

Missing Missiles

The Proliferation of Man-portable Air Defence Systems in North Africa

Introduction

The looting of Libya's massive stocks of weapons and ammunition was one of the most significant arms proliferation events of the 21st century. Anti-government forces seized tens of thousands of small arms, light weapons and other munitions, and thousands more were left unguarded in abandoned storage facilities. These weapons have fuelled crime and conflict in Libya and throughout North Africa. Of particular concern to the

international community were the government's large stockpiles of man-portable air defence systems (MANPADS). Many analysts and officials feared that these weapons would be smuggled out of Libya and used against military and civilian aircraft. The anticipated increase in MANPADS attacks has not materialized, raising important questions about the fate of Libya's missiles and the threat they pose to the region. What happened to the MANPADS looted from Libyan depots in 2011? Did armed groups in

North Africa acquire them? If so, what is the impact of these missiles on aviation security? Is Libya the only source of MANPADS in the region? This Issue Brief attempts to answer these questions by analysing the models, provenance and condition of MANPADS in North Africa, and the threat posed by these missiles.

The main findings of this Issue Brief include the following:

- Newly released data confirms that nearly all MANPADS documented in Libya were first-generation



Photo 1. Libyan rebels handle a Strela-2 pattern MANPADS, July 2011. Source: Alfred de Montesquiou/Getty Images

Strela-2 pattern systems. The only other MANPADS documented to date are four Pakistani Anza II missiles—without launchers.

- The proliferation of missiles looted from Libyan government depots has had little discernible effect on the illicit use of MANPADS in the region.
- Recent generation MANPADS in nearby conflict zones may soon pose a more significant threat to aviation security in North Africa than Libya's ageing, first-generation missiles.
- The non-state armed group known as Islamic State's (IS) access to MANPADS poses a potentially acute threat to civilian aviation in North Africa and elsewhere.

The Issue Brief begins by defining key terms. It then provides a short history of MANPADS and their use by armed groups followed by an in-depth analysis of the proliferation of MANPADS in North Africa since 2011, with a particular focus on missiles looted from storage facilities in Libya. It goes on to examine the implications for aviation security in North Africa. The Issue Brief concludes with a brief recap of key observations on MANPADS trafficking and aviation security in the region.

Terms and definitions

This Issue Brief uses the definition of MANPADS in the Wassenaar Arrangement's Elements for Export Controls of MANPADS:

- (a) surface-to-air missile systems designed to be man-portable and carried and fired by a single individual; and
- (b) other surface-to-air missile systems designed to be operated and fired by more than one individual acting as a crew and portable by several individuals (WA, 2007, art. 1.1).

When referring to specific models of MANPADS, the Issue Brief uses the transliterated model designations

assigned by the country of origin. When making a general reference to the model and foreign variants, the term 'pattern' is used, as in 'Igla-1 pattern MANPADS'. The term 'pattern' is also used when the precise model of the MANPADS is not known. For example, 'Strela-2 pattern' is used to refer to the sub-category of MANPADS consisting of the Strela-2 (SA-7a) and Strela-2M (SA-7b) systems and foreign variants, or to individual MANPADS that fall within this sub-category.

For the purposes of this Issue Brief, 'North Africa' refers to the following countries: Algeria, Egypt, Libya, Morocco, and Tunisia.¹ While most of the discussion focuses on activity in these countries, developments beyond North Africa are also referenced since they affect—and are affected by—the proliferation of MANPADS in the five countries studied.

MANPADS: A brief history

Since the United States and the Soviet Union fielded the first MANPADS in the late 1960s, manufacturers in more than 20 countries have produced over one million missiles for systems commonly categorized as MANPADS (Schroeder, 2013, pp. 1–5; US GAO, 2004, p. 10). In 2004, the US Government Accountability Office (GAO) estimated that 500,000–750,000 of these missiles were in existence and that roughly one per cent of them were outside government control (US GAO, 2004, p. 10). The GAO has not revised this estimate, and the MANPADS holdings of many governments have changed significantly since 2004. Nonetheless, the estimate provides at least a rough sense of the size of the global inventory of MANPADS.

The vast majority of MANPADS produced to date are shoulder-fired systems typically consisting of a missile in a launch tube, a gripstock (launcher), and a battery. They are lightweight, portable, and easy to smuggle across borders and to attack

sites. When assembled, most shoulder-fired MANPADS are less than two metres long and weigh less than 20 kg (Schroeder, 2013, p. 3)—easily concealed in the bed of a truck, the cargo hold of a small boat, or the backseat of a car. Most MANPADS are 'fire and forget' weapons, meaning that the missile guides itself to its target after it is launched. This type of guidance system is advantageous for armed groups in that, as soon as the missile leaves the launch tube, the attacker can immediately reload and fire a second missile—increasing the likelihood of hitting the target—or quickly leave the attack site, reducing the risk of detection and apprehension by authorities.

Armed groups began to use MANPADS shortly after the first systems were produced.² Among the early documented terrorist plots involving MANPADS was an attempt by a radical Palestinian group to shoot down an Israeli airliner as it was departing from Rome's Fiumicino Airport. In September 1973, Italian security authorities raided the apartment that was to serve as the attack site. On the balcony, they found two Strela-2 pattern MANPADS 'ready to shoot down an El Al plane after takeoff'. The government of the former Libyan leader, Muammar Qaddafi, reportedly provided the missiles (US DOS, 1994, p. 85). Libyan MANPADS have featured prominently in the illicit trade ever since.

By the early 1990s, the US Department of State had identified at least 25 MANPADS attacks against civilian aircraft, resulting in more than 500 deaths (US DOS, 1994, p. 75).³ In a 1994 report on 'Terrorist Tactics and Security Practices', the State Department referred to these attacks as 'a third world phenomena'—an apt description given that all of the MANPADS attacks assessed in the report took place in Africa, Central America, the former Soviet Union, and the Middle East (US DOS, 1994, p. 75). Reports of

illicit MANPADS activity since then suggest that this description is still applicable; most documented illicit MANPADS activity since 2001 has occurred in developing countries, including those in North Africa.⁴

The proliferation of MANPADS in North Africa since 2011

With the possible exception of the Middle East, North Africa experienced the highest rate of illicit acquisition of MANPADS of any region over the last decade. The epicentre of most of this activity was Libya, where hundreds, possibly thousands, of MANPADS missiles were looted from government depots in 2011.⁵ These and other MANPADS have been acquired by armed groups throughout the region.

Table 1 lists the models of MANPADS identified in North Africa since 2011.

The looting of Libya's arms depots

The first significant MANPADS proliferation event of the 'Arab Spring' began when dissidents overran and looted the depots in eastern Libya in early 2011. The depots contained dozens, possibly hundreds, of MANPADS and key components.⁸ Photos and video footage from Libya in early 2011 suggest that, at least initially, there was minimal control over the seized MANPADS and that distribution was haphazard. The images show MANPADS launch tubes in the hands of individuals with no apparent knowledge of the weapons or how to use them. Among the most obvious examples are photos of militia members on patrol with missiles but no launchers, and operators who are holding launch tubes upside down, or pointing the missile at the ground while 'engaging' enemy aircraft (see, for example, Chivers, 2011a; Smith, 2011). In one widely circulated photo, a militia

Table 1 Illicitly held MANPADS in North Africa, 2011–2014

System	US Department of Defense/NATO designation	Country of origin	Year fielded	Selected foreign variants (by country)	Countries where illicit possession or use has been reported
9K32 Strela-2	SA-7a/Grail	Soviet Union	1968	Bulgaria, China, Czech Republic,	Algeria*, Egypt, Libya, Tunisia
9K32M Strela-2M	SA-7b/Grail Mod 1	Soviet Union	1971 ⁶	Egypt, North Korea, Pakistan, Poland, Romania, Serbia	
9K310 Igla-1	SA-16/Gimlet	Soviet Union	1981	Bulgaria, North Korea	Egypt ⁷
Anza II	Anza II	Pakistan	1994	China, Iran	Libya

Sources: Binnie, 2014b; Chikhi, 2011; Good Morning Libya, 2014; Jenzen-Jones, 2013; O'Halloran and Foss, 2011; Salem, 2011; UNSC, 2014a
⁶Reported but not independently verified by the UN Panel of Experts or the Small Arms Survey.



Photo 2. A Libyan rebel points a MANPADS tube at government forces, near Ajdabiya, eastern Libya, March 2011. Source: Anja Niedringhaus/AP Photo

member is aiming his weapon—a MANPADS launch tube—towards pro-government ground forces located near the city of Ajdabiya in north-eastern Libya. The launch tube is upside down and has no launcher (see Photo 2). Even if the militia member had a launcher, the missile would have been of little use against the Qaddafi forces since Strela-2M MANPADS have a minimum engagement altitude of 80 feet (24 metres) (UK MOD, 2010, p. 51).

Other evidence of lax stockpile security and control include photos of

numerous MANPADS components taken out of their storage crates and strewn on the ground by armed groups (see Photo 3). These practices were documented at depots at least until September 2011. Photos taken at military depots near Ajdabiya, Ras Lanuf, and Tripoli show multiple launch tubes and batteries among piles of weapons, munitions crates, and rubbish. The missiles in these photos appear vulnerable to theft, loss and diversion, and are emblematic of the pervasive (if predictable) lack of stockpile security and effective command



Photo 3. MANPADS components found outside of a Libyan military facility seized by rebel forces. Source: Goran Tomasevic/Reuters

and control in Libya during the civil war.

It is unclear how many MANPADS were stockpiled in Libyan depots at the start of the uprising. The most widely cited estimate was provided by General Carter Ham, head of the US Africa Command (AFRICOM). Testifying before the US Congress in early April 2011, General Ham told lawmakers, 'we do estimate that there were as many as 20,000 of these types of weapons in Libya before the conflict began' (US AFRICOM, 2011). US officials subsequently clarified that Gen. Ham was referring to major components for MANPADS (for example, missiles or gripstocks) rather than

complete systems (missile, gripstock, and battery).

A November 2011 report compiled by a contractor for the US Department of State and obtained by the Small Arms Survey sheds light on this estimate. Data collected from more than 80 ammunition storage sites throughout Libya reveals that since the 1970s, the Libyan government had received shipments containing at least 17,546 MANPADS missiles and an additional 760 missiles for Libya's vehicle-mounted Strelas air defence systems.⁹ The Small Arms Survey also obtained a similar report by the United Nations Support Mission in Libya (UNSMIL), which identified shipments totalling

18,156 MANPADS missiles (UNSMIL, 2013, p. 5).¹⁰

Research conducted by journalists and non-governmental organizations (NGOs) lends credence to these estimates. C. J. Chivers, a correspondent for *The New York Times*, collected information at a military facility in the western Libya town of Ga'a shortly after the site was looted. His data indicates that the MANPADS at the facility were part of shipments with a combined total of 5,270 Strela-2 pattern missiles (Chivers, 2011b). Given that most MANPADS-relevant materials found at the site were from Serbia and Bulgaria while most of Libya's MANPADS were imported from the Soviet Union, and that the depot at Ga'a was just one of many looted facilities, it is likely that MANPADS shipments documented at Ga'a reflect only a portion of total imports.

It should be noted that the number of complete systems imported by the Qaddafi regime was lower than the roughly 18,000 missiles documented by US contractors and UNSMIL. Governments usually import several missiles for every launcher and thus the number of complete MANPADS in national inventories is invariably lower than the total number of imported missiles. Data gaps preclude a more precise estimate, however.

Another key fact that is often not conveyed by the media is that most estimates of Libya's MANPADS refer to total imports over a period of 40



Photo 4. Fragment of a Strela-2 pattern launch tube, Mizda, Libya, 2011. Source: C.J Chivers/The New York Times



Photo 5. Four Anza II launch tubes photographed in Libya, 2011. Source: Confidential source/Armament Research Services (ARES)



Photo 6. Anza II launch tube prepped for destruction in Libya, 2011. Source: Mahmud Turkia/AFP Photo

years, not the number of MANPADS in the country at the time of the uprising. The total quantity of MANPADS in Libya in 2011 was undoubtedly lower than total imports due to testing, retransfers, and use in combat and training exercises.¹¹ An unknown number of MANPADS were also destroyed by NATO bombing. Munitions storage sites were a favourite target of NATO aircraft, which attacked dozens of them, including a depot at Mizdah (Mizdah) in north-west Libya (*The New York Times*, 2011). Photographs of the area surrounding the depot show fragments of MANPADS, including the battery receptacle in Photo 4 (Chivers, 2011c).

Other MANPADS missiles were fired by government forces and armed groups during the 2011 conflict, or recovered by multinational weapons-collection teams. These teams secured or otherwise accounted for roughly 5,000 MANPADS and components in 2012 (Shapiro, 2012; UNSC, 2011, p. 6). Subsequent threat-mitigation efforts have netted additional missiles, although the number and condition of these items are unclear.¹²

Thus, the actual number of loose MANPADS in Libya is smaller than commonly assumed, though how much smaller remains unknown. A UK government official put the number of Libyan MANPADS not accounted for in 2013 at between 3,000 and 12,000 missiles—a huge range that reflects the difficulty of accounting for the items in the Qaddafi regime’s massive, sprawling inventory of conventional weapons.¹³

Models and provenance of Libya’s MANPADS

Accounts of MANPADS imported by the Qaddafi regime indicate that nearly all were first-generation systems produced in the 1970s and 1980s.¹⁴ Data obtained by the Small Arms Survey indicates that the vast majority were Soviet-made Strela-2Ms,

Table 2 **Distribution of MANPADS missiles acquired by Qaddafi regime, 1973-1986**

Model*	Country of manufacture	Quantity	% of total imports
SA-7b	Former Soviet Union	15,490	88%
SA-7b	Bulgaria	2,026	12%
SA-7b	Yugoslavia	22	<1%
Anza MK-II	Pakistan	4	<1%
SA-7b	Poland	4	<1%
Total		17,546	

Source: US DOS, 2011b, p. 3

The figures in this table were derived from data found at 80 munitions storage sites in 2011. As noted in the report, it is possible that not all of the MANPADS shipments were received by Libya in their entirety. See US DOS, 2011b, pp. 1-2).

* As identified in the source document.

which accounted for nearly 90 per cent of shipments documented by explosive ordnance disposal (EOD) experts working in Libya in 2011 (US DOS, 2011b, p. 3). All but four of the remaining missiles were Strela-2M variants made in Bulgaria, Poland, and the former Yugoslavia.¹⁵ Table 2 lists the models and countries of manufacture of MANPADS documented by the EOD experts.

Evidence collected by journalists and NGOs appears to corroborate these claims. For example, all of the MANPADS documented at the depot near Ga’a were Strela-2M missiles manufactured in Bulgaria and the former Yugoslavia (Serbia) (Chivers, 2011b). Similarly, all of the MANPADS in the photos and videos reviewed by

the Small Arms Survey appear to be Strela-2 pattern systems and components, with the exception of four Pakistani Anza II missiles (Photos 5 and 6).¹⁶

Libya’s MANPADS in 2015: Safe and secure?

Despite national and international efforts to collect and secure Libya’s MANPADS, many remain outside government control and are vulnerable to theft, seizure, or loss. In early 2014, UN investigators reported that ‘thousands of MANPADS were still available in arsenals controlled by a wide array of non-state actors with tenuous or non-existent links to Libyan national authorities’ (UNSC, 2014a, p.92). This vulnerability was highlighted by the



Photo 7. MANPADS launch tubes seized by Ansar al-Sharia, Benghazi, 2014. Source: Ansar al-Sharia/Twitter

Box 1 Mythical missiles

The growing number of information sources and the increasingly rapid spread of information online help to explain the widespread proliferation of erroneous claims about the presence of advanced Russian Igla-S and US Stinger MANPADS in Libya. The misinformation about Igla-S MANPADS dates back to the discovery of looted crates of 9M342 missiles, which have the same model designations as missiles used with Igla-S MANPADS. However, available evidence indicates that the missiles are for vehicle-mounted Strelas systems, not MANPADS (Photos 8 and 9). Russian industry officials denied exporting Igla-S MANPADS to the Libyan government, and no gripstocks for Igla-S missiles have been spotted in Libya to date. Furthermore, the 9M342 missiles sold to Libya are not compatible with Igla-S gripstocks, according to Russian officials (Pyadushkin, 2012, p. 6; UNSC, 2012, p. 6; Binnie, 2014c). Assuming that this assertion is accurate, it addresses concerns about the potential pairing of Libyan Igla-S missiles with man-portable launchers obtained elsewhere. Much of this information has been in the public domain for several years yet reports of Igla-S MANPADS in Libya continue to appear in press articles and social media.



Photos 8 and 9. Vehicle-mounted missile systems in Libya, 2011. Sources: Ahmed Jadallah/Reuters; Ben Curtis/AP Photo

Another widely cited myth concerns the alleged presence of US-made FIM 92 Stinger MANPADS in Libya. These claims hold that, at the time of the 2012 attack on the US diplomatic facility in Benghazi, US officials were attempting to buy back Stinger missiles that the US Department of State had supplied to al-Qaeda-affiliated groups:

Stevens' mission in Benghazi, they will say, was to buy back Stinger missiles from al-Qaeda groups issued to them by the State Department, not by the CIA. Such a mission would usually be a CIA effort, but the intelligence agency had opposed the idea because of the high risk involved in arming 'insurgents' with powerful weapons that endanger civilian aircraft. Hillary Clinton still wanted to proceed because, in part, as one of the diplomats said, she wanted 'to overthrow Gaddafi on the cheap' (Simon, 2013).

More recent accounts take this narrative a step further, claiming that Stinger missiles originally intended for Libyan armed groups were given to the Taliban in Afghanistan and used against US forces. In 2014, the *New York Post* ran an article claiming that '...sources in the US Special Operations community believe the Stinger fired against the Chinook was part of the same lot the CIA turned over to the Qataris in early 2011, weapons Hillary Rodham Clinton's State Department intended for anti-Khadafy forces in Libya' (Timmerman, 2014).¹⁷

The Small Arms Survey has found no evidence to support these claims. No photographs or video footage of Stinger missiles in Libya or Afghanistan have surfaced, and the only evidence offered to support these claims are statements made by anonymous sources. Given the US government's leadership role in international counter-MANPADS efforts, its tight restrictions on exports of Stinger MANPADS, the robust post-shipment controls on exported Stinger missiles, and the Obama Administration's public opposition to sending MANPADS to armed groups in Syria, assertions that the administration provided—or consented to the provision of—Stinger MANPADS to armed groups in Libya or Afghanistan seem highly implausible.

seizure of Strela pattern launch tubes from a military facility in Benghazi in 2014. The base was captured by Ansar al-Sharia, a violent Islamist group linked to the 2012 attack on the US

consulate (Binnie, 2014d; UNSC, 2015, p. 45; US DOS, 2014c). Shortly after the battle for the base, the group posted images of the captured launch tubes online (Photo 7).

Images of several additional MANPADS reportedly acquired by Ansar al-Sharia and other Islamist groups were posted on social media sites in 2014. The missiles appear to be Strela-2 pattern systems—the same type of MANPADS looted from the Qaddafi regime's stockpiles.¹⁸

Confirming the source of the missiles is extremely difficult, however, as none of the markings on the launch tubes are visible. While Qaddafi-era stocks are the most likely source, Strela-2 pattern MANPADS are widely circulated and it is possible (though unlikely) that the missiles were smuggled into Libya. A definitive account of their provenance would require significantly more information than is currently in the public domain.

Cross-border trafficking of Libya's MANPADS since 2011

International trafficking of Libyan weapons began shortly after government storage facilities were looted in early 2011. Unconfirmed reports of MANPADS trafficking date back at least to April 2011 (Chikhi, 2011) and have frequently appeared in various media outlets since then. By early 2015, trafficking of Libyan MANPADS had been reported in at least nine countries: Algeria, Chad, Egypt, Gaza, Lebanon, Mali, Niger, Syria, and Tunisia.¹⁹ Many of these reports are unverifiable, consisting solely of claims by unnamed officials. In recent years, however, the UN Panel of Experts corroborated several of these claims. By comparing lot and serial numbers of the seized MANPADS with those in Libya, the Panel has linked launch tubes recovered in Central African Republic, Lebanon, Mali, and Tunisia to shipments to Libya (see Table 3).

It is often extremely difficult to assess claims about seized MANPADS that have *not* been examined by the UN Panel.²⁰ Chadian officials have reportedly seized several dozen MANPADS trafficked from Libya but, as of

Table 3 **Trafficked Libyan MANPADS and components assessed by the UN Panel of Experts, 2011-2014**

Country	Item description	No. of items seized	Seizure date	Seizure location	Notes
Central African Republic	Strela-2M launch tube	1	Unspecified	Unspecified	UN sources reportedly confirmed that 'lot 01-81 existed in Libya and that serial numbers relatively close to the item were recorded there'. However, the Panel noted that transfer of the launch tube may have occurred prior to the Libyan civil war (UNSC, 2014a, p. 39).
	Strela-2M battery	1			
Lebanon	Strela-2M launch tubes	10	April 2012	Near Tripoli, Lebanon	The MANPADS were found on board the Letfallah II, a ship that had taken cargo in Misrata, Libya, before being interdicted by Lebanese authorities (UNSC, 2013, pp. 35-6). The MANPADS and other weapons on the ship were reportedly bound for Syria.
	Strela-2M gripstock	1			
	Strela-2M batteries	6			
Mali	Strela-2M launch tubes	13	Unspecified	Unspecified	The French government traced at least two seized MANPADS back to Libya (UNSC, 2014a, p. 31).
	Strela-2M gripstock	1			
	Strela-2M batteries	11			
Tunisia	Strela-2M missiles	8	January 2013	Medenine	The UN Panel checked the lot number on one of the launch tubes and found the same number in Libya. The serial number was also very close to those found in Libya (UNSC, 2014a, pp. 29 & 91).
	Strela-2M gripstocks	2			
	Strela-2M batteries	11			

Source: UNSC, 2014a and 2013

early 2015, they had not provided the UN Panel with access to the missiles or released photos of their markings (UNSC, 2014a, p. 37 and UNSC, 2015, pp. 131-2). Algerian authorities claim to have recovered dozens of Libyan MANPADS, including at least ten 'Strela type' missiles seized from a local arms-smuggling ring in 2014 and 100 'antiaircraft missiles' reportedly found in a large cache in 2013 (Houamdi, 2014; Reuters, 2013). To date, the Small Arms Survey has not found any photos of MANPADS seized in Algeria.

Similarly, an unnamed 'member state' reportedly told the UN Panel that Libyan MANPADS were transferred to Syria in 2013. It is not clear what evidence the official provided to support these claims (UNSC, 2015, p. 129). Photos of MANPADS recovered by Egyptian authorities confirm that they are the same model of MANPADS found in Libya (Egyptian MOI, 2013) (Photo 10), but the markings on the launch tubes are not visible, precluding identification of their origins.²¹ Without additional information, the origins of these missiles will remain unverifiable.

Even when governments provide comparatively detailed information about seized MANPADS, it is still dif-

icult to confirm the provenance of the weapons. For example, in October 2014 French and Nigerien forces seized an unspecified number of Strela-2 pattern MANPADS as part of Operation Barkhane. The weapons were seized in northern Niger from a convoy linked to al-Qaeda in the Islamic Maghreb. The convoy was reportedly en route to Mali from Libya when it was intercepted (French MOD, 2014b; UNSC, 2015, pp. 133-4). Two months later, French and Malian troops found three Strela-2M missiles in a buried arms cache located west of the Malian town of Almoustarat (French MOD, 2014a, 2015).²² Photos posted on the French Ministry of Defence website reveal the dates of manufacture of two of the missiles, and the lot and serial number of one missile (Photo 12). The manufacture dates are consistent with the timeline of the Qaddafi government's imports but publicly available records on lot and serial numbers in Libya are too limited to confirm that the missiles came from Libyan stocks.

Some militants attempt to conceal the source of their weaponry by altering the images of weapons in the photos and videos that they post online. A recent example is a photo of a

militant holding what appears to be a Strela-2 pattern launch tube and gripstock. The image of the launch tube is blurred in an apparent attempt to prevent identification of the model (Photo 13). However, close inspection of the photo reveals that the weapon's physical characteristics are consistent with Strela-2 pattern MANPADS. The photo was posted on a website linked



Photo 10. Strela-2 pattern MANPADS and components recovered in Egypt, 2013. Source: Egyptian Ministry of the Interior



Photos 11 and 12. Contents of an arms cache discovered near Almoustarat, Mali, 2014. Source: Ministère de la Défense de France



Photo 13. Blurred image of a militant with MANPADS, 2015. Source: 258Ansar/Twitter



Photos 14 and 15. Iglas-1 pattern MANPADS seized by Egyptian authorities in 2011. Source: Youm7.com

to Wilayah Sinai, a group based in Egypt that has pledged allegiance to IS.

Verifying the provenance of MANPADS offered for sale online poses additional challenges. In March 2015, Armament Research Services reported on an advertisement for a Strela-2M pattern gripstock posted on the page of a private Facebook group. Many of the group's members, including the individual who posted the advertisement, are reportedly based in Libya (Smallwood, 2015a). Confirming the claims made in this advertisement, including that the seller is located in Libya and that he has access to the gripstock, is exceedingly difficult, however.

MANPADS from sources other than Libyan stocks

Contrary to popular perception, not all illicitly held MANPADS in North Africa come from Libya. In Egypt, for example, authorities have seized at least one shipment of Iglas-1 pattern missiles, none of which has been spotted in Libya. The missiles were recovered in September 2011 near the city of Ismailia in north-east Egypt. Media coverage of the seizure describes the items as US-made missiles smuggled from Libya (Salem, 2011), but the missiles featured in photos accompanying the article are clearly not US made; Iglas-1 pattern missiles are not produced in the United States (Photos 14 and 15). The claim that the missiles were smuggled from Libya is also questionable given that there is no evidence that the Qaddafi regime imported Iglas-1 pattern MANPADS.

Another example is the missile used in an attack on the Egyptian helicopter in January 2014. The group Jamaat Ansar Bayt al-Maqdis took credit for the attack, which killed five soldiers. Initial reports identified the missile as a Strela-2 but available evidence suggests that it was actually an Iglas or Iglas-1 MANPADS—again, systems not known to be in Qaddafi's

stocks. The only publicly available images of the MANPADS used in the attack are from a video posted online by Jammāt Ansar Bayt al-Maqdis (Photo 16). Attempts to conceal the identity of the attacker (and perhaps the weapon) preclude a definitive identification of the model, but the shape and location of the battery offer clues. The battery—or battery-coolant unit in this case—appears to be the type used with second- and third-generation Soviet-designed systems (Strela-3, Igla-1, Igla, or Igla-S), the Chinese-designed QW-2, and the Polish Grom series. According to IHS Jane’s, the length and width of the launch tube rule out the Strela-3 (Binnie, 2014b), and while the QW-2 cannot be ruled out, there are no documented reports of armed groups acquiring these systems. Since Grom series missiles are rarely seen outside government control, the MANPADS used in the attack was most likely an Igla series system. There is no record of Igla series MANPADS in Libyan stocks, so the weapon almost certainly came from elsewhere.

Implications for aviation security

The widespread proliferation of Libya’s missiles has had little discernible effect on the illicit use of MANPADS. The anticipated increase in missile attacks has not come to pass, and there is little reason to think that it will. In the four years since the looting of Libya’s depots, there have been no documented MANPADS attacks on commercial airliners in North Africa.²³ Reports of MANPADS attacks on *military* aircraft in the region are limited to a handful of incidents in Libya and Egypt. Use of MANPADS during the Libyan civil war appears to have been minimal, in part due to the rapid establishment of a ‘no fly’ zone. Prior to its imposition, rebel attacks on government aircraft involved a wide array of weapons, not only MANPADS. More



Photo 16. A MANPADS attack on an Egyptian military helicopter, Sinai Peninsula, 2014. Source: Sinai Province/Ansar Beit al-Muqdis

Box 2 Serviceability: A key variable

Among the most important questions regarding the MANPADS looted in Libya is whether and to what extent they are still serviceable. Key components of Strela-2 pattern MANPADS deteriorate over time, making them more difficult to operate and less capable of chasing down targeted aircraft. This deterioration is accelerated by improper storage and inadequate maintenance. Similarly, some components are fragile and can be damaged by improper handling.²⁴

Information on the serviceability of Libya’s MANPADS is incomplete. The 2011 report by contractors working for the US State Department notes that many of the MANPADS missiles recovered in 2011 ‘still appeared to be in excellent condition’ (US DOS, 2011b, p. 1). Whether the missiles were actually functional is not specified, however. In 2014, the UN Panel reported that Strela-2M components tested by international experts were ‘still serviceable despite their age’ (UNSC, 2014a, p. 92). The components tested were reportedly found outside Libya and thus the tests are presumably more indicative of the hundreds of MANPADS components handled and stored in sub-optimal conditions²⁵ than if the experts had tested only components that were found in purpose-built depots and in their original storage crates. Less clear is which components were tested, how many were tested, and what percentage were operational—information that is vital for determining what the tests actually revealed about the serviceability of, and threat posed by, the broader inventory of Libya’s MANPADS.

Other evidence from Libya suggests that an unknown quantity of the MANPADS are probably un-serviceable. At the time of the anti-Qaddafi uprising, the vast majority of the regime’s MANPADS were well past their estimated shelf life of ten to 20 years.²⁶ Furthermore, many of the missiles and other components looted by anti-Qaddafi forces were subject to rough handling and sub-optimal storage conditions. Photos and videos from Libya include numerous images of missiles and batteries taken out of their storage crates and stacked on the ground, in the back of pick-up trucks, and on the floors of ad hoc storage facilities. Others show components caked with dirt or badly corroded.²⁷ MANPADS and components were also damaged during the NATO air campaign. According to UNSMIL’s 2013 report, roughly 25 per cent of the 499 launch tubes examined by UN and private EOD teams in 2012-13 were ‘damaged beyond use or were just destroyed components found in ASAs as a consequence of NATO bombing’ (UNSMIL, 2013, p. 5).

Some of Libya’s MANPADS may have never functioned as intended. According to an EOD technician interviewed by the Small Arms Survey, a well-placed Libyan official told him that ‘a significant number of [MANPADS] systems arriv[ed] in-country with defective battery systems’. The official also noted that ‘an eastern European team had arrived to provide “some solutions” to the battery issues, to include locally improvised alternatives’.²⁸

Accounts of rebels firing MANPADS at government aircraft suggest that some of the missiles were at least partially operational in 2011, but whether they performed as designed is unclear. A widely publicized photo from March 2011 clearly shows a Strela-2 pattern MANPADS missile shortly after leaving its launch tube (Photo 17). The image confirms that the system’s battery still had a charge and that the booster and main motors were working. However, since the photo does not reveal whether the MANPADS hit its target, it tells us little about the serviceability of other key components, such as the propellant and the control section, the proper functioning of which is critical for successfully engaging aircraft.

recently, ground fire appears to account for many of the aircraft damaged and destroyed in Libya.

The only successful documented use of MANPADS against aircraft in the region since 2011 is the attack on the Egyptian military transport helicopter in January 2014. As noted above, the missile that struck the helicopter is not a model known to have been in Libyan stocks.

There are several possible explanations for why Libya's loose MANPADS have not brought down more aircraft. The Libyan armed groups holding many of the MANPADS view them as sources of political leverage and as military and economic assets (UNSC, 2012, pp. 6, 8) and are therefore reluctant to part with them. As noted by the UN Panel, the perceived value of MANPADS and other weapons by Libyan armed groups 'could actually be considered a mitigating factor against the proliferation of weapons outside Libya' (UNSC, 2012, p. 8). Concerns about terrorism also shape the behaviour of these groups. 'Many of the commanders fear the use of MANPADS against civilian airlines in Libya, which their families regularly use', notes analyst Brian McQuinn.²⁹

Just as important, at least some of Libya's MANPADS are probably no longer serviceable. Existing evidence indicates that a large quantity of the missiles are past their estimated shelf lives,³⁰ and images from Libya depict rough handling and improper storage of the missiles, which can damage key components or hasten their deterioration (see Box 2).

Demand-side dynamics may also be a contributing factor. Armed groups may be hesitant to plan attacks around ageing, first-generation missiles. Determining which missiles are fully functional requires technical skill and knowledge that most armed groups in the region probably lack. Even if some groups have this capacity, the mixed record of Strela-2 pattern MANPADS may make them hesitant to use the missiles.

While early generation MANPADS such as the Strela-2M can be effective against helicopters in certain circumstances, their overall record against military aircraft is relatively poor. Anti-Soviet groups in Afghanistan had little success with Strela-2 pattern missiles, which they acquired prior to receiving the highly effective US Stingers. Only about three per cent of

Strela-2 pattern missiles fired by the groups hit their targets (Bearden and Risen, 2004, p. 247). Operation Iraqi Freedom offers more recent insight into the efficacy of early generation MANPADS against modern military aircraft. Thousands of first- and second-generation SA series MANPADS were looted from the Iraqi government's arsenals in 2003. Many of the looted missiles remained outside of government control for years thereafter.³¹ Losses attributable to attacks with these missiles appear to be minimal, however. As of 2011, the Brookings Institute had identified just 75 US military helicopters downed in Iraq since 2003. Of those helicopters, about half were brought down by enemy fire, and only some of those helicopters were hit by MANPADS (O'Hanlon and Livingstone, 2011, p. 14).³²

Armed groups using MANPADS to target fixed-wing civilian aircraft have had even less success in recent years. Since 2001, unsuccessful terrorist attacks with MANPADS far outnumber successful ones, and many of the failed operations involved Strela-2 pattern missiles—the systems that constitute most of the loose MANPADS in North Africa. In 2001, members of the Basque separatist organization (ETA) tried repeatedly to shoot down the Spanish prime minister's plane with a Strela-2 pattern MANPADS. The attacks were unsuccessful because the missile failed to launch, according to a former ETA member (Lavery, 2010; Goodman, 2010). A year later, two Strela-2 pattern missiles fired at an Israeli airliner flew harmlessly past the large aircraft and its 271 passengers and crew.³³ In 2003, Iraqi militants hit a DHL cargo aircraft with a Strela-2M MANPADS, causing severe damage to the left wing and knocking out the plane's hydraulics systems. Nonetheless, the pilot was



Photo 17. A rebel fires a Strela-2 pattern MANPADS at a Libyan Airforce jet near Brega, Libya, March 2011. Source: Joel Silva/Folhapress/Reuters

Box 3 The MANPADS threat: Looking beyond Libya

Of potentially greater concern for aviation security than Libya's Strela-2M missiles are advanced MANPADS in neighbouring conflict zones. Since 2011, armed groups in Iraq and Syria have acquired dozens of recent generation Chinese and Russian MANPADS, including systems not previously seen outside of government control (Schroeder, 2014, p. 1; Rigual, 2014, p. 2). These systems include the Russian Igla-S—a third-generation system with an improved range, warhead, and fuse—and the Chinese FN-6, which also features several notable improvements over the first-generation MANPADS currently available in North Africa (Rosoboronexport, n.d.; O'Halloran and Foss, 2011, pp. 6-7) (Photos 18 and 19).

Recent (authorized) transfers of advanced MANPADS to the governments of Iraq and South Sudan raise similar concerns. In September 2014, the Iraqi Ministry of Defence published photographs of Igla-S MANPADS recently acquired from Russia (Photo 21). The systems were part of a USD 4.2 billion contract signed in October 2012 that reportedly includes 1,000 missiles for use with an unspecified number of MANPADS gripstocks and pedestal-mounted launchers (*Russia Today*, 2014). The delivery of Chinese QW-2 MANPADS to South Sudan was first revealed in late 2014 (Smallwood, 2015b) (Photo 20). South Sudanese officials hinted at the transfer in November 2014 but provided few details regarding the type, quantity, or sources of the systems it was planning to acquire (Binnie, 2014e).

Both governments are contending with significant political instability and are embroiled in conflicts with local armed groups. The seizure of large quantities of Iraqi government weapons by IS and evidence of sub-optimal stockpile security in South Sudan raise questions about the security of the imported MANPADS (UNSC, 2014b, pp. 15-16; King, 2014).

The planned production of MANPADS by Sudan's Military Industrial Corporation also raises concerns about illicit proliferation and use. The new system, a model of which was displayed at the 2015 International Defence Exhibition and Conference (IDEX) in Abu Dhabi, is similar in appearance to the Chinese FN-6. A company representative told the Small Arms Survey that the system was 'under development, and would be ready for service in one to two years' (Small Arms Survey, 2015, p. 6). Armed groups throughout Africa and elsewhere have acquired Sudanese-produced weapons and ammunition, including light weapons.³⁴ Similar proliferation of Sudanese MANPADS would have significant implications for aviation security across the African continent and beyond.

Libya itself remains an attractive import market for weapons, possibly including MANPADS. A recently posted photo of a Chinese FN-6 MANPADS reportedly taken in Libya raises the possibility that advanced MANPADS have already been trafficked to North Africa. The photo, which appeared on Twitter in September 2014, shows a complete FN-6 MANPADS—a system not previously seen outside government control in North Africa. The source claims that the photo was posted by Ansar al-Sharia in Benghazi (Good Morning Libya, 2014). Confirming this claim is difficult since the photo itself provides no clues as to where it was taken. Efforts by the Small Arms Survey to find corroborating evidence have thus far been unsuccessful.

If the photo was indeed taken in Libya, it would be significant for two reasons. First, there is no evidence that the Qaddafi regime imported FN-6 MANPADS, which means that it came from outside the country. Second, the FN-6 is a newer and more advanced system than Strela-2 pattern MANPADS. Acquisition of even moderate quantities of operational FN-6 MANPADS by armed groups would pose an immediate threat to Libyan aircraft and a potential threat to military and civilian aircraft throughout the region.

The risks associated with international trafficking of advanced MANPADS are heightened by the rise of IS in the Middle East and North Africa. Shooting down a commercial airliner would be consistent with the group's use of increasingly brutal acts to heighten its international profile. To the extent that IS and its affiliates can obtain access to advanced MANPADS, this represents a particularly acute threat to aviation security.



Photo 18. Syrian rebels displaying MANPADS, including FN-6 and Igla-S systems, 2013. Source: Alasala Watanmya/YouTube



Photo 19. Alleged IS member firing an FN-6 in Iraq, 2014. Source: IS (via The Threat Matrix blog)



Photo 20. A Chinese QW-2 MANPADS in South Sudan, 2014. Source: Wangdunkon blog



Photo 21. Russian Igla-S MANPADS displayed by the Iraqi military, 2014. Source: Iraqi Ministry of Defense

able to land the aircraft. Photos of the battered but intact plane and its unscathed crew underscore the difficulty and unpredictability of attacking large, fixed-wing aircraft with MANPADS, especially first-generation systems (US FAA, 2011, p. 4; Warwick, 2004; Northcott, n.d.).

Given these incidents—widely covered by the media—the low number of MANPADS attacks in North Africa is likely to be due, at least in part, to a reluctance on the part of armed groups to rely on decades-old weapons of dubious serviceability. Successful MANPADS attacks require substantial investments of time and resources, and targeting civilian aviation entails significant risk for the groups planning the attacks. Few groups are likely to incur these costs and risks without a high degree of confidence that their attack will be successful, and most MANPADS documented in North Africa are unlikely to inspire that confidence. This cost–benefit analysis could change if advanced MANPADS from neighbouring conflict zones make their way to North Africa (see Box 3).

Conclusion

The widespread proliferation of MANPADS and other weapons looted from Libyan depots is a prime example of a significant but often overlooked source of illicitly held weapons: large stockpiles of arms and ammunition in fragile states. Since 2000, the looting of government depots precipitated by regime collapse has led to the massive influx of weapons, including MANPADS, into local and regional black markets in Iraq, Libya, and Syria.³⁵ Fortunately, few (if any) of the MANPADS held by military forces in these countries were recent generation systems. Libya’s MANPADS inventory consisted almost exclusively of ageing,

first-generation Strela-2M MANPADS, which may help to explain why their proliferation has had little apparent effect on the illicit use of MANPADS in North Africa.

The illicit acquisition of advanced Russian and Chinese MANPADS by armed groups in Iraq and Syria raises concerns that future trafficking of MANPADS to and within North Africa will have a more profound impact on aviation security. Authorized transfers of such weapons to fragile states in the Middle East and Africa raises similar concerns, which are heightened by the expanding influence of violent, transnational jihadist groups such as IS. Access by IS to even modest quantities of advanced MANPADS would have significant implications for aviation security. Even an unsuccessful attack would disrupt air travel to the targeted region, at least temporarily. Less likely but still possible are coordinated attacks at multiple airports, which would likely bring air travel to and within the region to a sudden halt. Failure to address this threat adequately could have significant consequences that extend well beyond North Africa. ■

List of abbreviations

CIA	Central Intelligence Agency
ETA	Euskadi Ta Askatasuna ('Basque Homeland and Freedom')
GAO	Government Accountability Office
IDEX	International Defence Exhibition and Conference
IISS	International Institute for Strategic Studies
IRA	Irish Republican Army
IS	Islamic State
MANPADS	Man-portable air defence system(s)
SIPRI	Stockholm International Peace Research Institute

Endnotes

- 1 The term 'North Africa' is used to refer to various groupings of countries in and near the Sahel region that may differ from the definition used here. See, for example, Warmington (n.d.), African Development Bank (n.d.), and UNHCR (n.d.).
- 2 For a history of the illicit proliferation and use of MANPADS, see Schroeder, Smith, and Stohl (2007).
- 3 As of 2011, 40 civilian aircraft had been hit by MANPADS, resulting in about 28 crashes that killed more than 800 people (US DOS, 2011a).
- 4 See also Schroeder (2013, pp. 9–17). Since 2001, the Small Arms Survey has found credible references to only two illicitly held MANPADS in the 36 'advanced economies' as defined by the International Monetary Fund. These items consist of two missiles seized in France that were allegedly linked to several failed attempts to shoot down the plane of then Prime Minister José María Aznar in Spain (Lavery, 2010; BBC News, 2004; Goodman, 2010).
- 5 See Binnie (2014c) and UNSC (2014a, p. 92).
- 6 Fiszer and Gruszczynski (2004) claim that the Strela-2M was accepted into service in 1970.
- 7 In addition to Iglá-1 MANPADS seized by Egyptian authorities, militants used what is presumed to be an Iglá series MANPADS to shoot down a military helicopter. However, since images of the missile used in the attack are deliberately distorted in the video subsequently posted by the militants, it is impossible to definitively identify the model (see p. 9).
- 8 See, for example, Bouckaert (2011) and Human Rights Watch (2011).
- 9 This figure does not include separate shipments of dummy or training missiles (US DOS, 2011b, p. 2). The report includes an important caveat: '...Libya may not have received these shipments in their entirety'. Therefore the total number of missiles received by the Qaddafi regime may be lower than the sum of the missiles in the shipments (US DOS, 2011b, p. 1).
- 10 These estimates are significantly higher than those published by NGOs before the 2011 uprising, which ranged from

- 350 to 1,500 MANPADS (IHS Jane's, 2009; IISS, 2010, pp. 262–3; SIPRI, n.d.). It is not clear how the lower figures were calculated, and some organizations have since revised their estimates upwards, presumably to reflect US government data.
- 11 The Qaddafi regime exported MANPADS to several governments and armed groups, including the Ugandan government and the Irish Republican Army (IRA) (see US DOS, 1994, pp. 85–6 and Schroeder, Smith, and Stohl, 2007, pp. 63–4, 89). In its 2013 report, UNSMIL notes that unnamed 'Libyan Air Defence staff' informed them that the Qaddafi regime had 'gifted' approximately 12,000 of its MANPADS missiles to several unspecified foreign nations (UNSMIL, 2013, p. 5). It is unclear whether UNSMIL was able to verify this claim.
 - 12 See, for example, BBC (2012).
 - 13 Email correspondence with UK government official, 3 March 2015.
 - 14 See SIPRI (n.d.); and UNSC (2014a, p. 92).
 - 15 The UNSMIL's assessment from 2013 includes a brief reference to 'reports of remnants from SA-14, SA-16/SA-18 Battery Cooling [*sic*] Units' (UNSMIL, 2013, p. 2). The Small Arms Survey has seen no evidence of Igla or Igla-1 MANPADS in Libya, and the vague nature of the reference precludes analysis of its veracity. The same is true of the reference to reports from 'local contacts' of Anza II MANPADS missiles in addition to the four identified by EOD technicians in 2011.
 - 16 The Anza II is a system developed by Pakistan's Institute of Industrial Control Systems (IICS) that is similar in appearance to the Chinese QW-1 MANPADS (O'Halloran and Foss, 2011, pp. 24–5). Photos of the Anza II missiles recovered in Libya clearly show several launch tubes with receptacles for the distinctive, perpendicularly mounted cylindrical batteries used with the Pakistani system and its foreign variants (Jenzen-Jones, 2013). A similar launch tube is shown in photos taken at a weapons-disposal event attended by US Assistant Secretary of State Andrew Shapiro in December 2011 (NBC News, 2011) (see Photos 5 and 6). Notably, no gripstocks or batteries are visible in the photographs, and the Small Arms Survey has not found images of these items elsewhere. Publicly available data on international arms transfers contains no references to imports of Anza II MANPADS by Libya (SIPRI, n.d.; IHS Jane's, 2009; IISS, 2010; UNODA, n.d.). Given the gaps in official reporting on arms transfers, however—and the ad hoc nature of information available in other sources—it is possible that the Libyan government imported complete Anza II systems.
 - 17 See also Timmerman (2015) and Spookd Blog (2014).
 - 18 See, for example, SITE Intelligence Group (2014).
 - 19 See Schroeder (2011, p. 19); Barnett (2013); Chikhi (2011); *Jerusalem Post* (2011); UNSC (2014a, 2015); and Xinhua (2013).
 - 20 See, for example, Binnie (2014c); Fadel (2011); and Xinhua (2013).
 - 21 The Egyptian government's claims are echoed by the Israeli Defense Force, which reportedly told the UN Panel that '...weapons from Libya that transited into other areas, including the Sinai Peninsula and the Gaza Strip, included man-portable air defense systems and anti-tank guided missiles'. See UNSC (2014a, p. 42).
 - 22 The buried cache also contained homemade explosives, mortar rounds, a pick-up truck, and a motorcycle (French MOD, 2014a).
 - 23 Statements made by the UN Panel of Experts on Libya and other analysts support this claim. 'To the knowledge of the Panel,' reads their February 2014 report, 'no MANPADS attacks have been documented in the Sahel region since the Libyan uprising' (UNSC, 2014a, p. 92). Six months later, Jeremy Binnie of IHS Jane's commented that 'to date, the only confirmed incidents outside Syria have happened in Egypt and Ukraine and are unlikely to have involved systems that have come from Libya since 2011' (Binnie, 2014c). See Aviation Safety Network (n.d.).
 - 24 For reasons of security, the Small Arms Survey does not identify these components.
 - 25 See, for example, King et al. (2013, pp. 2–6).
 - 26 Existing evidence indicates that most of the Libyan government's MANPADS were acquired between 1973 and 1986 (US DOS, 2011b, p. 1), meaning that they were roughly 25 to 40 years old in 2011.
 - 27 A UK official interviewed by the Small Arms Survey noted an acute shortage of thermal batteries, which '...have either not been stored correctly, destroyed and/or used for "training" with users not realising they only have a 30 second battery life' (Email correspondence with a UK government official, March 2015).
 - 28 Email correspondence with an in-country EOD expert, March 2015.
 - 29 Interview with Brian McQuinn, January 2015.
 - 30 See, for example, Chivers (2011a) and (2011b).
 - 31 See Schroeder (2013, p. 13).
 - 32 Estimates of helicopters lost during Operation Iraqi Freedom vary. In 2010, the former head of Army Aviation stated that 130 helicopters had been lost in Iraq—nearly twice as many as identified by the Brookings Institute (Mundt, 2010, p. 6). The former director's estimate of helicopters *lost to enemy fire* is roughly consistent with the data compiled by the Brookings Institute, however.
 - 33 In contrast, a car bomb that detonated at a nearby hotel at about the same time killed or injured more than 50 people, and destroyed most of the building (US DOS, 2004 and 2011a).
 - 34 See, for example, Small Arms Survey (2015, pp. 2–9); and LeBrun and Leff (2015, pp. 49–52).
 - 35 For more information on MANPADS looted from depots in Iraq and Syria, see Schroeder and King (2012) and Schroeder (2014).

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About the Security Assessment in North Africa

The Security Assessment in North Africa is a multi-year project of the Small Arms Survey that supports actors engaged in building a more secure environment in North Africa and the Sahel–Sahara region. It produces timely, evidence-based research and analysis on the availability and circulation of small arms, the dynamics of emerging armed groups, and related insecurity. The project places special emphasis on the local and transnational effects of the region's recent uprisings and armed conflicts on community safety.

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