The MANPAD threat: A current assessment

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Editor's Note: *The Department of Homeland Security (DHS) is currently investigating Directional Infared Countermeasures (DIRCM) and other existing technologies to provide protection against MANPADS for commercial airliners and has received a $100 million allocation from the Bush Administration for the two-year project. In addition, Israel's Prime Minister Ariel Sharon announced late last summer that all El Al and Arkia aircraft will be outfitted with anti-missile technology, marking the first government to implement this policy on commercial transport aircraft. British Airways also is in preliminary talks with Airbus and Boeing about the possibility of fitting their airplanes with anti-missile systems.*

OLD THREAT, RENEWED INTEREST

Man Portable Air Defense Systems, MANPADS, have existed since the 1960s Vietnam War era. Concern for the misuse and the potent destruction that these small, rocket-propelled warheads can wreak on commercial aircraft emerged even before the advent of 9/11. Congress and the Federal Aviation Administration (FAA) conducted studies in the mid-1990s on how MANPADS would affect commercial wide-body aircraft and to begin developing technology that would counter surface-to-air (SAM) missile attacks. Transportable SAMs reemerged as a significant commercial aviation security issue when terrorists attacked an Israeli commercial airliner on November 28, 2002, as it flew over Mombasa, Kenya, carrying 200 passengers on its way to Tel Aviv.

The RSB70 is an example of the latest MANPAD technology from Saab Bofors Dynamics. It is advertised as being "unjammable" and is currently operational in 13 countries.

In the attack against a chartered Arkia Airlines plane, officials believe attackers launched two, 35-pound Russian-made SA7s, each programmed to lock onto the engine of the 757-300. These heat-seeking MANPADS are relatively simple to operate and are quickly deployed. In fact, assailants can assemble and shoulder the entire launcher in less than 30 seconds, triggering a launch within 10 seconds.

In the Kenyan attack, both missiles failed for several reasons. Most notably, the aircraft was at 152 meters Above Ground Level (AGL), well outside the minimum engagement range for the SA-7 of 800 meters AGL. The weapon was too close for the missile seeker to maintain continuous target lock. Additionally, the SA-7 provides little opportunity for it to take corrective action for intercept if its target disappears shortly from the seeker's field of view.

The first reported attempt to use a MANPAD against a civilian aircraft was in 1973 when officials arrested Palestinian terrorists in Rome before they could launch the weapons. According to the FBI, since the

A U.S. SAM, the "Stinger".

1970s, MANPADS have hit at least 42 civilian aircraft, causing the deaths of 550 people when 29 of those aircraft crashed. The Center for Defense Information says strong evidence links several unsuccessful MANPAD attacks on civilian aircraft in Saudi Arabia over the past few months. British Airways recently cancelled flights to Saudi Arabia in the aftermath of the discovery by Saudi authorities of an Al Qaeda cell that, according to intelligence reports, was planning to use MANPADS against a BA aircraft.

What do officials know about the locations of the approximately 500,000 MANPADS existing today? Consider the following information gathered by Jane's Intelligence:

- Roughly 150,000 are unaccounted for, missing primarily from inventories of the former Soviet Union and Afghanistan.

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- Approximately 350,000 remain in defense inventories.
- As many as 27 "nonstate end-users" — i.e. guerrilla and terrorist groups — are known to have acquired MANPADS on the black market for as little as $5,000 for older models such as the SA-7 that have simpler operational systems.

Individuals with the "right" connections and necessary funding, can purchase later models thought to be available for up to $100,000. The British arms dealer who smuggled a Russian Igla into the U.S in August — an attempt that was foiled by U.S., Russian, and British intelligence agencies — said he was completing the sale of the MANPAD for $85,000.

Worrisome to U.S. officials are 40 U.S.-built Stinger MANPADS, which are more sophisticated and effective than their Russian counterparts. These are allegedly unaccounted for since the 1991 Gulf War. Additionally, in technological warfare, the U.S. must contend with a situation that political scientists refer to as "blowback." The U.S. supplied more than 900 Stingers to the Taliban government in Afghanistan and its Al-Qaeda operatives who were fighting the Russian army. (It is rumored that Osama Bin Laden's personal bodyguards today may be equipped with Stingers, presumably to counter an airborne attack.) Now, the U.S. faces the possibility that some of these MANPADS could fall into the wrong hands and combatants could use them against U.S. commercial and military aircraft. The U.S. has also found and confiscated a cache of approximately 30 Chinese-made HN-5s. In addition, officials recovered more than 5,000 missiles from Al-Qaeda bases during the Afghanistan campaign, furthering the notion that MANPADS are readily available to nonstate end-users.

A Russian SA-7 missile. A British arms dealer was arrested recently in Newark for smuggling and attempting to sell a more sophisticated version of this missile, the SA-18. The SA-18 IF tracking device is designed to avoid decoys. It is deployable in a scant 13 seconds and can fit inside a golf bag.

FACTS ABOUT SHOULDER-FIRED MISSILES

MANPADS range from simple projectiles to sophisticated missiles equipped with countermeasure rejection capability (flares). A trained operator can trigger the weapon using a tube-like, disposable launcher. Designed to follow the heat of a jet engine's exhaust to its source, MANPAD missiles move out at speeds up to 1,500 mph and are generally effective only on relatively slow-moving targets at low altitude. Transport-type aircraft in takeoff or landing configuration accurately fit this profile. Missiles typically carry two to four pounds of high explosive, enough to destroy an engine or cause localized damage to a wing. U.S. Defense agencies and the FAA do not consider MANPADS as being a reliable means of downing large passenger aircraft, because most large aircraft have more than one engine and can still fly after losing an engine to a heat-seeking missile.

Experts consider MANPADS active missiles for more than 22 years, and a simple battery replacement can easily extend their shelf-lives. Missile propellants and seeker coolants generally do not deteriorate because designers construct hermetically-sealed launchers for rough field handling by soldiers. Today's versions can be effective up to 15,000 feet with upgraded seekers designed to defeat newer countermeasures. The envelope for MANPADS is three to five nautical miles and 150 to 16,000 feet AGL, depending on the type. Weighing between 10 and 35 lbs., shoulder-fired SAMs are approximately 5 feet long and 3 inches in diameter, making them relatively easy to conceal. Most are deployable in less than 60 seconds.

GLOBAL CONCERN

World attention focused on MANPADS in August when G8 leaders met in Evian, France and reached an accord that signaled the growing global importance of this issue.

World leaders define MANPADS as "surface-to-air missile systems specifically designed to be carried and fired by a single individual." Given the proliferation of MANPADS, these leaders recognize the threat that MANPADS carry and have agreed to measures to protect civil aviation worldwide that include:

- Adopting strict national export controls on MANPADS and their essential components;
- Securing stockpile management of existing MANPADS and destroying surplus;
- Ensuring strong national regulation of production, transfer, and brokering of MANPADS;
- Banning transfers of MANPADS to non-state end-users;
- Exchanging information on uncooperative countries and entities;
- Examining the feasibility of developing technical performance specifications or launch control features that preclude unauthorized usage of MANPADS; and
- Supporting and encouraging action of the ICAO Aviation Security Working Group on MANPADS.

U.S. THREAT ASSESSMENT

In May, 2002, the FBI issued a warning that MANPADS may have been smuggled into the U.S., and the

FAA issued a General Notice to pilots about the possible presence of missiles. Since then, experts warn that the threat to commercial aviation has escalated.

The federal government has stepped up assessments of international airport security. In August, it dispatched teams of aviation safety investigators to Iraq and major capital cities in Europe and Asia to determine if their commercial airports could defend themselves against terrorist threats to use SAMs against commercial planes. Further proving that U.S. officials are taking the threat of missiles seriously, the Department of Homeland Security opened a special office to deal with the threat and recently requested that Congress grant an initial $2 million funding for it.

U.S. defense experts, while trying to determine the number of illegal MANPADS circulating on the black market, are also trying to assess the accuracy of these weapons. Some analysts contend that their use against a civilian aircraft is not as simple as "firing and forgetting," a catchphrase earned by the Stinger.

First, they say failure of the missiles to strike the Israeli plane in Kenya suggests either operator inexperience or a fault in the missile's guidance system. Additionally, the aircraft may have been equipped with anti-missile countermeasures.

Secondly, hitting a target with MANPADS requires the operator to track the target while manually directing the missile's flight. The operator must also take into account ground "clutter" when firing a heat-seeking MANPAD. Missiles fired too close to the ground can be distracted by other heat sources. This happened in Afghanistan when missiles flew toward the sun rather than the targeted aircraft. Some MANPADS leave a visible, white vapor trail that can indicate the position of the launcher. And since range-to-target is an important consideration, launching the weapon from a close proximity does not necessarily guarantee a hit.

MITIGATING A MISSILE

While authorities and analysts are defining the threat of MANPADS against commercial aircraft, vendors are busy developing automatic onboard systems to defeat these threats. There are four main types of countermeasures for mitigating the MANPAD threat:

Ejecting flares during a test of an infrared missile warning and self-protection system that was installed on a C-130 Hercules.

Evasive maneuvering of the plane to avoid the missile.

Generally this option is unfeasible for a passenger aircraft as it presents significant risks. The size of large transport aircraft generally precludes enough maneuverability to evade a SAM, but even if these aircraft performed evasive maneuvers, loss of control or structural failure could result.

Pilot training and implementing new air traffic procedures.

Properly training crews on the use of other special procedures to evade missile attacks is more viable than employing techniques to try to outmaneuver a missile. Crew training would include procedures on reducing an airplane's heat signature by minimizing the use of auxiliary power units and other heat sources when operationally feasible, minimizing engine power settings, and — if a missile launch is detected — reducing the engine power settings to a minimum level necessary to sustain flight at a safe altitude.

Other mitigation techniques may be:

- Altering air traffic procedures to decrease the amount of time airliners are vulnerable to missile launches
- Making flight patterns less predictable by varying approach and departure patterns.
- Using a spiral descent — a technique employed by military aircraft operating in hostile areas. This technique has limited use however, since it would most likely create a negative impact on passenger comfort and confidence in flight safety.

Increased use of nighttime flying paired with minimal use of aircraft lighting has generally been rejected due to the detraction in safety of avoiding midair collisions since a flight crew's ability to see and avoid other aircraft would be tremendously altered.

Infrared Countermeasures (ICMs) and aircraft improvements

Flares and chaff are used to throw off heat-seeking missiles honing in on a plane's hot exhaust. Burning phosphorous flares are ejected in all directions to "fool" the missile. This option presents a potential problem in that flares, if ejected at low altitude (which presumably they would be on an attack involving a passenger plane), might land on the ground hitting people, cars, and buildings, causing damage and potentially starting fires. Chaff are strips of aluminum designed to confuse an incoming missile's electronic homing equipment.

Equipping and using an onboard electronic jamming system on commercial aircraft is an option. These devices send out special infrared radiation, referred to as Infrared Countermeasures (ICMs), which confuses the missile and causes it to fly off course. Although not widely advertised, business aircraft have been

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fitted with ICM equipment at a cost of $3.5 million, a price tag that also includes crew training. The equipment has also been installed on some U.S. Air Force cargo planes. The ICMs detect the launch of a MANPAD missile and target the guidance system with lasers, rendering missile navigation inoperable.

This system has proved to be 100% effective in the testing phase, but the cost of designing new commercial aircraft and retrofitting older commercial aircraft with this system could exceed $25 billion. Given the current financial state of the industry, the Air Transport Association (ATA) insists that "any cost of implementing a large-scale countermeasure installation program on commercial aircraft or simply armed guards at airfield perimeters should be assumed by the federal government."

Some vendors are also looking at employing technology that would require users to enter a code before the missile could activate. This would hinder the prolific black resale market, making it more difficult to use MANPADS illegally.

Airport and local security improvements

Heightened security, surveillance, and patrols in the vicinity of airports are the most expedient measures to mitigate the risk against shoulder-fired SAMs. This would likely combine airport security and local law enforcement efforts — while one force ups airport perimeter patrols, the other force steps up patrols in outlying locations defined to have high threat potential for aircraft.

Strategic and tactical considerations assume that every airport represents a potential deployment location. Nominally, a 12 x 12-mile box is the template security experts denote as the most likely threat area. This box is being surveyed at all major U.S. airports and will lead to several possible security improvements that could include increased visual and electronic surveillance. This might be accomplished by frequent but unscheduled security patrols by law enforcement, closed circuit television or infrared monitoring, or a combination of the three. Airport perimeter surveillance, however, has a limited utility in densely populated areas near large cities.

In addition to increased security, airports could implement a procedure where flares would be dispensed randomly in the vicinity. However, this procedure contains the attendant risk of starting fires on the ground, thus making it unsuitable for airports located in highly populated or wooded areas.

Northrup Grumman is researching another protective measure involving a system that security experts could deploy at every airport. While the most long-ranging solution, it might also be the most cost effective. A new, high-power, directed-energy laser would defeat or jam all threats in the vicinity of the airport by burning out the seeker head on a MANPAD missile causing it to fly harmlessly off course. Under this type of defense system, approximately 429 airport locations would be fitted versus retrofitting 6,800 commercial aircraft with onboard systems.

WHICH TECHNOLOGY IS BEST?

No single solution is likely to mitigate the risk against MANPADS. Both the House and Senate Appropriations Committees have approved separate plans to fund contracts valued at up to $60 million to deploy antimissile technology on commercial airliners. However, the DHS does not know when it could deploy the technology.

Some congressmen are frustrated at what they perceive is the Administration's "halting" approach on the issue. In the meantime, the DHS is assessing proposals for the technology contracts from eight defense contractors who are competing for full-scale development contracts.

Some officials at the DHS are skeptical that any system would be effective and affordable. "We are in the process of determining if, in fact, there is a viable technology that could be deployed on commercial aircrafts," said Brian Roehrkasse, a DHS spokesman. But one thing is clear — policy questions remain:

- Will more than one technology be approved and certified?
- Will the DHS initiate a "layered" approach to this threat, requiring that several technologies be integrated at airports and on aircraft?
- Will an already financially-burdened industry share costs with the federal government in implementing any defense against SAMs?

In the meantime, the TSA will likely begin an educational program geared toward law enforcement officials in the recognition of this viable threat. Knowledge and vigilance are a pilot's best defense, according to Captain Jim McNamara, National Security Committee member. The question that looms large is whether the industry will suffer a 9/11-type event before technology is developed at a financially-acceptable level for commercial installation. The Allied Pilots Association National Security Committee (NSeC) continues to keep abreast of this issue and is presently discussing it with the TSA. Additionally, the NSeC has asked to have a representative voice in an industry Working Group on the topic. Stay tuned.