

Drones over Ukraine: Death in different sizes

Iranian Shahed-136 drones can loiter over areas for hours until their cameras identify a target and the drone drops on it like a bomb. The Russians are using these weapons to devastating effect without risk to their troops.

SHAHED-136 (IRAN)

Length: 11 feet

Max. speed: 115 mph

Approx. weight:
440 pounds

Range: About 1,100-
1,500 miles

Nose contains
explosive warhead
as well as cameras

But the Iranian drones
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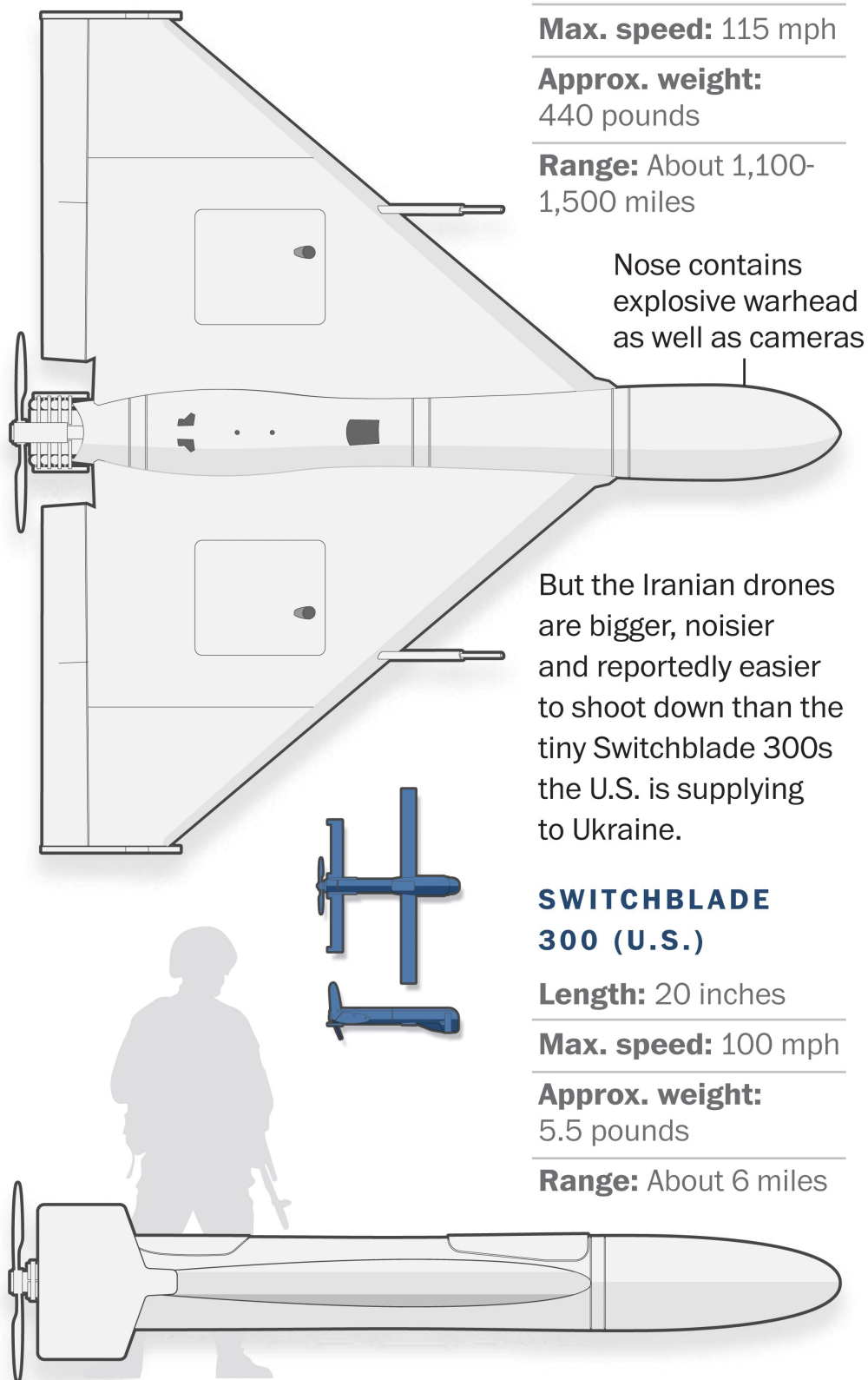
SWITCHBLADE 300 (U.S.)

Length: 20 inches

Max. speed: 100 mph

Approx. weight:
5.5 pounds

Range: About 6 miles



Sources: Defense Express, AeroVironment

WILLIAM NEFF/THE WASHINGTON POST



The Times of Israel



Russia uses Iranian drones against Ukrainian civilians

In a war of attrition, cheaper weapons such as Iranian drones are effective.

Length 3.5 meters long (11.5 feet)

Shahed-136 (Geran-2)

Explosive charge: ~40 kg (88 pounds) compared with cruise missile's warhead which weighs 480 kg (1,050 pounds)

Delta-wing: 2.5 meters wide (8.2 feet)

Propeller and engine with a top speed of 185 kph (114 mph).

Cost: \$20,000 apiece. By comparison cruise missiles cost about \$1 million each.

Source: Defense Express (Ukrainian online publication); National Institute for Strategic Studies

AP

The Iranian-made killer drones vying for supremacy in Ukrainian skies

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Credit: Associated Press

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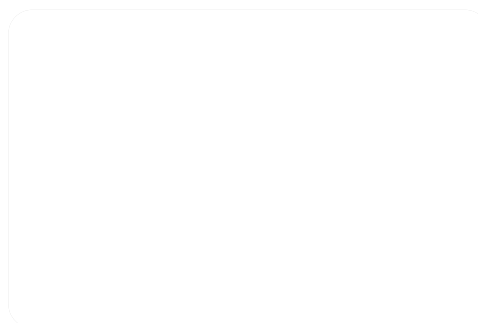
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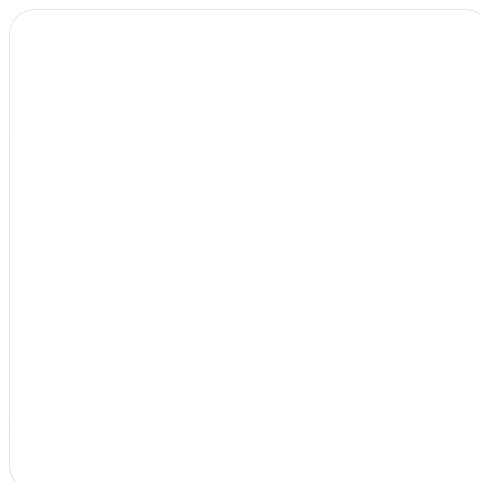
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How are 'kamikaze' drones being used by Russia and Ukraine?

🕒 3 January

Russia-Ukraine war



REUTERS

| Wreckage of a Shahed-136 (or Geranium-2) kamikaze drone shot down by the Ukrainians

Russia is planning to "exhaust" Ukraine with attacks using Iranian-made drones, President Volodymyr Zelensky has said.

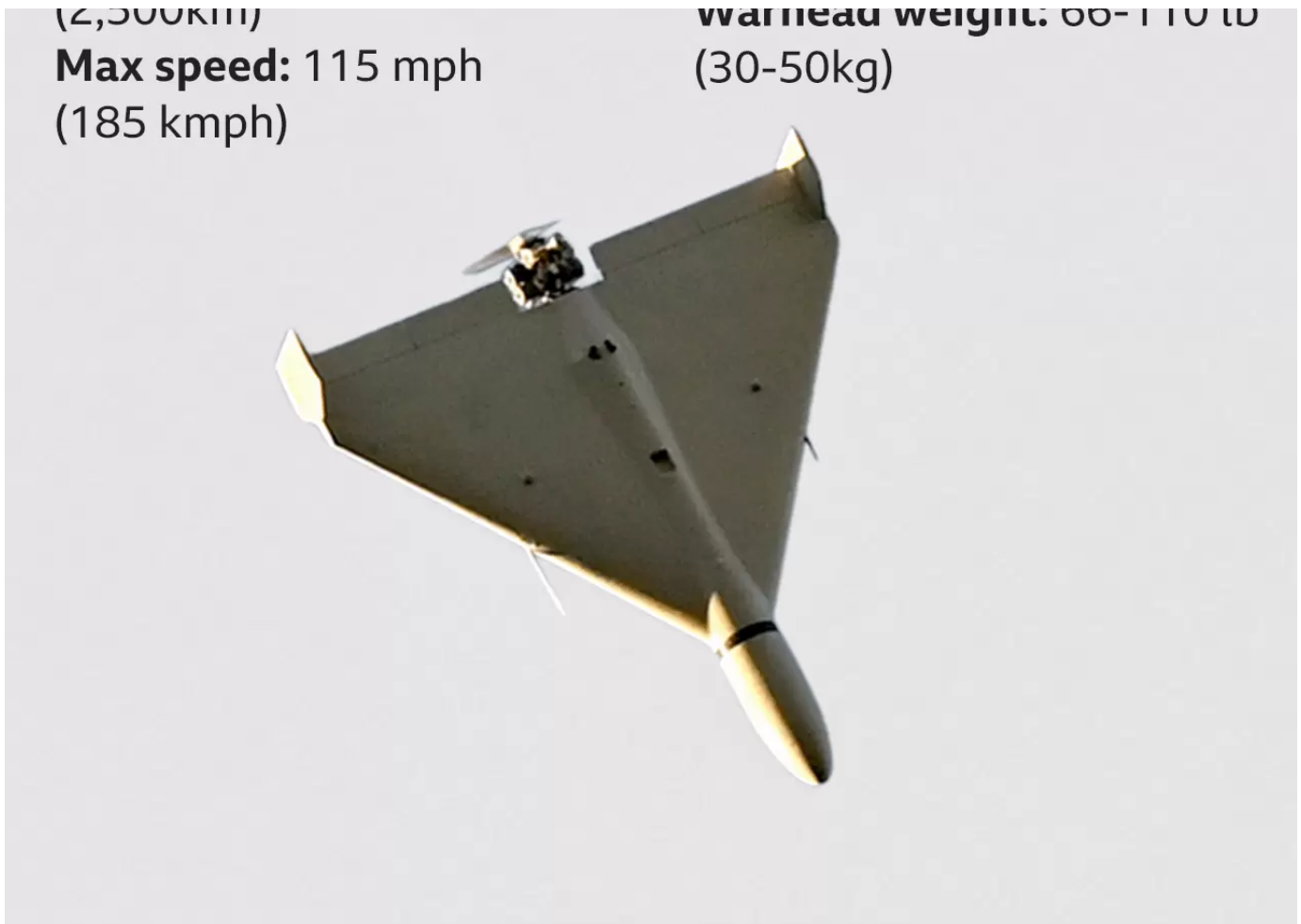
Ukraine's government and Western intelligence agencies say Russia has been using **Iranian-made Shahed-136 drones in the conflict since autumn last year.**

Also called the Geranium-2 by Russia, it has explosives in a warhead on its nose and is designed to loiter over a target until it is instructed to attack.

The Shahed-136 has a wingspan of about 2.5m (8.2ft) and can be hard to detect on radar.

Iran's government says **it supplied "a small number" of drones to Russia before the war.**

But the US and the European Union have accused Iran of sending regular deliveries of drones to Russia, and **the EU has imposed sanctions in response.**



Source: Defence Express, Getty Images

BBC

Defence experts think Russia may be using Shahed-136 drones rather than cruise missiles for air attacks because they are relatively cheap - about \$20,000 (£17,800) each.

What damage have kamikaze drones done in Ukraine?

Russia was first reported to have used a Shahed-136 drone on 13 September, attacking military targets in the Kharkiv region in the east of the country.

Since then, Russia has made repeated attacks with drones on both military and civilian targets in the areas of Kyiv, Odesa and Mykolaiv.

Ukraine says Russia launched more than 80 Iranian-made Shahed drones on 1 January and 2 January, but claims to have shot all of them down.

Ukrainian armed forces have used small arms fire, heavy machine guns, portable anti-air missiles and electronic jamming devices to try and shoot down drones.

This can be difficult when they are sent in large numbers, or "swarms".

However, Ukraine says its air defences have managed to shoot down over 80% of all the drones Russia has sent against it.

Has Ukraine used 'kamikaze' drones?

The US has said it is supplying Ukraine with 700 of its Switchblade kamikaze drones, but it is not known whether any have yet been used.

Experts say Ukraine used kamikaze drones of some sort last autumn to attack a Russian military base in western Crimea, an airbase near Sevastopol, and ships in Sevastopol harbour.

Russia says Ukraine also used kamikaze drones in December for three separate attacks on airbases at Saratov and Ryazan - both hundreds of miles inside Russian territory.

What other drones do Ukraine and Russia have?

Ukraine's main military drone is the Turkish-made Bayraktar TB2. It is about the size of a small plane, has cameras on board, and can be armed with laser-guided bombs.

A Bayraktar drone was used in the attack which **sank the Russian warship Moskva in the Black Sea** in April 2022.

Russia also uses the smaller, more basic Orlan-10, which has cameras and can carry small bombs.



Source: BBC Research, Getty Images

BBC

How have military drones been used?

For both sides - Russia and Ukraine - drones have been effective for locating enemy targets and guiding artillery fire toward them.

In the past, observers might have had to spend 20 or 30 minutes pinpointing a target, says Dr Jack Watling, defence analyst at the Royal United Services Institute.

Now, however, he says: "Russian forces can bring their guns to bear on the enemy within only three to five minutes of an Orlan-10 drone spotting the target."

Dr Marina Miron, defence researcher at Kings College London, says drones have allowed Ukraine to stretch its limited forces.



EPA

| Russian Orlan-10 drones can target artillery fire on enemy positions within minutes

The main problem in using military drones is that they are large and slow moving, and are easy to shoot down.

They are also expensive to replace - a single Bayraktar TB2 costs about \$2m (£1.7m).

How are non-military drones being used?

Both sides in the war - but especially Ukraine - have increasingly been using **small, cheap commercial models of drone** such as the DJI Mavic 3, which costs about £1,700.



Source: DJI, Getty Images

BBC

These can be fitted with small bombs, but are mainly used to spot enemy troops and to direct attacks.

However, commercial drones are much less capable than military ones.

For example, the DJI Mavic's total flying distance is only 30km, and it can only fly for a maximum of 46 minutes.

Russia is using electronic devices to counter them, says Dr Miron.

"Russian forces have the Stupor rifle, which shoots electromagnetic pulses," she says. This stops commercial drones from being able to navigate using GPS, she explains.

Russian forces have also used online systems, such as Aeroscope, to detect and interrupt communications between commercial drones and their operators.

These systems can cause a drone to crash or return to base, and can stop it sending back information.

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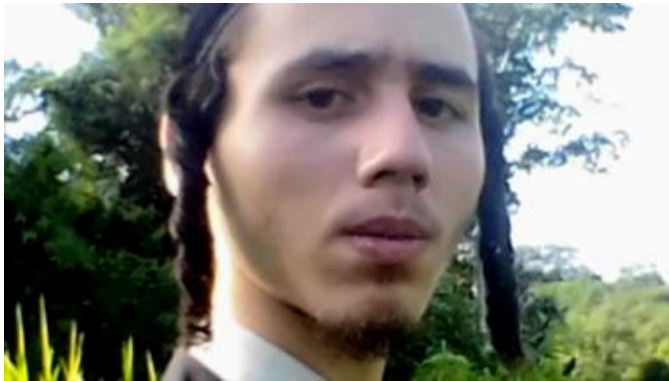
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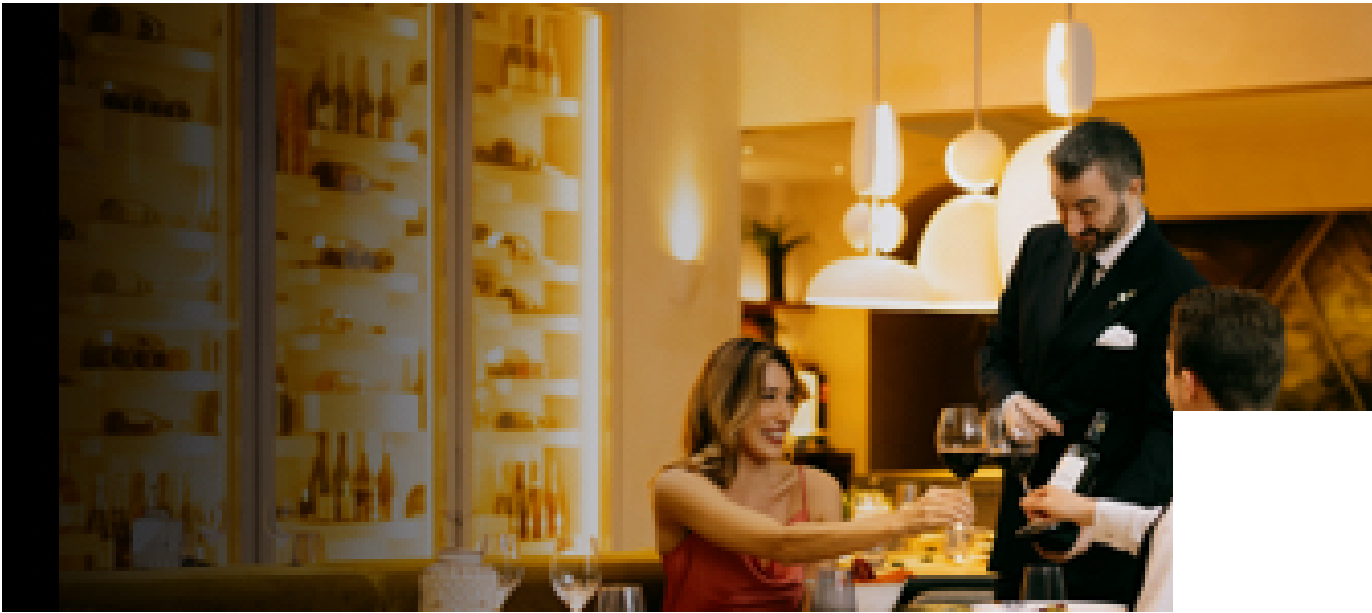
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Kamikaze drones strike Ukraine

Russia has been blamed for using “kamikaze drones” to attack Kyiv and other cities in Ukraine. The small, slow-flying weapons are used to strike targets by crashing into them

SHAHED-136: Ukraine accuses Russia of using Iranian-made suicide drones

Engine: 50-horsepower motor drives two-bladed propeller

Stabilising rudders

Delta wing configuration

Weight
200kg

Speed
185km/h

Claimed flight range
1,000km

Multiple launch truck

Drones fired in batches of five from racks inside truck-mounted container

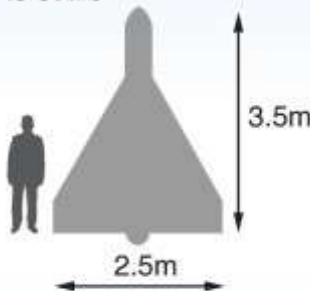
Warhead weight
40kg approx.

Guidance

Drone can be programmed to fly automatically to set of GPS coordinates with payload of explosives

Target must be stationary

Drone and human to scale



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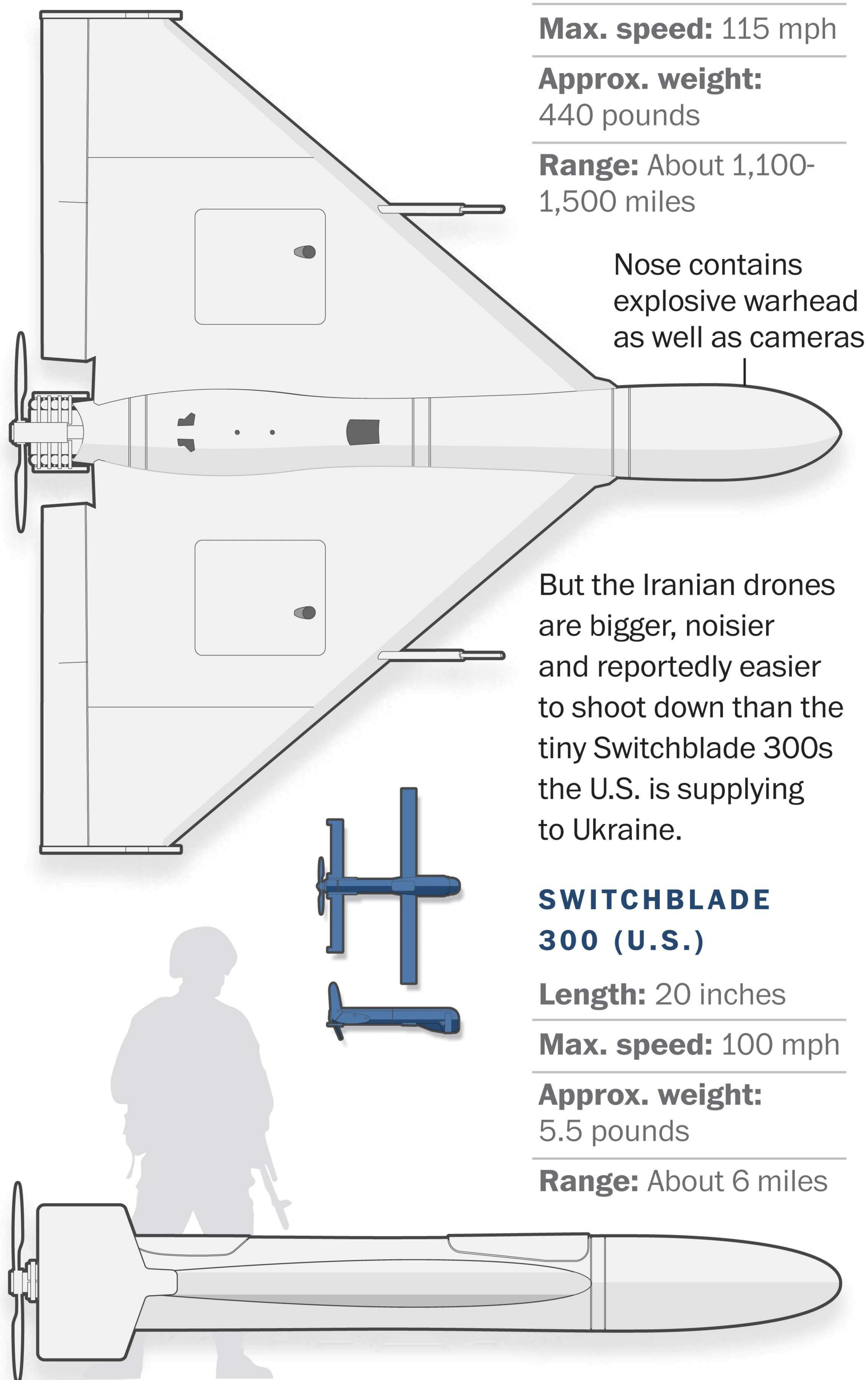
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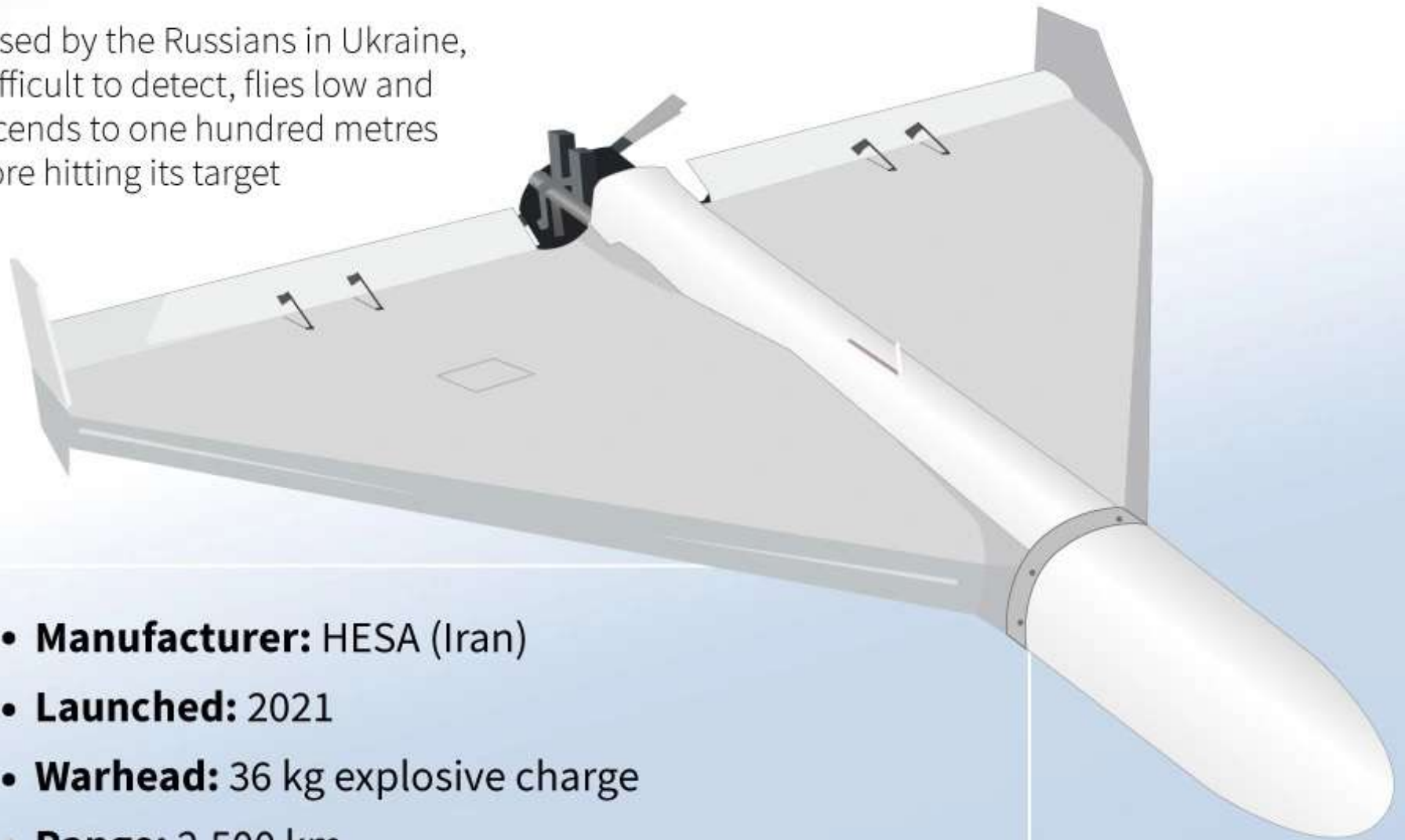
Sources: Defense Express, AeroVironment

WILLIAM NEFF/THE WASHINGTON POST

Iranian drone Shahed 136

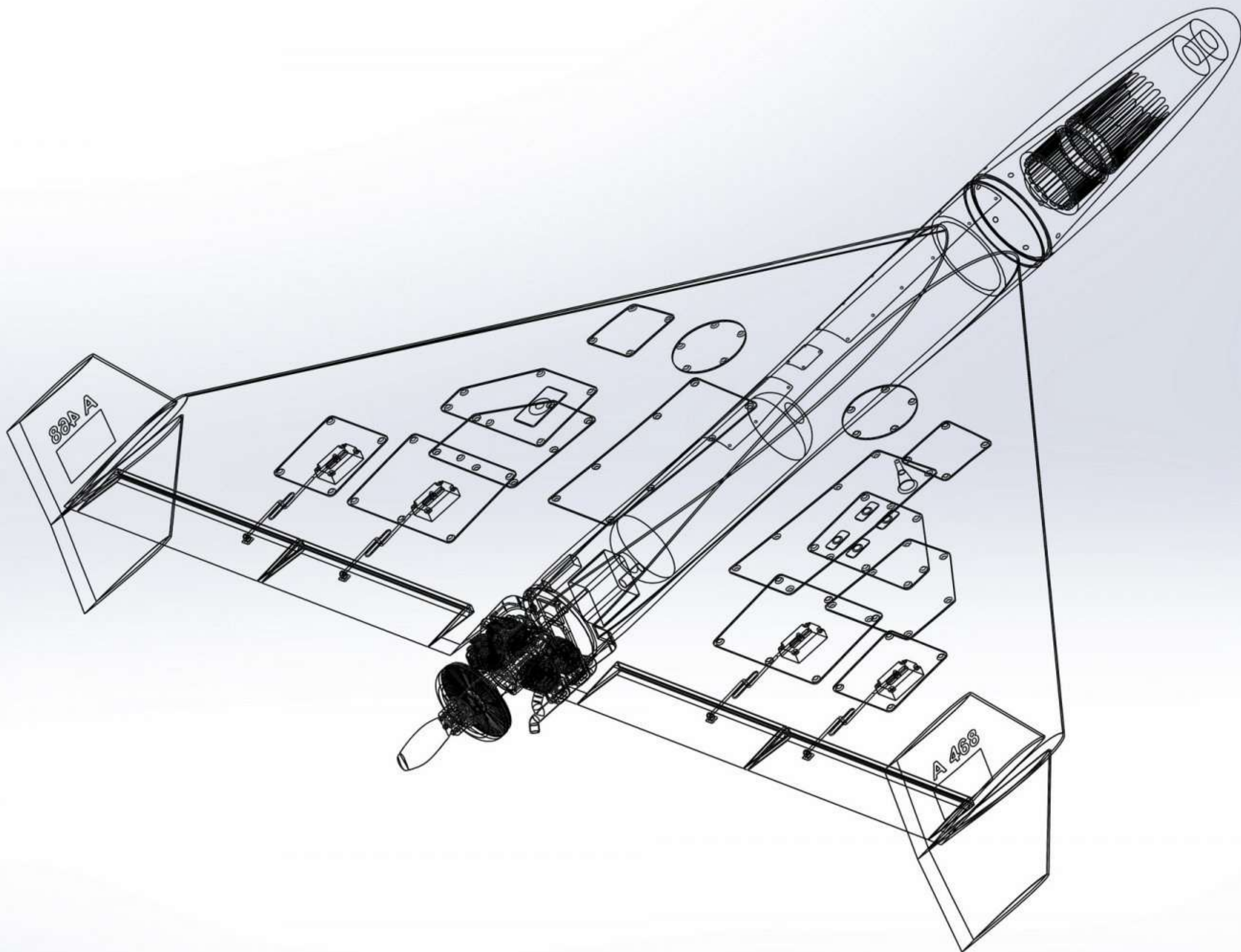
A long-range suicide drone for hitting fixed targets

Utilised by the Russians in Ukraine, is difficult to detect, flies low and descends to one hundred metres before hitting its target



- **Manufacturer:** HESA (Iran)
- **Launched:** 2021
- **Warhead:** 36 kg explosive charge
- **Range:** 2,500 km
- **Maximum speed:** 185 km/h
- **Weight:** 200 kg

Length: 3.5 m
Wingspan: 2.5 m



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Russian Ministry of Defence and Military Analysis



SHAHED-136 (Geran-2)

Length - 12 feet

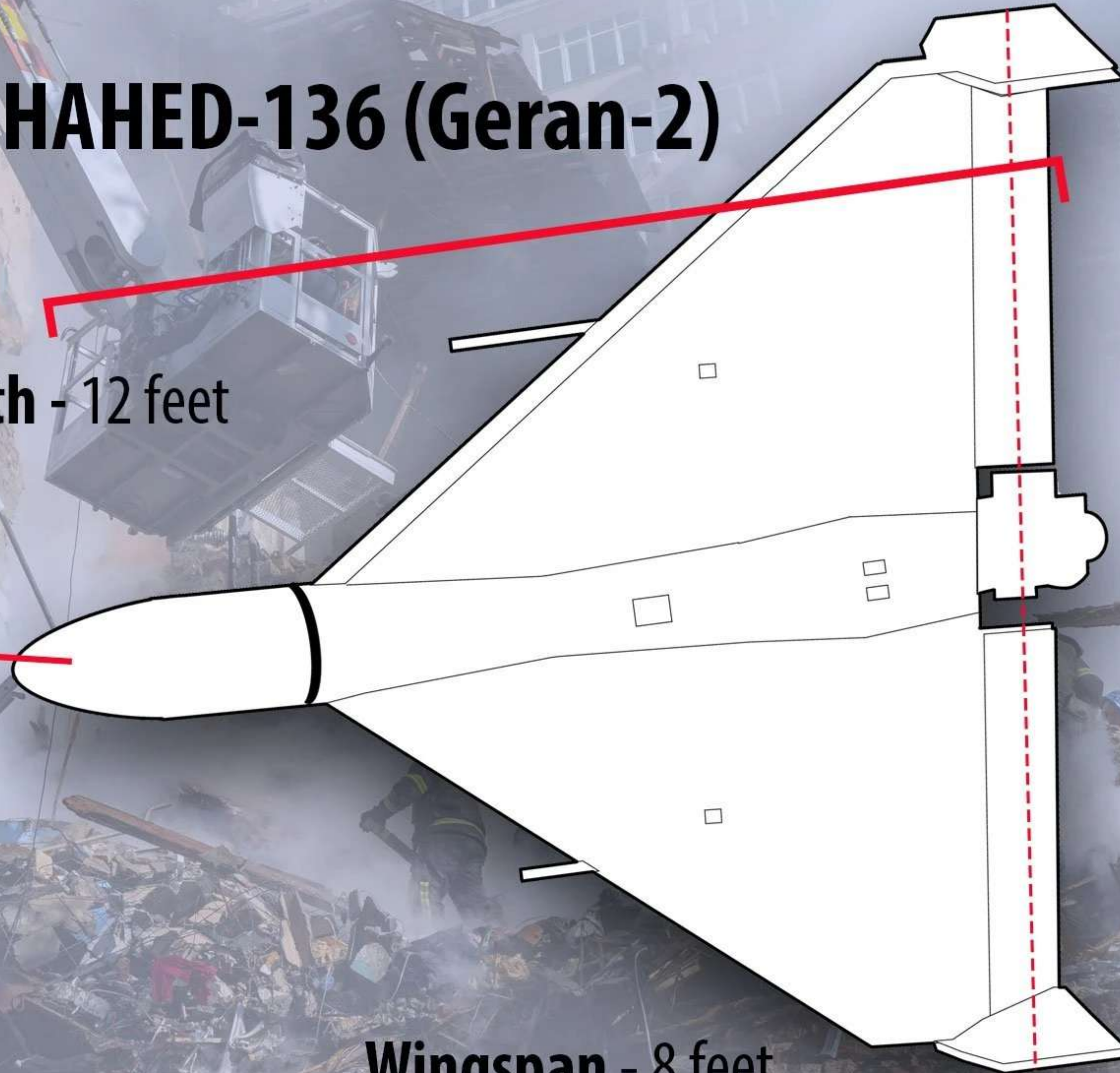
Explosive Charge - 40KG

Range - 600 miles

Speed - 120 miles per hour

Cost - \$20,000

Wingspan - 8 feet



Kamikaze drones strike Ukraine

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SHAHED-136: Ukraine accuses Russia of using Iranian-made suicide drones

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Stabilising rudders

Delta wing configuration

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Claimed flight range
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Multiple launch truck

Drones fired in batches of five from racks inside truck-mounted container

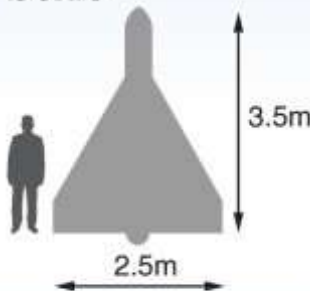
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Shahed-136 drone

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Max speed: 115 mph
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Wingspan: 8.2 ft (2.5m)

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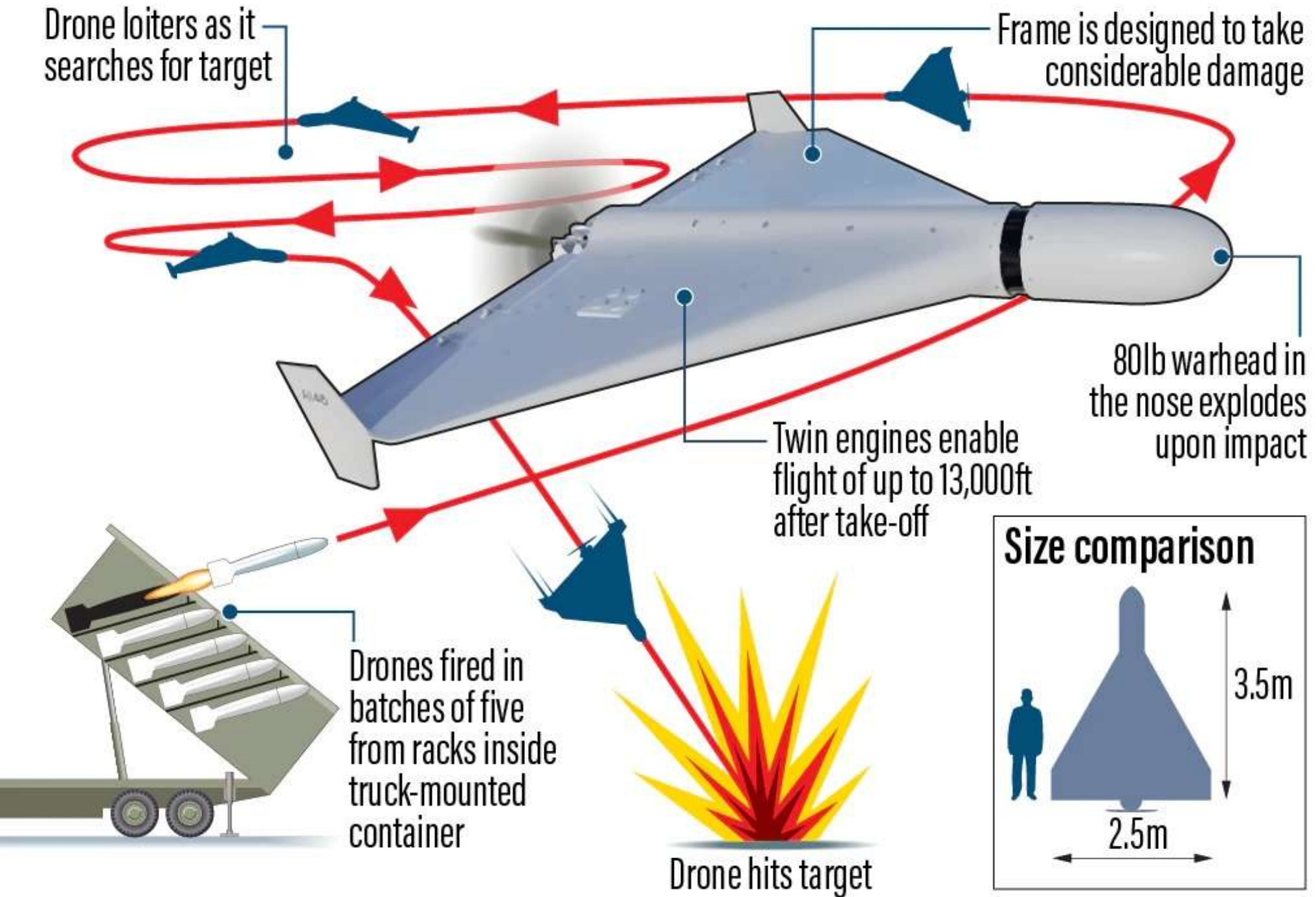
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Cost: \$20,000 apiece. By comparison cruise missiles cost about \$1 million each.

HESA SHAHED 136 ALSO KNOWN AS GERAN-2





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Explainer: Killer drones vie for supremacy over Ukraine

 By Associated Press | 10:03am Oct 18, 2022

Fighter jet crashes into Russian apartment

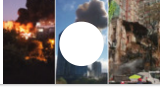
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They are precise, small in size, able to engage a target in relatively large numbers like a swarm of wasps and above all, they're cheap.

In [Russia's invasion of Ukraine](#), drones have cemented their reputation as a potent, hard-to-stop and cost-effective weapon to seek out and destroy targets while simultaneously spreading the kind of terror that can fray the resolve of soldiers and civilians alike.



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Fighter jet crashes into Russian apartment



A drone flies in the sky seconds before it fired on buildings in Kyiv. (AP)

Russia's unleashing of successive waves of the "kamikaze" Iranian-made Shahed drones over Ukraine has multiple goals — taking out key targets, crushing morale, and ultimately draining the enemy's war chest and weapons as they try to defend against them.

How do wartime drones work?

The Shahed drones that Russia has rebranded as Geran-2 are packed with explosives and are pre-programmed to loiter overhead until they nosedive into a target.

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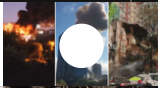
That's reminiscent of Japan's World War II-era kamikaze pilots who would fly their explosive-laden aircraft into US and other allied warships and aircraft carriers during the war in the Pacific.

According to the Ukrainian online publication *Defence Express*, which cites Iranian data, the delta-wing Shahed is 3.5m long, 2.5m wide and weighs approximately 200kg.

It's powered by a 50-horsepower engine with a top speed of 185km/h.

Behnam Ben Taleblu, senior fellow at the Washington-based think tank Foundation for Defence of Democracies, said the drone has already been deployed in Yemen and in a deadly oil tanker attack last year.

He said its range is about 1000km.

**WATCH AND READ****Fighter jet crashes into Russian apartment**

Russia has hit Ukraine with a wave of attacks, dive-bombing the capital, Kyiv, with what appear to be Iranian-made drones. (Getty)

The new drone technology does not need trained personnel to be sacrificed nor a huge amount of money spent on building sophisticated aircraft to reach a target.

In Monday's attack on the Ukrainian capital of Kyiv, the city's mayor, Vitali Klitschko, said 28 drones made up waves of successive attacks.

Fired from a truck launcher in rapid succession, the drones can fly low and slow, better able to avoid radar detection.

They can also swarm a target, overwhelming defences particularly in civilian areas.

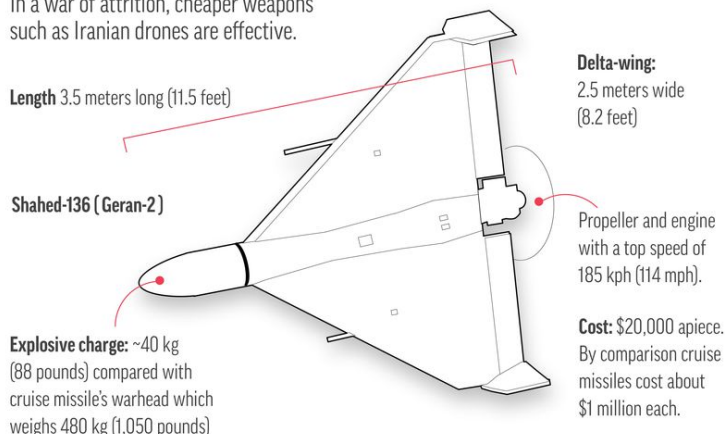
But according to Mykola Bielieskov, a research fellow at Ukraine's National Institute for Strategic Studies, the Shahed only carries a 40kg explosive charge, which pales in comparison to the explosive force that a conventional missile's 480kg warhead can deliver at a much longer range.

"It is difficult to hit serious targets with such drones," Bielieskov said.

READ MORE: [At least four dead after Russian fighter jet crashes into apartment block](#)

Russia uses Iranian drones against Ukrainian civilians

In a war of attrition, cheaper weapons such as Iranian drones are effective.



Source: Defense Express (Ukrainian online publication); National Institute for Strategic Studies

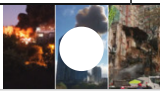
AP

Russia has deployed Iranian drones against Ukrainian cities. (AP)

Small punch but low cost

At a mere \$US20,000 (\$30,000) apiece, the Shahed is only a tiny fraction of the cost of a more conventional, full-size missile.

For example, Russia's Kalibr cruise missiles, which have seen widespread use in eight months of war, cost the Russian military about \$US1 million (\$1.6 million) each.



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Fighter jet crashes into Russian apartment

In Monday's attacks, one drone struck an operations centre while another slammed into a five-storey residential building, ripping a large hole in it and collapsing at least three apartments, resulting in the deaths of three people.

READ MORE: [Australian company's drone jammers helping Ukraine fight Russia](#)



Critical infrastructure was hit in the Kyiv, Dnipro and Sumy regions, with electricity cut in hundreds of towns and villages. (AP)

Bielieskov, from Ukraine's National Institute for Strategic Studies, said the Russian military is opting to use Shaheds on civilian targets instead of the battlefield because Ukrainian forces have "learned how to fight them effectively," managing to intercept a little more than half of them.

With no immediate end in sight, the financial burden of the conflict will weigh heavier on Moscow, which isn't receiving billions in weapons transfers from Western nations like Ukraine is.

As the conflict essentially becomes one of attrition — who can withstand that human, material and financial burden the longest — finding cheaper but still potent weapons will be key.

For Moscow, the Shahed appears to be such an alternative.

"Shahed-136 is a cheap version of a cruise missile, which Russia can't produce fast," said Bielieskov.

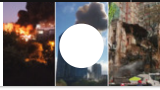


This file photo from the Iranian Army shows a military drone fired from a mobile launcher. (AP)

Taleblu said Russia will likely continue to boost its long-range strike capabilities with Iranian drones and reportedly even missiles.

"This should raise alarm bells for Europe and the world," he said.

Russian officials haven't issued any data about the number of missiles fired during the conflict, but Ukraine's defence minister recently alleged that Russia has used most of its high-precision missile arsenal — from 1844 on the eve of Russia's invasion to 609 by mid-October.



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Fighter jet crashes into Russian apartment

That sound exacerbates anxiety and chips away at morale, for no one on the ground knows exactly when or where the weapon will strike.

Ukrainian President Volodymyr Zelenskyy seized on the drones' terror element, posting on social media: "The whole night, and the whole morning, the enemy terrorises the civilian population."

"Kamikaze drones and missiles are attacking all of Ukraine," he added.



Ukrainian President Volodymyr Zelenskyy said Russia had unleashed a wave of 'kamikaze' drones against civilian targets. (AP)

Bielieskov conceded that Shahed drone strikes stir up fears that Ukraine's air defences are inadequate to meet the threat.

But he said their use — even in large numbers — isn't enough to reverse Ukraine's battlefield gains.

Sky-borne terror weapons are nothing new — Nazi Germany employed them during World War II in the form of the V-1 flying bomb or "buzzbomb," the earliest type of cruise missile in the shape of a small aircraft that targeted British cities.

Eight decades later, the much smaller Shahed can be guided to its target at a much cheaper cost, potentially enabling Russian forces to launch many more drones than the 9500 "buzzbombs" that Nazi Germany unleashed on Britain.



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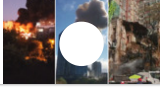


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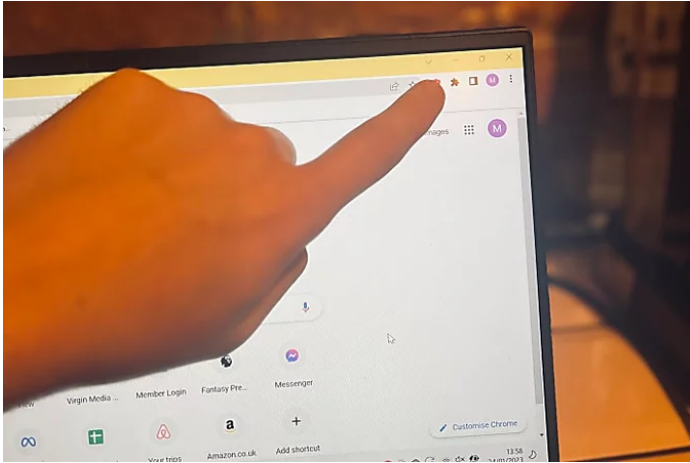


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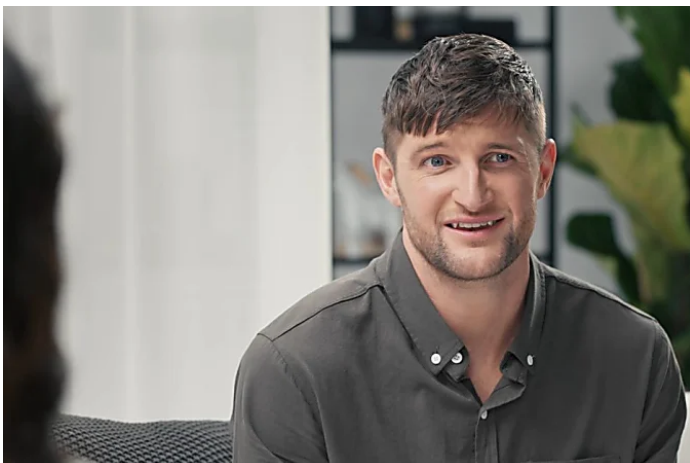
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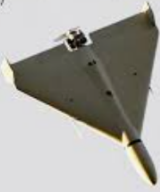
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Shahed-136 drone

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(2,500km)
Max speed: 115 mph
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Wingspan: 8.2 ft (2.5m)
Warhead weight: 66-110 lb
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Source: Defence Express, Getty Images



Bayraktar TB2 drone

Max altitude: 25,000 ft (7,600 m)
Max range: 186 miles (300km)
Max speed: 140 mph (220 kmph)

Weapons: 4 MAM-L
laser-guided bombs
Wingspan: 39 ft (12 m)



Source: BBC Research, Getty Images



DJI Mavic 3

Max altitude: 19,685 ft (6,000 m)
Max flying distance: 18.6 miles (30 km)
Max speed: 42.5 mph (68 kmph)
Wingspan: 11.1 inches (282 mm)



Source: DJI, Getty Images

about \$20,000

Defence experts think Russia may be using Shahed-136 drones rather than cruise missiles for air attacks because they are relatively cheap - **about \$20,000 (£17,800) each.**

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Loitering munitions downed after they have reached cities can lead to large-scale collateral damage from falling wreckage. The average Shahed drone is worth **about \$20,000**. An IRIS-T missile is worth about \$430,000 in comparison.

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ATTACK HITS IRAN'S SHAHED-136 DRONE MANUFACTURING

~~Sandboxx~~ FACILITY, ACCORDING TO REPORTS

Steve Balestrieri (<https://www.sandboxx.us/blog/author/steve-balestrieri/>) | January 30, 2023

Iran was rocked by several explosions on Saturday night as an advanced weapons facility in Isfahan, 270 miles south of Tehran, was hit by a drone attack.

"An explosion has occurred in one of the military centers affiliated to the Ministry of Defense," Mohammad Reza Jan-Nesari, the deputy chief of security for the Isfahan governate, told (<https://www.cnn.com/2023/01/28/middleeast/drones-attack-iran-military-plant-intl-hnk/index.html#:~:text=Drones%20attacked%20a%20military%20plant,semi%20official%20Fars%20News%20Agency.>) the Fars News Agency. The attack caused some damage but no casualties according to Jan-Nesari.

Local officials told (<https://www.bbc.com/news/world-middle-east-64445306>) the government-controlled IRNA news agency that the building was a "workshop" although IRNA announced that the attack, which took place at 11:30 p.m. local time, had targeted "an ammunition manufacturing plant."

According to Israeli news media, the facility manufactured the Shahed-136 drones that Iran has been selling to Russia to use against Ukraine (<https://www.sandboxx.us/blog/is-russia-admitting-that-its-defense-industry-cant-keep-up-by-using-iranian-shahed-136-drones/>); the Russians are supposedly running low on the drones (<https://www.newsweek.com/russia-ukraine-iranian-shahed-136-drones-institute-study-war-volodymyr-zelensky-1772102>).





Purportedly part of a Shahed-136 drone that was shot down near the town of Kupiansk, Ukraine. ([The Strategic Communications Directorate of the Ukrainian Armed Forces](https://twitter.com/DefenceU/status/156965626164117696) (<https://twitter.com/DefenceU/status/156965626164117696>))

Iran's defense ministry said that it foiled the attack on the weapons facility by shooting down one small drone and catching two others in defense nets.

"This cowardly act was carried out today as part of the efforts made by enemies of the Iranian nation in recent months to make the Islamic Republic insecure," Iranian Foreign Minister Hossein Amir-Abdollahian said Sunday at a press conference.

"Such measures cannot affect the will and intention of our specialists for peaceful nuclear developments," he added.

However, the Jerusalem Post (<https://www.jpost.com/middle-east/iran-news/article-729959>) and the Wall Street Journal wrote that the drone strikes were successful with Wall Street Journal writing that Israel and Mossad carried out the strikes, citing U.S. officials who spoke on the condition of anonymity.

The drones were large and contained a large number of explosives, according to Jerusalem Post. A mobile phone video recorded the drone as it hit the building, sending up an explosion and a shower of sparks.

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Pentagon spokesperson Brigadier General Patrick Ryder said the U.S. military had no part in the drone strikes but declined to elaborate further and Israel has not confirmed or denied any involvement in the drone strikes.

Mossad has been linked to other operations inside of Iran. In 2020 Iran claimed that Israel was behind the assassination of Mohsen Fakhrizadeh (<https://www.bbc.com/news/world-middle-east-55128970>), one of its top nuclear scientists who was heavily involved in their nuclear weapons program. Mossad was alleged to have also been behind the sabotaging of two key nuclear facilities outside the city of Natanz and a third in the city of Karaj in 2020 and 2021.

In a separate incident on Saturday, a large fire broke out at an oil facility near the Iranian city of Tabriz, the IRNA news reported. No details of the cause of the blaze have been reported.

In related news, a convoy of 25 Iranian trucks entering Syria (https://www.timesofisrael.com/warplanes-said-to-strike-convoy-of-iranian-militia-trucks-on-syria-iraq-border/?utm_source=article_hpsidebar&utm_medium=desktop_site) from Iraq was attacked over the weekend by unknown aircraft at a border crossing run by Iranian-proxy militias. The aircraft also targeted a group of Iranian commanders who were meeting nearby.

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A fire is seen burning, purportedly at the al-Qaim crossing on the Syria-Iraq border, in unverified footage posted online, January 29, 2023. ([The Times of Israel](https://www.timesofisrael.com/warplanes-said-to-strike-convoy-of-iranian-militia-trucks-on-syria-iraq-border/) (<https://www.timesofisrael.com/warplanes-said-to-strike-convoy-of-iranian-militia-trucks-on-syria-iraq-border/>) via Twitter)

The incidents come after last week, the U.S. and Israel conducted joint exercises geared toward showing Iran that the U.S. was not distracted by the war in Ukraine. CIA Director William Burns was also recently in Israel for a meeting with his Mossad counterpart.

Israel has made it clear that unless the U.S. can secure a deal with Iran similar to the Joint Comprehensive Plan of Action (<https://www.timesofisrael.com/report-israel-carried-out-drone-attack-on-iranian-defense-facility/>) (JCPOA) to stop its nuclear weapons program, it will take unilateral action to do so.

Prime Minister Netanyahu considers nuclear weapons in the hands of Tehran an existential threat. Under President Trump, the U.S. withdrew from the JCPOA in 2018.

Feature Image: Screenshot of the explosion at the Iranian weapons facility. (Yeni Safak (<https://twitter.com/yenisafakEN>) Twitter)

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Steve Balestrieri

Steve Balestrieri is a proven military analyst. He served as a US Army Special Forces NCO and Warrant Officer in the 7th Special Forces Group (<https://www.soc.mil/USASFC/Groups/7th/7thSFGHomepage.html>). In addition to writing for Sandboxx.com (<https://www.sandboxx.us/>), he has written for 19fortyfive.com (<https://www.19fortyfive.com/>) and SOFREP.com (<https://sofrep.com/>); he has covered the NFL for PatsFans.com (<https://www.patsfans.com/>) for over 11 years. His work was regularly featured in the Millbury-Sutton Chronicle and Grafton News newspapers in Massachusetts.

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EUROPE

What are kamikaze drones? Here's how Russia and Ukraine are using them.

By [Annabelle Timsit](#), [Isabelle Khurshudyan](#), [Adam Taylor](#) and [William Neff](#)

Updated October 18, 2022 at 4:26 p.m. EDT | Published October 17, 2022 at 10:09 a.m. EDT

This week, Russia struck deep into Ukraine and hit the capital, Kyiv, with kamikaze drones. These small and noisy airborne devices are designed to strike at a distance. They are nimble enough to avoid many air defense systems.

Unlike many other attack drones, they do not use weapons to destroy their targets. They are the weapon.

The kamikaze drones used by Russia are believed to be imported from Iran. They “are both military weapons and psychological weapons,” said Samuel Bendett, a Russian-military analyst at the Virginia-based research group CNA. “Attacks on major cities that are supposed to be well-defended against aerial threats demonstrate that Russia still has the capacity to inflict damage, whether military or civilian targets are struck.”

But drone attacks have already become a regular feature of the war in Ukraine, with both sides utilizing the deadly aircraft in different ways.

What are kamikaze drones?

The drones that Russia has been deploying, Ukrainian and U.S. officials say, are manufactured in Iran, where they are known as Shahed-136s. They are designed to strike specific targets with explosives that can be delivered at distances of up to 1,500 miles.

Russia has renamed the Shahed-136 as the Geran-2. Iran has denied giving Russia drones for its war against Ukraine.

The drones are part of a weapons category known as loitering munitions — meaning that they “are designed to loiter over battlefields,” looking for targets such as radars, Ingvild Bode, an associate professor of international relations at the Center for War Studies, a research group within the University of Southern Denmark, previously told The Washington Post. “When they have found the target, [they] launch themselves onto it.”

The “kamikaze” term is often applied to this and weapons such as the U.S.-made Switchblade drones in reference to the military aviators who flew suicide attacks for the Japanese empire during World War II. Unlike those aircraft, these new weapons have no pilot onboard.

Ulrike Esther Franke, a senior policy fellow at the European Council on Foreign Relations, said that kamikaze drones have been used regularly in other conflicts, including in the recent wars between Azerbaijan and Armenia. In those conflicts, Azerbaijani troops used the Israeli-developed Harop drones, which are similar to Shahed-136s in size and capabilities.

However, the scale of use by Russia and the reports that it has bought an arsenal of thousands “makes this relatively unique,” Franke added.

Because of the distinctive buzzing sounds they make as they approach, the Shahed-136s are typically less destructive than precision missiles — civilians can see and hear them coming, so they have more time to seek shelter before any explosion. Some Ukrainians have dubbed them “flying mopeds” because of their loud engines.

Unlike large missiles, the drones have a blast radius that is smaller, and they don’t necessarily send shrapnel flying in every direction.

But they can also slip past Ukraine’s air defenses — or force the military to use its limited air defense resources to neutralize them before they can strike their target.

How is Russia using them?

Russian forces seeking an advantage on the battlefield have increasingly been making use of drones. U.S. and allied officials, speaking on the condition of anonymity to discuss security matters, have told The Post that Iran recently began delivering the drones and other weapons to Russia, sending technical advisers to train Russian forces in how to operate them. Pentagon officials have publicly confirmed the use of Iranian drones in Russian airstrikes.

Ukraine believes Russia has ordered as many as 2,400 kamikaze drones from Iran. In response, Kyiv has urged its allies to send sophisticated air defense systems.

Russia has its own arms industry, and to some experts it is notable that Moscow has to rely on Tehran for drones. “Turning to Iran in 2022 suggests that Moscow still has an inadequate domestic capability in drones,” Douglas Barrie of the International Institute for Strategic Studies wrote in one recent analysis.

But the attacks in Kyiv have shown the value in kamikaze drones, even if they are procured from abroad.

“Many in Russia were calling for mass strikes against Ukrainian infrastructure months ago to slow down the Ukrainian military’s progress,” Bendett said. “These cheap, expendable drones offer a simple solution.”

Franke, of the European Council on Foreign Relations, had a similar observation: “These systems allow Russia to terrorize Ukrainians at low costs, and far away from the front lines. While fighting these drones is not the most difficult task ever, it is difficult to do so everywhere at once.”

Russia has largely used kamikaze drones to attack military and infrastructure targets in southern Ukraine. Its forces first deployed the Shahed-136 in northeastern Ukraine in September, according to Britain’s Defense Ministry. In an intelligence update, the ministry argued that the use of the weapons near the front lines suggested “that Russia is attempting to use the system to conduct tactical strikes rather than against more strategic targets farther into Ukrainian territory.”

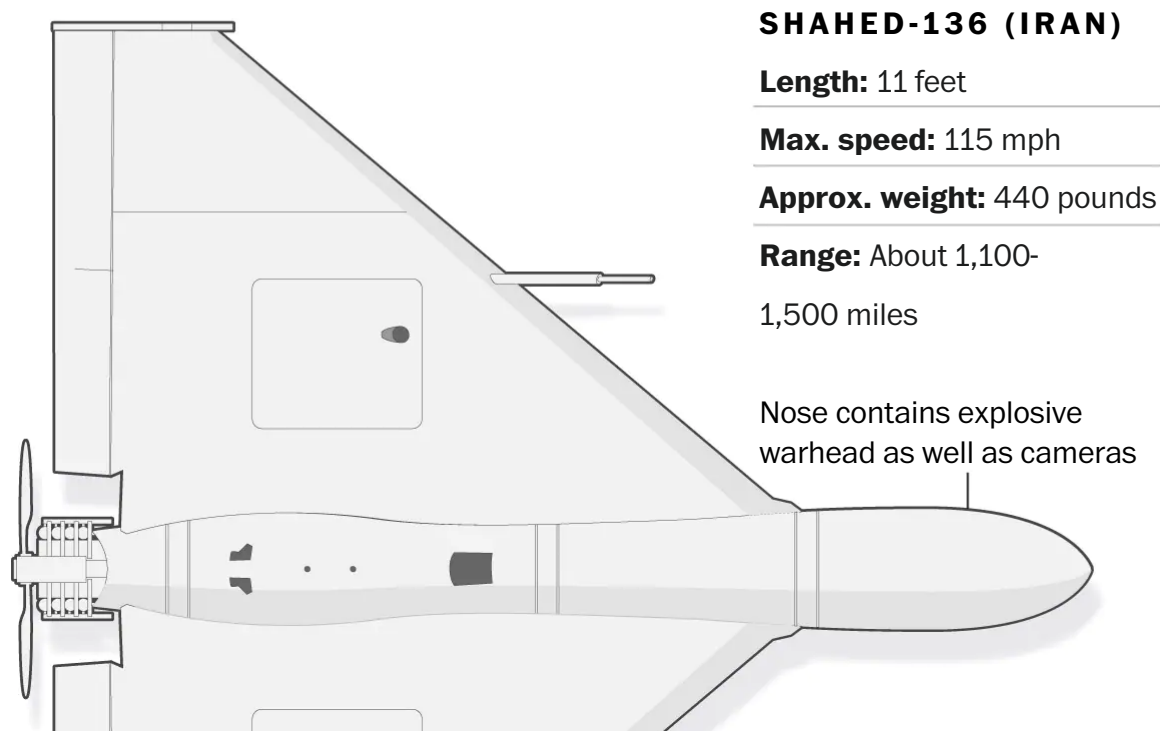
Since mid-September, Ukrainian forces have claimed they shot down Iranian-made drones in various parts of Ukraine. Speaking by video conference to Group of Seven leaders last week, Ukrainian President Volodymyr Zelensky said, “Every 10 minutes I receive a message about the enemy’s use of Iranian Shaheds.”

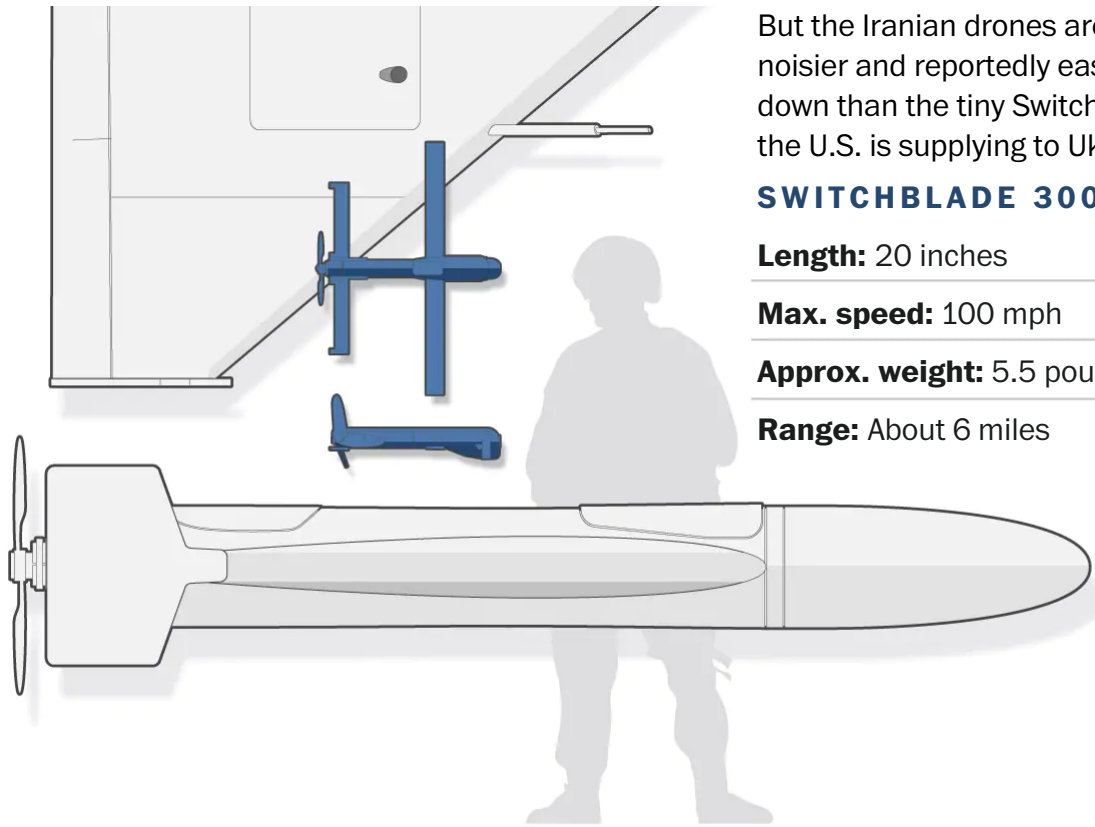
This has led Kyiv to downgrade its diplomatic relations with Tehran. Zelensky called the partnership between Russia and Iran a “collaboration with evil,” while Tehran accused Kyiv of overreacting based on “unconfirmed reports” and “media hype by foreign parties.”

The drones were used for the first time to strike central Kyiv on Monday in what appeared to be an attempt to target a thermal power station that supplies the capital. At least four people were killed in the blasts, officials said. Mykhailo Podolyak, a senior adviser to Zelensky, accused Iran of being “responsible for the murders of Ukrainians.”

Drones over Ukraine: Death in different sizes

Iranian Shahed-136 drones can loiter over areas for hours until their cameras identify a target and the drone drops on it like a bomb. The Russians are using these weapons to devastating effect without risk to their troops.





But the Iranian drones are bigger, noisier and reportedly easier to shoot down than the tiny Switchblade 300s the U.S. is supplying to Ukraine.

SWITCHBLADE 300 (U.S.)

Length: 20 inches

Max. speed: 100 mph

Approx. weight: 5.5 pounds

Range: About 6 miles

Sources: Defense Express, AeroVironment

WILLIAM NEFF/THE WASHINGTON POST

How is Ukraine using them?

The United States has pledged to send Ukraine more than 700 of its own kamikaze drones, called Switchblades, and trained some Ukrainian soldiers in April on how to use them.

With its thin body and ruler-shaped wings, the Switchblade 300 drone, the model in widespread use, is different in appearance from the Shahed-136, which looks like a miniature delta-winged fighter plane. But the idea behind the two weapons is similar: Allow a remote operator to take out a target with deadly efficiency and evade detection and air defense.

A key difference between the Shahed-136 and the Switchblade is range: Even the larger model of Switchblade has a maximum range of up to 25 miles, a fraction of that of Russia's kamikaze drones.

The Switchblade 300, of which hundreds have been sent to Ukraine, can be deployed in the field, and packs less of a punch than larger drones but can be harder to shoot down. The United States is set to send 10 Switchblade 600s, a larger model, to Ukraine, Angela Schutt, a spokeswoman for AeroVironment, the company that makes them, confirmed in an email.

Ukraine also has been using the domestically developed RAM II kamikaze drones, which were partly paid for by crowdfunding. This drone also has a smaller range, going up to only 18 miles, and production has been hampered by supply issues.

Non-kamikaze drones have proved important for Ukraine, too. Ukraine also has deployed Turkish-made Bayraktar TB2 drones and claims to have destroyed many Russian military targets with the aircraft's laser-guided missile attack system. That drone is so popular in Ukraine that a Ukrainian soldier released a song in its honor.

Joby Warrick, Ellen Nakashima and Shane Harris contributed to this report.