BLACK ROSE TECHNOLOGY

2024-04-26 KHOR MOR GAS PLANT

BRT-9-W-24-0007

TRAJECTORY ANALYSIS OF THE INBOUND DRONE IN THE DANA GAS ATTACK FROM CCTV VIDEO FEED.

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On 2024-04-26 at 18:43, the Khor Mor gas plant storage container, located at 35.136958°, 44.827098° (38SMD8424888245) was hit by an armed suicide drone that caused a major secondary explosion. The attack caused 4 fatalities and a number of injuries and cut the primary gas supply to the city of Erbil. It has been widely reported that the drone used was the IRN-16/Shahed-101/Murad-5 drone.

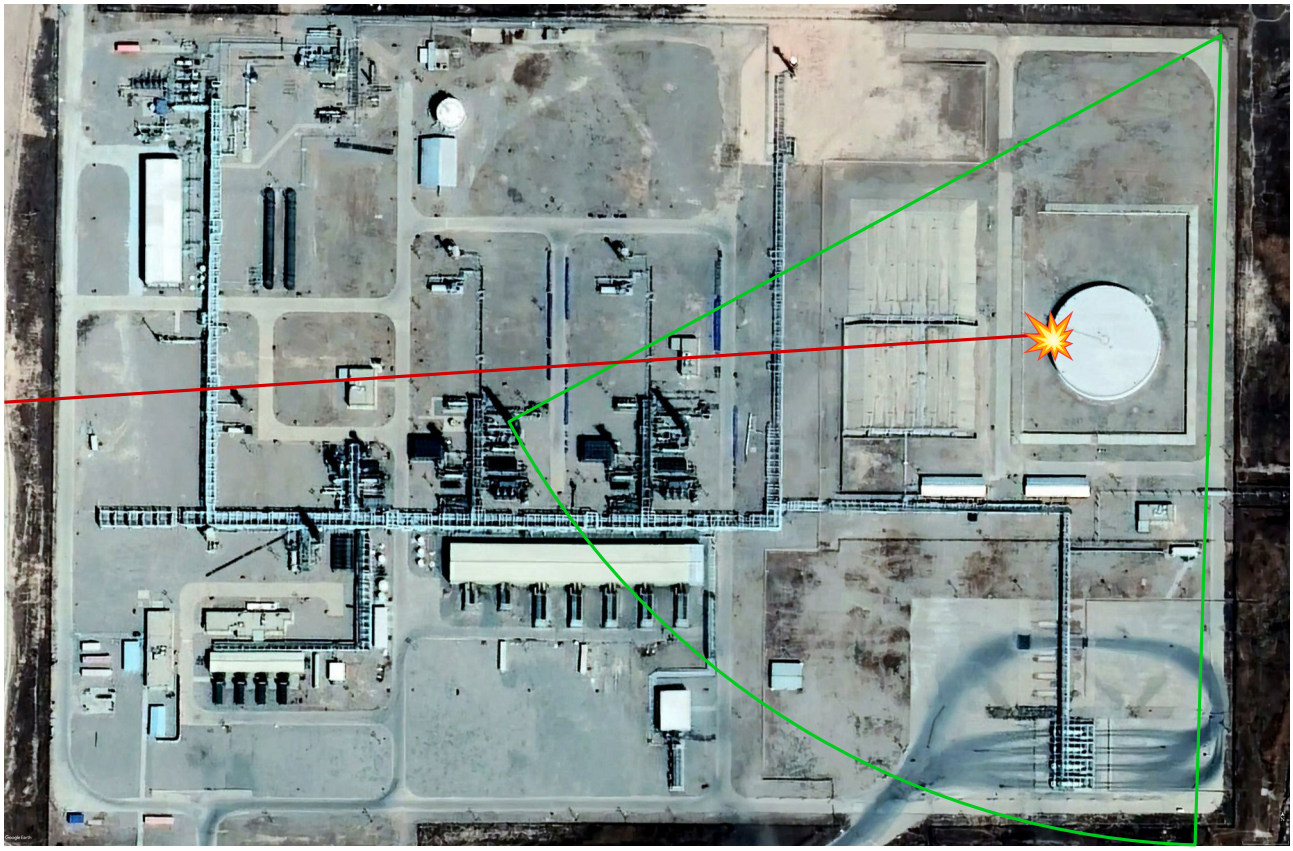
1 SHAHED 101/IRN-16/MURAD-5 SPECIFICATIONS

The Shahed-101 is a straight-wing, x-tailed gas pusher drone with a substantially carbon fiber body. It has been used extensively in the Levant region since approximately 2021 and is believed to have GPS, possibly consumer or GLONASS, and possibly (perhaps rarely) live video feed final control, note side-mounted antenna in at least one sample.

Specification	Measure	Specification	Measure
Length	1.6m	Wingspan	2.5m
Max takeoff weight	25 kg	Max warhead/payload	8 kg
Motor type	Gas piston	Motor Power	3.5 hp
Flight Duration	5 hrs	Cruising speed	120 km/h 33 m/sec
Control	GNSS	*Video type (unconfirmed)*	*480p*
Flight range	600–700 km	*Video range (unconfirmed)*	*50 km*

2 GEOLOCATION

The video can be geolocated to the Khor Mor facility with high confidence based on clearly visible features. The camera is located at approximately 35.138100°, 44.827877° (38SMD8431988371), direction of view 212°N and has an approximately 60° field of view.



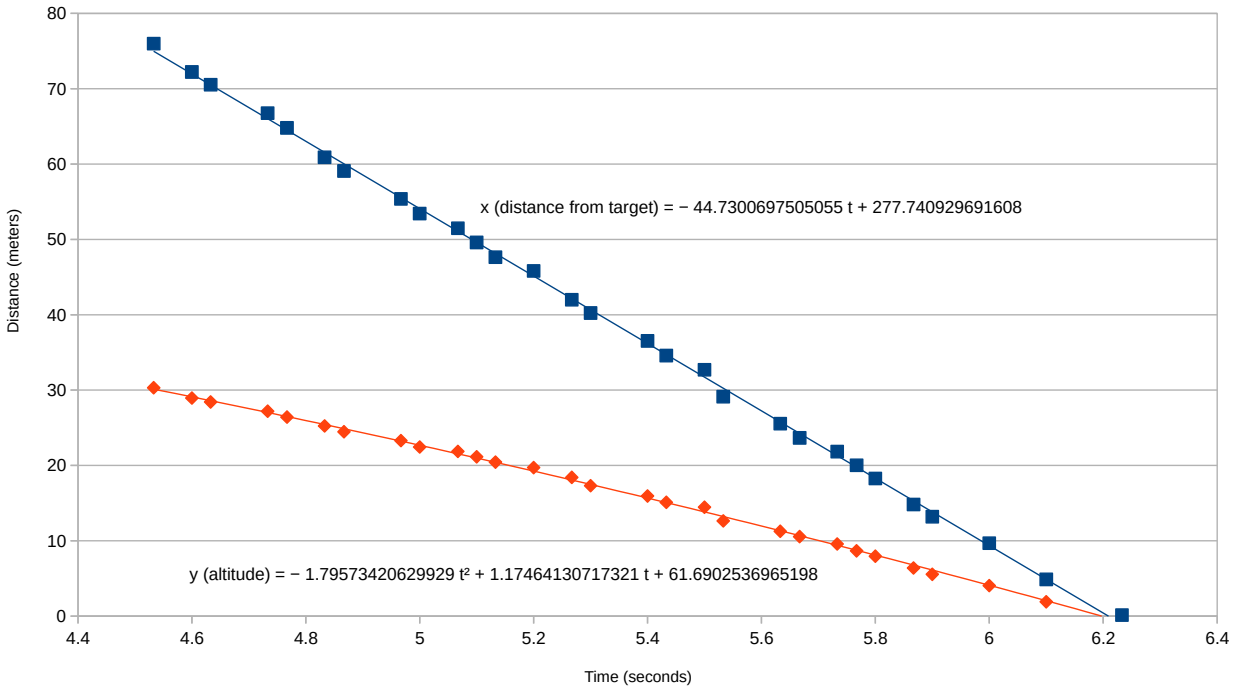
3 VIDEO ANALYSIS OF DRONE FINAL APPROACH

A fairly high quality CCTV video feed from the facility was made available on line shortly after the attack. From the video feed, and by geolocating and scaling, we can compute some useful values about the flight characteristics: velocity, rate of descent, and direction of flight. The drone appears to be ~2–2.5m long and made a banking turn on final approach, suggesting live control, likely via real time video feed, which puts operators within 50 km, likely less.

Thanks to a static camera position, it is fairly straightforward to create a video overlay motion analysis to see the inbound and impact.

The upper track is the inbound drone following a typical final approach trajectory at about 60 m/sec. The lower track appears to be a fragment from a secondary explosion. It seems to have been ejected at approximately 90 m/sec and, as it is clearly not aerodynamic, followed a path driven by rotation. It appears to be, based on motion, fairly massive.

The drone is on-screen for 1.7 seconds, with a ground speed of 44.7 m/sec (160 km/h) and a descent rate of 17.9 m/sec and an air speed of 48.1 m/sec (173 km/h) coming in for impact. The below plot shows the horizontal position (blue) and vertical position (red) of the drone from entry into the frame at t=4.533 to impact at t=6.233.



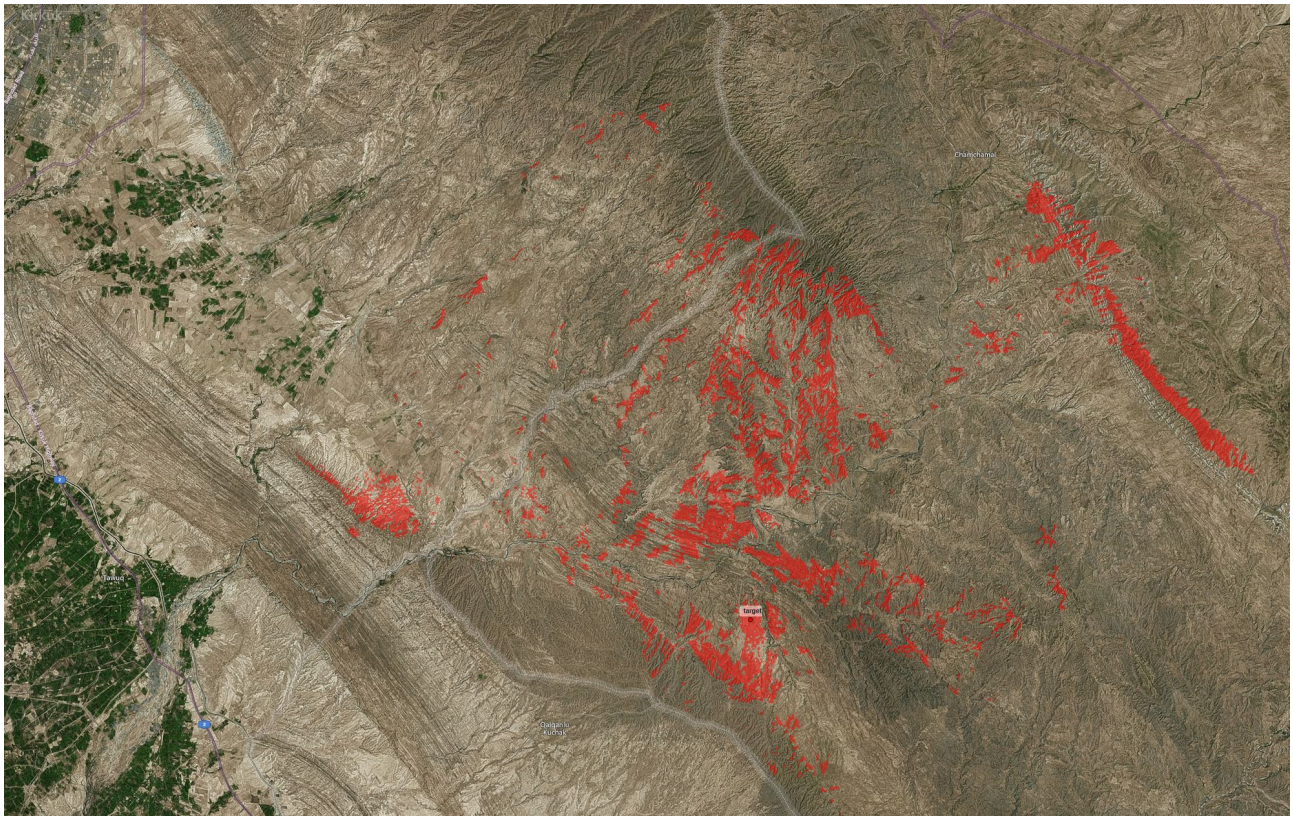
The lower track is a secondary fragment that appears 2.8 seconds after impact and flies off frame with an airspeed of approximately 77 m/sec (277 km/h). Such a large fragment at that velocity could be highly destructive.

4 CONTROL RANGE

As the drone appeared to make a course correction about 1.3 seconds before impact, it seems possible that a ground operator had a live video feed at that time. However, only one open-source image of a Shahed-101 with a suitable antenna has been found to support this possibility and wreckage pictures of that one don't include the nose cone. Most images only have an upward facing dual GPS antenna visible and show plain blank carbon fiber nose cones over the warhead.

If it was under live control, and assuming a 1.4 GHz transmitter (a common long-distance video link frequency), then we can estimate operator positions based on line of sight RF control. At the moment of apparent course correction, the drone

was about 25m AGL and given a hypothetical operator vantage of 4m AGL, the mountainous region limits possible control points based on RF LOS analysis, substantially closer in than the estimated 50 km maximum video link range reported.



5 CONCLUSION

The Khor Mor attack demonstrates the vulnerability of critical infrastructure to attack by low cost drones. The cost-benefit for an antagonist of deploying low-cost weapons with extremely low risk of loss of operators makes such attacks extremely attractive to NSAIG world-wide, and successes such as this will drive further use. A cost-effective, symmetric countermeasure to reduce the success rate of such attacks is increasingly essential for the protection of critical infrastructure.