Iranian operations against el-Asad and Erbil bases: what can be learned from the imagery?

Part One

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Agnès LEVALLOIS (FRS), Vincent TOURRET (FRS) and Stéphane DELORY (FRS) in partnership with Géo4I

Background to the operation

As it comes under increasing pressure from the United States, the Islamic Republic of Iran is currently facing the issue of strengthening its regional influence. Through the support of multiple militia groups, it has established itself as the ascendant, even dominant, power in the Middle East. Yet, it has also fuelled popular protests against its Lebanese and Iraqi proxies as well as directly in Iran. Indeed, the financial effort that Tehran is demanding from its population, as well as the climate of insecurity and corruption that it maintains in the countries where its allies operate, generate considerable resentment. This has been further aggravated by the regime's negligence regarding the management of the Ukrainian Boeing *crash.* While the elimination of Qassem Soleimani on the 3rd of January seemed to momentarily strengthen popular support for the regime, the destruction of the plane has rekindled tensions stemming from the deterioration of the economic situation, which is reflected in the rise in fuel prices. Thus, these events reveal a situation of growing polarization within the Iranian population, as evidenced by several cases of civil disobedience.

Since Washington's withdrawal from the nuclear agreement in May 2018 and the imposition of extremely harsh economic sanctions, Iran considers itself to be in a state of war as the regime, deprived of its oil exports, is losing its main financial windfall as well as its primary client, the European Union[1]. By seeking "maximum resistance" to counter this maximum American pressure, its current strategy could be seen as a refinement or upgrading of that previously implemented during the tanker war between 1984 and 1987. This fundamentally asymmetrical posture has seen traditional harassment operations in the Gulf combined with military pressure on American bases and – if its responsibility for the attack on Aramco on the 14th of September 2019 were to be confirmed – by direct strikes on allied critical infrastructures. In the absence of direct American retaliation, this strategy has encouraged a

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[1] Jean-Jacques Guillet, *L'Iran après 2008,* Rapport d'Information, Assemblée Nationale, n°3788, 5 October 2011, http://www.assemblee-nationale.fr/13/pdf/rap-info/i3788.pdf.

certain amount of risk-taking among Iranian officials, with the aim of reinforcing the country's capacity for strategic intimidation. The elimination of Soleimani thus seems to have been a real surprise for Iran, which retaliated with strikes on the 8th of January 2020.

The analysis of the ballistic strike of the 8th of January 2020 is rich in lessons about Iran's ballistic capabilities. It calls into question many of the assessments that are currently available. It also shows the importance - often overlooked by observers - of very accurate short-range strike systems, which are gradually being modernised and upgraded and are now capable of operating across almost the entire regional theatre.

Several signs had already suggested the emergence of this trend. The strikes against the Islamic State, in Deir el Zor on the 18th of June 2017, and in Abu Kamal on the 1st of October 2018, then against the Democratic Party of Iranian Kurdistan on the 8th of September 2018, were carried out by missiles generally identified as Zulfiqar (a highly modified derivative of the Fateh-110 guided heavy rocket), and Qiam (derived from Shahab-2, the Iranian version of the North Korean Scud C). Despite doubts about Iran's ability to carry out high-precision strikes, the nature of the intended targets confirmed Iran's use of relatively precise systems in order to give the strike real military significance.

With this in mind, the operation of the 8th of January 2020 further clarifies the matter since it confirms the Iranian ballistic programme's orientation towards a strategy of precision strikes. However, a more detailed analysis sheds light on certain technological developments in the Iranian arsenal, which until now have been poorly understood, and allows the development of hypotheses on the rationale behind the strikes that may have been overlooked. Assessing the strike also makes it possible to draw conclusions about the strategic consequences of the operation, which are far from negligible.

Data available after the attack

According to U.S. sources, 15 to 16 missiles were fired, 11 of which were fired at Ain el-Asad. According to Iran, a total of 13 missiles were fired[2]. The figures are relatively consistent, considering the apparent dysfunction of some weapons, of which two were acknowledged by the Commander of the Revolutionary Guards himself, General Hossein Salami[3]. The operation against Erbil seems to have been plagued by technical difficulties.

The images broadcasted by Iran on the morning of the strike showed the firing of a salvo (6 visible shots, fired in sequence by units of two launchers for 1.5 minutes[4]) of missiles that could correspond to heavy guided rockets of the Fateh-110 type, the take-off trajectory being

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[2] Press conference by General Amir Ali Hajizadeh, Commander of the Revolutionary Guards Aerospace Force, IRINN, 9 January 2020, translated by Memri.org (https://www.memri.org/tv/general-hajizadeh-irgac-aerospace-missile-attack-us-iraq-beginning-revenge-casualties-arab-countries-expel-region-else)

[3] *MEMRI TV,* « IRCG Commander-In-Chief General Hossein Salami: I Wish I Had Crashed and Burned with the Ukrainian Plane; I Wish to Be "Cut In Pieces And Sacrificed" for the Sake of The Iranian People », *MEMRI TV Clip #7727,* 12 janvier 2020.

[4] Sequence available on Fars News, "Iran Revenge: No Missiles Intercepted in Attack on US Bases", 8 January 2020 (https://en.farsnews.ir/player.aspx?nn=13981018000825).

different from that of a ballistic missile of the Shahab-2, Qiam or even Shahab-3 types. A Fars Agency tweet posted the same evening (opposite)[5] identified the missile as probably a Fateh-313, a modernized version of the Fateh-110 heavy guided rocket but with a shorter range than the Zulifqar. Subsequent photographs, attributed to the strike on the 8th of January, clearly show Fateh type gear, without it being possible to identify the model, the variations between the different versions of the Fateh itself and the Fateh and Zulifqar types being indistinguishable in such photographs.

فاتح

موشک زمین به زمین کوتاه‌برد

برد ----------- ۳۰۰ کیلومتر
وزن موشک ---- ۳۳۲۰ کیلوگرم
وزن سرجنگی -----۴۴۸ کیلوگرم
طول موشک --------- ۸/۸ متر
قطر موشک ----- ۶۱ سانتی‌متر
نوع پیشران ----- سوخت جامد

خانواده موشک‌های فاتح که شامل نمونه‌های مختلف موشک فاتح-۱۱۰ با برد بین ۲۰۰ تا ۳۰۰ کیلومتر و موشک فاتح-۳۱۳ و فاتح مبین با برد ۵۰۰ کیلومتر دقیق‌ترین و نقطه‌زن‌ترین موشک‌های بالستیک ایران به شمار می‌روند.

Debris of missile booster found in Iraq also confirmed the use of Qiam-type missiles, which were assumed to have been used primarily against Erbil Air Base. The operation against the latter appears to have been a failure - only one of the missiles fired seems to have hit the base and this one did not detonate, the use of the Qiam was systematically neglected by observers. However, the presence of missile debris near the city of Hit, some 30 kilometres from the el-Asad base, suggests that the Qiams were also used against it, with tangible operational results.

Analysis of the strike against the American el-Asad base by target typology

Eleven impacts have been recorded on Ain el-Asad, with US sources estimating that 11 missiles were fired at the base.

Examination of the strikes appears to show two distinct sequences: the first, high-precision, aimed at unhardened support infrastructure on the northern zone of the base; the second, less precise, aimed at hardened infrastructure and possibly runways, on the southern zone of the base. This distinction suggests that two types of missiles (or two separate models from the same family) were used.

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[5] Fars Agency, "Which Iranian missile targeted the Ein el-Assad base?", Twitter, January 8, 2020 at 2:02 a.m. (https://twitter.com/FarsNews_Agency/status/1214714011087970306).

Strike distribution on the el-Asad base with an apparent distribution between the northern and southern zone
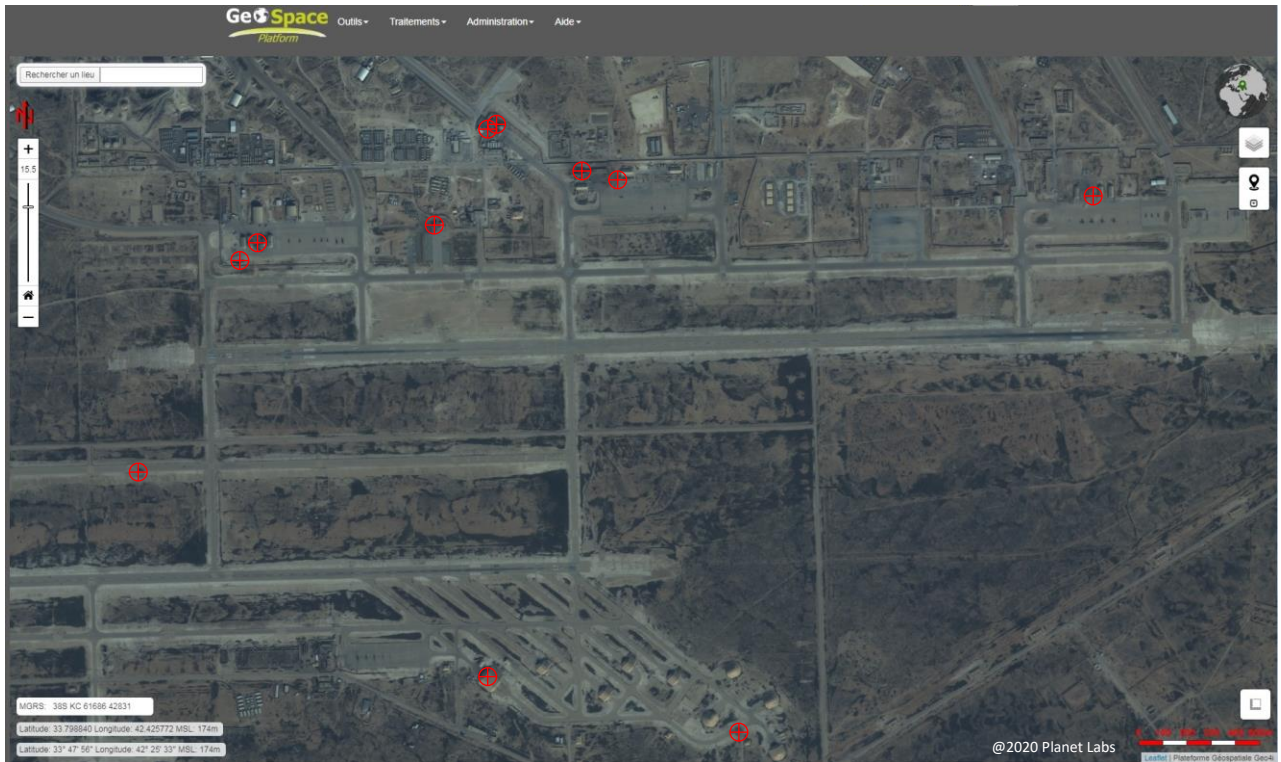
Source: Skysat image of January 08, 2020

The images of the strike sites in the northern zone demonstrate the strikes' very high accuracy, with circular errors probable (CEP), likely being close to the specifications put forward by Iran, which claims about 10 metres for its Fateh-110/Fateh-313 and Zulfiqar type missiles, and metric accuracy for its Kalije Fars and Mobin type missiles, also derived from the Fateh-110 but equipped with a terminal guidance system. Although the exact targets are not known (targeting individual buildings for direct destruction or targeting the median area between different buildings for blast destruction), the distribution of impacts in relation to possible targets shows a circular error probable which is likely to be less than twenty metres.

The striking of the southern zone of the base shows differences with regard to the choice of objectives and precision. One impact can be spotted on an area of closed hardened hangars, a second - on a large hardened hangar capable of housing large aircraft, and a third - on an abandoned runway parallel to the north and south operational runways. While this specific impact is difficult to explain due to the lack of an apparent target, the impact on the large hangar demonstrates a precise targeting capability against this type of infrastructure. The destruction of hardened targets generally relies on missiles with relatively heavy warheads, specifically designed for this purpose, which might suggest that Iran has pursued two distinct operational effects: one against base support infrastructure in the north; the other against heavy infrastructure in the south.

Area of three hardened hangars, southeast zone, impact on access road

Source: Skysat Images, December 30, 2019 and January 8, 2020

Direct impact on the large hangar, south zone

Source: Skysat Images, December 30, 2019 and January 8, 2020

The strike's very high level of overall accuracy almost necessarily implies that the distribution of the impacts fairly exactly matched the Iranian strike plan, leading to the conclusion that two types of targets were selected and two different types of missile were used on each set of targets. Considering that Fateh type missiles are known to have a high degree of accuracy, and that Qiam's payload is much heavier but its accuracy much lower, inevitably the conclusion arises that Iran sought to minimize destruction in the northern area, using Fateh type missiles, and carried out a heavy anti-infrastructure strike on the southern area with Qiam missiles, where the base's personnel were less exposed. Moreover, this interpretation is more or less compatible with the version presented by Iran the day after the strike, the idea being that the destruction on the most populated area of the base was deliberately controlled. This version was tacitly accepted by the United States.

Impact analysis of the strike against the US el-Asad base: a different scenario

However, the analysis of impacts from the images shows a potentially different scenario. Indeed, while Fateh type missiles, derived from heavy rockets, have a relatively flat trajectory, Qiam missiles follow a more rounded curve. The angle of incidence of re-entry of the head in relation to the ground is therefore higher for the latter than for the former, leading to a different type of detonation, clearly observable when the explosion takes place by means of percussion. Touching the ground at an angle close to vertical, the head of a Qiam will produce a circular shock wave while that of a Fateh type system will be oriented in the direction of the missile's arrival.

Indications of the angle of impact (impact from the east, destroying the building to the west but having little impact on the equidistant building to the east, indicative of a Fateh type missile

Source: Skysat Image January 8, 2020

Circular impact, typical of a ballistic missile, where the head hits at an angle of approximately 90 %, of which the Qiam type is an example.

Source: Skysat Image January 8, 2020

The analysis of the impacts makes it possible to draw a different conclusion from the previous one. While the majority of the strikes were indeed carried out by Fateh type missiles, the distribution of impacts demonstrates that it was not conducted according to the level of targets' hardening (lightly hardened in the north, strongly hardened in the south), with the unhardened targets being hit by Fateh type systems, and the hardened area by Qiam. The two strikes by Qiam were on the northern area, while Fateh type missiles were used on the southern area. There is therefore no targeting adjusted to the type of missile and the type of target's hardening.

The impacts of Fateh type missiles show that the warhead of the missile is relatively light. As illustrated by the damage inflicted upon the majority of the infrastructure, the blast effects resulting from the detonation were limited, even though the structures hit had little or no hardening.

Limit of the blast effect of the Fateh type missile

Source: Skysat images December 30, 2019 and January 8, 2020

The choice to detonate the missiles on the ground may imply that Iran intended to minimize damage. Detonation prior to ground impact is indeed more destructive on light structures, as the blast effect and the fragments are not partially absorbed by the ground. It is also possible that Iran has not mastered pre-impact detonation on its ballistic missiles, a capability hard to achieve due to the velocity of the warheads and the need to detonate them at very low altitudes.

Fateh-type impacts were noted in the southern area, i.e. on or near hardened hangars. Whether there were missiles that deviated from their targets or an attempt to assess the effects of this type of missile on hard targets is open to question. The answer is difficult to provide, as some elements seem to illustrate high precision - impact of the large hangar - others possibly approximate precision - impact on the runway, impact on the servicing of the three hardened hangars. However, the direct impact on the large hangar in the southern area shows that, while an anti-bunker strike was attempted, the missile's warhead is largely unsuitable for this purpose. More generally, the warhead of the Fateh type missiles used seems insufficient for a precision strike against any type of hardened infrastructure and possibly of limited effect against unhardened or weakly hardened targets.

Two circular impacts are evidence of the use of a Qiam-type ballistic weapon, the propellant debris found in Iraq excluding any other missile types (Shahab-2 or Shahab-3). The impact zones, within the northern zone, show that the Qiam used is in fact a Qiam-2, a version

equipped with a manoeuvring head, as such a level of precision cannot be expected from the previous inertially guided version. The Qiam-2's accuracy is an important piece of information, revealing that Iran now has a good level of control over the warheads and also that the missile is operational. Until now the majority of observers tended to assume that this was not the case, systematically associating the missile with the failed operation against Erbil.

The two areas targeted by the Qiam-2s appear to be associated with the use of UAVs. One of the impacts probably collapsed a hard-built building, which may have housed some of the facilities related to UAV operations on the base. The area was targeted by a complementary strike from a Fateh missile. The second impact missed drone support buildings. The destructive effect of the Qiam-2's warheads appears to be greater than that of the Fateh type systems, possibly due to the higher velocity of the warhead and a larger warhead charge.

The two Qiam-2 strikes are interesting as they suggest that the idea of an Iranian strike strictly adjusted to minimize damage and/or the risk of loss must be nuanced. Since Fateh type missiles have also targeted areas that could be associated with drones, it cannot be excluded that Iran has assigned the Qiams to the targets considered the most sensitive or potentially the most hardened. On the other hand, if the whole operation is indeed demonstrative in nature, the use of the two Qiam-2s demonstrates an explicit will to completely destroy two of the targets, with then, possibly, an underlying punitive dimension (see second part).