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# NDIA

## Joint Ground Robotics Update

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# Public Law 109-364 SEC 941



**POLICY REQUIRED.** – 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.

**ELEMENTS.** – The policy required by subsection (a) shall include or address the following:

- 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.
- An assessment of the circumstances under which it would be appropriate to pursue joint development and procurement of unmanned systems and components of unmanned systems.
- The transition of unmanned systems unique to one military department to joint systems, when appropriate.



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- An organizational structure for effective management, coordination, and budgeting for the development and procurement of unmanned systems, including an assessment of the feasibility and advisability of designating a single department or other element of the Department of Defense to act as executive agent for the Department on unmanned systems.
- The integration of unmanned and manned systems to enhance support of mission identified in paragraph (1).  
Such other matters as the Secretary of Defense considers to be appropriate.

**CONSULTATION.** – The Secretary of Defense shall develop the policy required by subsection (a) in consultation with the Chairman of the Joint Chiefs of Staff.



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**REPORT.** – Not later than 120 days after the date of the enactment of this Act, the Secretary shall submit to the congressional defense committees a report containing –

- the policy required by subsection (a); and an implementation plan for the policy that includes –
  - a strategy and schedules for the replacement of manned systems with unmanned systems in the performance of the mission identified in the policy pursuant to subsection (b)(1);
  - establishment of programs to address technical, operational, and production challenges, and gaps in capabilities, with respect to unmanned systems; and
  - an assessment of progress towards the goals identified for the subset of unmanned air and ground systems established in section 220 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (as enacted into law by Public Law 106-398; 114 Stat. 1654A-38).

**UNMANNED SYSTEMS DEFINED.** – In this section, the term “unmanned systems” consists of unmanned aerial systems, unmanned ground systems, and unmanned maritime systems.



# Signed Interim Report



ACQUISITION,  
TECHNOLOGY  
AND LOGISTICS

THE UNDER SECRETARY OF DEFENSE  
3010 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3010

MAR 23 2007

The Honorable Robert C. Byrd  
Chairman, Committee on Appropriations  
United States Senate  
Washington, DC 20510-6025


Dear Mr. Chairman:

Pursuant to section 941 of the John Warner National Defense Authorization Act for FY 2007, Public Law 109-364, the Secretary of Defense is to submit a report on the Department's unmanned systems policy and implementation plan no later than 120 days after enactment of the Act. This letter is an interim response to section 941.

The Department has initiated activities required to address unmanned policy, planning, and assessment. The Department has made significant progress in addressing section 941. A single integrated Unmanned Systems Roadmap is being drafted with contributions from all Military Services and Combatant Commands for all unmanned domains (land, sea, and air). This roadmap addresses the areas of policy, congressional direction, technology enablers, organizational structure, goals and objectives for unmanned systems, and schedules for introducing unmanned systems into the force structure.

We anticipate that we will submit the required report by fall. A similar letter has been provided to the other congressional defense committees.

Sincerely,



Kenneth J. Krieg

cc:  
The Honorable Thad Cochran  
Ranking Member



# Public Law 109-364 SEC 941 Status

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- **JCIDS Process enables identification of mission/requirements that UMS can satisfy**
- **DOD 5000: EOA/AOA enables identification of timely/affordable solution to meet requirements to include UMS**
- **Circumstances for Joint development/procurement of UMS are already being pursued**
- **Transition of service unique to Joint already being pursued**
- **Single DOD Organizational Management Structure already exists – PSA**
- **Integration of manned and unmanned is working (e.g. operations in theater today, FCS, etc.)**
- **Implementation Plan will be developed as the 2nd iteration of the Integrated UMS Roadmap scheduled for FY09**

# COCOMs Identify Priorities

| Mission                                   | Company | BCT | Division | Ranking |
|---|---------|-----|----------|---------|
| Reconnaissance                            | 1       | 1   | 1        | 1       |
| Mine Detection/CM                         | 2       | 2   | 2        | 2       |
| Precision Target Location and Designation | 3       | 3   | 5        | 3       |
| Chem/Bio Reconnaissance                   | 6       | 4   | 3        | 4       |
| Weaponization/Strike                      | 4       | 6   | 6        | 5       |
| Battle Management                         | 8       | 5   | 4        | 6       |
| Communications/Data Relay                 | 5       | 7   | 7        | 7       |
| Signals Intel                             | 7       | 8   | 8        | 8       |
| Covert Sensor Insertion                   | 9       | 9   | 10       | 9       |
| Littoral Warfare                          | 13      | 10  | 9        | 10      |
| Counter Cam/Con/Deception                 | 10      | 11  | 11       | 11      |
| SOF Team Resupply                         | 11      | 12  | 12       | 12      |
| Combat SAR                                | 12      | 13  | 13       | 13      |
| Information Warfare                       | 14      | 14  | 14       | 14      |
| Decoy/Pathfinder                          | 15      | 15  | 15       | 15      |

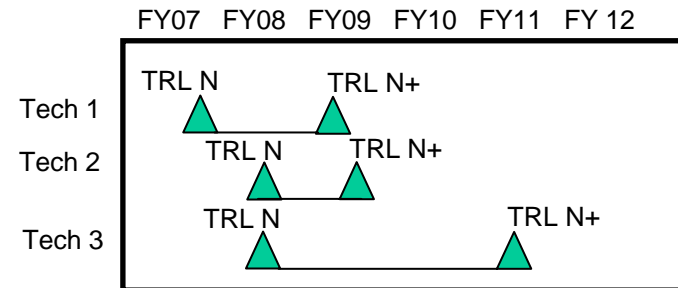
# TAB Products:

## Technology & Capability Mapping

|       | Tech 1 | Tech 2 | Tech 3 |
|-------|--------|--------|--------|
| Cap 1 | X      |        | X      |
| Cap 2 |        | X      | X      |
| Cap 3 | X      | X      |        |

- Map Technologies to Capability Gaps/Needs
- Identify transition strategies

## Technology Maturity & Funding Assessment



- Assess Tech Maturity
- Create Maturation Path
- Identify funding levels

FY07 FY08 FY09 FY10 FY11 FY12

|       |   |   |   |   |  |  |      |
|-------|---|---|---|---|--|--|------|
| Cap 1 | ▲ | — | ▲ |   |  |  | \$XX |
| Cap 2 |   | ▲ | — | ▲ |  |  | \$XX |
| Cap 3 | ▲ | — | ▲ |   |  |  | \$XX |

- Inform Funding Decisions
- Input to UMS Roadmap
- Ensure tech transition



# Capability-Technology Mapping



- Admin info (Executing organization, POC information)
- Narrative describing project
- Technologies being pursued
- Capability supported (payoff)
- Key objectives with intermediate milestones, capabilities, demonstrations and levels of robustness identified
- Objectives demonstrated to date
- Limitations
- Planned ATD(s), ACTD(s), experiments, etc.
- Current or future acquisition program(s) supported
- Funding profile by fiscal year, including appropriation type and source from initiative start (to include prior year) to completion (to include current and planned funds).
- Transition points and ties to Acquisition Programs or Spirals
- Transition organization
- Technology Readiness Levels by budget year
- Identify leveraged technologies and partners from other programs or initiatives
- Is acceleration possible? Include associated costs/risks and rationale.
- Criticality rating
- Maturation rating
- Interoperability rating



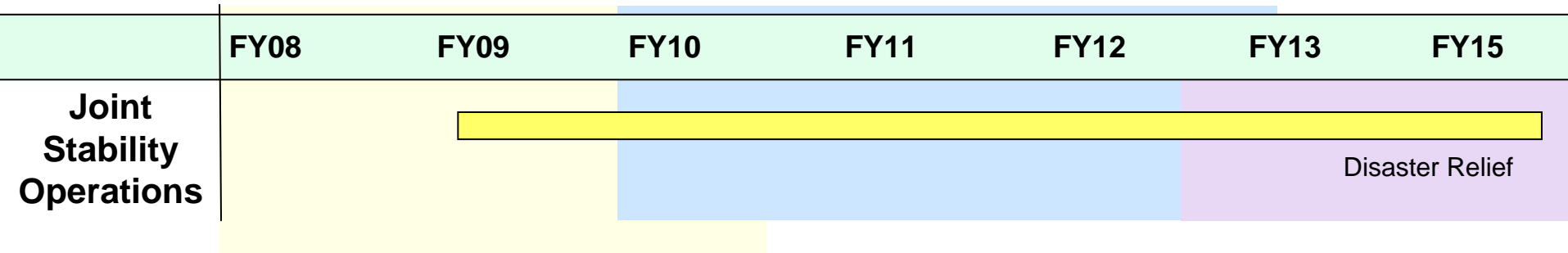
# JGRE Portfolio (Notional)



Tele-Op
  Near Autonomous
  Autonomous
  Funded
  Planned

|                                 | FY08 | FY09 | FY10 | FY11 | FY12 | FY13 | FY14 |    |
|---------------------------------|------|------|------|------|------|------|------|----|
| Joint Land Ops                  |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
| Joint Access & Acc Denial       |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
| Joint Stability Ops             |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
| Joint Info Ops                  |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
| Joint Homeland Defense          |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
| Joint Battlespace Awareness     |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
| Joint Logistics                 |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
| Joint Special Ops & Irr War     |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
| Joint Def Support Of Civil Auth |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
| Joint Protection                |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
| Tech Enablers                   |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
|                                 |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
|                                 |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
|                                 |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
|                                 |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
|                                 |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
|                                 |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
|                                 |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
|                                 |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |
|                                 |      |      |      |      |      |      |      | \$ |
|                                 |      |      |      |      |      |      |      |    |





**Joint Stability Operations**

|                      |   |
|----------------------|---|
| Title                | Robotic Cbt Casualty Ext. & Evac                      |
| Narrative            | Build prototype sys. w/ tele-, semi-, & auto. control |
| Technologies Pursued | Patient location, auto. patient spt & monitoring      |
| Limitations          | None  |
| Funding Profile      | FY06-\$1M (ARO, ONR, TATRC)                           |
| TRL by Year          | TRL 4   |
| Criticality          | 5   |
| Maturation           | 4   |
| Interoperability     |   |

|                      |   |
|----------------------|---|
| Title                | Visualization in tight/unlit spaces                                   |
| Narrative            | Develop sensor w/ passive illumin. In adv. conditions                 |
| Technologies Pursued | Passive light sensors, miniaturized cameras, flexible manipulator arm |
| Limitations          | N/A   |
| Funding Profile      | FY09-\$YYYYK, FY010-\$ZZZK, FY011-\$AAAK                              |
| TRL by Year          | FY09-TRL B, FY10-TRL C, FY11-TRL 6                                    |
| Criticality          | 4   |
| Maturation           | 4   |
| Interoperability     | 2   |

|                      |  |
|----------------------|--|
| Title                | Complex Terrain Mobility   |
| Narrative            | Develop mobility cap. in adverse natural disaster and man-made environ. for large and small robots |
| Technologies Pursued | XXXX   |
| Limitations          | N/A  |
| Funding Profile      | FY09-\$YYYYK, FY010-\$ZZZK, FY011-\$AAAK   |
| TRL by Year          | FY09-TRL 3, FY10-TRL5, FY11-TRL 6  |
| Criticality          | 4  |
| Maturation           | 3  |
| Interoperability     | 3  |

Tele-Op

Near Autonomous

Autonomous

Funded

Planned

FY08

FY09

FY10

FY11

FY12

FY13

FY15

**Joint Special Ops & Irreg. Warfare**

Robotic Drug Interdiction

|                      |  |
|----------------------|--|
| Title                | Complex Terrain Mobility   |
| Narrative            | Develop mobility cap. in adverse natural disaster and man-made environ. for large and small robots |
| Technologies Pursued | XXXX   |
| Limitations          | N/A  |
| Funding Profile      | FY09-\$YYYYK, FY10-\$ZZZK, FY11-\$AAAK   |
| TRL by Year          | FY09-TRL 3, FY10-TRL5, FY11-TRL 6  |
| Criticality          | 4  |
| Maturation           | 3  |
| Interoperability     | 3  |

|                      |   |
|----------------------|---|
| Title                | Collaborative UGV/UAV Recon   |
| Narrative            | Develop capability for collaborative UGV & UAV recon ops in adverse terrain & weather |
| Technologies Pursued | Visual. sensors in adverse cond., situational aware./ data exchange                   |
| Limitations          | None  |
| Funding Profile      | FY10-\$YYYYK, FY11-\$ZZZK, FY12-\$AAAK  |
| TRL by Year          | FY10-TRL 3, FY11-TRL5, FY12-TRL 6   |
| Criticality          | 5   |
| Maturation           | 4   |
| Interoperability     | 3   |

|                      |  |
|----------------------|--|
| Title                | Detection of drug labs                                       |
| Narrative            | Develop sensors for use in adv. Terrain & weather conditions |
| Technologies Pursued | FOLPEN, IR, "see thru walls", chem. detection                |
| Limitations          | N/A  |
| Funding Profile      | FY08-\$WWWK, FY09-\$YYYYK, FY10-\$ZZZK, FY11-\$AAAK          |
| TRL by Year          | FY08-TRL 4, FY09-TRL 5, FY10-TRL 5, FY11-TRL 6               |
| Criticality          | 4  |
| Maturation           | 4  |
| Interoperability     | 2  |



# Performance Profile (Plan)

## Collaborative Reconnaissance



- **Description:** Proof of principle and technology development effort to increase the users' understanding in the potential of collaborative unmanned systems to conduct recon in complex terrain.

- The project will be synchronized with the Complex Terrain Transportation project (s)
- JCA - Joint Special Operations & Irregular Warfare (Tier 2 Special Reconnaissance)

- **Deliverables:**

- Autonomous data sharing
- UGV/UAS integrated s/w and h/w at TRL 5
- Exercise/Experiment Reports

| Tasks                              | FY 2008 |    |     |     | FY 2009 |    |    |     |
|------------------------------------|---------|----|-----|-----|---------|----|----|-----|
|                                    | Q1      | Q2 | Q3  | Q4  | Q1      | Q2 | Q3 | Q4  |
| Simulation Experiment              |         | 57 |     |     |         |    |    |     |
| J AUS Compliance                   |         |    | 23  |     |         |    |    |     |
| OA algorithm development           |         |    | 125 |     |         |    |    |     |
| UGV/UAS integrated s/w and h/w     |         |    |     | 135 |         |    |    |     |
| Live Experiment Dev. & Integration |         |    |     | 145 |         |    |    |     |
| Relative GPS optimization          |         |    | 165 |     |         |    |    |     |
| Live Experiment, Analysis & Report |         |    |     |     | 75      |    |    |     |
| Warfighter Exercise                |         |    |     |     |         |    |    | 275 |

- Funding Request \$1.000M
- Obligation Plan – 100% 30 Nov 2007
- Disbursement Plan – 57% 30 Sep 2008 & 100% 30 Sep 2008

[TAB data and data from execution]

**Overall Performance: New Start**

**TRL:** 3 - [with short narrative to identify current TRL]

**Criticality:** 4 – [with short narrative to identify criticality]

**Risks:** [Short narrative to identify risks - integrated baseline]



# Portfolio Path Forward



**12 June** – TAB IV

**13-29 June** – Temp. Working Group refines Portfolio: includes identifying all appropriate technologies (currently funded or not), refined timelines and funding profiles to achieve TRL 6, criticality factors. Portfolio includes technologies that Services are funding, as well as the JGRE.

**2-9 July** – TAB coordination of revised Portfolio, to include J8/FCB members and DDR&E

**Week of 16 July** – O-6 Council meeting

**16 - 25 July** – Coordination period: O-6 Council vets Portfolio, approval due 25 July, begin writing Project Plans

**21 August** – Project Plans due

**24 Aug - 9 Sept** – O-6 Council reviews Plans

**10 September** – O-6 Council meeting provides prioritized list of Plans

**Late September** – SSG meeting update & funding profile review

**1 October** – Anticipated President's Budget release



# COCOM Experimentation Workshop



- **US Southern Command and Joint Ground Robotics Enterprise Co-Sponsors**
- **Day 1 – SOUTHCOM and Partner Nations present capability Gaps and potential applications for ground robotics to address those gaps**
- **Day 2 – Joint Ground Robotics Developers present current technology development efforts and provide demonstrations of actual systems**
- **Seeking industry participation via currently contracted endeavors to support demonstrations.**
- **Day 3 – SOUTHCOM and JGRE personnel generate a propose experimentation plan to simultaneously pursue operational concept and technology development.**



# What's Next?



- **Submit legislative proposal to modify Sec 941 language so it is executable.**
- **Incorporate Study findings into JGRE Portfolio to balance technology development with issue resolution (e.g. greater engagement with international partners, spectrum crowding, common controller for tele-op).**
- **Continue engagement with COCOMs to obtain greater understanding of needs and provide opportunities to become familiar with ground robotics technology.**
- **Pursue additional opportunities with the COCOMs to leverage JCTD process to advance requirements development and technology maturation prior to transition to program of record.**
- **Continue collaboration with industry...any suggestions?**