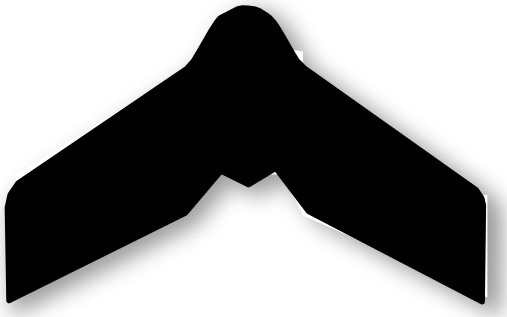
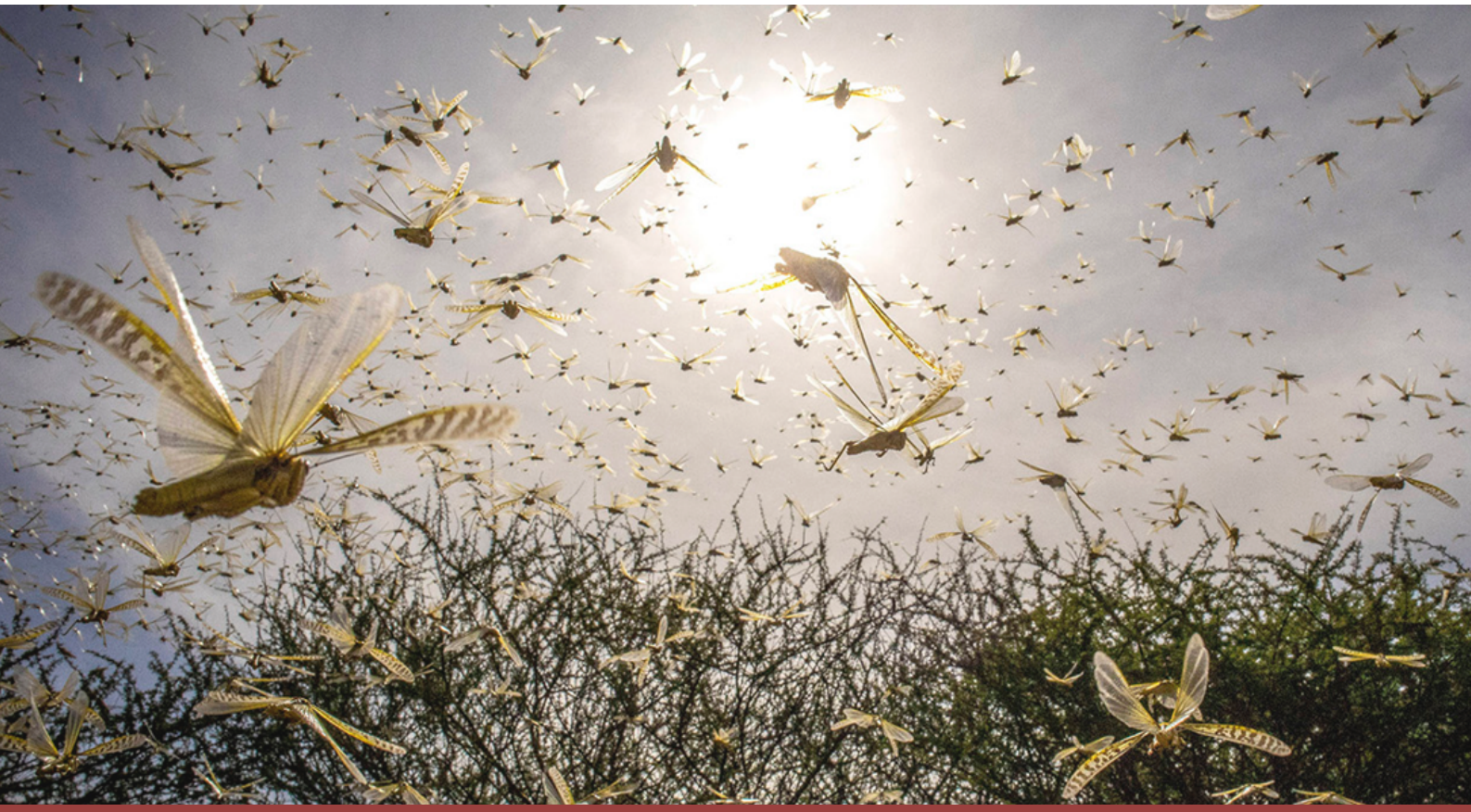
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

The use of drones for Desert Locust survey





Food and Agriculture Organization of the United Nations

SUMMURY

The use of drones for Desert Locust survey in Kenya

1. Introduction and background

Vast areas of remote desert within approximately 16 million sq. km. that stretch from West Africa to India and include some of the world's poorest countries are regularly monitored for Desert Locust by national ground teams. Monitoring constitutes the primary activity in any locust early warning and response. Although satellite-based estimates of rainfall and green vegetation are utilised to reduce and prioritize these large and potentially suitable areas, imagery suffer from omission errors and are often not available in time. Aerial surveys are usually not possible due to high costs and unavailable aircraft. Consequently, there is a need to supplement these tools with additional technologies to guide ground teams to green vegetation and locust infestations. Fixed-wing drones can be used to assist in identifying potential areas of locust development, including large, insecure and inaccessible areas, which should improve Desert Locust monitoring, early warning and rapid control and reduce the cost of survey operations. Overall, drones can contribute to a stronger Desert Locust preventive control strategy as well as better addressing crises when they occur. This was confirmed by a study conducted by Wageningen University, Netherlands, in 2015, and the idea to use the drones in Desert Locust management was proposed by the FAO Desert Locust Information Service (DLIS), and during the regional workshop on research held in November 2015 and organized by the FAO Commission for controlling the Desert Locust in the Western Region (CLCPRO), it was recognized that drone technology had become sufficiently mature to be utilized in Desert Locust management.

Accordingly, three trials were conducted by FAO in collaboration with Hemav Foundation during the past two years to develop and test a cost-effective set of drone-based tools to detect potential breeding areas and locusts and then conduct well-targeted control operations. The trials took place under real conditions in typical Desert Locust habitats in affected countries, in Mauritania in March 2018 and January 2020 and in Oman in January 2019, in collaboration with the FAO regional Commissions for Controlling the Desert Locust in the Western Region (CLCPRO) and Central Region (CRC) and DLIS.

Different types of drones with different sensors were tested. This joint work allowed addressing technical challenges related to aeronautics and sensors data processing, drone robustness for desert conditions, operability (size, take-off/landing system, navigation) as well as a number of issues related to flight procedures and daily operation, including system capability to perform long-term flights, communication and data transfer capabilities during the flight, simplicity of use, battery recharging, and maintenance. Linkages were also established with the existing eLocust3 tablet and other Android devices for communicating with the drone, specifically for the operation preparation and guiding it automatically whenever possible; automatic processing and manual viewing photos or videos of green vegetation and locusts; and receiving related data (geolocation, vegetation and locust characteristics). As a result of this work, appropriate and customized drones for Desert Locust detection are now ready to be deployed.

2. The solution

The solution as described above is called **dLocust** and consists of launching a fixed-wing drone by a survey team in a breeding area or elsewhere where locusts are thought to be present. The drone should be capable to fly some 80–100 km while collecting data on the location of green vegetation and processing this imagery on board as a map.

The drone is capable to perform different missions depending on the situation and the needed information:

- Rectangle mission
- Straight mission
- Zig-Zag mission
- Periscope mission

The drones are lightweight, portable, durable, easy to use and maintain. dLocust is integrated with eLocust3 the hand-held rugged tablet used by survey and control teams for recording observations and transmitting them in real-time by satellite. It can also be used with other Android devices. These devices are used for all dLocust flight operations and to view the data collected by the drone as well as navigating to identified areas. dLocust would be the property of the National locust centers, which would be responsible for managing and using dLocust as required.

2.1 Characteristics of the developed drone

- **Operational capabilities**: Ability to fly under operational conditions for more that 90 min and cover up to 80 Km.
- **Tested and developed in the desert on three field trials**: Proper level of robustness to allow operations under extreme environmental conditions.
- **Vegetation detection**: Equipped with a monospectral camera and an embedded computer that allow to automatically detect vegetation during the flight.
- **Detection and surveillance of desert locust swarms**: Equipped with a high-resolution camera for detection of Desert Locust hopper bands and swarms.
- **Easy to deploy, handle and maintain**: After a few steps and a safety check, the drone is ready to fly in less than 15 minutes.

2.2 Components of the solution

- **Hardware**

(a) Basic equipment (required):
    - 1 fixed-wing HP2 drone with integrated monospectral and visual sensor system
    - 2 LiPo battery
    - 1 Battery charger
    - 1 Launch system (bungee)

(b) Extra equipment (optional):
    - 4 LiPo batteries
    - 1 Satellite coverage (20 000 messages)
    - 1 Power generator
    - 1 Spare parts*

- **Software**
  dLocust application: compatible with eLocust3 and any other device with an Internet search engine and Android OS.

3. Training of the national locust officers

The training of the national officers of the Locust Control Unit will be achieved by completing a four-step process:

(a) **Online courses** to acquire all theoretical knowledge necessary for the operation of drones;
(b) **Face-to-face lessons** to make sure that the theoretical lessons were understood, to prepare the field officers for the practical exercises, and to explain the entire operation of the drone and proper handling of all equipment;
(c) **Field training** to apply the learned knowledge under real conditions;
(d) **Training courses** for drone maintenance to ensure the reliability of the drone and perform periodic maintenance.

4. Impact

In a few years' time, the regular integration of dLocust with current survey activities undertaken by national teams on the ground will enhance the efficiency and timeliness of Desert Locust monitoring and early warning, leading to a decline in frequency, duration and intensity of devastating plagues, and improving food security and livelihoods. It will allow each ground team to cover much larger areas and access those that are difficult or impossible such as sand dunes and insecure zones. Moreover, using drones for control will minimize risks to humans and make operations more effective and safer for the environment, leading to a reduction in the use of chemical pesticides.