TECHNICAL REPORT

ISLAMIC STATE RECOILLESS LAUNCHER SYSTEMS

April 2018

CONTEXT

For ideological, logistical, and tactical reasons, Islamic State (IS) forces have increasingly developed improvised weapons to supplement their stockpile of conventional materiel. During the course of field investigations in Iraq, Conflict Armament Research (CAR) has extensively documented the group's research, development, and large-scale production of improvised weapons and ammunition.[1]

IS ideologues mentioned the development, production, and management of weapons as early as 2013. In a document entitled *Principles in the Administration of the Islamic State*, the author, Abu Abdullah al-Masri, writes that

> *it is necessary for a plan to be put in place including […] establishing factories for local military and food production and independence from the monopoly of arms dealers for materials of necessity and cutting them off in the event of contravening the interests.*[2]

To meet these objectives, IS forces established a centralised authority to exercise standardisation and quality control for their numerous, geographically dispersed improvised weapon production facilities.[3]

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IS forces appear to have developed the improvised launchers featured in this report in view of the fact that the 73 mm rockets in their holdings far outnumbered the weapons required to launch them. Indeed, between 2014 and 2017, CAR documented only two SPG-9-pattern launchers compared with 499 PG-9-pattern rockets recovered from IS forces—across an arc of territory extending from Kobane, Syria, to Baghdad, Iraq.[4] Developing improvised launchers for otherwise redundant rockets would thus help IS forces to meet logistical requirements.

The ability to assemble and deploy different types of recoilless launcher also has tactical advantages in urban environments. Variations in warhead design and range indicate that the launchers described in this report were designed to fulfil different aims. They are shorter and lighter than traditional SPG-9 launchers and consequently easier to transport and deploy. Equipped with pre-loaded launchers, IS fighting forces are able to launch anti-armour projectiles from inside buildings without experiencing the hazardous backblast that would result from firing an RPG-7 or SPG-9.

CAR field investigation teams documented four types of recoilless launcher, their components, and respective projectiles on multiple occasions in the Iraqi cities of Baghdad, Mosul, and Tel Afar in March, May, July, and September 2017. During the final month of the study in Mosul and Tal Afar, the teams also observed dozens of rockets, which IS forces had modified—presumably prior to loading them into their improvised launchers.

The four systems share common features and components, such as the gripstock assembly, launch tube diameter, and overall configuration—consisting of a projectile, propelling or expelling charge, and countermass. The propelling or expelling charge and countermass follow the same basic design for all launchers, but they vary in mass due to differing projectile weights.

Three of the four systems are designed to launch repurposed, factory-produced high-explosive anti-tank (HEAT) rockets. Their shaped charge is effective against armoured vehicles. The fourth launcher fires a fully improvised high-explosive blast projectile, filled with homemade explosive and fitted with an entirely improvised base-detonating fuze. This projectile may be more effective against soft-skinned vehicles and personnel in confined spaces. IS forces affixed labels on the launchers, indicating maximum ranges of 200 m, 300 m, and 700 m for the modified PG-7 rockets and PG-9 projectiles (see the Annex). The range of the fourth type of projectile is unknown (see Table 1).

THE ABILITY TO ASSEMBLE AND DEPLOY DIFFERENT TYPES OF RECOILLESS LAUNCHER HAS TACTICAL ADVANTAGES IN URBAN ENVIRONMENTS.

Qayyarah oil fields on fire, February 2017.

Table 1
Projectiles, ranges, and effects of IS recoilless launcher systems

IS recoilless launcher systems	Projectile	Range	Characteristics and effects
Model 1	PG-7 40 mm rocket	200 m	Shaped charge. Effective against armoured vehicles.
Model 2	PG-9 73 mm rocket	50–700 m	Shaped charge. Effective against armoured vehicles.
Model 3	PG-9 73 mm rocket warhead	50–300 m	Shaped charge. Effective against armoured vehicles.
Model 4	Improvised projectile	Unknown	Blast overpressure. Effective against soft-skinned vehicles and personnel in confined spaces.

Figure 1
Model 1 with components.
Documented by a CAR field investigation team in Mosul, Iraq, September 2017.

Figure 2
Model 2 with components.
Documented by a CAR field investigation team in Mosul, Iraq, September 2017.

Figure 3
Model 3 with components.
Documented by a CAR field investigation team in Mosul, Iraq, September 2017.

Figure 4
Model 4 with components.
Documented by a CAR field investigation team in Mosul, Iraq, September 2017.

Islamic State improvised munitions, Hawija, November 2017.

COMMON FEATURES

Gripstock assembly
The black plastic gripstock assemblies contain the launchers' firing and safety systems. Each gripstock houses a trigger mechanism, which consists of a folding pistol grip, trigger, 9-volt battery, micro switch, trigger spring, safety pin, twin flex wire, and rudimentary sights. The similar morphology—including moulding features and markings—of all the injection-mould gripstocks viewed by CAR suggests that they were produced on identical machinery (and potentially using a single machine).

The safety pin holds the folding pistol grip in place over the trigger and trigger guard to prevent inadvertent firing. There are no further safety features. On more recently recovered launchers, the safe/fire (S/F) markings on the left-hand side of the gripstock assemblies do not appear to have any purpose. The initial models of launcher, as documented by CAR in March 2017, have mechanical (possibly coupled with electrical) safe/arm switches. IS forces appear to have abandoned this mechanism in subsequent models, although they retained the S/F markings, presumably to avoid constructing new injection moulds. Testing on the battlefield by IS forces may have indicated that the second safety mechanism was unnecessary and interfered with rapid use of the weapon.

In each gripstock assembly, the twin flex wire runs towards the rear of the launcher. It passes through a tube within the countermass and into the propelling or expelling charge. It is then spliced to the orange wires of the igniter. When depressed, the trigger pulls the trigger spring and pushes against the micro switch, closing the circuit between the single 9-volt battery and the igniter, thus initiating the propelling or expelling charge. The gripstock assembly is secured to the launch tube with two brackets, which also house the sights, affixed with four screws per bracket.

Launch tube
Each tube is straight-walled and sealed with rubber end caps (a fire-through muzzle cover and a rear seal). The caps are secured either with hose clamps or stiff metal wire.

The rubber end caps have been designed to keep out foreign contaminants while allowing the projectile to exit the front of the tube, and the countermass and exhaust gases to exit the rear, upon firing.

As is the case with the gripstock assemblies, morphological similarities on different injection-moulded rubber parts examined by CAR suggest that they were produced using identical machinery (and possibly a single machine).

Some of the launchers feature printed instructions for use, which are taped to the exterior wall of the tube (see the Annex). Typically, the instructions describe the type of projectile, its range, preferred targets, and a diagram demonstrating correct sight alignment. Some instructions also request the return of the launch tube after use, undoubtedly for reloading, since this procedure cannot be performed by the user on the battlefield.

Fin assembly
The basic tail fin unit employed in all four launchers is of entirely improvised design and construction. The fin socket is manufactured from turned aluminium, externally threaded, and flanged towards the rear. The external diameter of the flange is slightly smaller than that of the projectile.

A black rubber O-ring, which is a repurposed hydraulic piston rod seal, is seated in the base of a blue rubber seal. The blue seal is slightly larger than the inner diameter of the tube and acts as a gas seal.

THE SIMILAR MORPHOLOGY OF ALL THE INJECTION-MOULD GRIPSTOCKS SUGGESTS THAT THEY WERE PRODUCED ON IDENTICAL MACHINERY.

A black plastic fin anchor is affixed around the fin socket to secure eight black plastic fins. The fins fold and are kept in place by steel springs, which are tensioned to deploy on release from the tube.

The final element of the fin assembly is an internally threaded steel cylinder with a slight flange running around the top edge. The cylinder is screwed onto the externally threaded portion of the fin socket and locks the entire fin assembly together.

Propelling or expelling charge

All four models of launcher follow the same arrangement, which features a plastic disc sandwiched between two cup-shaped plastic containers of larger diameter. The components are press-fitted together.

One of the larger-diameter containers is lined with a plastic film and contains a propellant (composition unknown). The smaller-diameter disc covers a compartment that is filled with a powder (composition unknown), into which an igniter passes. The igniter is covered with aluminium foil and is connected to orange wires.

Each assembled plastic unit is placed within a two-piece plastic sabot. CAR has recovered two types of sabot, manufactured with either black or white plastic; the white sabots are slightly larger.

Countermass

Each countermass is made of a thin, black plastic cylinder with a thicker, white plastic inside cover of concave design. CAR infers that the concave shape (which abuts the propelling or expelling charge) allows for limited expansion of gases produced by the propelling or expelling charge.

The countermass cylinder is divided into two compartments. The first section (closest to the propelling or expelling charge) is larger and occupies approximately 80 per cent of the cylinder. It contains salt. The smaller section contains swarf (waste shavings produced during the machining of metal components).

CAR notes that the design of the countermass may allow for firing from confined spaces. In this case, the salt would cool the propellant/expellant gases to reduce backblast. The swarf adds weight to the countermass.

The cylinder is sealed at the base with plastic discs. Constructed from a plastic similar to that used in the walls of the cylinder, the discs are glued or taped into place.

A piece of flexible plastic tubing runs internally along one side of the entire length of the countermass to accommodate the igniter wires.

Tal Afar, September 2017.

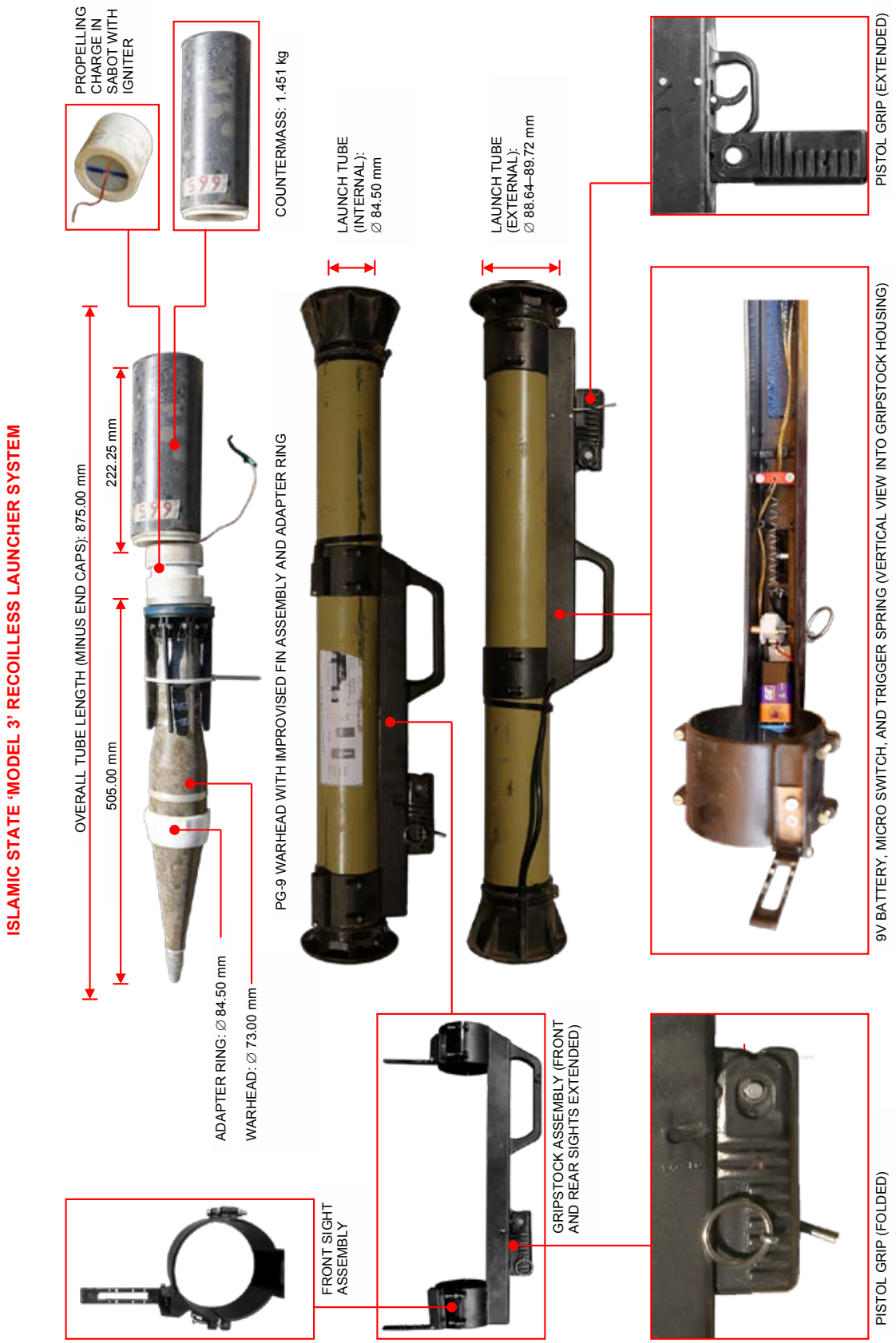
TYPES OF LAUNCHER

MODEL 1

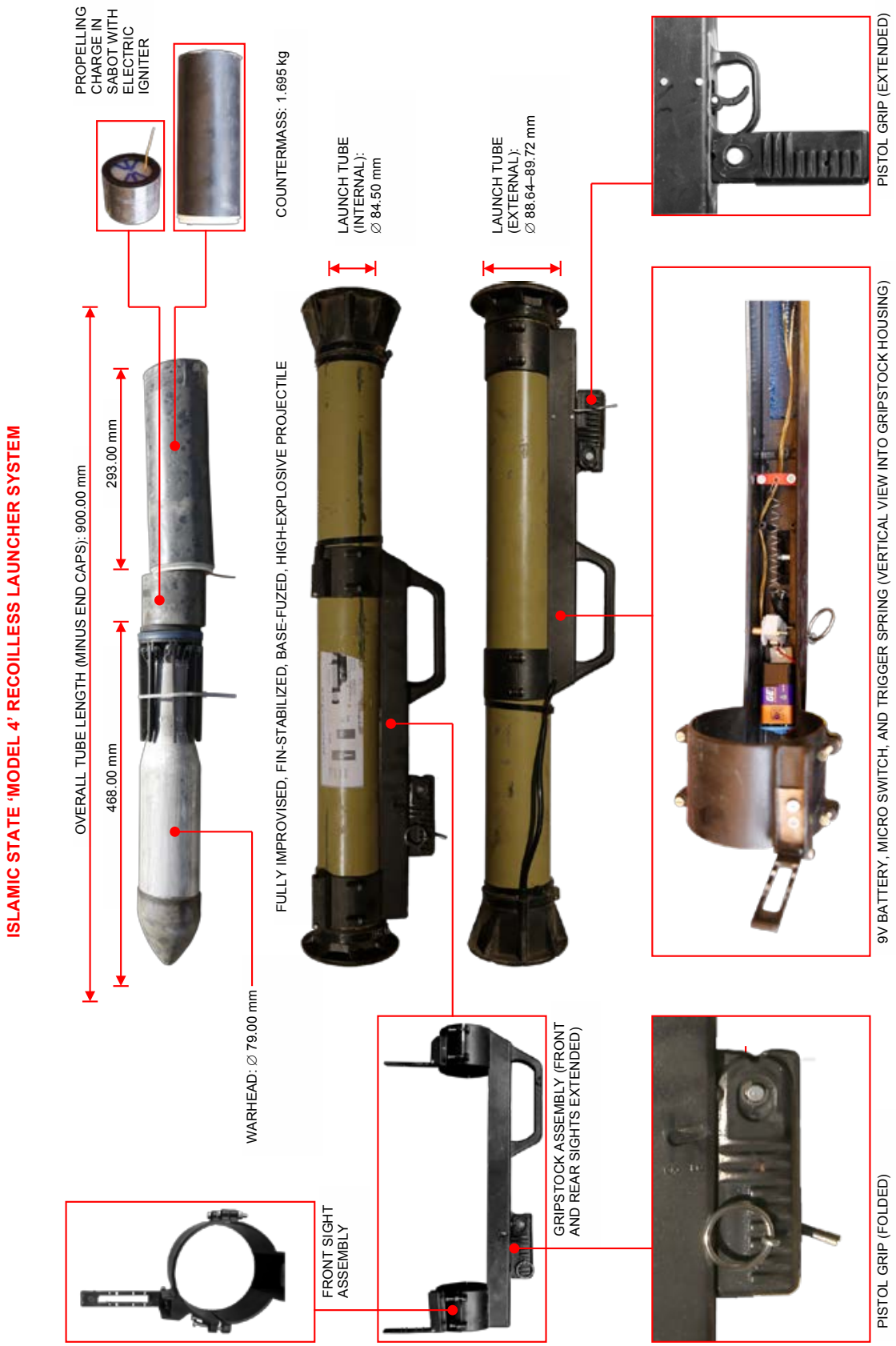
MODEL 2


ISLAMIC STATE 'MODEL 2' RECOILLESS LAUNCHER SYSTEM
OVERALL TUBE LENGTH (MINUS END CAPS): 1,035.00 mm
311.00 mm
757.00 mm
WARHEAD: ∅ 73.00 mm
MODIFIED PG-9 ROCKET WITH IMPROVISED FIN ASSEMBLY
PROPELLING CHARGE IN SABOT WITH IGNITER
COUNTERMASS: 2.719 kg
LAUNCH TUBE (INTERNAL): ∅ 84.50 mm
LAUNCH TUBE (EXTERNAL): ∅ 88.64–89.72 mm
PISTOL GRIP (EXTENDED)
9V BATTERY, MICRO SWITCH, AND TRIGGER SPRING (VERTICAL VIEW INTO GRIPSTOCK HOUSING)
PISTOL GRIP (FOLDED)
GRIPSTOCK ASSEMBLY (FRONT AND REAR SIGHTS EXTENDED)
FRONT SIGHT ASSEMBLY

MODEL 3


ISLAMIC STATE 'MODEL 3' RECOILLESS LAUNCHER SYSTEM
PROPELLING CHARGE IN SABOT WITH IGNITER
COUNTERMASS: 1.451 kg
LAUNCH TUBE (INTERNAL): ∅ 84.50 mm
LAUNCH TUBE (EXTERNAL): ∅ 88.64–89.72 mm
PISTOL GRIP (EXTENDED)
OVERALL TUBE LENGTH (MINUS END CAPS): 875.00 mm
222.25 mm
505.00 mm
PG-9 WARHEAD WITH IMPROVISED FIN ASSEMBLY AND ADAPTER RING
9V BATTERY, MICRO SWITCH, AND TRIGGER SPRING (VERTICAL VIEW INTO GRIPSTOCK HOUSING)
ADAPTER RING: ∅ 84.50 mm
WARHEAD: ∅ 73.00 mm
FRONT SIGHT ASSEMBLY
GRIPSTOCK ASSEMBLY (FRONT AND REAR SIGHTS EXTENDED)
PISTOL GRIP (FOLDED)

MODEL 4


ISLAMIC STATE 'MODEL 4' RECOILLESS LAUNCHER SYSTEM
PROPELLING CHARGE IN SABOT WITH ELECTRIC IGNITER
COUNTERMASS: 1.695 kg
LAUNCH TUBE (INTERNAL): ∅ 84.50 mm
LAUNCH TUBE (EXTERNAL): ∅ 88.64–89.72 mm
PISTOL GRIP (EXTENDED)
OVERALL TUBE LENGTH (MINUS END CAPS): 900.00 mm
293.00 mm
468.00 mm
FULLY IMPROVISED, FIN-STABILIZED, BASE-FUZED, HIGH-EXPLOSIVE PROJECTILE
9V BATTERY, MICRO SWITCH, AND TRIGGER SPRING (VERTICAL VIEW INTO GRIPSTOCK HOUSING)
WARHEAD: ∅ 79.00 mm
FRONT SIGHT ASSEMBLY
GRIPSTOCK ASSEMBLY (FRONT AND REAR SIGHTS EXTENDED)
PISTOL GRIP (FOLDED)

CONCLUSION

Fielded for the first time in early 2017 during the second half of the battle of Mosul, IS improvised recoilless launcher systems underscore the group's capacity to develop, assemble, and deploy innovative weapons and to refine such weapons following battlefield testing. The launchers analysed in this report are sophisticated inventions that appear well suited for urban warfare. This report confirms the presence of skilled workers and weapon designers within IS ranks, the group's advanced technical knowledge, and its centralised management and quality control, all of which have been documented in previous CAR reporting.[5]

Recovery locations to date suggest that the deployment of these weapons was limited to the Nineveh Governorate of Iraq in 2017, with weapons and components recovered only in Mosul and Tel Afar (and in some cases moved to Baghdad by Iraqi security forces). When IS forces lost control of urban centres, which they had previously used to locate improvised weapon workshops and aggregate raw materials, they effectively reduced their capacity to produce or assemble such weapons.

CAR investigations have yet to identify similarly sophisticated improvised weapons produced, assembled, or deployed in other conflicts.

THE LAUNCHERS ANALYSED IN THIS REPORT ARE SOPHISTICATED INVENTIONS THAT APPEAR WELL SUITED FOR URBAN WARFARE.

Al Jamhuri Hospital compound, Mosul, November 2017.

ANNEX

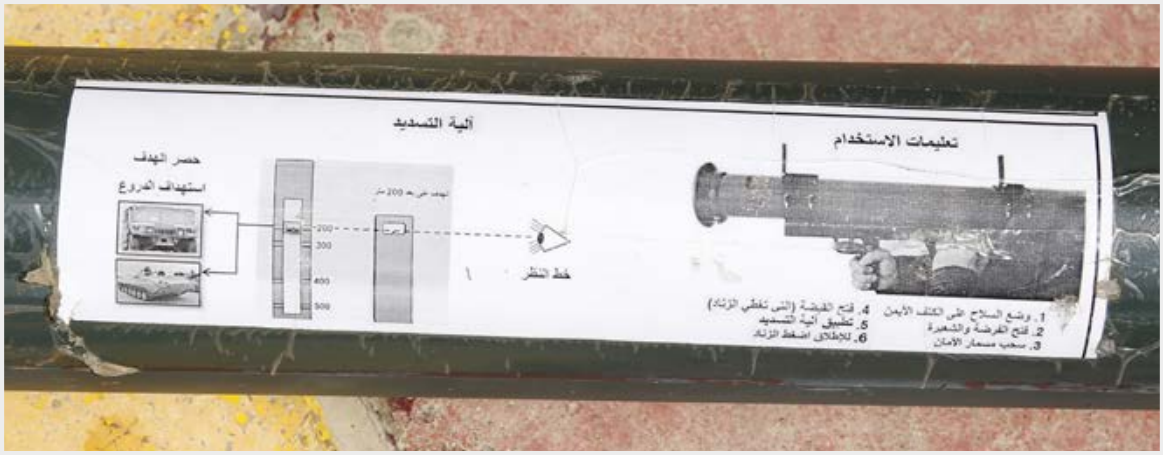


Figure 5
Model 1 launcher sticker.
Documented by a CAR field investigation team in Baghdad, Iraq, July 2017.

Translation

Instructions for use	Firing mechanism	Pinpoint target
1. Place the weapon on your right shoulder 2. Open the sights 3. Pull the safety pin 4. Open the handle (that covers the trigger) 5. Engage the firing mechanism 6. Pull the trigger to launch	Line of vision Target at 300 m distance	Targeting armoured vehicles and buildings

Figure 6
Model 2 launcher sticker.
Documented by a CAR field investigation team in Mosul, Iraq, September 2017.

Translation

Shoulder-borne launcher armed with SPG-9 warhead[6]

For targets within 50–700 m range

	Instructions for use	Firing mechanism	Pinpoint target
Please return the launcher after use	1. Place the weapon on your right shoulder 2. Open the sights 3. Pull the safety pin 4. Open the handle (that covers the trigger) 5. Engage the firing mechanism 6. Pull the trigger to launch	Line of vision Target at 300 m distance	Targeting armoured vehicles and buildings

Figure 7
Model 3 launcher sticker (version 1).
Documented by a CAR field investigation team in Baghdad, Iraq, July 2017.

Translation

Shoulder-borne launcher armed with SPG-9 warhead[7] For targets within 50–300 m range			
Please return the launcher after use	**Instructions for use**	**Firing mechanism**	**Pinpoint target** **Target width (2 m)**
	1. Place the weapon on your right shoulder 2. Open the sights 3. Pull the safety pin 4. Open the handle (that covers the trigger) 5. Engage the firing mechanism 6. Pull the trigger to launch	Line of vision	Targeting armoured vehicles and buildings

Figure 8
Model 3 launcher sticker (version 2).
Documented by a CAR field investigation team in Mosul, Iraq, September 2017.

Translation

Shoulder-borne launcher armed with SPG-9 warhead[8] For targets within 50–300 m range		
Instructions for use	**Firing mechanism**	**Pinpoint target** **Target width (2 m)**
1. Place the weapon on your right shoulder 2. Open the sights 3. Pull the safety pin 4. Open the handle (that covers the trigger) 5. Engage the firing mechanism 6. Pull the trigger to launch	Line of vision	Targeting armoured vehicles and buildings
Please return the launcher after use		

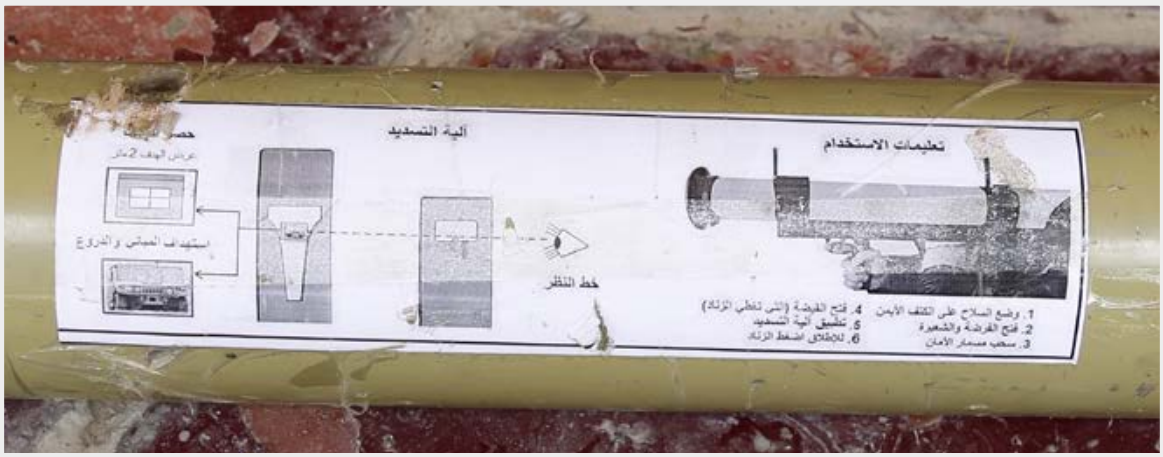


Figure 9
Model 4 launcher sticker (version 1).
Documented by a CAR field investigation team in Baghdad, Iraq, July 2017.

Translation

Instructions for use	**Firing mechanism**	**Pinpoint target** Target width (2 m)
1. Place the weapon on your right shoulder 2. Open the sights 3. Pull the safety pin 4. Open the handle (that covers the trigger) 5. Engage the firing mechanism 6. Pull the trigger to launch	Line of vision	Targeting buildings and armoured vehicles

Figure 10
Model 4 launcher sticker (version 2).
Documented by a CAR field investigation team in Baghdad, Iraq, July 2017.

Translation

Shoulder-borne launcher armed with a thermobaric warhead		
Instructions for use	**Firing mechanism**	**Pinpoint target** Target width (2 m) **Target buildings**
1. Place the weapon on your right shoulder 2. Open the sights 3. Pull the safety pin 4. Open the handle (that covers the trigger) 5. Engage the firing mechanism 6. Pull the trigger to launch	Line of vision	
Please return the launcher after use		

ENDNOTES

1. CAR (2016a; 2016b; 2016c; 2017a).
2. *The Guardian* (2015).
3. CAR (2016c).
4. CAR (2017b).
5. CAR (2016c).
6. The warhead is a component of a PG-9 rocket. The designation SPG-9, as employed by IS forces on this sticker, refers to a launcher and is incorrect in this context.
7. Idem.
8. Idem.

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