# OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

**February 2008**

| APPROPRIATION/ BUDGET ACTIVITY | PE NUMBER AND TITLE |
|---|---|
| **RDTE, Defense Wide BA 02** | **0602000D8Z - Joint Munitions Technology** |

| COST ($ in Millions) | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | FY 2012 Estimate | FY 2013 Estimate |
|---|---|---|---|---|---|---|---|
| P000 Insensitive Munitions | 10.323 | 12.433 | 15.254 | 15.371 | 15.250 | 15.453 | 15.670 |

**A. Mission Description and Budget Item Justification:** (U) This program addresses applied research associated with improving the lethality, reliability, safety and survivability of munitions and weapon systems. The goal is to develop joint enabling technologies that can be used by the Services as they develop their specific weapon programs. The program invests in technologies from a Joint Service perspective thus ensuring the development of technology with the broadest applicability, while avoiding duplication of efforts.

(U) Under the Joint Insensitive Munitions (IM) Technology Program (JIMTP), investments are focused on specific munition areas that have been identified by the S&T community and validated by the technology needs identified in the IM Strategic Plans submitted by the Program Executive Officers (PEOs). These five munitions areas are: 1) high performance rocket propulsion, 2) minimum smoke rocket propulsion, 3) large caliber gun propulsion, 4) anti-armor warheads, and 5) blast and fragmentation warheads.

(U) Munition Area Technology Groups (MATGs) have been established for each area and are tasked with 1) coordinating, establishing, and maintaining five-year technology development plans and roadmaps, 2) coordinating biannual meetings to review technical and programmatic details of each funded and proposed efforts, 3) developing and submitting Technology Transition Agreements in coordination with appropriate PEOs for insertion in their IM Strategic Plans, and 4) interfacing with other MATGs and IM science and technology projects as appropriate. The JIMTP Technical Advisory Committee (TAC) (consisting of senior DoD and DOE laboratory representatives and senior Munitions PEO representatives) will provide program oversight, policy, direction and priorities during its annual meeting.

| **B. Program Change Summary** | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|
| Previous President's Budget (FY 2008) | 11.133 | 15.542 | 15.283 |
| Current BES/President's Budget (FY 2009) | 10.323 | 12.433 | 15.254 |
| Total Adjustments | -0.810 | -3.109 | -0.029 |
| Congressional Program Reductions | | -3.000 | |
| Congressional Rescissions | | | |
| Congressional Increases | | | |
| Reprogrammings | | | |
| SBIR/STTR Transfer | | | |
| Other | -0.810 | -0.109 | -0.029 |

| **C. Other Program Funding Summary** | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 | FY 2013 |
|---|---|---|---|---|---|---|---|
| 0603000D8Z - BA3 Insensitive Munitions Advanced Technology | | 3.966 | 15.970 | 20.802 | 17.824 | 22.779 | 24.760 |

Comment:

**D. Acquisition Strategy** Not applicable for this item.

**E. Performance Metrics:** Not Applicable.

# OSD RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

| APPROPRIATION/ BUDGET ACTIVITY | PE NUMBER AND TITLE | PROJECT |
|---|---|---|
| **RDTE, Defense Wide BA 02** | **0602000D8Z - Joint Munitions Technology** | **P000** |

| COST ($ in Millions) | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | FY 2012 Estimate | FY 2013 Estimate |
|---|---|---|---|---|---|---|---|
| P000 Insensitive Munitions | 10.323 | 12.433 | 15.254 | 15.371 | 15.250 | 15.453 | 15.670 |

**A. Mission Description and Budget Item Justification:** (U) This RDT&E effort is aimed at developing the enabling technologies needed to build weapons in compliance with Insensitive Munitions (IM) requirements established in statute (Title 10, United States Code) and regulation (DoDI 5000.1 and CJCSI 3170.01F). Using technology available today, the Department has incrementally improved the IM response of our current munitions. New munitions which have fully implemented current IM technology and design practices have been able to achieve IM compliance. However, these have been the most easily solved problems. Without new technology, future variants of current weapon systems will have the same, or worse, response to IM stimuli (i.e., they will not improve with the technology available today). New weapon developments will face similar challenges.

Under the Joint Insensitive Munitions Program (JIMTP), investments are focused on five Munition Areas: High Performance Rocket Propulsion, Minimum Signature Rocket Propulsion, Blast and Fragmentation Warheads, Anti-Armor Warheads, and Large Caliber Gun Propulsion. Munition Area Technology Groups (MATGs), under tri-service leadership, have developed technology roadmaps for each Munition Area which are used to guide investments based on goals consistent with the DoD IM Strategic Plan. The program is structured around these five areas with clear cross-cutting tasks.

**B. Accomplishments/Planned Program:**

| Accomplishments/Planned Program Title: | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|
| Insensitive Munitions (IM) | 10.323 | 12.433 | 15.254 |

FY 2007 Accomplishments: (U) In FY 2007, the program remained focused on the five munition areas:
(1) High Performance Rocket Propulsion: (a) A new binder system was shown to change time-to-reaction in cook-off analog rocket motors and may improve IM response with incorporation of new case venting technology. (b) The feasibility of an insensitive ammonium perchlorate (AP) was demonstrated, which inhibited its decomposition to potentially allow a reduction in slow cook-off (SCO) violence. (c) Propellant formulation containing fluoropolymer binders were examined in the subscale and have shown promising safety, mechanical, and ballistic properties.
(2) Minimum Signature Rocket Propulsion: (a) Preliminary studies were conducted on new rocket motor formulations using new high nitrogen and reduced sensitivity ingredients. Initial small-scale results are promising in terms of safety, performance, and sensitivity.
(3) Blast and Fragmentation Warheads: (a) Development of a family of melt cast insensitive high explosives was accelerated, resulting in a successful engineering demonstration of a potential explosive replacement for artillery shells. A Joint effort with an artillery program of record resulted in one formulation passing 3 of 4 full-scale IM engineering tests (the existing formulation fails all four). (b) Multiple reactive liner designs were examined for general purpose bomb application. Subscale testing showed improvements over existing explosive fills without reactive liners. A design of experiments study is underway to optimize the explosive level, reactive liner volume and reactive liner composition. (c) New potentially less sensitive melt-cast explosive and ionic liquid ingredients were identified and synthesized and initial evaluations have commenced. (d) Potentially less sensitive explosive formulations using new polymeric binder system approaches were formulated in the subscale to determine processing potential.
(4) Anti-Armor Warheads: (a) Development of a new explosive for anti-armor applications has shown success in small-scale performance and sensitivity testing and will proceed to component level evaluation. (b) A new task was commenced to develop an initiation system for an Extremely Insensitive Detonating Substance using previously identified insensitive ingredients. (c) It was shown that the Variable Confinement Cook-off Test (VCCT) lacked the fidelity needed to discriminate between reaction levels of moderately filled plastic bonded explosives. Thus, to evaluate thermal

absorbing energy binder systems, a new protocol was developed, using the combination of Accelerated Rate Calorimetry, Rapid Scanning Device, and the VCCT. (d) Several crystallization techniques were studied for coating sensitive energetic ingredient particles with less sensitive energetics to reduce overall formulation sensitivity. Initial coating studies show promise.
(5) Large Caliber Gun Propulsion: (a) Seven energetic thermoplastic elastomer-based gun propellant formulations were selected for an initial assessment of thermal and shock reaction properties and ballistic performance. (b) A new task was started to examine four new gun propellant formulations using both new less sensitive additives to replace explosive ingredients and two possible binder systems.
(6) Multi-area: (a) A trade study and thermal analysis were conducted for design of analogue rocket motors to evaluate case venting technology. (b) Multiple munition packaging coating materials were evaluated for thermal response.

FY 2008 Plans: (U) Rocket propellant formulation work will begin to narrow down through down-selects to focus in on achieving IM goals. The exploration of a cast-cure explosive for use in mortar shells will be accelerated for a potential near term transition. For higher energy metal acceleration and anti-armor applications, new polymers included in studies to develop tough, thermally absorptive binders will be combined with improved, less sensitive energetic crystals. Evaluation of alternate binders and cure chemistries, and a relatively new thermally reversible binder will take place to determine their influence on thermal reactions. Metal-accelerating pressed explosive development using two new binder systems is proceeding and on track for a demonstration (IM and performance) of a single enhanced warhead by the end of FY 2008. Tailorable aggregate and ionic liquid material synthesis routes will be optimized. The Reactive Liner Evaluation Study will wrap-up with the design of experiments, and mid-scale tests and M&S will be employed to demonstrate lethality. This task will transition to an advanced development project. Multiple gun propellant formulations with combinations of relatively new additives to replace sensitive explosive ingredients and three different binder systems will undergo sub-scale testing for down selection to larger scale IM demonstrations. Development of new less sensitive initiation systems and detonator and booster materials will continue.

FY 2009 Plans: (U) Promising technologies at a Technical Readiness Level (TRL) of 5/6 will be transitioned to BA 6.3/6.4 programs or into weapon development programs. Experimental data from promising new insensitive ingredients, binders, liners and case technologies will be used to extend and validate modeling and simulation tools used for the design of weapon systems. Novel energetic ingredients will be evaluated in formulations and small-scale IM hardware. As high performance and minimum signature formulations and the newer, novel ingredients mature, rocket propellant efforts will begin to scale-up to prepare for static motor firings and full-scale IM screening tests. More venting technologies will be investigated for self-venting of rocket motors. Plastic Bonded Explosive studies will lead to less sensitive, high performance explosives by developing binders that are tougher and thermally absorptive via alternate cure chemistries and by paying attention to Hot Spot Theory looking at very fine crystal forms of existing energetic materials and at relatively new energetic materials. Emerging materials from FY 2006-2008 investments will be incorporated into and characterized as explosive formulations. Engineering level IM/vulnerability evaluations will be conducted on two large caliber gun propellants. An initiation system study will be completed.

| **C. Other Program Funding Summary** | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 | FY 2012 | FY 2013 |
|---|---|---|---|---|---|---|---|
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Comment:

**D. Acquisition Strategy** Not applicable for this item.

**E. Major Performers** Not applicable for this item.