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Iranian Falaq-1 and Falaq-2 Rockets in Syria

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ABBREVIATIONS AND ACRONYMS

DIO
Defense Industries Organization

IRAM
Improvised Rocket-Assisted Mortar

IRGC
Islamic Revolutionary Guard Corps

MODLEX
Ministry of Defence Logistics Export

NDF
National Defence Force

OPCW
Organisation for the Prohibition of Chemical Weapons

SAA
Syrian Arab Army

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INTRODUCTION

Both the Falaq-1 and Falaq-2 rockets and their associated launchers have been documented in Syria during the ongoing conflict.

The Falaq-1 and Falaq-2 comprise a family of unguided surface-to-surface rockets produced in Iran, used by the Iranian military, and offered by Iran for export. The Falaq (also transliterated as 'Falagh') family is, like other Iranian solid-fueled artillery rockets, manufactured by Shahid Bagheri Industrial Group; a subsidiary of the Iranian Aerospace Industries Organization. Falaq-1 and Falaq-2 rockets are launched from similar 240 mm and 333 mm short-tube launchers, respectively. Falaq-1 launchers have been documented in configurations featuring one to eight launch tubes, whilst Falaq-2 launchers have featured one to three launch tubes. Man-portable versions of the Falaq-1 system are known to exist, and both the Falaq-1 and Falaq-2 have been documented on a variety of land and sea based platforms. Despite these systems having been offered for export for many years, and documented in use by the military wing of Hezbollah in Lebanon, Gaza[1], and Iraq[2], the first evidence of a Falaq launcher in use by the Iranian military did not surface until 2013.

THE FALAQ FAMILY IN IRAN

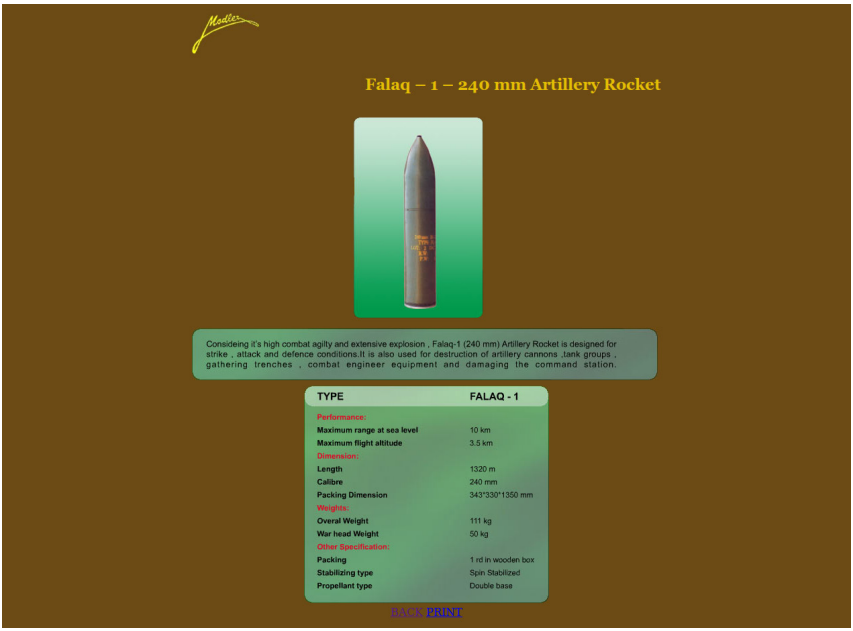
Whilst there is little verifiable data about the history of the Falaq family of rockets, their origin likely lies in the technology exchanges with China and North Korea during the 1980s/90s. These exchanges proved highly influential in the formative years of Iran's rocketry program.

There are some indications that the Falaq family of rockets was developed following Iran's experiences in the final stages of the eight year Iran-Iraq War to fulfil a requirement for a more capable direct fire support weapon. Short-range engagements against enemies in fortified positions or urban structures demonstrated the insufficient firepower of the 106 mm recoilless guns and 107 mm rockets in service at the time. In the 1990s, the Falaq-1 and Falaq-2 systems were developed, resulting in short-range weapons capable of delivering a relatively large explosive payload. Whatever its origin, the technical specifications of the Falaq-1 indicate a connection with the Soviet BM-24 system, particularly the M-24FUD rocket. The two share approximate dimensions, payload and propellant weight, and flight mechanism (Shirokorad, 2000; Gurov, 2011).

Until recently, there was little to suggest that Falaq rockets were used by Iran's armed forces. Instead, the only evidence of their existence came from the Defense Industries Organization's (DIO) export catalogs from the late 1990s until present. Early catalogues, which were first referenced by Jane's Defense Weekly in 2003, showed less developed launchers for the rocket series. For the Falaq-1 rocket (FL1-A), the DIO offered a six-round, cage-style launcher reminiscent of the BM-24. For the Falaq-2 rocket (FL2-A), they offered a single-round, tube-style launcher. Both were shown mounted on early (J40-series) Toyota Land Cruisers (MODLEX, n.d.; DIO, n.d.). The first references to the weapons appeared sometime before this point, although the exact date cannot be pinpointed (Cordesman, 2004).

In 2006, during a tour of Iranian armament factories, the then Iranian defense minister Mostafa Mohammad-Najjar was photographed alongside an eight-tube FL1-A launcher designed for use aboard fast-attack boats (see Photo 1). Then, between 2007 and 2012, two different web-based catalogs (now defunct) continued to advertise the rockets, but not their associated launchers (MODLEX, n.d.). The most recent catalog was published in 2013 and features entries for both the aforementioned naval launcher, and the rockets themselves (DIO, n.d.2). Although there were no entries for the corresponding ground-based launchers, the rocket-entries themselves featured thumbnails showing three-round tube-type launchers mounted on an unidentified 6 x 6 platform.

Photo 1 Iranian Minister of Defense Mostafa Mohammad-Najjar tours an Iranian naval weapon production line in 2006. Pictured is an eight-tube FL-1A launcher intended for fast attack boats.
Photo credit: Hossein Fatemi/FARS News Agency



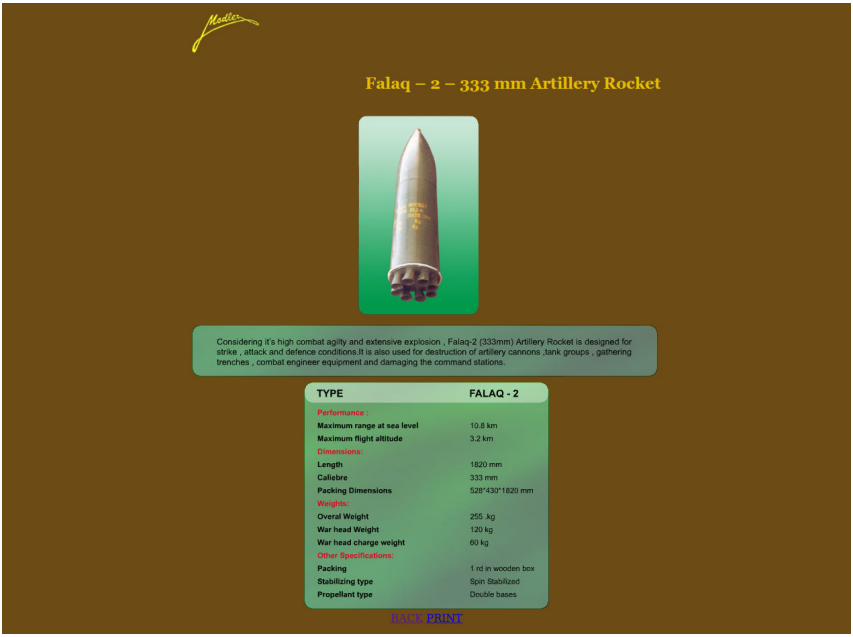


Photo 2 and 3 Technical specifications for Falaq-1 and Falaq-2 rockets, taken from now-defunct Iranian export catalogues. Note packaging specifications of "1 round per wooden box", which contrasts with most recent (2013) DIO catalogue entry "one round per can".
Photo credit: DIO

The belief that the Falaq was an export-only system has only recently been challenged. In September 2013, during the annual military parade commemorating the start of the Iran-Iraq War, the Falaq appeared for the first time in Tehran, mounted on a Sepehr tactical vehicle (see photo 4). The order in which it was paraded suggests that the system is now being operated by one of the Islamic Revolutionary Guards Corps[3] (IRGC) mechanized units in the greater Tehran area. This is further supported by the configuration of the system itself; the two-round launcher mounted on a ¾-ton vehicle is reminiscent of the eight-round 122 mm rocket launcher frequently employed by IRGC divisions for organic artillery support, in preference to the larger BM-21 derivatives found in artillery groups.

Unlike its earlier variants, these newer Falaq rockets appear to be packaged in a sealed, pre-loaded canister that both protects the rocket during transport and serves as a launcher. This modularity may also facilitate a mixed loadout; the IRGC vehicle on parade was equipped with both FL1-A and FL2-A launch tubes, which suggests that a tube of one size could easily be swapped out for a tube of another. This theory is further reinforced by a mixed loadout system visible in recent Iranian TV footage documenting President Hassan Rouhani examining various military products (see Photo 5). As seen, the launch system appears to be capable of mounting one FL2-A launch tube in place of two FL1-A launch tubes.

Photo 4 Sepehr tactical vehicle with FL1-A and FL2-A launch tubes on parade in Tehran.
Photo credit: Hossein Fatemi/FARS News Agency

Photo 5 Launch system with a mix of FL1-A and FL2-A launch tubes.
Photo credit: Islamic Republic of Iran News Network

THE FALAQ IN SYRIA

The combat application of Falaq and Falaq-like systems in Syria appears to have commenced with their use by government forces, first documented in videos towards the end of 2012[4]. The first clear picture of a two-tube launcher appeared in early November 2012 was taken in Aleppo (see photo 6). As characterised by their use in the ongoing Syrian conflict, the Falaq systems are ideal for the short-range fighting in dense urban areas. Compared to the payload of a typical Iranian 107 mm rocket (6.9 kg), the FL2-A has a similar HE warhead that is nearly nine times as heavy (60 kg)[5].

Photo 6 Falaq-2 system believed to belong to pro-government forces in Aleppo, Syria in November 2012
Photo credit: Al-Zahraa Aleppo News

Both Falaq-1 and Falaq-2 type systems have been observed in Syria in several configurations, and in the hands of armed groups on both sides of the conflict. Whilst some of these systems are almost certainly original Iranian manufacture, sources in Syria have suggested that copies of the Falaq-1 and Falaq-2 systems have been domestically produced[6]. Non-standard rockets have been documented in use with some of these systems, however the FL1-A and FL2-A rockets were thought to be produced solely in Iran. Several of these non-standard rockets appear to share design characteristics with improvised rocket-assisted mortar (IRAM) munitions used in Iraq. Similar munitions are produced by Hezbollah, and are known as *Bourkan* or 'Volcano' rockets. The example seen in Photo 7, below appears to be based on a 107 mm rocket (likely a Chinese Type 63 or Iranian Fajr-1), with an oversized payload seemingly designed to be fired from the Falaq-1 240 mm launcher. The principle behind these weapons is similar to that of the Falaq rockets: they trade range for the ability to deliver a larger explosive payload. These munitions, however, are likely to be significantly less accurate than the Falaq series rockets.

Photo 7 and 8 IRAM or 'Volcano' rockets in Syria, which appear to be designed for use with Falaq-1 type launchers.
Photo credit: Aleppo Media Center & Syrian National Defense official Facebook page

Various configurations of Falaq-1 type launchers have been documented. These include man-portable single-tube launchers; two-tube towed launchers; and four-tube and six-tube vehicle-mounted launchers. These appear to have been in use with Syrian government forces (Syrian Arab Army and the National Defense Force pro-government militia), as well as Jabhat al-Nusra.

Photos 9 Man-portable, single tube Falaq-1 type launcher.
Photo credit: Abkhazia Network News Agency (ANNA)

Photos 10 Two-tube, towed Falaq-1 type launcher.
Photo credit: Muhammad Hussain martyr Facebook page

Photos 11 and 12 Four-tube and six-tube vehicle-mounted Falaq-1 type launchers.
Photo credit: Syrian National Defense official Facebook page

Falaq-2 type launchers have been observed in two-tube configuration, mounted on light trucks. It appears that at least some of these vehicles have been left in a 'civilian' paint scheme and configured to allow for the rapid removal or replacement of canvas covers (Moaweiah Battalion, 2012).

Photo 13 Falaq-2 type launcher mounted on a light truck in Syria.
Photo credit: Imp Navigator blog[7]

In addition to the Falaq-1 and Falaq-2 type launchers observed in Syria, several larger calibre systems with similar characteristics to the Falaq launchers have been documented in service with government forces (National Defence, 2013). These appear to exist in two different diameters, one measured by OPCW personnel as 360 mm and one of at least 400 mm. Iran is not believed to possess Falaq type launchers larger than the 333 mm Falaq-2. The munitions associated with these launchers have also been referred to as 'Volcano' rockets; however, this appears to be an informal designation, possibly in reference to design similarities shared by these munitions and the 107 mm-based Volcano rockets.

Photo 14 Larger-calibre system in use with government forces in Syria.
Photo credit: Syrian National Defense, Damascus official Facebook page

Munitions seen in use with Falaq style launchers in Syria have been linked to the August 21, 2013 chemical munitions attack on East Ghouta. According to the UN/OPCW team who visited Ghouta, the unidentified munitions used in the attack were non-standard, surface-to-surface rockets of approximately 360 mm in diameter. The tail featured a straight fin assembly with a ring aerofoil and a single large exhaust nozzle for the rocket motor (see below). The thin-walled payload section of the weapon is significantly larger than the body. These munitions are also likely to be short-ranged, and quite inaccurate.

Photo 15 Unidentified rocket connected with the August 21, 2013 chemical weapons attack in East Ghouta, Syria.

FALAQ-1

240mm UNGUIDED SPIN-STABILIZED ROCKET

Maximum range	10,000 m
Maximum flight altitude	3,500 m
Maximum speed	445 m/s
Rocket length	1,318 mm
Rocket weight	113 kg
Warhead weight	50 kg
Type of warhead	High-explosive (HE)
Fragmentation radius	150m

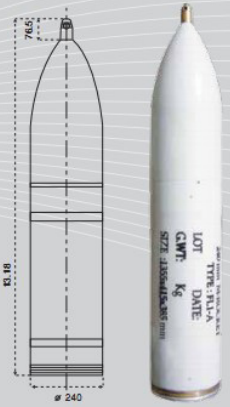
Source: DIO

www.diomil.ir

FALAGH 1 ROCKET | **240 mm SPIN STABILIZED**

General Specifications:

Having a wide spreading explosion rocket, 240 mm Falagh1 has been designed to be deployed in attacking and defending positions. Reinforcement of artillery fires and destroying enemy's Forces and equipments are the other purposes of its design. This rocket can be installed on vessels.



Technical Specifications:

Maximum Range in sea level	10 km
Maximum flight altitude	3500 m
Fragmentation radius	150 m
Maximum speed	445 m/s
Average time of motor operation	1.3 m/s
Rocket length	1320 m/s
Rocket caliber	240 mm
Rocket weight	113 kg
Warhead weight	50 kg
Quantity per wooden box (can)	one round
Type of warhead	high explosive
Type of propellant	Double base

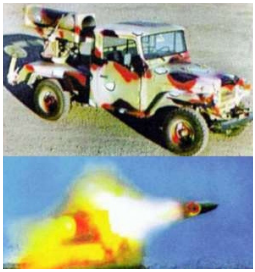
Pasdaran St., P.O.BOX:19585-777 Tehran,Iran.
Tel:+98 21 22 77 11 51 - 22 59 57 57 - 22 55 19 36 Fax:+98 21 22 77 11 53

Photos 16 and 17 Falaq-1 technical specifications (DIO)
Source: DIO

FALAQ-2

333mm UNGUIDED SPIN-STABILIZED ROCKET

Maximum range	10,800 m
Maximum flight altitude	3,200 m
Maximum speed	376 m/s
Rocket length	1,820 mm
Rocket weight	256 kg
Warhead weight	117 kg
Type of warhead	High-explosive (HE)
Fragmentation radius	300m



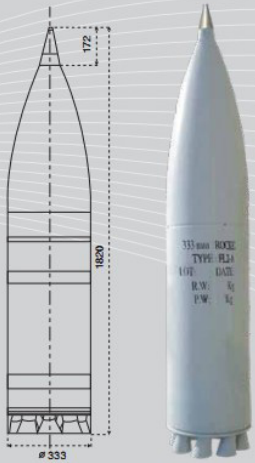
Source: DIO

www.diomil.ir

FALAGH 2 ROCKET | **333 mm SPIN STABILIZED**

General Specifications:

Having a wide spreading explosion rocket, 333 mm Falagh 2 has been designed to be deployed in attacking and defending positions. Reinforcement of artillery fires and destroying enemy's Forces and equipment are the other purposes of its design. This rocket can be installed on vessels.



Technical Specifications:

Maximum Range in sea level	10. 8 km
Maximum flight altitude	3200 m
Fragmentation radius	300 m
Maximum speed	376 m/s
Average time of motor operation	1/85 m/s
Rocket length	1820 m/s
Rocket caliber	333 mm
Rocket weight	256 kg
Warhead weight	117 kg
Quantity per wooden box (can)	one round
Type of warhead	high explosive
Type of propellant	Double base

Pasdaran St., P.O.BOX:19585-777 Tehran,Iran.
Tel:+98 21 22 77 11 51 - 22 59 57 57 - 22 55 19 36 Fax:+98 21 22 77 11 53

Photos 18 and 19 Falaq-2 technical specifications (DIO)
Source: DIO

NOTES

1 Both FL1-A and FL2-A rockets, fired from improvised and original launchers.

2 FL1-A rockets, fired in at least one case from improvised launchers.

3 Formally, the 'Army of the Guardians of the Islamic Revolution' (ارتش سپاه پاسداران انقلاب اسلامی)

4 This observation is based on the authors' review of hundreds of videos from the Syrian conflict, and communication with various specialists and in-country sources.

5 Calculated as NEQ (net explosive quantity) based on Iranian DIO/MODLEX sources.

6 Correspondence with confidential source, January 2014.

7 The original source video has since been removed from YouTube

8 Source: DIO, n.d.2

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