Scenarios (DPS) that apply. This ICD is applicable to the full range of Defense Planning Scenarios, with particular applicability to IR-2, IR-3, and IR-4.

3. **Required Capability**.

a. Unmanned Systems provide commanders with capabilities necessary to provide dynamic situational awareness (SA), employ lethal to non-lethal scalable effects to defeat any enemy, protect, and sustain the force, and assure freedom of maneuver. The required capabilities in this paragraph are organized by Warfighting Function and prioritized according to the OSD FY2009-2034 Unmanned Systems Integrated Roadmap1.

(1) Intelligence: The JFC requires a layered network of unmanned, manned, and space sensor capabilities enabling persistent, all weather, all terrain, multi-discipline situational awareness of the OE. Unmanned Systems provide unique sensor employment capabilities enhancing the Commander's SA and understanding.

(2) Fires: Unmanned Systems will assist in the conduct of Fires by facilitating planning, development, and execution of Lethal and Non-lethal precision and area engagements, including but not limited to: Joint Precision Targeting, Electronic Attack, and Information Operations. Unmanned Systems will support precision direct and indirect fires and cooperative engagement through automated

1 The prioritized capability needs of the Warfighter in the OSD Unmanned Systems Integrated Roadmap are Reconnaissance and Surveillance, target identification and designation, countermine and explosive ordnance disposal (EOD), and chemical, biological, radiological, nuclear (CBRN) reconnaissance.

dissemination and enhanced data distribution under the severest conditions in full spectrum operations. These systems also assist in target identification through the differentiation between friend and foe, combat identification, and/or positive identification.

(3) Protection: Unmanned Systems, teamed with manned systems, will enable 360 degree spherical protection of fixed, semi-mobile, and mobile forces from current and future threats by preventing, detecting, acting, and recovering. Unmanned Systems force health protection includes battlefield extraction and transport. Unmanned systems will improve the security of Sustainment Lines of Communication (LOCs) that protect personnel, information, infrastructure, and materiel assets from destruction or degradation, thus enhancing operational reach and endurance.

(4) Battle Command/C2: Unmanned Systems enhance commanders' situational awareness by providing near-real-time relevant information within a collaborative C2 environment based on federated data standards and schema, an open architecture, and common control standards. Commanders should also have the flexibility to selectively extend network transport connectivity to units or battle space via Unmanned Systems. This network extension capability enables information and knowledge connectivity to the tactical edge while operating in degraded or interrupted network environments.

(5) Movement and Maneuver: Unmanned Systems will assist in conducting tasks required for assured mobility and freedom of maneuver for the Warfighter. Unmanned Systems will enhance the commander’s reconnaissance and surveillance capabilities, with range and endurance to support worldwide contingency operations. Unmanned Systems will be capable of collaboration and coordination, autonomous operations, manned / unmanned teaming, and reducing Soldier loads. Unmanned Systems will provide lethal and non-lethal force application for effective maneuver and engagement in order to produce maximum relative combat power at the decisive place and time.

(6) Sustainment: Unmanned Systems must conduct or support sustainment tasks, functions, and missions of: supply, distribution, and services, from home station to forward deployed locations, including the sea base. In order to counter enemy anti-access strategies and provide for greatly increased and distributed force flow and sustainment, the adoption of new and improved systems, platforms, and autonomous navigation capabilities is required to enable a more rapid, precise, and responsive sustainment capability.

b. Capabilities essential to JFC. The ground force Commander requires the ability to execute all Army Warfighting Functions (WFF) in support of the JFC’s military objectives.

c. Timeframe in which the capabilities are required. Unmanned Systems capabilities are critical to current (2009) operations and are projected to be needed beyond 2034 in alignment with the Office of the Secretary of Defense (OSD) Unmanned Systems Roadmap. The specific requirements will be identified in follow-on CDDs, CPDs. and approved Combatant Commanders’ Operational Needs Statements (ONS).

d. All Unmanned Systems will comply with applicable Department of Defense (DOD), Joint, National, and International Policies and Regulations. Unmanned systems development or modifications will comply with health and safety standards and reporting requirements of DOD 6055.1, 5000.2 and AR 40-10.

e. Associated Joint Capability Areas (JCA).

Table 3.1 Associated JCAs

Tier 1	Tier 2
Force Application	- Engagement - Maneuver
Command & Control	- Organize - Understand - Planning
Battlespace Awareness	- Intelligence, Surveillance, & Reconnaissance - Environment
Net-Centric	- Information Transport - Enterprise Services - Net Management
Protection	- Prevent - Mitigate
Logistics	- Deployment & Distribution - Maintain - Logistics Services - Engineering
Building Partnerships	- Communicate - Shape
Force Support	- Force Preparation - Installation Support

Tier 1	Tier 2
	- Health Readiness

4. **Capability Gaps and Overlaps or Redundancies**. Many current Unmanned Systems were designed and fielded for specific niche applications in support of Operational Needs Statements (ONS). They lack the standardization and interoperability needed for the sustained Unmanned Systems program management and resource allocation. Current systems do not provide for modular, configurable payloads for mission specific package tailoring with sufficient to automatically disseminated tracking information. All of the required attributes that a program of record would assess and manage, i.e., force protection, survivability, payload, transportability, C2, and Reliability, Availability, Maintainability (RAM). Current Unmanned Systems do not meet the interoperability requirements for unified standards enabling aerial – ground teaming or controller commonality. Add-on C2, intelligence, and sensor payloads exceed the size, weight, and power (SWaP) constraints for current platform and dismounted employment. ONS from Combatant Commanders have identified gaps in Battle Command, Network, Fires, Sustain, Protect, and Battlespace Awareness capabilities that can be mitigated through the employment of Unmanned Systems.

a. Missions, tasks, and functions that cannot be performed or are unacceptably limited.

(1) Intelligence: The current force lacks the ability to conduct persistent multi-discipline intelligence collection, near-real-time reallocation, and dynamic re-tasking of assets. The leap-ahead technology to full autonomous capability with smart learning and self-adaptiveself adaptive applications will allow for intelligence fusion reduce cognitive workloads. This gap is an issue of both sufficiency (insufficient number of intelligence collection assets) and a lack of capability (limited sensing and endurance of assets).

(2) Fires: The force lacks the sufficient capability to deliver lethal and non-lethal fires, field-scalable munitions, and advanced technologies (electromagnetic (EM), high power microwave (HPM) and high pulse lasers (HPL)), where manned systems are limited, restricted, denied entry, or unavailable.

(3) Protection: The force lacks the sufficient capability to provide adequate standoff distance to protect the force from threats in the OE. Force health protection capability gaps include the inability to safely diagnose, recover, and transport casualties with enroute care from areas where manned systems are denied entry or unavailable.

(4) Command and Control: The force lacks sufficient capability to enable a robust network to fully support information and knowledge connectivity with required capacity throughout the extended OE. Unmanned Systems will also provide network extension capabilities to enable a robust network to fully support information and knowledge connectivity. This lack of capability impacts collaboration and dissemination of relevant information for the Common Operational Picture (COP), creating entire communications enterprise overload. The capability to access, update and collaborate on consistent geospatial and environmental data across the OE does not exist. Classification policies between nations, the absence of technological competency, consistency, and standards between disparate applications, further complicated by language and cultural differences, are examples of the challenges facing Commanders in the execution of Unified Action. Due to limited availability and capacity of the Space segment, long rang and beyond-line-of-site connectivity gaps for ground forces exist.

(5) Movement and Maneuver: The force lacks the sufficient capability to reduce the dismounted Soldier load, reduce cognitive workloads, provide extended weapons effects against the enemy, provide standoff from the threat, and provide assured mobility throughout the OE. Current Unmanned Systems do not support manned / unmanned teaming and lack sufficient power for continuous operations, operational ranges, endurance, and speed. Current Unmanned Systems lack the levels of autonomy to coordinate and collaborate between systems to enable multiple unmanned system force application. Current Unmanned Systems require one or more dedicated operators per Unmanned System. Current Unmanned Systems lack the required platforms, payloads, and sensors to accomplish the JFC's current and projected future missions described in ONS.

(6) Sustainment: The Force lacks sufficient autonomous ground, air, and maritime logistics and distribution capability to provide responsive, assured supply and services to highly dispersed units across the extended OE. The Force lacks the capability to provide health services or mortuary affairs services where manned systems are denied entry or unavailable.

b. Attributes of the desired capabilities. Unmanned Systems and autonomously augmented manned systems must be capable of interoperability, coordination, and collaboration with other manned and Unmanned Systems in the OE. As defined within the DOD sponsored National Institute of Standards and Technology (NIST) Special Publication 1011-I-2.0 (October 2008):

(1) Interoperability is the ability of software, hardware, or components to operate together successfully with minimal effort by the end user. Interoperability can be further attributed with

functional, behavioral, lifecycle, and architectural scopes and it can be delineated in terms of control, levels, types, or degrees. It is facilitated by common or standard interfaces.

(2) Coordination is the ability for Unmanned Systems to share common data such as mission or task plans, maneuver coordinates, or local Common Operating Picture (COP).

(3) Collaboration is the process by which multiple manned and/or Unmanned Systems perform a common mission or task synergistically, while sharing data (see coordination).

Attributes of specific Unmanned Systems, within their mission sets and environments, will be outlined in more detail in their specific requirements documents (CDD and CPD).

c. Recommended prioritization of the gaps. The capability gaps, overlaps, and redundancies organized by Warfighting Functions in paragraph 4 are listed by Tier 1 and Tier 2 JCAs and prioritized according to the OSD FY2009-2034 Unmanned Systems Integrated Roadmap2 within Table 4.1.

Table 4.1 Capability Gap Table

Priority	Tier 1 & Tier 2 JCAs	Description	Metrics	Minimum Values
1	**BattlespaceAwareness** - Intelligence, Surveillance, & Reconnaissance	The Force lacks the capability to conduct unattended persistent multi-discipline intelligence collection throughout the OE for Sustained Situational Awareness	Time on station (sufficiency) Percent of Time (operational availability)	24 hours per day 90%
2	**Force Application** -Engagement	The Force lacks sufficient resources to adequately, and for extended time periods and/or repetitive conditions, conduct unmanned or unattended Lethal	Number and Type of Engagements	Appropriate values will be established in the systems specific CDD/CPD

2 The prioritized capability needs of the Warfighter in the OSD Unmanned Systems Integrated Roadmap are Reconnaissance and Surveillance, target identification and designation, countermine and explosive ordnance disposal (EOD), and chemical, biological, radiological, nuclear (CBRN) reconnaissance.

Priority	Tier 1 & Tier 2 JCAs	Description	Metrics	Minimum Values
		and Non-Lethal fires operations The Force lacks the capability to conduct unattended precision target acquisition and targeting	Target Location Error	< 10 Meters
3	**Protect** -Prevent -Mitigate	The Force lacks the ability to provide maximum standoff from threats	Distance	Greater than threat lethal radius
4	**Command and Control** -Understand	The Force lacks the capability to display relevant and tailored Situational Awareness The Force lacks the ability to reallocate/retask unmanned assets in near real time	Time Time	< 5 Seconds (Network Latency) < 5 Seconds (Network Latency)
5	**Net-Centric** -Information Transport -Enterprise services -Net Management -Information Assurance -System-to-System	The Force lacks a network providing non-interrupted communications for dispersed units (Networked Enabled) The Force lacks unified interoperability standards to facilitate Open Architectures and common controls The Force lacks the capability to provide integrated sensor data in near real time to the exchange	% Critical Information Exchange Requirements Complete % proprietary Interface Controls Time	100% <10% < 5 Seconds (Network Latency)

Priority	Tier 1 & Tier 2 JCAs	Description	Metrics	Minimum Values
6	**Force Application** -Maneuver	The Force lacks the autonomy to assist in the reduction of operator task saturation	Autonomy Level	Human Machine Interface levels will be established in the systems specific CDD/CPD
		The Force lacks the ability to reduce the soldiers load	Weight	As appropriate for mission and environment
		The Force lacks the ability to deliver force application missions from distance	Effective Range	Appropriate values will be established in the systems specific CDD/CPD
7	**Logistics** -Deployment and Distribution -Supply -Maintain -Logistics Services -Installation Support	The Force lacks unmanned systems to perform logistics support and services	Reliability, Availability, Maintainability (RAM), and Throughput	Appropriate values will be established in the systems specific CDD/CPD
8	**Force Support** -Health Readiness -Human Capital Management	The Force lacks the capability to provide standoff Health Services and Force Health Protection where manned systems are denied entry or unavailable	Survival rate of casualties and first responders	Appropriate values will be established in the systems specific CDD/CPD

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314 **5. Threat and Operational Environment**

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a. Threat to be Countered or Targeted. Unmanned Systems' targets will be located throughout an OE that could include routes, areas of interest, point targets, personnel, weapons systems, the entire range of military and civilian vehicles, structures, minefields and obstacles, CBRN, IEDs, and other explosives. These targets may be located within battlefield and electromagnetic (EM) clutter, and may incorporate or operate employing various countermeasures to detection, identification, engagement and targeting.

b. Projected Threat Environment.

1. Over the next two decades, U.S. forces will operate in a geo-strategic environment of considerable uncertainty, an era of persistent conflict. This era will be characterized by protracted confrontation among state, non-state, and individual actors using violence to achieve their political and ideological desired end states. Future adversaries will rely less on conventional force on force battles to thwart U.S. actions and more on employing tactics that allow him to frustrate U.S. intentions without direct confrontations.

2. U.S. ground forces will operate in all terrain sets and weather conditions in increasingly complex environments which severely restrict engagement of the opponent at a time and place of our choice due to combinations of natural or manmade topography, dense vegetation, or civil populace. Adversaries will be networked and fighting on familiar terrain, among sympathetic civilians within a known cultural environment. Their forces and capabilities will be optimized for their terrain and circumstances, often enabled, or assisted by irregular forces, criminals, and terrorists. These "hybrid" threats will conduct complex, irregular warfare, characterized by dispersed operations. They will conduct standoff, hit-and-run attacks, ambushes, and other elusive tactics, techniques and procedures (TTP), incorporating capabilities ranging from the asymmetric to advanced. They recognize that small numbers of sophisticated "niche" systems can have a dramatic effect on the OE and perceptions. Extended routes of supply and lines of communication offer opportunities for attack of less protected logistics elements. Adaptive adversaries recognize U.S. dependence on logistics and will focus on disruption of the logistics tail.

(3) Adversaries reduce exposure to standoff fires and detection by utilizing complex battle positions (CBPs) and cultural standoff. CBPs are locations designed to protect the occupants from detection and attack while denying their seizure and occupation. They are not necessarily tied to an avenue of approach. CBPs protect forces while providing sanctuary from which to launch attacks. Camouflage, cover, concealment, and deception (C^3D) measures are critical to the success of a CBP. These C^3D efforts and actions include, but are not limited to, underground facilities, complex/urban terrain, fortification, false and decoy positions, and information warfare support. Cultural standoff TTPs employed by threat actors include: integrating religious, medical, and other sensitive facilities into

complex battle positions, employing human terrain for C^3D purposes, and exploiting a population using information warfare.

(4) Increasingly, they will possess advanced reconnaissance, surveillance, and target acquisition capabilities integrated within local networks. Enemies will attempt to achieve information dominance, manipulate information for their own ends, and deny information to friendly forces possibly through electronic warfare and computer network attack. Opponents will incorporate lessons learned from ongoing operations against U.S. forces and export these lessons. They have observed U.S. employment of unmanned systems in current operations, and will possess knowledge regarding TTP and vulnerable areas for Unmanned Systems and will adapt operations over time to reflect their experience and other available information. Chemical and biological agents will become more diverse and sophisticated. Both state and non-state actors will be actively pursuing and will likely gain access to nuclear weapons, sophisticated and/or bio-engineered biological agents, and non-traditional chemical agents. The air and EM environments will be congested with competing demands for airspace, spectrum, and bandwidth among U.S., Allied, civilian and enemy elements.

c. Threats to Unmanned Systems. Threats to Unmanned Systems will be dependent upon platform and mission, but may include sea, ground, artillery, air, air defense, or any other type of conventional or unconventional attack. The primary threats to Unmanned Systems are physical damage and/or destruction by enemy combatants using bullets (including armor piercing); anti-armor munitions (hand held HEAT) and anti-material sniper rifles; surface and subsurface munitions and mines; indirect fire (rockets, mortars and artillery) with improved conventional munitions (ICM) and precision guided munitions (PGM); enhanced blast munitions (EBM) including thermobarics, flame and fire, mines, and improvised explosive devices (IEDs); surface-to-air missiles (SAM); and air defense artillery. Other threats include, fixed and rotary wing aircraft, UAS, UGS, UMS, CBRN, and information operations. Electronic attack will potentially threaten associated communications, data link, and position navigation systems; computer network operations could threaten associated networks. Enemies will possess a wide variety of target acquisition means from the intercept of unencrypted cell phone traffic, through image intensification (active and passive infrared), and thermal imaging systems. Employment of various camouflage, concealment, cover, denial, and deception means including obscurants, nets, and coatings will complicate intelligence collection missions. Finally, adversaries may employ various physical barriers and other techniques to counter employment of smaller and perhaps other Unmanned Systems. Directed energy weapons, including laser and radiofrequency weapons, and other developing technologies will pose increased threats over time.

d. Threat References. More detailed threat information is contained in the Defense Intelligence Agency-validated classified Future Combat System Brigade Combat Team (FCS-BCT) System Threat Assessment Report dated 27 February 2009, Air Capstone Threat Assessment, DoD-1577-4320-08, June 2008, and the Chemical/Biological, Radiological, and Nuclear Warfare Capstone Threat Assessment, DIA-05-0909-027, October 2009.

6. **Ideas for Non-Materiel Approaches (DOTmLPF analysis)**. Analysis to support this ICD considered DOTLPF alternatives other than a new materiel solution.

a. Doctrine. Changes to current doctrine will not eliminate or adequately reduce the capability gaps requiring persistent situational awareness and protection through standoff from the threat.

b. Organizational. The described capability gaps cannot be eliminated or adequately reduced by instituting organizational changes alone. Increasing the number of manned systems to the force structure can mitigate some persistence gaps, but may increase risk with those additional forces exposed to the enemy. Likewise, continued funding for contracted logistics support (CLS) can mitigate sustainment gaps, though at excessive cost and risk to contractors. Fielding technologically advanced Unmanned Systems in effective manned / unmanned teams is expected to deliver efficiencies in force structure and costs over time.

c. Training. Changes to training can optimize effectiveness when employing current Unmanned Systems and may improve capabilities, but they cannot eliminate the capability gaps. Common control standards described in this document could reduce training load through efficiencies and standards in commonality.

d. Leadership & Education. Educating Leaders on the employment and capabilities of current Unmanned Systems can optimize mission effectiveness, but it cannot eliminate all of the capability gaps.

e. Personnel. Identify, track, and manage critical skills related to Unmanned Systems operators, leaders, and maintainers. Unmanned Systems maintainers (Mechatronics) require multi-technical automotive, electronic, and programming skill sets added to an existing or new Military Occupational Specialty (MOS). Changes to personnel within the force structure will not eliminate the capability gaps.

f. Facilities. Facility changes will not address the capability gaps, although existing facilities will benefit from Unmanned Systems applications reducing cognitive and physical workloads with increased force protection.

7. **Final Recommendations**. The gaps identified in this ICD, which cannot be mitigated with a non-materiel solution, could be satisfied through the development of interoperable Unmanned Systems in the air, ground, and maritime domains. Current systems do not provide modular, configurable payloads for mission specific package tailoring. These systems should be modular within their capability range (example: small, medium, large) to establish commonality at the platform and controller levels. Additionally, appliqué systems that roboticize manned tactical vehicles and can provide a cost effective unmanned capability; therefore, every new or upgraded manned vehicle should include connectivity for an autonomous appliqué system. Mission specific payloads (ex: intelligence collection, EOD, weapons, sustainment, network extension) are interchangeable within a platform class. Recommend a common

standardized remote remotely operate control system for Unmanned Systems currently in use. Likewise, the operating software, integrating network, and communications architecture must be standardized across all Unmanned Systems to enable collaboration and coordination in operations. This synergistic, common operational picture and extended battlespace awareness enables the integrated battle command systems network to support informed decision-making. Unmanned Systems can support future forces within the expanded battlespace by serving as economy of force assets with intelligence collection and area security and by enhancing force protection by providing standoff operational capabilities.

a. As new Unmanned Systems are developed for the force, recommend a continuous organizational assessment of the mix of manned and Unmanned Systems to ensure a synchronized and increased capability is introduced. This continuous assessment, including bandwidth availability and network integration considerations, allows for the evolutionary introduction of additional unmanned capabilities in conjunction with evolutionary networks required to horizontally/vertically integrate, collaborate, and coordinate effectiveness and efficiencies between manned and Unmanned Systems. Recommended changes to doctrine, training, or facilities will be updated within the system specific CDD or CPD.

b. The recommended approach is interoperable Unmanned Systems and their modular payloads that will cover the following desired capabilities; Battlespace Awareness, Force Application, Protection, Command and Control, Logistics, Force Support and Net-Centric. Unmanned Systems will be responsive to near-real-time changes and mission requirements. This approach takes advantage of experiences with units equipped with Unmanned Systems. It also takes the next step to ensure that the systems fielded to the force are fully supportable. The recommended materiel solutions involve the harvesting of Lessons Learned from current programs and systems equipped to meet ONSs to ensure that future programs of record will enable accomplishment of capabilities necessary to mitigate gaps.

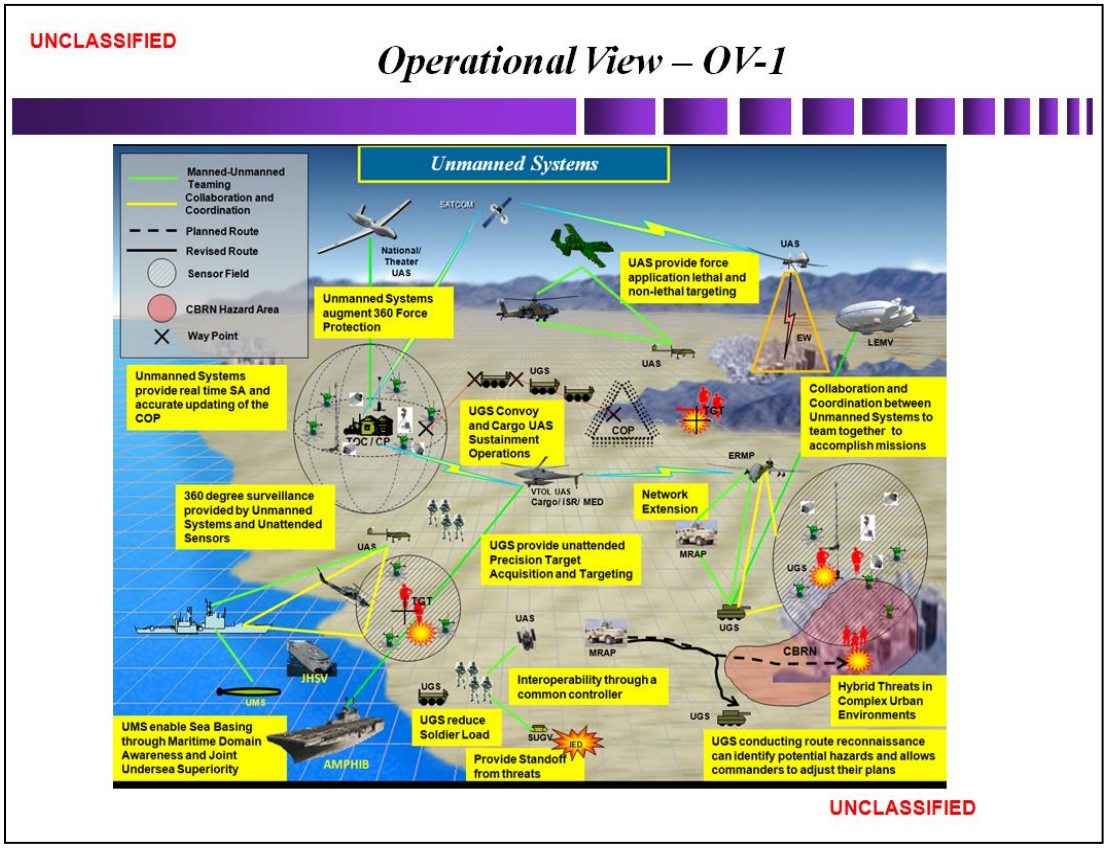
c. Recommend the continued evaluation of Unmanned Systems currently fielded in support of approved Joint Urgent Operational Need Statements (JUON) and ONSs for potential enduring capabilities and transition to a Program of Record through the Capabilities Development for Rapid Transition (CDRT) process. To meet other unfulfilled capability gaps, recommend the continued evaluation of Unmanned Systems prototypes, advanced engineering concepts, and Joint Capability Technology Demonstration (JCTD) projects that have the potential to satisfy approved JUONs or ONS.

d. Recommend the establishment of a TRADOC Capabilities Manager Unmanned Ground Systems (TCM UGS) under the Maneuver Center of Excellence, the current TRADOC lead for UGS, in order to align with Robotic Systems Joint Program Office (RSJPO) for program management and integration of UGS across the Force. The U.S. Army Policy for the Acquisition of Unmanned Ground Systems and Integration of Mission Capability Packages (24 Nov 09) “charters the Program Manager (PM), RSJPO as the centralized PM with the responsibility for the acquisition life-cycle of Unmanned Ground Systems.”

This would provide UGS with the structure currently provided UAS, whose proponency, management, and oversight are provided by the Aviation Center of Excellence, the UAS Center of Excellence, and TCM UAS.

Appendix A. Integrated Architecture Products

High-level Operational Concept Graphic (OV-1)



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686 **Appendix C. Acronym List**

687 **Part I Acronyms:**

688

ACT	Acquisition Category
AMSAA	Army Materiel Systems Analysis Activity
Ao	Operational Availability
AoA	Analysis of Alternatives
AR	Army Regulation
ARCIC	Army Requirements Capabilities Integration Center
ARL	Army Research Labs
ASI	Additional Skill Identifier
AT	Antitank
ATGM	Anti-Tank Guided Missile
C2	Command and Control
C^3D	Camouflage, Cover, Concealment, And Deception
CBA	Capability Based Assessments
CBP	Complex Battle Positions
CBRN	Chemical, Biological, Radiological, and Nuclear
CBRNE	Chemical, Biological, Radiological, Nuclear and High-yield Explosives
CDD	Capability Development Document
CDID	Capabilities Development and Integration Directorate
CDRT	Capabilities Development for Rapid Transition
CLS	Contractor Logistics Support
CONOPS	Concept of Operations Summary
CONUS	Continental United States
COP	Common Operating Picture
COTS	Commercial Off-The-Shelf

CPD	Capability Production Document
CREW	Counter RCIED (Remote Control Improvised Explosive Device) Electronic Warfare
DPS	Defense Planning Scenarios
DoD	Department of Defense
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities
EBM	Enhanced Blast Munitions
EFF	Essential Function Failure
EFP	Explosively Formed Penetrator
EM	Electromagnetic
EMR	Electromagnetic Radiation
EOD	Explosive Ordnance Disposal
ETM	Electronic Technical Manual
EW	Electronic Warfare
FOC	Full Operational Capability
GCS	Ground Control Station
HEAT	High Explosive Anti-Tank
HQDA	Headquarters Department of the Army
IAW	In Accordance With
ICD	Initial Capabilities Document
ICM	Improved Conventional Munitions
IED	Improvised Explosive Device
IOC	Initial Operational Capability
ISR	Intelligence, Surveillance and Reconnaissance
JCA	Joint Capability Areas
JCIDS	Joint Capabilities Integration and Development System

JCTD	Joint Capability Technology Demonstration
JFC	Joint Force Commander
JIIM	Joint, Interagency, Intergovernmental and Multi-national
JUON	Joint Urgent Operational Needs Statement
LOC	Line Of Communications
MANSCEN	Maneuver Support Center
MCOE	Maneuver Center of Excellence
MIL STD	Military Standard
MIL-PER	Military Personnel
MIL-SPEC	Military Specification
MOS	Military Occupational Specialty
NATO	North Atlantic Treaty Organization
Net-Centric	Operations and Warfare (NCOW)
OCU	Operator Control Unit
OE	Operational Environment
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
ONS	Operational Needs Statement
PGM	Precision Guided Munitions
PM	Program Manager
POR	Programs of Record
RAM	Reliability, Availability, and Maintainability
RDD	Requirements Determination Division
RDT&E	Research, Development, Test & Evaluation
REG	Regulation
RSJPO	Robotic Systems Joint Program Office
RSTA	Reconnaissance, Surveillance and Target Acquisition

DOTMLPF RIO	Resource-informed, integration-focused, and outcome-based solutions which address doctrine, organization, training, materiel, leadership and education, personnel, and facilities gaps
SAM	Surface-To-Air Missiles
STANAG	Standardization Agreement
STAR	System Threat Assessment Report
SWaP	Size, Weight and Power
TCM	TRADOC Capability Manager
TRADOC	US Army Training & Doctrine Command
TTP	Tactics, Techniques and Procedures
UAS	Unmanned Aircraft Systems
UGS	Unmanned Ground Systems
UMS	Unmanned Maritime Systems
U.S.	United States
USAES	United States Army Engineer School
USAF	United States Air Force
USAICoE	US Army Intelligence Center of Excellence
USMC	United States Marine Corps
USN	United States Navy
VBIED	Vehicle Borne Improvised Explosive Device
WFF	War Fighting Functions

Part II Terms and Definitions:

Acquisition Category (ACAT). Categories established to facilitate decentralized decision-making and execution, and compliance with statutorily imposed requirements. The categories determine the level of review, decision authority, and applicable procedures. DOD 5000.2-R, part 1, provides the specific definition for each acquisition category (ACAT I through IV).

Analysis of Alternatives (AoA). The evaluation of the operational effectiveness, operational suitability, and estimated costs of alternative systems to meet a mission capability. The analysis assesses the advantages and disadvantages of alternatives being considered to satisfy capabilities, including the sensitivity of each alternative to possible changes in key assumptions or variables.

Analysis of Materiel Approaches (AMA). The JCIDS analysis to determine the best materiel approach or combination of approaches to provide the desired capability or capabilities. Though the AMA is similar to an AoA, it occurs earlier in the analytical process. Subsequent to approval of an ICD, which may lead to a potential ACAT I/S&RL Integrated Enterprise Domain Architecture program, Director Program Analysis & Evaluation provides specific guidance to refine this initial AMA into an AoA.

Architecture. The structure of components, their relationships, and the principles and guidelines, governing their design and evolution over time.

Attribute. A testable or measurable characteristic that describes an aspect of a system or capability.

Capability. The ability to execute a specified course of action. It is defined by an operational user and expressed in broad operational terms in the format of an initial capabilities document or a DOTMLPF change recommendation. In the case of material proposals, the definition will progressively evolve to DOTMLPF performance attributes identified in the CDD and the CPD.

Capability Gap. Those synergistic resources (DOTMLPF) that is unavailable but potentially attainable to the operational user for effective task execution. These resources may come from the entire range of DOTMLPF solutions.

Capability Production Document (CPD). A document that addresses the production elements specific to a single increment of an acquisition program.

Chairman of the Joint Chiefs of Staff Instruction (CJCSI). A replacement document for all types of correspondence containing Chairman of the Joint Chiefs of Staff (CJCS) policy and guidance that does not involve the employment of forces. An instruction is of indefinite duration and is applicable to external agencies or both the Joint Staff and external agencies. It remains in effect until superseded, rescinded, or otherwise canceled. CJCS Instructions, unlike joint publications, will not contain joint doctrine and/or joint tactics, techniques, and procedures.

Crew. The people who man a ship, aircraft, or vehicle.

Deploying. The act of relocation of forces and materiel to desired operational areas. Deployment encompasses all activities from origin or home station through destination, specifically including intra-continental United States, inter-theater, and intra-theater movement legs, staging, and holding areas.

Doctrine. Fundamental principles by which the military forces or elements there of guide their actions in support of national objectives. It is authoritative but requires judgment in application.

DOTMLPF RIO. Resource-informed, integration-focused, and outcome-based solutions which address doctrine, organization, training, materiel, leadership and education, personnel, and facilities gaps.

Embedded instrumentation. Data collection and processing capabilities integrated into the design of a system for one or more of the following uses: diagnostics, prognostics, testing, or training.

Environmental quality. The condition of the following elements that make up the environment: flora, fauna, air, water, land, and cultural resources.

Functional area. A broad scope of related joint war fighting skills and attributes that may span the range of military operations. A major area of related activity. Specific skill groupings that make up the functional areas are approved by the JROC.

Increment. A militarily useful and supportable operational capability that can be effectively developed, produced or acquired, deployed, and sustained. Each increment of capability will have its own set of threshold and objective values set by the user.

Information Exchange. Is an act of exchanging information between two distinct operational nodes and the characteristics of the act, including the information element that needs to be exchanged and the attributes associated with the information element (e.g., Scope), as well as attributes associated with the exchange (e.g., Transaction Type).

Initial Capabilities Document (ICD). Documents the need for a materiel approach to a specific capability gap derived from an initial analysis of materiel approaches executed by the operational user and, as required, an independent analysis of materiel alternatives. It defines the capability gap in terms of the functional area, the relevant range of military operations, desired effects, and time. The ICD summarizes

the results of the DOTMLPF analysis and describes why non-materiel changes alone have been judged inadequate in fully providing the capability.

Integrated architecture. An architecture consisting of multiple views or perspectives (operational view, systems view and technical standards view) that facilitate integration, promote interoperability, and permit identification and prioritization of capability shortfalls and redundancies.

Intelligence. The product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations. The term is also applied to the activity which results in the product and to the organizations engaged in such activity." JP 1-02 June 2007 (This term and its definition modify the existing term and its definition and are approved for inclusion in the next edition of JP 1-02.) And "intelligence 1. (Joint) The product resulting from the collection, processing, integration, analysis, evaluation, and interpretation of available information concerning foreign countries or areas. 2. Information and knowledge about an enemy obtained through observation, investigation, analysis, or understanding." (FM 2-0, May 2004)

Joint. Connotes activities, operations, organizations, etc. in elements of two or more Military Departments or countries participate.

Joint Capabilities Integration and Development System (JCIDS). Policy and procedure that support the Chairman of the Joint Chiefs of Staff and the Joint Requirements Oversight Council in identifying, assessing, and prioritizing joint military capabilities needs. Implement an integrated, collaborative process to guide development of new capabilities through changes in DOTMLPF. Change recommendations are developed, evaluated, and prioritized based on their contribution to future joint concepts.

Joint Force. The term "Joint Force" in its broadest sense refers to the Armed Forces of the United States. The term "joint force" (lower case) refers to an element of the Armed Forces that is organized for a particular mission or task. Because this could refer to a joint task force or a unified command, or some yet unnamed future joint organization, the more generic term "a joint force" will be used, similar in manner to the term "joint force commander" in reference to the commander of any joint force.

Mission. A collection of tasks and sub-tasks that defines some specific aspect of commander's intent. The aspect could be bounded geographically, by time, by desired outcome (end state), by allocation to specific forces capabilities, by type of operations, or by a combination of the aforementioned. (Used akin to commander's intent, job, task, sub-task.)

National Security Systems (NSS). Telecommunications and information systems, operated by the DOD – the functions, operation or use of which involves (1) intelligence activities, (2) cryptologic activities related to national security, (3) the command and control of military forces, (4) equipment that is an integral part of a weapon or weapons systems, or (5) is critical to the direct fulfillment of military or intelligence missions. Subsection (5) in the preceding sentence does not include procurement of automatic data processing equipment or services to be used for routine administrative and business applications (including payroll, finance, logistics, and personnel management applications).

Objective. An operationally significant increment above the threshold. An objective value may be the same as the threshold when an operationally significant increment above the threshold is not significant or useful.

Operational Requirements. A system capability or characteristic required to accomplish approved mission needs. Operational (including supportability) requirements are typically performance parameters, but they may also be derived from cost and schedule. For each parameter, an objective and threshold value must also be established.

Operator. Somebody who operates machinery, an instrument, or other equipment.

Payload. The quantity of cargo or number of passengers that a plane, train, or other vehicle can carry, often expressed as weight or volume, or the revenue-producing portion of its cargo or passengers

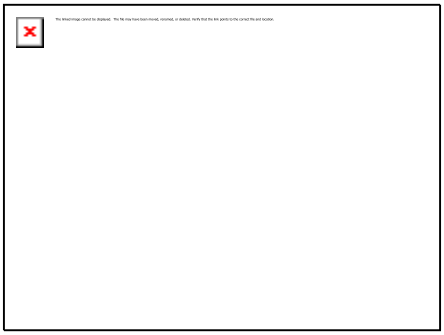
System Characteristics. Design features such as weight, fuel capacity, and size. Characteristics are usually traceable to capabilities (e.g., hardening characteristics are derived from a survival capability) and are frequently dictated by operational constraints (e.g., carrier compatibility) and/or the intended operational environment (e.g., CBRN).

Threshold. A minimum acceptable operational value below which the utility of the system becomes questionable.

Throughput. In transportation, the average quantity of cargo and passengers that can pass through a port on a daily basis from arrival at the port to loading onto a ship or plane, or from a discharge from a ship or plane (clearance) from the port complex. Throughput is usually expressed in measurement tons (short tons, passengers). Reception and storage limitation may affect final throughput. In patient movement and care, the maximum number of patients (stable or stabilized) by category, that can be

841 received at the airport, staged, transported, and received at the proper hospital in the same 24 hour
842 period.

Appendix D. Cost-Benefit Analysis



(See attached slides)