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Red Six Solutions, LLC

Flash Report (FR) 009

UAS Event of Community Interest

December 4, 2019

SUBJECT: Houthi Rased UAV

Summary:

On 4 December 2019, Yemen Now posted an image showing the inside of a Houthi Movement *Rased* Unmanned Aerial Vehicle (UAV) which was recovered in Al-Jawf, Yemen. The Houthis use the *Rased* UAVs primarily for observation and surveillance; however, photos posted on social media sometimes show them armed with explosives or carrying small packages. Ordinarily, pictures posted online of Houthi aircraft provide little information about their components. What is useful about this image is it provides a good view of aircraft's autopilot, battery, and wiring, as well as some aspects of its overall design.



Inside compartment of recovered Rased UAV (photo: Yemen Now)

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Background

Houthi-Movement rebels, officially *Ansar Allah*, copied the design of the *Rased* from the Skywalker X8 drone, which is a remote control (RC) aircraft manufactured by Chinese company Skywalker Technology Co. Ltd. The *Rased* uses a flying wing design. With a wingspan of a little over seven ft. wide, the aircraft is small. It is just a fraction of the size of similarly shaped drones used in the attacks conducted against the Abqaiq-Khuraib petroleum infrastructure in Saudi Arabia this past September.

The post on Twitter did not include a complete picture of the aircraft. As such, any context for where the aircraft was when the picture was taken or what might have happened to the aircraft is absent. For reference, the image below is a picture of a complete *Rased* that was recovered in September 2018 (Source 2). This particular *Rased* was setup with a mechanism to enable it to carry a weapon (not shown).



Figure 1 - Houthi Rased UAV recovered in September 2018 (photo: Lost Weapons)

Analysis:

Before describing the components of the *Rased*, which was recovered this week, a couple of notes on its composition. While the Chinese manufactured Skywalker X8 is made of Expanded Polyolefin foam (EPO), the recovered *Rased* is made of Kevlar synthetic fiber. Kevlar is lighter and more durable than EPO. It also has a smaller radar cross section than EPO. Whoever made this *Rased* and others recovered in Yemen, probably built a mold using a Skywalker X8 fuselage then, made multiple copies of it using Kevlar instead of EPO. A close look inside the fuselage of the *Rased* does show some pieces of EPO. Those pieces of EPO are there to provide anchor points to attach the components and wiring to the aircraft and possibly to

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provide some vibration dampening. The image below of the *Rased* is labeled to make it easier to follow the discussion.

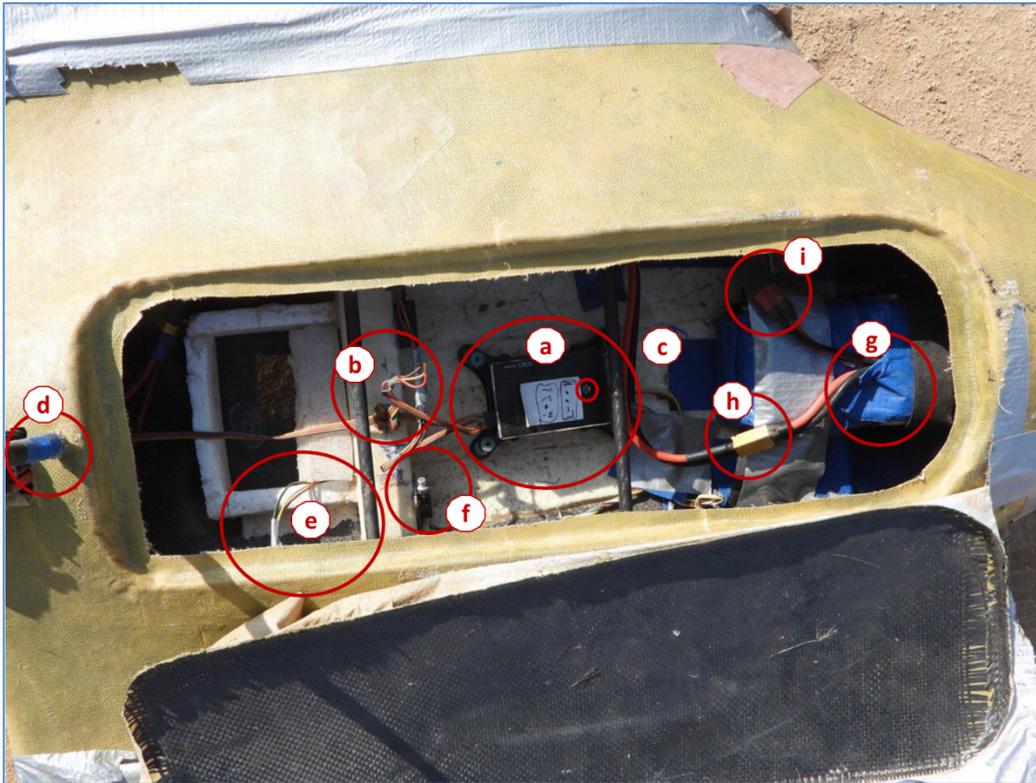


Figure 2 - Labeled components of the Rased UAV

- a. **Flight controller:** The aircraft used a PixHack autopilot for its flight controller. The PixHack is marketed toward commercial manufacturers of drones. It is based on the PixHawk-project open hardware design and is fully compatible with both PX4 or ArduPilot firmware. The flight controller is recognizable as a PixHack, even though the product label was removed, because of the location of the small LED light used display the controller's status (see small red circle inside circle a.).
- b. **Radio receiver:** The *Rased's* remote control receiver was removed from the aircraft. What remains are the wires which would have connected it to the flight controller. A likely radio receiver for this type aircraft is something like the RMILIC NB20 UHF system. While there is no indication of what type of radio receiver the aircraft had, the NB20 is exemplary because it is a 20 channel radio with a selectable 5W output that can transmit at 433 MHz, enabling it to communicate at the long ranges necessary for UAS operations in open, desert environments.
- c. **Telemetry module (absent):** The aircraft was setup without a telemetry capability meaning it was flown using first person view (FPV) and was incapable of autonomous flight. Had there been a telemetry module, there would be a ribbon coming from the right-side of the flight controller. The ribbon would be connected to a software-defined radio (SDR) to either communicate with the ground station or to accept a

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preset flight plan. A common SDR in this type of configuration would be the RFD900 Radio Modem, which is designed for long range, serial communication on ISM bands.

- d. **Video antenna:** The video antenna enables the pilot at the ground station to see through the FPV camera and fly the aircraft.
- e. **GPS (absent):** The GPS for the aircraft was also removed with only the connector wires remaining.
- f. **Arming switch:** The arming switch is a safety feature that enables the pilot to enable or stop the motor independent of the electronic speed controller (ESC).
- g. **Batteries:** The blue tape wrapped around the batteries indicates they were removed from their original shrink wrapping and reconfigured. This may have been done because their original shape was unable to fit inside the fuselage or to enable the aircraft builder to add additional battery cells to the configuration. Also noted: There is piece of silver duct tape underneath the blue taped batteries, which appears to be securing additional batteries. The combined stored energy of all these batteries would enable the *Rased* to stay in the air a long time, at least one hour and probably longer.
- h. **ESC connector:** This is the main connector from the batteries to the motor.
- i. **Deans connector (unused):** There are wires and an unused Deans connector coming from the batteries. This connector could be used to power an external payload, such as a surveillance camera or drop harness for an explosive device.

Sources

- a. Yemen Now (Twitter account), The National Army in al-Hesam brigade border guards down a militia Houthi drone, 4 December 2019, <https://twitter.com/ALyemennow/status/1202242301071908865/> [accessed: 4 December 2019]
- b. Lost Weapons (Twitter account), 1st complete Houthi Skywalker, 16 September 2018, <https://twitter.com/lostweapons/status/1041417125934456832/> [accessed: 4 December 2019]

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Contact Information

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