



IRIDIUM® TECHNOLOGY ENABLES TROPICAL CYCLONE FORECASTS IN THE SOUTH-WEST INDIAN OCEAN

The ReNovRisk project uses innovative technology to improve the understanding and modelling of tropical cyclones in the South-West Indian Ocean (SWIO), with the goal of making populations in the SWIO less vulnerable to the hazards associated with cyclones. Iridium Connected unmanned aerial vehicles (UAVs) allow the program operators to take advantage of Iridium's Global Line of SightSM services to perform missions that allow them to better understand storm formation and provide more precise weather forecasts.

THE CHALLENGE

Gathering weather data is instrumental for understanding the cyclone phenomenon and related hazards in order to make populations and territories less vulnerable to extreme weather. Most islands affected by tropical cyclones in the SWIO, like Madagascar, Mauritius, and La Reunion, do not have the resources to protect against major disasters. It is crucial to determine when and where tropical cyclones are most likely to make landfall in order to protect these populations.

Collecting weather data is not an easy task. Piloted research aircraft cannot fly at very low altitudes for safety reasons, but

COMPANY

- **ATMOSPHERE** is an engineering company with a core expertise in aeronautics, satellite telecommunication, networking, and weather science.
- **Iridium** owns and operates the world's only truly global satellite communications network, with solutions that span from pole-to-pole. Iridium provides superior voice and data communications solutions that allow global companies, government agencies, and individuals to stay connected everywhere.
- **BOREAL SAS** is an UAV operator using aeronautical technologies to design, develop, and build UAV systems, particularly for scientific applications and measurement collection.

CHALLENGES

- The atmosphere over the Indian Ocean is critical to explain cyclone formation, but there are safety barriers to studying it.
- Historically, pilots tasked with gathering data in the atmosphere had limited ability to retrieve accurate data, and real-time weather information.
- Traditional UAVs equipped with radio connectivity can only operate within a 50-kilometer radius from shore. If an aircraft needs to be redirected because of a tropical storm, there is a high probability of losing contact with it.

BENEFITS

- Thanks to Iridium technology, scientists can collect extremely valuable data which can only be sampled by UAVs.
- The Iridium Connected drones allow quick retrieval of situational data and extend the range of operations in the SWIO from ~50 km to 250 km (500-600km round trip) through Global Line of Sight (GLOSSM) technology, limited only by the drones' operational range, rather than their communications.

a cyclone zone at 50-meter altitude can provide a wealth of important weather data. Meanwhile, UAVs can reach low altitudes and provide accurate observations – but, they also have limitations.

Many scientists and researchers rely on UAVs with integrated line-of-sight radios for gathering weather data. Historically, the ReNovRisk project used drones with radio connectivity to study the SWIO's atmosphere, but the range of operation of the radios was only about 50 kilometers. The collection of data was possible, but insufficient due to the limited distance the radio could transmit. Not only were scientists limited by altitude and radio range, but they were also challenged by quickly-developing storms. Missions were often rerouted or even canceled due to weather.

From these limits grew the need for a new, innovative approach that would allow scientists to collect weather measurements and turn them into actionable data.

THE SOLUTION

The ReNovRisk scientific project was aimed at analyzing the hazards associated with tropical cyclones and their impacts on the economic development of countries around the SWIO. The program, conducted by Meteo France, The French National Meteorological Service, and drone-manufacturer BOREAL SAS, took place in February and March of 2019. The BOREAL UAVs were launched from Reunion Island.

The scientific objective of this campaign was to sample the atmosphere over the Indian Ocean in areas of cyclone formation, allowing researchers to better understand these storm patterns and improve weather modelling and forecasts. The BOREAL UAVs used the PLANET Terminal from Iridium partner ATMOSPHERE. In addition to PLANET Terminal, BOREAL UAVs were equipped with scientific sensors to measure pressure, temperature, humidity, wave level, and solar radiation, among other important metrics. The data collected from these sensors is crucial for researchers to continue analyzing the size and direction of storms, and relay the information back to meteorologists. The role of Iridium connectivity was critical, as it enabled the operators to take advantage of Iridium's Global Line of Sight services to provide command and control of the UAVs, allowing the operators to modify flight plans when necessary in real-time.

The safe return of the UAVs – and the collected data – was made possible by the Iridium Core 9523 transceiver and RUDICS service. The truly global reach of the Iridium network extended the range of the UAV operations, allowing the remote pilots to redirect the drones to avoid storms, and keep in constant communication throughout the duration of the flight.

Service Provider: ATMOSPHERE
Product: ATMOSPHERE Planet Terminal
Enabling Product: Iridium Core 9523 Transceiver
Enabling Service: Iridium RUDICS

Additionally, connected by Iridium, the Boreal UAVs could fly at varying altitudes, including extremely low heights, that are unsafe for piloted aircraft. The flexibility of the UAVs and the reliability of Iridium helped researchers make precise observations and gather important weather data, both of which are instrumental for understanding the SWIO tropical storms.

THE RESULT

The ReNovRisk program enabled scientists around the world to collect the extremely valuable data necessary to better understand tropical storms' formation.

“Thanks to the Iridium service, ATMOSPHERE successfully supported the RENOVRIK UAV mission. Iridium satellite connectivity secures BOREAL's long-range flights in Beyond Visual Line of Sight conditions, removing the limitations of terrestrial radio datalinks. Essentially, thanks to Iridium we've gone into airspace no man has gone before. In addition to that, during flight operations, the UAV could be flexibly controlled in varying weather situations via Iridium connectivity,” said Jean Marc Gaubert, Managing Director of ATMOSPHERE.

Throughout the two-month mission, Iridium Connected drones performed 12 scientific flights in international waters up to 250 kilometers offshore and to a height of 1,000 meters above sea level. The UAVs performed 54 hours of cumulative operation and traveled for more than 5,000 kilometers.

TAKE AWAY

With Global Line of Sight capabilities, the Iridium Connected UAVs used in the ReNovRisk project, were able to reach previously inaccessible airspace, allowing researchers to collect crucial storm data. This important project gathered extensive new data being used to improve storm modelling and forecasting tools, as well as meteorologists' understanding of tropical cyclones on the islands of the South-West Indian Ocean.



BOREAL UAV

ATMOSPHERE