

## FIELD DISPATCH

**DISSECTING IRANIAN  
DRONES EMPLOYED BY  
RUSSIA IN UKRAINE**

November 2022

## BACKGROUND

The Russian Federation's use of Iranian-manufactured uncrewed aerial vehicles (UAVs) in Ukraine represents a notable development in the evolution of the conflict. Conflict Armament Research (CAR) investigators physically documented a number of these UAVs in Ukraine in November 2022 and are conducting a detailed dissection of their design characteristics and key components, comparing them with CAR's previous documentations of similar technology used in conflicts in the Middle East.<sup>1</sup>

This comparative analysis demonstrates that these UAVs did, as is widely reported,<sup>2</sup> originate in Iran, and that they include many recently manufactured components produced by companies mostly based in the United States. This raises important questions regarding the effectiveness of existing sanction regimes, most

notably United Nations (UN) Security Council resolution 2231, which prohibits the transfer of certain goods and equipment to or from Iran.

CAR field investigators have been documenting advanced weapon systems—including UAVs—that the Russian Federation uses in its war in Ukraine. This is the third dispatch from the field since the invasion in February 2022.

- In May 2022, CAR showed that these systems are highly reliant on components produced by companies based in Europe and the United States.<sup>3</sup>
- This analysis was updated in CAR's second dispatch in September 2022, which highlighted the critical commonalities in the technology used across Russian systems.<sup>4</sup>

## DOCUMENTATION AND COMPONENT ANALYSIS

Between 2 and 5 November 2022, a CAR field investigation team physically documented one Shahed-131 (marked 'ГЕРАХЬ-1') UAV, two

Shahed-136 (marked 'ГЕРАХЬ-2') UAVs, and one Mohajer-6 UAV.

**IRANIAN UAVS USED BY RUSSIAN FORCES IN UKRAINE INCLUDE MANY RECENTLY MANUFACTURED COMPONENTS PRODUCED BY COMPANIES MOSTLY BASED IN THE UNITED STATES.**

**Figure 1** A Shahed-131 UAV documented by CAR in Ukraine in November 2022.





**Figure 2** A Shahed-136 UAV documented by CAR in Ukraine in November 2022.



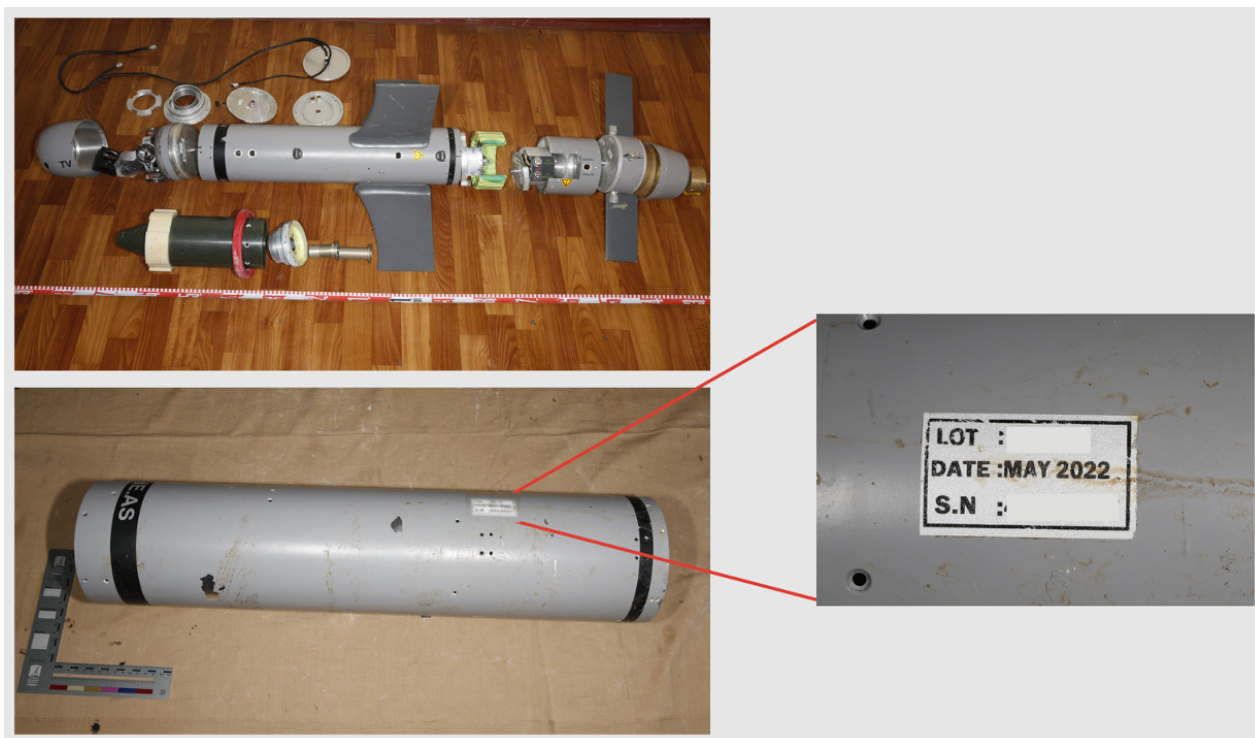
**Figure 3** A Mohajer-6 UAV documented by CAR in Ukraine in November 2022.



Investigators also documented one Qaem-5 precision-guided munition that bears markings showing that it was manufactured in May 2022. This date mark indicates that Iran has carried out at least some supplies since the invasion of

Ukraine in February 2022. CAR has withheld the serial and lot number from display in this publication in accordance with its tracing methodology.

**Figure 4** Markings on a Qaem-5 precision-guided munition indicating manufacture in May 2022. Documented by CAR investigators in Ukraine in November 2022.



CAR's analysis reveals that each of these documented UAVs, as well as the precision-guided munition, is made almost exclusively of components produced by companies based in Asia, Europe, and the United States. CAR documented more than 500 components spanning some 200 unique models across the four UAVs (495 total) and the Qaem-5 (23).

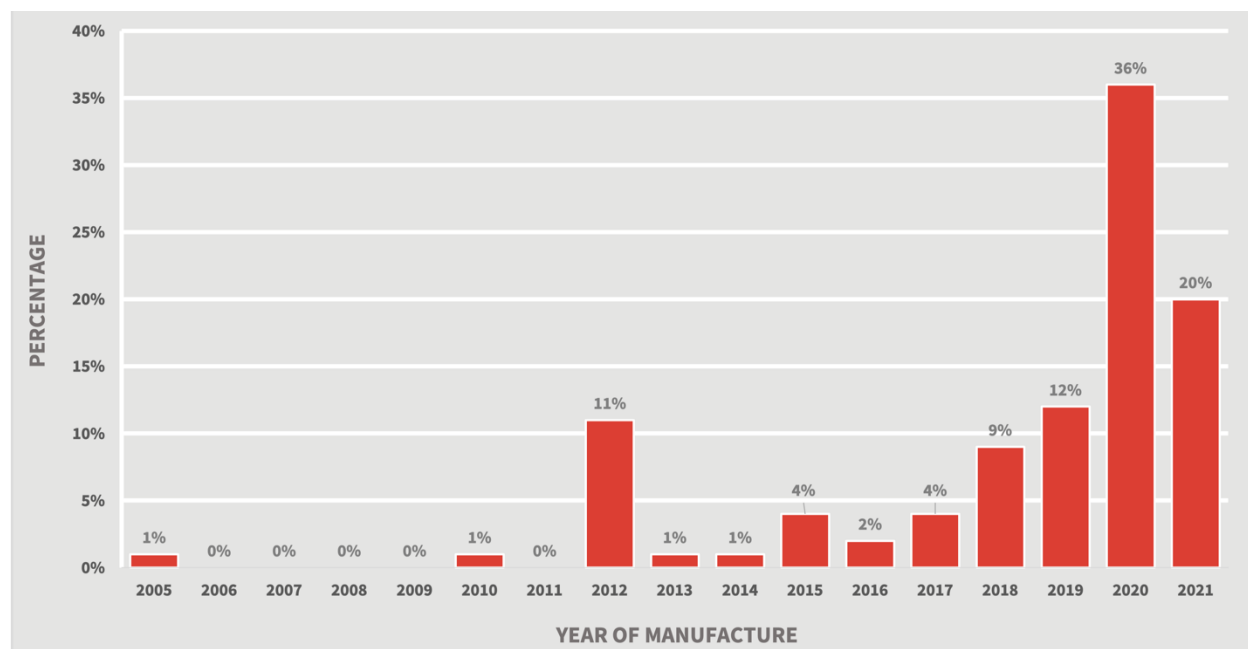
More than 70 manufacturers based in 13 different countries and territories

produced these components, with 82 per cent of them manufactured by companies based in the United States. CAR is not in a position to identify the manufacturers of the documented components publicly until formal tracing operations have concluded, as per CAR's methodology.

Many of these components have been recently manufactured, including a large number that were produced in 2020 and 2021 (Figure 5 below).



**Figure 5** Year of manufacture of components documented in Iranian materiel in Ukraine, where age could be identified (n=188)



## UAV COMPARISONS

CAR reached the conclusion that the UAVs documented in Ukraine are of Iranian origin based on visual comparison of six different physical features (cabling, labelling, airframe structure, servo motors, part and serial numbering, and mechanical gyroscopes) of the Shahed-131, Shahed-136, and Mohajer-6 UAVs documented in November 2022 in Ukraine, with four other Iranian UAV models that CAR documented in the Middle East between 2017

and 2022: a Shahed-141 UAV, a Shahed-197 UAV, and Qasef-1 and Sammad-pattern UAVs. The similarities in components across these systems strongly suggest that these UAVs share a common manufacturing origin in Iran.

CAR has obscured unique identifiers from this dispatch, in accordance with its tracing methodology.

## COMPARISON 1: CABLING

The cable connectors documented in each of the three systems in Ukraine are of the same brands and models as ones documented in a Shahed-141 in the Middle East. Figure 6 shows four cable connectors documented in different UAVs.

CAR also found two identical brands of heat shrinkable cable sleeves in all three models documented in Ukraine, and in three of the four UAV models documented in the Middle East.



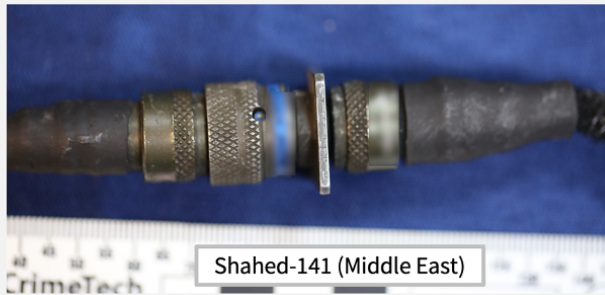
Shahed-131 (Ukraine)



Shahed-136 (Ukraine)



Mohajer-6 (Ukraine)

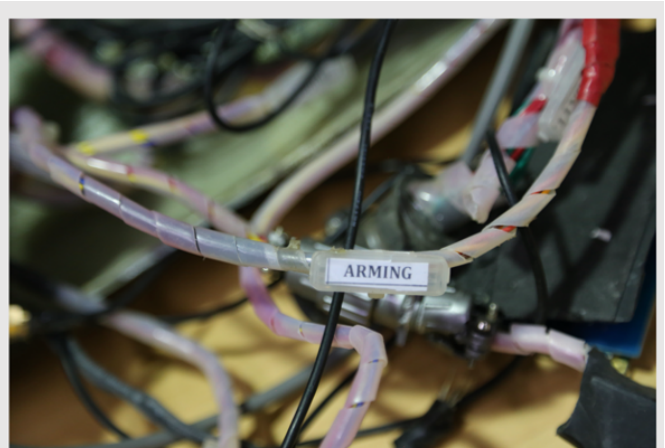
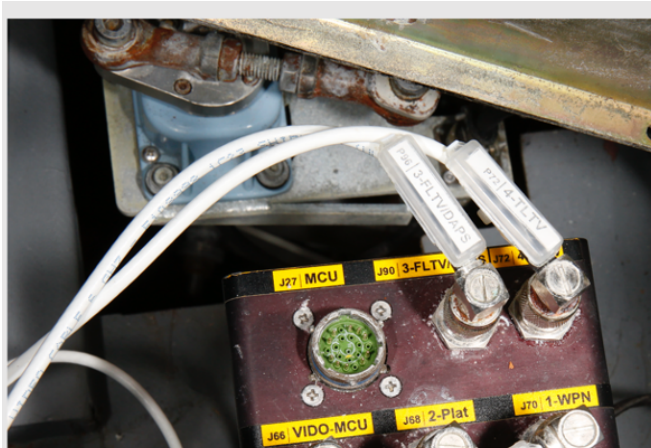


Shahed-141 (Middle East)

## COMPARISON 2: LABELLING

CAR found similarities between cable labelling observed in the Mohajer-6 UAV which CAR documented in November 2022 in Ukraine

(Figure 7, left) and in a Qasef-1 UAV previously documented by CAR in the Middle East (Figure 7, right).





### COMPARISON 3: AIRFRAME STRUCTURE

The inter-layered honeycomb airframe structure CAR observed in the Shahed-136 (Figure 8, left) UAV, and the Shahed-13 both

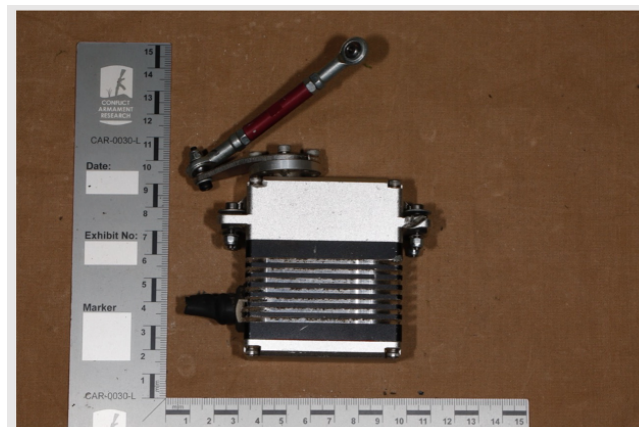
documented in November 2022 in Ukraine is similar to that of a Shahed-197 UAV previously documented by CAR (Figure 8, right).



### COMPARISON 4: SERVO MOTORS

CAR documented servo motors in the Shahed-136 UAVs documented in November 2022 in Ukraine (Figure 9, left) that resemble servo

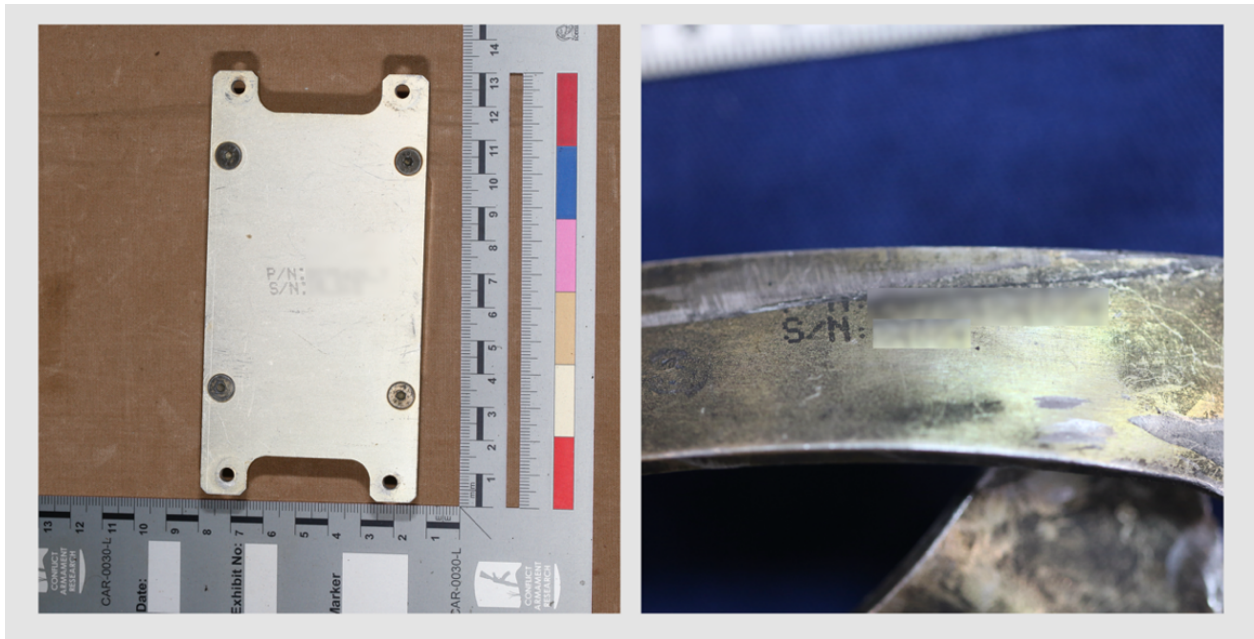
motors in a Shahed-141 UAV previously documented by CAR (Figure 9, right) and that may be a variant of the same model.



### COMPARISON 5: PART AND SERIAL NUMBERING

Part and serial numbering observed by CAR on components in the Shahed-131, Shahed-136, and Mohajer-6 UAVs in Ukraine is similar in its formatting. In the case of the Shahed UAVs, the dot-peened application is similar to numbering that CAR previously identified on parts of a Shahed-141. CAR has also

documented the use of dot-peened marks on Iranian conventional weapons.<sup>5</sup> Figure 10 shows the dot-peen markings of the part and serial numbers, comparing a component documented within a Shahed-131 in Ukraine and a Shahed-141 in the Middle East.



### COMPARISON 6: MECHANICAL GYROSCOPES

CAR found a mechanical gyroscope in a Mohajer-6 UAV in Ukraine that resembles

gyroscopes found in a Qasef-1 UAV previously documented by CAR (Figure 11).





## ADVANCED CAPABILITIES

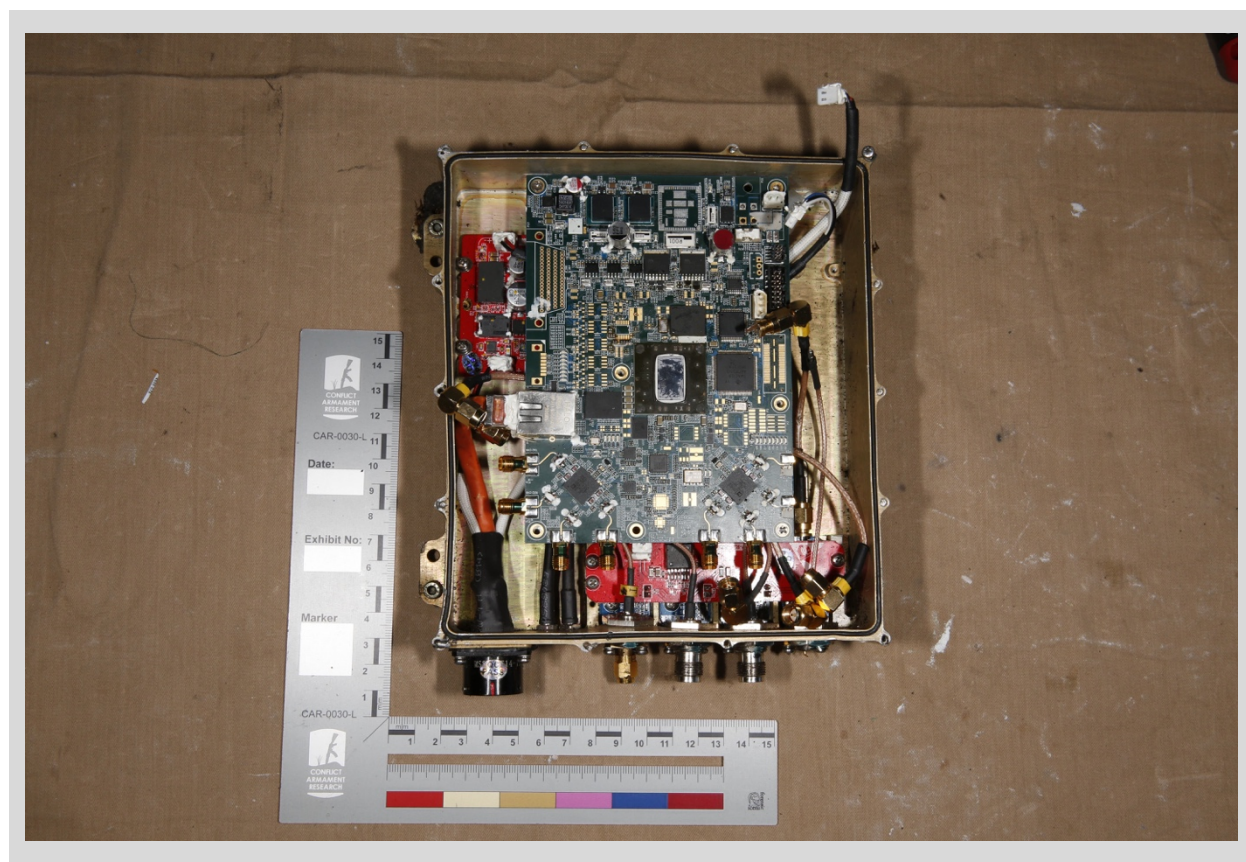
CAR's analysis suggests that the Iranian UAVs documented in Ukraine demonstrate a significant jump in hardware for single-use systems compared with other systems previously observed in the Middle East, which featured commercial off-the-shelf autopilots, accessories commonly seen in the hobbyist UAV community, and custom circuit boards of a much lower quality and older design era.

CAR has identified several features that significantly advance the capabilities of these single-use UAVs compared with previous systems. These features include methods that improve the accuracy of the Shahed-131 and Shahed-136 UAVs, as well as satellite navigation

modules that allow these two UAV models to operate in non-permissive environments.

The move towards higher-end technological capabilities in export model weapons used in Ukraine demonstrates that Iran has been able to circumvent current sanction regimes and has added more capabilities and resiliency to its weapons. The Shahed-131 and Shahed-136 UAVs that CAR documented in Ukraine include high-end components, such as semiconductors and tactical-grade inertial measurement units, that have been sourced outside Iran. Some of these components are on the US control list for hardware prohibited for export to Iran.

**Figure 12** A flexible software defined radio found by CAR in a Shahed-136 UAV in Ukraine November 2022.



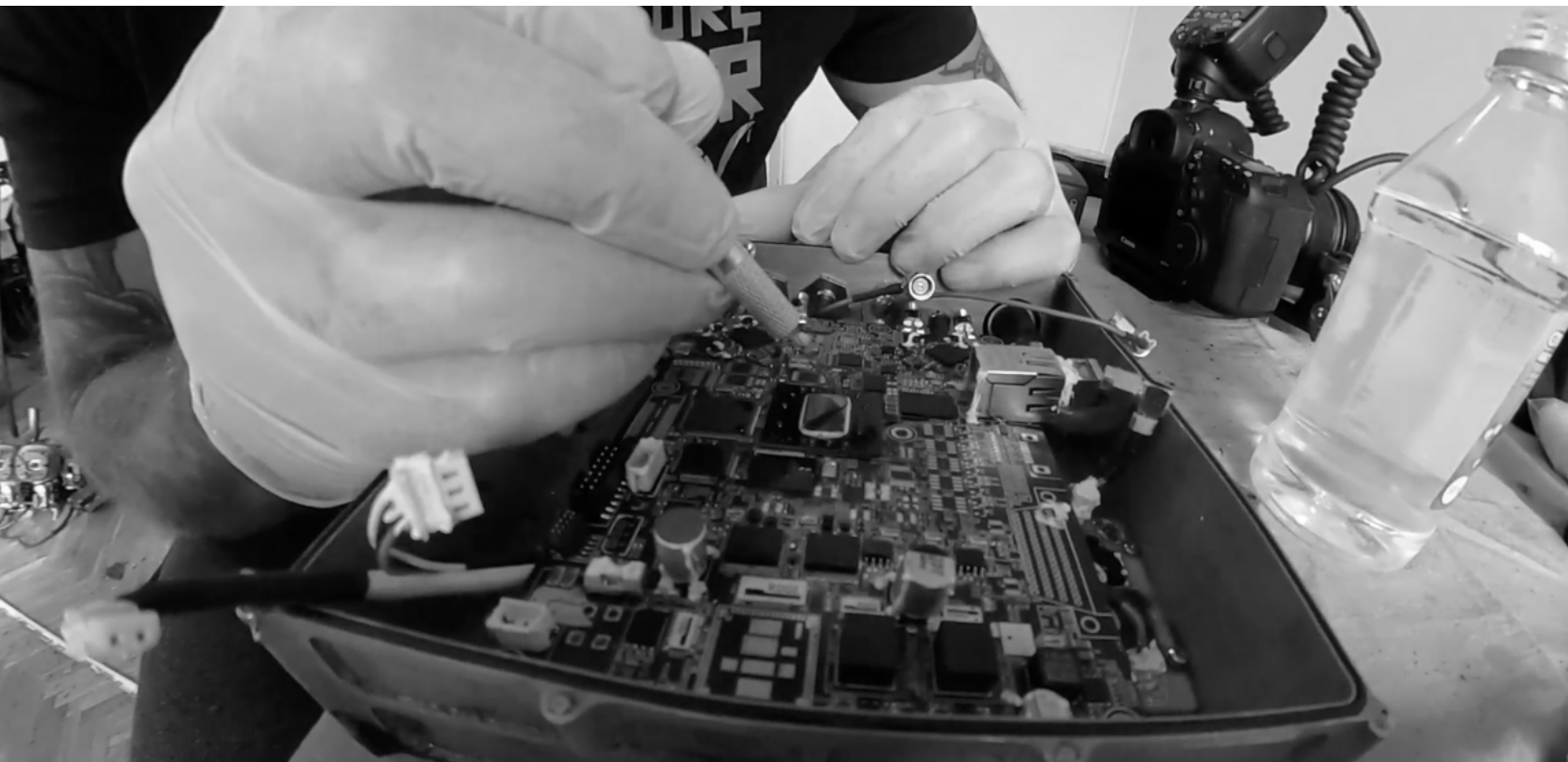
## INTERNATIONAL REGULATIONS

On 20 July 2015 the UN Security Council adopted resolution 2231.<sup>6</sup> This resolution endorses the Joint Comprehensive Plan of Action (JCPOA), which establishes restrictive measures on the transfer of certain equipment and technology to or from Iran unless states have obtained prior approval from the Security Council itself (paragraph 4 of Annex B, valid until October 2023).

The purpose of this resolution is to control goods and technology that could contribute to the development of nuclear weapon delivery systems. The full list of items subject to prohibition under resolution 2231 is detailed in the Missile Technology Control Regime.<sup>7</sup> The list includes ballistic and cruise missiles, as well as ‘unmanned aerial vehicle systems,’ with a range equal to or greater than 300 km. As the capable range of the Shahed-131 and Shahed-

136 UAVs documented by CAR in Ukraine meet these criteria,<sup>8</sup> these UAVs would therefore qualify as restricted items for transfer under resolution 2231. Following the adoption of resolution 2231 in 2015, any transfer of these UAVs from Iran to a third party without the prior approval of the UN Security Council would appear to be inconsistent with the obligations enshrined under this resolution.

Resolution 2231 also contains an asset freeze on certain individuals and entities, referred to as the ‘2231 List’. This list may be relevant for transfers of restricted items from Iran, and further investigation could help determine if individuals or entities procuring these UAVs from Iran provided funds or assets to designated individuals or entities under the 2231 List.





## RETHINKING IRAN'S UAV PROGRAMME

CAR's dissection and analysis of the UAVs used in the conflict in Ukraine confirms that the Russian Federation has—as has been reported—recently procured and used Iranian-manufactured UAVs. The apparent readiness of the Russian Federation to acquire such materiel from Iran may be in part a reflection of growing challenges as the war becomes increasingly protracted.

CAR's recent documentations also shed new light on the previously held view that Iran's UAV programme is based primarily on domestic defence production capabilities<sup>9</sup>, as sanctions create severe import restrictions. CAR's documentation of these four UAVs in Ukraine demonstrates that the Shahed-131, Shahed-136, and Mohajer-6 UAVs are in fact highly dependent on components and technologies produced outside Iran. As such, Iran's use of

foreign components in UAV production mirrors the Russian Federation's reliance on non-domestic technology, as previously documented by CAR.

CAR continues to investigate the exact chains of custody of military equipment and related commodities that result in their presence in Russian and Iranian weapons. CAR does this by tracing documented components with their manufacturers to confirm their provenance and onward supply. These trace requests will help to inform companies and governments on the presence of such components in advanced Russian and Iranian weapon systems used in the war in Ukraine. CAR's tracing operations also highlights supply chain vulnerabilities that allowed the Russian defence industry to acquire components, as well as associated diversion risks that remain to be addressed.

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## ENDNOTES

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<sup>1</sup> See for example, CAR (2017) and CAR (2020).

<sup>2</sup> Nissenbaum, Dion, and Faucon, B. (2022).

<sup>3</sup> CAR (2022a.)

<sup>4</sup> CAR (2022b.)

<sup>5</sup> CAR (2021).

<sup>6</sup> United Nations Security Council (n.d.).

<sup>7</sup> Missile Technology Control Regime (MTCR) Annex, Current version updated 21 October 2022.

<https://mtcr.info/mtcr-annex/>

<sup>8</sup> See for example, Sabbagh, Dan, Higgins. C. and Lock, S. (2022).

<sup>9</sup> See for example, Barrie, D. (2021).