

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)						DATE February 2006	
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development			R-1 ITEM NOMENCLATURE Guidance Technology PE 0603768E				
COST (In Millions)	FY 2005	FY2006	FY2007	FY 2008	FY 2009	FY 2010	FY 2011
Total Program Element (PE) Cost	111.145	101.797	157.367	159.094	155.760	151.097	151.597
Guidance Technology GT-01	39.002	51.973	68.005	69.399	60.707	60.500	60.000
Classified GT-CLS	72.143	49.824	89.362	89.695	95.053	90.597	91.597

(U) Mission Description:

(U) The Guidance Technology program element is budgeted in the Advanced Technology Development Budget Activity because it is developing system oriented technologies that will improve our ability to navigate weapon systems with more precision and increase the capability to meet current and emerging threats.

(U) The Guidance Technology project will increase the ability of Global Positioning System (GPS) users to operate effectively in the presence of enemy jamming; to increase the versatility of navigation systems applications by developing microelectromechanical sensor inertial navigation system technologies; and to apply the geolocation technologies/techniques to precision threat geolocation of short-dwell emitters or passive air defense systems. Fire-and-forget standoff weapons need precise targeting information if critical fixed and mobile targets are to be eliminated effectively with minimal collateral damage and minimum cost-per-kill. This requires that: (1) military surveillance and targeting systems geolocate targets accurately in the same coordinate system in which the weapon system navigates; (2) the surveillance, targeting and weapon systems have precision navigation and guidance systems on-board; and (3) navigation and target location systems robustly operate day/night and in adverse weather. In addition, future systems designed to accomplish precision strike missions must be significantly more affordable. The achievement of these characteristics in an integrated system is the goal of this project.

UNCLASSIFIED

R-1 Line Item No. 49

Page 1 of 8

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 2006
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Guidance Technology PE 0603768E	

(U) <u>Program Change Summary:</u> <i>(In Millions)</i>	<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>
Previous President's Budget	114.330	103.272	111.473
Current Budget	111.145	101.797	157.367
Total Adjustments	-3.185	-1.475	45.894
Congressional program reductions	-0.097	-1.475	
Congressional increases	0.000		
Reprogrammings	0.000		
SBIR/STTR transfer	-3.088		

(U) Change Summary Explanation:

FY 2005	Decrease reflects DOE transfer for P.L. 108-447 and SBIR/STTR transfer.
FY 2006	Decrease reflects undistributed reductions for Section 8125 and the 1% reduction for Section 3801: Government-wide rescission.
FY 2007	Increase reflects increased emphasis on classified projects, extension of MEDUSA through brassboard testing, and expansion of the Robust Surface and Subsurface Navigation Thrust.

UNCLASSIFIED

R-1 Line Item No. 49

Page 2 of 8

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)						DATE February 2006	
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development			R-1 ITEM NOMENCLATURE Guidance Technology PE 0603768E, Project GT-01				
COST (In Millions)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Guidance Technology GT-01	39.002	51.973	68.005	69.399	60.707	60.500	60.000

(U) **Mission Description:**

(U) Fire-and-forget standoff weapons need precise targeting information if critical fixed and mobile targets are to be eliminated effectively with minimal collateral damage and minimum cost-per-kill. This requires that: (1) military surveillance and targeting systems geolocate targets accurately in the same coordinate system in which the weapon system navigates; (2) the surveillance, targeting and weapon systems have precision navigation and guidance systems on-board; and (3) navigation and target location systems robustly operate day/night and in adverse weather. In addition, future systems designed to accomplish precision strike missions must be significantly more affordable. Thrusts are included in this project to improve our ability to navigate when the Global Positioning System (GPS) is jammed or otherwise unavailable; to increase the versatility of navigation systems applications by developing microelectromechanical sensor inertial navigation system technologies; and to apply the geolocation technologies/techniques to precision threat geolocation of short-dwell emitters or passive air defense systems.

(U) **Program Accomplishments/Planned Programs:**

	FY 2005	FY 2006	FY 2007
MEDUSA	21.002	18.000	13.005

(U) The Multifunction Electro-Optics for Defense of U.S. Aircraft (MEDUSA) program will develop the technologies and systems to give the U.S. air dominance at low altitude and at night. This program will develop the technologies to leap-frog reactive end-game countermeasures and enable increased threat warning times, denial of launch, and put EO-IR air defense threats at risk. MEDUSA is a three-part technology program: (1) conduct phenomenological measurements and develop countermeasures and target classification/identification techniques; (2) develop critical component technologies such as high power IR laser sources, advanced IR detectors, and fibers for high power IR transmission; and (3) develop and demonstrate an end-to-end MEDUSA system. The MEDUSA technology is planned for transition to the Air Force and Army at the conclusion of technology development and flight demonstration, which is anticipated to be completed during FY 2011.

UNCLASSIFIED

R-1 Line Item No. 49

Page 3 of 8

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 2006
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Guidance Technology PE 0603768E, Project GT-01	

- (U) Program Plans:
- Developed and evaluated MEDUSA countermeasure and classification techniques and conduct phenomenological measurements.
 - Fabricated and evaluated initial critical component technologies.
 - Continued refinement of MEDUSA system designs.
 - Built and demonstrated, from a tower, the breadboard MEDUSA design concept against realistic targets and environments.
 - Fabricate and evaluate full-scale focal plan arrays and supporting technologies to support flight domain objectives.
 - Build and flight test a MEDUSA brassboard design against realistic targets and environments.

	FY 2005	FY 2006	FY 2007
Advanced Gyroscopes	4.500	4.973	4.000

(U) The Advanced Gyroscopes program is investigating the feasibility of a very high-accuracy gyroscopes and other technologies to provide extremely precise navigation, with a goal of reducing noise error to 10^{-5} degree/hour or less. This would enable more robust operations in several applications—from underwater (including covert submarine operation and littoral navigation around obstacles) to outer space (from space flight to precise, autonomous satellite positioning). Technical challenges include the exploitation of quantum effects, such as correlated photons and atom interference effects, as well as gravity and gradiometer based technologies.

- (U) Program Plans:
- Developed concepts for achieving the required accuracy.
 - Continue to evaluate feasibility of underlying approach via analysis and laboratory measurements.

UNCLASSIFIED

R-1 Line Item No. 49

Page 4 of 8

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 2006
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Guidance Technology PE 0603768E, Project GT-01	

	FY 2005	FY 2006	FY 2007
Precision Inertial Navigation Systems	8.500	8.000	9.800

(U) The Precision Inertial Navigation Systems program will develop an entirely new class of inertial navigation instruments using atomic inertial force sensors. These sensors utilize the quantum-mechanical wave-like nature of atoms in the atomic analogue of an optical interferometer to provide unprecedented sensitivity to accelerations and rotations. The atomic sensors will further be used to measure the local gravitational field gradient to ensure that instrument alignment is properly maintained throughout vehicle maneuver, thus mitigating gravity-induced navigation errors. Initial program efforts will focus on developing fundamental technology components upon which later systems would be constructed. The PINS technology is planned for transition to the Navy and Air Force at the conclusion of Phase 3, which is anticipated to be completed by FY 2008.

(U) Program Plans:

- Develop and demonstrate an inertial navigation system with positional bias drift rate below 5 meters/hour.
- Develop compact narrow-linewidth, tunable 780 nm laser sources with large modulation bandwidth via monolithic solid-state microchip design.
- Demonstrate motion-compensated gravity gradiometer.
- Demonstrate approaches for GPS free navigation combining MEMS inertial navigation with locally derived location position information.

	FY 2005	FY 2006	FY 2007
Robust Surface and Sub-Surface Navigation (RSN/SSN)	5.000	11.500	18.000

(U) The Robust Surface and Sub-Surface Navigation (RSN/SSN) program, formerly known as Navigation via Signals of Opportunity (NAVSOPP), will provide the U.S. Warfighter with the ability to navigate effectively when the Global Positioning System (GPS) is unavailable due to hostile action (e.g. jamming) or blockage by structures and foliage. The RSN/SSN program will use signals of opportunity and specialized

UNCLASSIFIED

R-1 Line Item No. 49

Page 5 of 8

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 2006
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Guidance Technology PE 0603768E, Project GT-01	

signals from a variety of ground-, air-, and space-based sources; these will be received on the Warfighter's forth coming software defined radios, and will use specially tailored algorithms to determine position. Other signals such as the Earth's magnetic field (micro deviations), cyclic variations in the Earth's gravitational field due to tidal motion, and judiciously placed low frequency RF beacons will also be used. The greater strength and diversity of these signals will provide coverage when GPS is denied due to lack of penetration into buildings and underground, and when severe multipath is a problem. This is a two part program: (1) cataloging and assessing of potential exploitable signals followed by analysis and performance modeling and hardware-based concept validation and (2) designing, testing, and demonstrating of a (non-form-fit) of a prototype receiver(s) and algorithms for geolocation using the signals of opportunity. The RSN/SSN technology is planned for transition to United States Special Operations Command and the Air Force at the conclusion of Phase 3, and is anticipated to be completed by FY 2008.

(U) Program Plans:

- Evaluate feasibility of candidate approaches using modeling, analysis, and simulation.
- Develop critical RSN/SSN technologies and conduct phenomenological measurements to validate the down-selected concepts.
- Design, fabricate and test functional prototype systems for above-ground and underground use.
- Field test and demonstrate the functional prototype in realistic environments.
- Perform technical risk mitigation experiments and analysis on the bimorph based magnetic sensors, the piezo-electric driving motors and signal and control processing algorithms.
- Integrate technologies into a micro sensor and radiometer structure.

	FY 2005	FY 2006	FY 2007
Navigation-Grade MEMS Inertial Measurement Unit (IMU)	0.000	9.500	15.500

(U) The Navigation-Grade MEMS Inertial Measurement (IMU) program will develop micro-scale accelerometers and gyros with navigation-grade performance that use only milli-watts of power. The program will transcend traditional single mass-spring methods for navigation sensing and will explore alternative approaches, such as multiple, interconnected mass-spring systems, micro-levitated spinning structures, micro-optical readout mechanisms, atomic interferometric readout mechanisms, and fluidic contortions.

UNCLASSIFIED

R-1 Line Item No. 49

Page 6 of 8

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 2006
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Guidance Technology PE 0603768E, Project GT-01	

- (U) Program Plans:
- Attain 3D resonator structures (e.g., spheres, full wine-glass structures).
 - Develop levitation methods.
 - Develop fluid contortion sensing.
 - Develop micro-environmental control.
 - Control electronics integration.

	FY 2005	FY 2006	FY 2007
Active Electrol-Optical Mapping and Navigation System (AONS)	0.000	0.000	7.700

(U) The Active Electrol-Optical Mapping and Navigation System (AONS) program will provide GPS-denied navigation and detailed building interior mapping to soldiers operating in urban environments. AONS will employ electro-optic system strengths in image registration and precision range to track and map a soldier's position continuously. Using image-flow methods, a compact, power-efficient camera and laser radar system will track the imagery from frame-to-frame and back out camera pose and position information to provide the soldier a very precise estimate of current position as well as a continuously upgraded map of the building or underground facility (UGF) being traversed. This same system will make real-time estimates of range and relative position of objects in the scene, and will provide real-time position estimates outside under GPS-denied conditions in urban, mountainous and even foliated areas given access to a high-resolution terrain map of the area. This system would match small-scale features, such as shrubs, trees and small buildings, to features in the map and provide real-time estimates of the soldiers location within that map. The capability will be transitioned to Army via PEO Soldier and USSOCOM starting in FY 2009.

(U) The primary technical challenges are the development of compact, integrated high-resolution passive EO/IR and multi-pixel or scanning laser radar systems along with the development of real-time processing capability to provide the soldier up to date position estimates both inside building and outside buildings in GPS denied conditions.

- (U) Program Plans:
- Develop initial real-time navigation algorithms based on real and synthetic data.

UNCLASSIFIED

R-1 Line Item No. 49

Page 7 of 8

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE February 2006
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Guidance Technology PE 0603768E, Project GT-01	

- Develop an integrated breadboard system with key initial sub-systems including video, laser radar and inertial navigation aids.
- Develop and demonstrate an integrated portable prototype AONS system.
- Demonstrate real-time navigation and building extraction.

(U) Other Program Funding Summary Cost:

- Not Applicable.

UNCLASSIFIED

R-1 Line Item No. 49

Page 8 of 8