Bull Dog Unmanned Ground Vehicle (UGV)

Capability Development Document
1. Capability Discussion. The potential joint functional areas affected are battlespace awareness, command and control, force application, and force protection. The basis for the need is established in the Joint Autonomous Reconnaissance and Targeting (JART) Initial Capabilities Document and is summarized below. The mission of the contemplated unmanned ground system will be to locate, track and destroy enemy vehicles and perform other detection and reconnaissance functions in areas too hazardous to send humans or manned vehicles. This vehicle will offer the ability to conduct missions from remote locations where humans are not exposed to such hazards. Power will be sufficient to assist in utility tasks that require movement of other vehicles or loads over rough terrain and to climb over hills. The vehicle will also be small and lightweight enough for use with rapid deployment forces. The unmanned nature of the vehicle contemplated will reduce both costs and risks associated with these dangerous missions.

2. Analysis Summary. Current systems tend to be manned, complex, heavy and expensive. Manned systems require armor to protect crewmembers. The size and weight of these vehicles makes them difficult to transport by air to remote locations to support rapid deployment forces. The UGV will offer an inexpensive, expendable vehicle that will not expose human operators during operations, and may be air transported in large numbers to remote trouble spots throughout the world. While the proposed system may be vulnerable to threats as described, the low costs contemplated and the fact that no loss of life would be associated with destruction of the vehicle while carrying out hazardous missions will make it a valuable addition to the force structure.

3. Concept of Operations Summary. The UGV will be designed to confront low-end and mid-range threats that may employ both conventional and asymmetric capabilities, and be
employable in small-scale contingency (SSC) operations in complex and dangerous terrain and in the attack of high value, heavily defended targets where the probability of heavy casualties exists e.g., biological and chemical (BC) environment, mine fields, dense urban areas, and command and control centers.

4. Threat Summary.

a. Potential threat forces will be armed with various mixes of increasingly sophisticated weaponry. Weaponry includes small arms and automatic individual/crew served weapons, antitank (AT) weapons to include antitank guided missiles (ATGM), medium caliber cannon (20-75mm), hand held high explosive antitank (HEAT), shoulder fired Surface to Air Missiles (SAM), and land mines. Regardless of its location on the battlefield, the UGV can be threatened by indirect fire, to include advanced munitions, such as Artillery Delivered High Precision Munitions (ADHPM). They will also potentially operate in a BC environment that could include weaponized agents, toxic industrial hazards, and battlefield residues.

b. Many future regional conflicts will include low to medium range military operations, or small-scale contingencies (SSC). Many of the world’s major military powers, as well as third world nations, are moving toward smaller, better-trained and equipped forces. Less developed nations have increased their warfighting capabilities through greater access to military technologies and increased availability of a wide range of advanced military equipment on the international market. Even relatively underdeveloped countries may acquire a minimum number of advanced systems to fill a specific technology void and/or increase their leverage in terms of another regional power. These forces will attempt to undermine U.S. technical superiority by making maximum use of asymmetric techniques that may impact on our capability to maintain total situational understanding and/or employ long-range fires or precision munitions. Threat forces are capable of employing BC weapons and directed energy, electronic attacks on communications, camouflage dispersion, the potential use of human shields, deception, and psychological operations (PSYOPS).

c. High value, highly defended targets that may produce significant casualties. These include mounted and dismounted infantry, artillery, air defense units, C4ISR facilities/platforms, bunkers, concrete buildings/revetments, dug-in and concealed weapon platforms, and light/Interim Armored Vehicles. See DIA validated series of Land Threat Environment projections, NGIC-1100-600 Series, volumes 1-6.

5. Program Summary. (Not provided as part of this exercise)


a. General. The capability to detect, track and launch a weapon to destroy a moving vehicle or fixed target shall be required. While attacking a target, a system to identify friendly units and automatically override firing commands shall be required. The carrier shall be capable of performing reconnaissance in areas that are contaminated by chemical weapons or that would otherwise expose human operators to extreme risk. The vehicle shall be capable of operation across hilly terrain. The vehicle shall be capable of off-road operations in grass, dirt and sand.
The following are UGV performance characteristics and critical system characteristics that are needed to satisfy the operational capability requirements.

b. Attributes

(1) Target Attack Operations.

(a) Laser Attack Pk. The UGV shall be capable of lasering a target to allow an airborne unit to launch one or more weapons with a probability of kill of 0.75 (threshold), 0.90 (objective). [KPP]

(b) Control. The UGV shall be capable of conducting operations by remote control using line-of-sight communications.

(c) Speed. Speed and ease of operation are closely intertwined. The system shall be capable of moving at a speed of 14 kph (threshold), 30 kph (objective). [KPP]

(d) Range. The UGV shall have a range of not less than 10 km (threshold), 30 km (objective) [KPP].

(e) Terrain. The UGV shall be capable of operating across grass, dirt and loose sand and climb inclines up to 15 degrees (threshold), 30 degrees (objective).

(f) IFF Accuracy. The UGV shall be capable of identifying friendly targets with a single-target accuracy of 0.90 (threshold), 0.99 (objective).

(g) Automatic fire override. The UGV shall automatically override any firing command, stop and provide a message should the IFF system detect a friendly target.

(h) Transportability. The UGV shall be capable of being moved within theater by C-130 (t/o).

(2) Reconnaissance Operations.

(a) Chemical Detection. The UGV shall be capable of detecting the presence of contamination from chemical weapons with an accuracy of 0.8 (threshold) 0.95 (objective).

(b) Biological Detection. The UGV shall be capable of detecting and identifying each of the 14 biological agents listed in the classified annex to this CDD with an accuracy of .9 (t) and .98 (o). (Exercise note: not provided to students.)

(c) Mine Detection. The system shall be capable of warning the operator of a buried mine so that the operator may take actions to avoid running over the mine. The BD shall be capable of locating buried mines with a single-mine detection reliability of .95 (threshold), .99 (objective) [KPP].
(d) Terrain. The UGV shall be capable of maneuvering over small obstacles and around large obstacles while conducting this mission.

(3) Mission Scenarios.

(a) Target Attack Operations. The UGV shall be capable of quickly closing and laser designating the target to avoid counter fire. Prior to airborne weapon launch, the UGV shall positively identify the target as either friendly or unfriendly. If an identification of friendly is made, the UGV shall abort the attack and signal that the target is friendly to the airborne unit.

(b) Reconnaissance Operations. As a secondary mission, the UGV shall be capable of detecting the presence of mines. The most likely scenario for use of the mine detection capability would be to lead friendly forces through a mine field. Therefore, the UGV shall be capable of both rapid and precise maneuver in restricted spaces to move around mines during this mission.

c. Summary Tables

<table>
<thead>
<tr>
<th>Key Performance Parameter (KPP)</th>
<th>Development Threshold</th>
<th>Development Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser Attack Probability of Kill (Pk)</td>
<td>0.75</td>
<td>0.9</td>
</tr>
<tr>
<td>Mine Detection Probability</td>
<td>0.95</td>
<td>0.99</td>
</tr>
<tr>
<td>Speed</td>
<td>14 kph</td>
<td>30kph</td>
</tr>
<tr>
<td>Operational Availability (Ao)</td>
<td>93%</td>
<td>98%</td>
</tr>
<tr>
<td>Range</td>
<td>10 km</td>
<td>30 km</td>
</tr>
<tr>
<td>Net-Ready</td>
<td>.98 connectivity with controller</td>
<td>.99 connectivity with controller</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Key System Attribute (KSA)</th>
<th>Development Threshold</th>
<th>Development Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain (Incline)</td>
<td>15 degrees</td>
<td>30 degrees</td>
</tr>
<tr>
<td>Transportability</td>
<td>C-130</td>
<td>Same as threshold</td>
</tr>
</tbody>
</table>

Net-Ready KPP

<table>
<thead>
<tr>
<th>KPP</th>
<th>Threshold</th>
<th>Objective</th>
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<tr>
<td>All activity interfaces, services, policy-enforcement controls, and data sharing of the NCOW-RM and GIG-KIPs will be satisfied to the requirements of the specific Joint integrated architecture products (including data correctness, data availability and data processing*), and information assurance accreditation, specified in threshold (T) and objective (O) values.</td>
<td>100 percent of interfaces; services; policy-enforcement controls; and data correctness, availability and processing* requirements designated as enterprise-level or critical in the Joint integrated architecture.</td>
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</tbody>
</table>
* Data processing is defined as: The input, output, verification, organization, storage, retrieval, transformation and extraction of information from data.

7. Family of System and System of System Synchronization. N/A

8. National Security System and Information Technology System (NSS and ITS) Supportability. *(Not provided as part of this exercise)*

9. Intelligence Supportability. *(Not provided as part of this exercise)*

10. Electromagnetic Environmental Effects (E3) and Spectrum Supportability. *(Not provided as part of this exercise)*

11. Assets Required to Achieve Initial Operational Capability. *(Not provided as part of this exercise)*

   a. Initial Operational Capability (IOC) shall be 2nd quarter FY-5 and consist of five Bull Dog UGV’s supporting the other system components.
   b. Full Operational Capability (FOC) shall be in FY-8

13. Other Doctrine, Organization, Training, Materiel, Leadership and education, Personnel, and Facilities (DOTMLPF) Considerations. Light and mechanized brigades, as currently organized and equipped, cannot provide the core capabilities required to meet this need without suffering significant casualties. Unmanned systems will allow existing units to be organized, streamlined and tailored to improve deployability and battlefield agility. This concept will require the synergistic application of new and existing materiel technologies, doctrine, training methods, organizational designs, force structure and groupings of individual and crew skills. A rapidly deployable unmanned ground capability is required to optimize the Army and Marine Corps effectiveness in the small scale contingency and early entry environments, while providing warfighting commanders greater operational flexibility for employment of joint forces within a greatly expanded future battlespace.

14. Other System Attributes.

   a. Infrastructure Support. Vehicles must be supportable by current and projected combat support and service support assets. Forces must be transportable in an operational configuration in strategic and tactical air transportation aircraft. Systems must also be capable of transport on unrestricted highway, rail, maritime prepositioned ships, amphibious ships, amphibious landing craft, and other marine transport worldwide.

   b. Manpower and Personnel. A primary goal is to reduce the number of personnel involved in hazardous operations (e.g., RSTA and mine detection), and thus to cut casualties. Maintenance of UGV shall require no skills not already in existence within the Army, Marine Corps, or Air Force personnel structures.
c. Training. A complete training support package, including appropriate training methods, devices and simulators must be available concurrent with system fielding for both the institutional training base and units in the field.

d. Environmental. Must comply with all U.S. environmental regulations and with all international environmental protocols and treaties to which the U.S. is a signatory.

e. Command, Control Communications and Intelligence (C3I).

(1) Compatibility and interoperability with existing and planned C3I systems are the key to the success. The UGV must fully comply with all Global Information Grid (GIG) policies and be fully compatible with its architecture.

(2) The system must utilize a distributed network control-communication architecture which allows for flexible integration and operation of multiple remote sensor systems and control stations. This architecture must provide flexibility in future integration with evolving military digital radio networks (i.e. Army's Tactical Internet and DARPA's Warfighter Internet).

(3) Operational Environments.

(a) UGV must be capable of conducting operations in all applicable operational environments, including hot, basic, and cold climates. Environmental conditions include BC, electronic, and electromagnetic environments and toxic industrial chemicals.

(b) UGV must be able to provide commanders with a rapidly deployable and recoverable, air-mobile, day/night, all-weather, real-time, unmanned system that will provide surveillance, detection, and assessment with man-in-the-loop assault capabilities. These capabilities will provide timely mission-essential information on enemy activity and terrain. It will also provide commanders with an early warning device to aid them with force protection planning and the capability to attack from a remote location.

(4) Transportation. The UGV shall be capable of transportation to the theater of operation in standard shipping containers. These containers shall be selected from the existing government inventory. Once in theater, UGV shall be capable of rapid deployment to forward operating areas.

(5) Supportability. The UGV shall be supported over its life cycle by replacing individual parts as they wear out. The system is expected to be in service for a period of 15 years and shall be designed for a minimum service life of 15 years.

(6) Maintenance and Operations. The UGV will have three categories of maintenance: organization, intermediate and depot level. The system shall not require the use of highly educated or trained personnel for its operation or for organizational maintenance.

(7) Readiness/Operational Availability Measures. Fully mission capable (FMC) and mission capable (MC) rates will be the measures employed to assess system
readiness/operational availability. FMC is the percentage of time during which the system is capable of performing all assigned missions; MC is the percentage of time during which the system is capable of performing at least one of its assigned missions. Actual FMC and MC rates are evolving requirements and will be the subject of the next CDD review.

(8) Combat Support Requirements. The UGV shall be capable of battlefield damage repair in the field using currently available tools and repair techniques.

15. **Program Affordability.** *(Not provided as part of this exercise)*

Mandatory Appendices.

Appendix A. **Architecture Products.** *(Not provided as part of this exercise)*

Appendix B. **References.** *(Not provided as part of this exercise)*

Appendix C. **Acronym List.** *(Not provided as part of this exercise)*