

# **SPECIAL FILE: MISSILES OVER KENYA**

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## Communication os "Association Guerrelec Chapitre français La Fayette" of 'Association of Old Crows

For the first time on 28 November 2002, a terrorist organisation fired missiles at a civil airliner - a Boeing 757 of the Israeli charter company Arkia which had just taken off from Mombasa airport in Kenya. The two infrared-guided SAM-7 Strella surface-to-air missiles missed their target. The airliner later landed safely in Tel Aviv, escorted by F-15 fighters from the Israeli Air Force.

This terrorist attack points to the importance of protecting airliners and private and government aircraft against shoulder-launched weapons such as SAM-7s or Stingers during take-off and landing.

Once such a missile has been fired, the only effective countermeasure is for the target aircraft itself to implement some form of self-protection solution selected from the extensive range of electronic warfare systems available.

If it was a system of this type on board the Arkia plane that diverted the terrorist missiles, this would demonstrate that electronic warfare, as well as contributing to intelligence gathering, electronic deterrence and self protection of military platform , can also provide effective, credible solutions to counter the asymmetrical threats of today against civilian assets.

(photo Thales)



## A new type of conflict

We used to live in a world of symmetrical conflict: one state versus another via their armed forces or well identified paramilitary organisations. We have now entered the age of asymmetrical warfare: a state or coalition of states under the aegis of the United Nations faces one or more terrorist organisations, or even individuals, motivated by ideology or propaganda, who threaten both civil and military targets. This changes the whole game.

The September 2001 issue of the British journal *Intelligence Review* revealed that many countries had seized surface-to-air missiles during operations to curb illegal arms trafficking between 1999 and 2001. From 1996 to 2001, twenty-four aircraft - all of them military - were shot down by terrorists or armed rebels. An attack on a civil aircraft, as on 28 November, remains exceptional. However, in 1994, the Falcon carrying the president of Rwanda was destroyed in similar circumstances.

One notorious military target was the Italian G222 tactical transport aircraft shot down on its approach to Sarajevo airport during the airlift in 1992. This tragic incident during a peacekeeping operation was a catalyst for procurement programmes throughout Europe, particularly to protect military transport aircraft such as the Transall and the Hercules. Another episode involved an Etendard IVP reconnaissance aircraft based on the Clemenceau aircraft-carrier, which was hit by an infrared missile on 14 April 1994 while on a photo reconnaissance mission at the height of the civil war in Bosnia-Herzegovina. Fortunately the aircraft

managed to return to the carrier, but severe damage to its tail unit made the pilot's task highly dangerous. Christian Brincourt's television crew on the Clemenceau filmed the fighter's spectacular return, and their pictures were shown on television newscasts throughout the world.

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## **Proliferation of man-portable SAMs**

Very short-range (5-6 km) man-portable infrared-guided missiles present a diffuse and potentially ubiquitous threat. It is hard to prevent the spread of these weapons, according to experts from the French Air Force, and as a result they are proliferating in all theatres of war, not least in Afghanistan. They are effective, easy to operate and relatively cheap: the black market price is between \$80,000 and \$250,000 for a Stinger, and even lower for less sophisticated types.

The man-portable surface-to-air missile has exactly the features that belligerents in asymmetrical warfare seek. According to a fascinating study in the September 2001 issue of Jane's Intelligence Review, there are at least 30 terrorist or guerrilla organisations in the world today who possess these weapons. These include, unsurprisingly, Bin Laden's network and Hezbollah, but also the Rwandan Patriotic Front, the Somali National Alliance, the IRA, Chechen opposition forces and the FARC in Colombia. These organisations reportedly possess SA-7s, SA-14s, SA-16s, SA-18s, Redeyes and Stingers.



**SA-7** (photo Thales)



**STINGER** (photo Thales)

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## **High tech solution for protection from man-portable SAMs**

Protection involves either the permanent use of a jammer during vulnerable flight phases (1) or detecting each threat individually and then automatically activating an appropriate countermeasure (jamming or deception). The latter approach has been adopted for most military platforms that are equipped, including those in the French armed forces.

To detect infrared missiles, there are at present two technological approaches. Active systems rely on small radars with antennas positioned around the aircraft that establish a detection envelope of several kilometres across. Passive systems detect the source of heat radiated by the threat, especially its propulsion system.

Active systems are usually missile approach detectors (MAD), and most passive systems are missile launch detectors (MLD). Both are already in service with the French armed forces: the active Thales Damien on helicopters and MWS20 on the C-130 Hercules, the Elta 2160 detector on the C-160 Transall; MBDA passive systems on the Mirage 2000 D, Mirage 2000 N and Rafale fighter-bombers. These aircraft are also fitted with Thales radar warning receivers and electromagnetic jammers and MBDA chaff/flare dispensers.

Since an airliner needs to operate commercially, the easiest solution to use is probably an onboard infrared jammer. The pilot has then only to switch on the system, like the radio or the landing lights. A standard infrared jammer provides permanent protection and is highly likely to divert first-generation missiles, which have a fairly simple guidance system.

The use of decoys is much more difficult for civil aircraft. First, they have to be coupled to a missile detector, and then they require the handling of pyrotechnical devices which can represent a fire hazard. Chaff/flare dispensers are therefore not suitable for such aircraft.

To counter more up-to-date missiles with more sophisticated guidance systems, rare as these may be outside regular armies, infrared jamming or deception of the missile's seeker is feasible provided the threat can first be detected and located by angular tracking.

Once a mobile threat has been detected, however, decoys are usually highly effective. On military aircraft, the detection systems are therefore coupled automatically to chaff/flare dispensers which send off pyrotechnic devices to attract IR missiles away from the hot spots caused by the aircraft's engines.

The advantage of decoys launched from the aircraft is that they divert the missile from its target very quickly. A French Air Force Mirage F1 evaded an IR missile during a reconnaissance mission over Bosnia in 1994 by using its Corail chaff/flare dispenser (MBDA). And on 17 December 2001, two US Air Force C-130 Hercules approaching Kandahar airport in Afghanistan diverted SA-7 missiles in this way during the final phases of the battle for Tora Bora.

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## Long-standing consideration of airliner self-protection

The Kenya incident occurred not long after a warning of this danger from General Alain Baer, former French Air Force pilot, at the France-US seminar held by the Institut Diplomatie & Défense at the Senate in Paris on 11-12 September 2002, on "The war against terrorism".

The idea of equipping airliners with self-protection systems is not a recent one. The terrorist attacks on New York and Washington, and other attacks up to and including the failed SAM attack in Mombasa, merely revealed a risk that had already been identified.

Self-protection for airliners was a topic at the International Electronic Warfare Symposium held by the French La Fayette Chapter of the Association of Old Crows in Paris in April 1998. The stands at the exhibition presented a number of new-generation directional jamming solutions for military aircraft, including the Flash project developed in France by Thomson-CSF (now Thales) under contract to the French defence procurement agency DGA.

An article also appeared in the 21 January 1999 issue of the French weekly, TTU Europe. It reported that Airbus Industrie had begun research into fitting airliners with anti-missile protection systems. According to TTU Europe, a number of airlines had expressed interest in installing warning systems (detection of anti-air weapon systems' target acquisition sensors and missile launch detectors), electronic countermeasures and decoy systems. Hitherto this need was mainly expressed for military transport aircraft. The topic received further media coverage in a short article entitled "Self-protection for Airbus" in the January-February 1999 issue of the military aviation publication Air Zone Magazine, sold on news-stands.

The security imperative has been taken very seriously by security services. The highly public Air Force One in the United States is fitted with the ALQ-204(V) Matador system, which requires a specially trained operator. The presidential helicopters supplied by the US Navy are fitted with radar warning detectors, AN/ALQ-144 infrared jammers and AVR-2A laser warning receivers. Queen Elizabeth II's aircraft also has an anti-missile protection system. The December 2002 issue of the British magazine Air Forces Monthly, which is also sold on news-stands, contains a high-resolution photograph of the Queen's aircraft (part of the Royal Squadron) fitted with the new equipment. Far from being a state secret, the self-protection of the royal planes was described in frank detail by an official from the RAF's Air Warfare Centre on 30 September 2002. His presentation to over one hundred electronic warfare experts invited to London by IQPC included close-up photographs of the system - a DIRCM (Directional InfraRed Counter Measures) jammer - fitted to the BAe 146 CC2s of the 32 (The Royal) Squadron.

Directed IRCounter Measure type jammers are very attractive while complex. They use first a passive missile warning system (using UV sensors for in service equipment) that provide a very good threat Direction Of Arrival. One track is then transferred to an IR thermal camera that follow one missile (open loop principal) and aim the narrow beam of an IR lamp for equipment presently in operational use (NEMESIS AAQ24 of BAe and Northrop Grumman), or an IR lamp and/or a mono frequency laser for in development equipment (ATIRCM ALQ212 of BAe North America).

The jamming modulation transmitted allows then to off boresight the missile with more effectiveness than classical omnidirectional IR jammers.

Drawback are the price and the weight (roughly 60Kg per system for the lightest ones).

Contrary to a classical IR jammer, they can process only one missile at a time during the jamming duration which can last several seconds. This explains their frequent requirement to be duplicated or coupled with a flares dispenser. At last, a very accurate installation and calibration is necessary and, as for all jammers, a very good preemptive knowledge of the threat is required to program an effective disturbing modulation.

More robust systems, lighter and more generic in their effectiveness, built their modulation by "interrogating" the threat seeker through a very narrow laser beam (close loop system). Such systems are studied at Thales and Northrop Grumman companies but will not be available before several years (except if a crash program is decided).

All this is evidence of threat awareness at the highest level. Since government aircraft are fitted with such systems, the question must now be seriously asked whether self-protection should not be extended to certain private aircraft and to civil airliners.

Redeye missile (photo Thales)



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### What action to take ?

Man-portable infrared surface-to-air missiles are now a credible, technically effective threat. Solutions developed in the defence sector exist to counter them.

The performance and characteristics of these missiles are well-known, not least at the CELAr (Centre d'Electronique de l'Armement) at Bruz outside Rennes in Brittany, which is the DGA's centre of technical excellence in this field. Since 1983, NATO'S Embow trials have provided regularly updated data about them. The latest campaign, Embow 9, which focused on

protection against infrared guided missiles, was held in France in March 2002 and attended by 11 other nations: Belgium, Canada, Denmark, Germany, Greece, Italy, the Netherlands, Norway, Turkey, the United Kingdom and the United States. All the participating countries provided their military aircraft, specially fitted with chaff/flare dispensers, as well as their testing apparatus and their leading experts in self-protection.

The attacks in Kenya in November 2002 could have been much more lethal. They raise the issue of whether self-protection systems should be installed, certainly on government and some private aircraft, and possibly also on commercial airliners. In France this would involve no more than strict application of the Decree of 7 January 1959 on the organisation of national defence, Article 1 of which specifies that "the purpose of defence is to ensure at all times, in all circumstances and against all types of aggression, the security and integrity of the territory and the lives of its citizens."

We don't know if it is thanks to the EW that 261 passengers on the Arkia 757 fired by the two IR missiles owe their lives but if it is only the result of an incredible stroke of luck, we can unfortunately think that there is big risks not to be so lucky if the same situation happens again.

(1) Mainly during take-off, and to a lesser extent in the approach phase before landing

Association Guerrelec's self-protection specialists  
[www.guerrelec.asso.fr](http://www.guerrelec.asso.fr)

28 November attacks in the press

" Missiles and Airlines: fear becomes reality. Herald Tribune, 30 November 2002.

" SAM attacks on jet reignites old fears. Jane's Defence Weekly, 4 December 2002.

" Missiles scrape past Boeing. France Soir, Paris, 29 November 2002

" Tom Clancy scenario. "24 heures", Lausanne, 29 November 2002

" Fearsome weapons. Tribune de Genève, Geneva, 29 November 2002

" Anti-Israeli attacks in Kenya. Thursday morning, in Mombasa, a hotel of an Israeli chain and an aircraft of Arkia were attacked. Le Monde, Paris, 29 November 2002

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