

Exhibit R-2, RDT&E Budget Item Justification							Date: February 2003	
Appropriation/Budget Activity RDT&E,D BA4				R-1 Item Nomenclature: 0604618D8Z, Man Portable Air Defense Systems (MANPADS)				
Cost (\$ in millions)	FY 2002	FY 2003	FY 2004	FY2005	FY 2006	FY 2007	FY 2008	FY 2009
Total PE Cost	0	0	25.000	21.609	13.712	.971	.979	.978
MANPAD	0	0	25.000	21.609	13.712	.971	.979	.978
A. Mission Description and Budget Item Justification:								
<p>(U) Man Portable Air Defense (MANPAD) systems are very widely proliferated, with greater than 500,000 produced and many poorly controlled. These weapons can be easily concealed and transported in a container as small as a suitcase, and can be lethal to a wide range of military and dual use aircraft. MANPAD systems and their launchers are available on the black market for as little as \$15,000. Department of Defense (DOD) and Civil Reserve Air Fleet (CRAF) aircraft are attractive terrorist targets, and are very vulnerable to MANPAD attack. Due to the limited effective range of MANPADS, any attack would probably occur in the close vicinity of an airfield, possibly outside any protected perimeter.</p> <p>(U) Current systems to counter the MANPAD threat carry all components in the protected aircraft, and cost between \$250,000 and \$5,000,000 per aircraft installation. Integration of these systems (especially their advanced launch detection sensors) is complex, time consuming and expensive.</p> <p>(U) The process of defeating a MANPAD missile includes two necessary tasks, detecting missile launch, and deploying countermeasures to defeat the missile guidance system. Current approaches rely either on visual detection (unreliable) or on expensive aircraft sensors mounted on the protected aircraft. Countermeasures consist of either infrared decoys (usually pyrotechnic flares) or directed energy systems such as lasers. Reliable missile launch detection is a technological challenge, and drives both the cost and effectiveness of countermeasures systems</p> <p>(U) Two new techniques are being considered to reduce the cost and lead time required to protect aircraft from a MANPAD. The first is the development of an innovative ground based, networked electro-optical sensor grid that would provide missile launch detection and data link this information to protected aircraft. The second is the development of new countermeasures technologies based upon special materials which will be safer to use and more acceptable for use in urban and expeditionary airfields than pyrotechnic flares.</p> <p>(U) The ground based sensor grid consists of an array of sensors that constantly monitor for the presence of a MANPAD launch. Several factors favor this architecture, with much higher detection and lower false alarm rates than current on-aircraft launch detectors. First, the sensors will be looking up at the uncluttered sky as a background versus aircraft based sensors that look down at the ground that's cluttered and full of sources of false alarms. Second, the system will rely on the detection of a launch by two overlapping sensors before a launch is declared. The sensor grid will use commercially available components to reduce cost and the lead-time to field a system. Additionally, it will be possible make the system portable by mounting the sensors on vehicles and using wireless networking between the sensors. Expeditionary airfields could be quickly protected. The key element of this approach is that the missile threat will be declared by the off board sensor grid, and then the aircraft under attack would be notified via data link to dispense countermeasures (without humans in the loop due to meet the required response time).</p> <p>(U) The most commonly used MANPAD countermeasure today is a pyrotechnic flare that is ejected from a dispenser on the protected aircraft. While these countermeasures are effective and relatively cheap, frequent use in heavily populated areas, or from aircraft such as transport/CRAF aircraft, would be difficult to explain and introduce to the public.</p>								

B. Program Change Summary: (Show total funding, schedule, and technical changes for the program element that have occurred since the previous President's Budget Submission)

	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
Previous President's Budget	0	0	0	0
Current FY2004 President's Budget	0	0	25.000	21.609
Total Adjustments				
Congressional program reductions				
Congressional rescissions				
Congressional increases				
Reprogrammings				
SBIR/STTR Transfer				
Other			+25.000	+21.609

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RDTE&E Budget Item Justification Sheet (R-2a Exhibit)							Date: February 2003	
Appropriation/Budget Activity RDT&E, Defense Wide/BA-5				R-1 Item Nomenclature Man Portal Air Defense System (MANPADS): PE 0604618D8Z				
Cost (\$ in Millions)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
MANPADS	0	0	25.000	21.609	13.712	.971	.979	.978

A. Mission Description and Budget Item Justification

(U) Man Portable Air Defense (MANPAD) systems are very widely proliferated, with greater than 500,000 produced and many poorly controlled. These weapons can be easily concealed and transported in a container as small as a suitcase, and can be lethal to a wide range of military and dual use aircraft. MANPAD systems and their launchers are available on the black market for as little as \$15,000. Department of Defense (DOD) and Civil Reserve Air Fleet (CRAF) aircraft are attractive terrorist targets, and are very vulnerable to MANPAD attack. Due to the limited effective range of MANPADS, any attack would probably occur in the close vicinity of an airfield, possibly outside any protected perimeter.

(U) Current systems to counter the MANPAD threat carry all components in the protected aircraft, and cost between \$250,000 and \$5,000,000 per aircraft installation. Integration of these systems (especially their advanced launch detection sensors) is complex, time consuming and expensive. The process of defeating a MANPAD missile includes two necessary tasks, detecting missile launch, and deploying countermeasures to defeat the missile guidance system. Current approaches rely either on visual detection (unreliable) or on expensive aircraft sensors mounted on the protected aircraft. Countermeasures consist of either infrared decoys (usually pyrotechnic flares) or directed energy systems such as lasers. Reliable missile launch detection is a technological challenge, and drives both the cost and effectiveness of countermeasures systems

(U) Two new techniques are being considered to reduce the cost and lead time required to protect aircraft from a MANPAD. The first is the development of an innovative ground based, networked electro-optical sensor grid that would provide missile launch detection and data link this information to protected aircraft. The second is the development of new countermeasures technologies based upon special materials which will be safer to use and more acceptable for use in urban and expeditionary airfields than pyrotechnic flares.

(U) The ground based sensor grid consists of an array of sensors that constantly monitor for the presence of a MANPAD launch. Several factors favor this architecture, with much higher detection and lower false alarm rates than current on-aircraft launch detectors. First, the sensors will be looking up at the uncluttered sky as a background versus aircraft based sensors that look down at the ground that's cluttered and full of sources of false alarms. Second, the system will rely on the detection of a launch by two overlapping sensors before a launch is declared. The sensor grid will use commercially available components to reduce cost and the lead-time to field a system. Additionally, it will be possible make the system portable by mounting the sensors on vehicles and using wireless networking between the sensors. Expeditionary airfields could be quickly protected. The key element of this approach is that the missile threat will be declared by the off board sensor grid, and then the aircraft under attack would be notified via data link to dispense countermeasures (without humans in the loop due to meet the required response time).

(U) The most commonly used MANPAD countermeasure today is a pyrotechnic flare that is ejected from a dispenser on the protected aircraft. While these

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countermeasures are effective and relatively cheap, frequent use in heavily populated areas, or from aircraft such as transport/CRAF aircraft, would be difficult to explain and introduce to the public. Fortunately, there are some other techniques that may be effective against the most likely threats and carry few of the disadvantages of conventional pyrotechnics. Systems such as BOL-IR, the Comet pod and other special materials decoys use oxidizing metals to produce the signature for an IR decoy. These are much less hazardous and likely have good effectiveness against the MANPADS that terrorists could most likely employ.

U) The AAR-47 missile warning system is in production and is currently used on many Joint Service aircraft. This system is effective in detecting missile launches, but has some drawbacks in terms of its false alarm rate. Additionally, the system requires significant aircraft modification due to the need to integrate these sensors in locations that provide the necessary field of view for each sensor without masking, etc. while simultaneously minimizing aerodynamic drag. (U) Current IR countermeasure systems use either a doppler radar, staring focal plane array or other techniques to detect missiles, and decoys (mostly flares), modulated heat lamps or directed energy (lasers) to defeat the incoming missile. These systems are not practical for widespread use because of their recurring and integration cost. Additionally, the need to carry classified information for modulated heat lamps and directed energy countermeasures limits their use in uncontrolled areas. Cost is the principal reason why these technologies are not practical in today's environment

B. Program Plans – FY 2004 Through FY 2005:

	FY 2002	FY2003	FY 2004	FY 2005
Man Portal Air Device	0.000	0.000	25.000	21.609

(U) Pending results from the initial study phase, this effort is planned to consist of two demonstration phases.. Initial studies will refine our implementation plan for the demonstrations in the following areas:

- Assess the signatures and vulnerabilities of the protected aircraft (as input to both the sensor algorithm development, and the countermeasures selection analysis.
- Refine the sensor grid design by analyzing the demonstration airport for likely launch regions, sensor range performance, etc.
- The system must monitor FAA air traffic control data to determine which aircraft are potentially under attack.
- Refine the sensor grid communications network design

(U) The initial testing will occur at the Naval Air Warfare Center, Weapons Division (NAWC-WD), China Lake, and will consist of a ground based network of a few sensors and an aircraft with engines running, but tethered on the ground. Objectives of the test are to show that the sensors/algorithm can reliably detect a missile launch and provide a declaration in the time required to dispense countermeasures (time is classified). Man Portable Air Defense (MANPAD) systems are very widely proliferated, with greater than 500,000 produced and many poorly controlled. These weapons can be easily concealed and transported in a container as small as a suitcase, and can be lethal to a wide range of military and dual use aircraft. MANPAD systems and their launchers are available on the black market for as little as \$15,000. Department of Defense (DOD) and Civil Reserve Air Fleet (CRAF) aircraft are attractive terrorist targets, and are very vulnerable to MANPAD attack. Due to the limited effective range of MANPADS, any attack would probably occur in the close vicinity of an airfield, possibly

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outside any protected perimeter.

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The process of defeating a MANPAD missile includes two necessary tasks, detecting missile launch, and deploying countermeasures to defeat the missile guidance system. Current approaches rely either on visual detection (unreliable) or on expensive aircraft sensors mounted on the protected aircraft. Countermeasures consist of either infrared decoys (usually pyrotechnic flares) or directed energy systems such as lasers. Reliable missile launch detection is a technological challenge, and drives both the cost and effectiveness of countermeasures systems

Two new techniques are being considered to reduce the cost and lead time required to protect aircraft from a MANPAD. The first is the development of an innovative ground based, networked electro-optical sensor grid that would provide missile launch detection and data link this information to protected aircraft. The second is the development of new countermeasures technologies based upon special materials which will be safer to use and more acceptable for use in urban and expeditionary airfields than pyrotechnic flares.

The ground based sensor grid consists of an array of sensors that constantly monitor for the presence of a MANPAD launch. Several factors favor this architecture, with much higher detection and lower false alarm rates than current on-aircraft launch detectors. First, the sensors will be looking up at the uncluttered sky as a background versus aircraft based sensors that look down at the ground that's cluttered and full of sources of false alarms. Second, the system will rely on the detection of a launch by two overlapping sensors before a launch is declared.

The sensor grid will use commercially available components to reduce cost and the lead-time to field a system. Additionally, it will be possible make the system portable by mounting the sensors on vehicles and using wireless networking between the sensors. Expeditionary airfields could be quickly protected.

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The most commonly used MANPAD countermeasure today is a pyrotechnic flare that is ejected from a dispenser on the protected aircraft. While these countermeasures are effective and relatively cheap, frequent use in heavily populated areas, or from aircraft such as transport/CRAF aircraft, would be difficult to explain and introduce to the public. Fortunately, there are some other techniques that may be effective against the most likely threats and carry few of the disadvantages of conventional pyrotechnics. Systems such as BOL-IR, the Comet pod and other special materials decoys use oxidizing metals to produce the signature for an IR decoy. These are much less hazardous and likely have good effectiveness against the MANPADS that terrorists could most likely employ.

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uncontrolled areas.

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Additionally, we may conduct some limited flight test of the advanced, special materials countermeasures against captive carried missile seekers on NAWCWD range aircraft.

C. Other Program Funding Summary: N/A

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