

IS42: COVID-19 breakdown Operation and Maintenance constrains in the Azores Islands

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Located on the island of Graciosa, Azores, the infrasound station's (IS42) operation and management (O&M) activities are carried out by two station operators, a local operator and IVAR technical staff.

The operation is carried out remotely from the IVAR facilities, located on the São Miguel Island. Inspection and preventive maintenance are carried out at 15-day intervals by the local operator and bimonthly by a station operator. This is performed annually by both operators, IVAR staff and subcontracted companies. Air travel between São Miguel and Graciosa last two hours, including Terceira Island.

The first COVID-19 active case occurred in the Azores on March 15. On the nine islands with 243 000 inhabitants and initially only one with a limited yet COVID-19 capable health care infrastructure, the Government of the Azores implemented restrictive measures to mitigate the virus propagation and monitored the related epidemiology.

The IVAR also implemented restrictive actions in its contingency plan. Those constraints included, among others, closure of public and private services; confinement of visitors and residents; establishment of sanitary fences; suspension of air links, etc.

We present here a timeline of the active cases, the related constraints and O&M actions taken, with the PTS support, to guarantee the mission capability of the station.

IS42 Station

IS42 is located in Graciosa Island, Azores archipelago, in the middle of North Atlantic Ocean (Figure 1).

IS42 is composed by an array with 8 elements and a Central Facility (CF), designed in a 1 km aperture pentagonal main array with an inner 200 m aperture triangular sub-array. Both are linked to the CF via optical fibre (Figure 2).

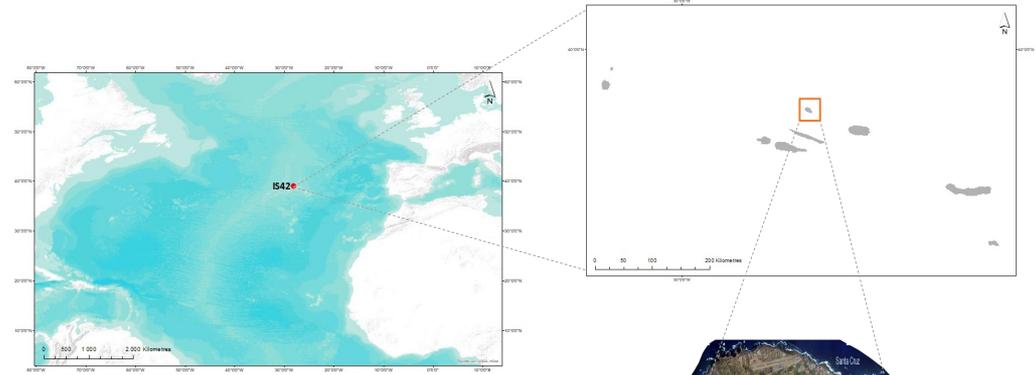


Figure 1 - Graciosa Island location.



Figure 2 - IS42 location and geometry.

Covid-19 in the Azores Islands

The Azores islands, as an outermost region of the EU, with a great territorial discontinuity and with important constraints in terms of accessibility and health resources, namely the existence of only 3 hospitals for the 9 islands (Figure 3).

These limitations have been particularly experienced during the pandemic of COVID-19, forcing the authorities to take particularly severe decisions of confinement and restriction of mobility, with the risk of losing rapid control of the situation.

IS42 O&M tasks were affected by those restrictions, demanding extra team efforts to keep good DA, causing also more stress to PTS.

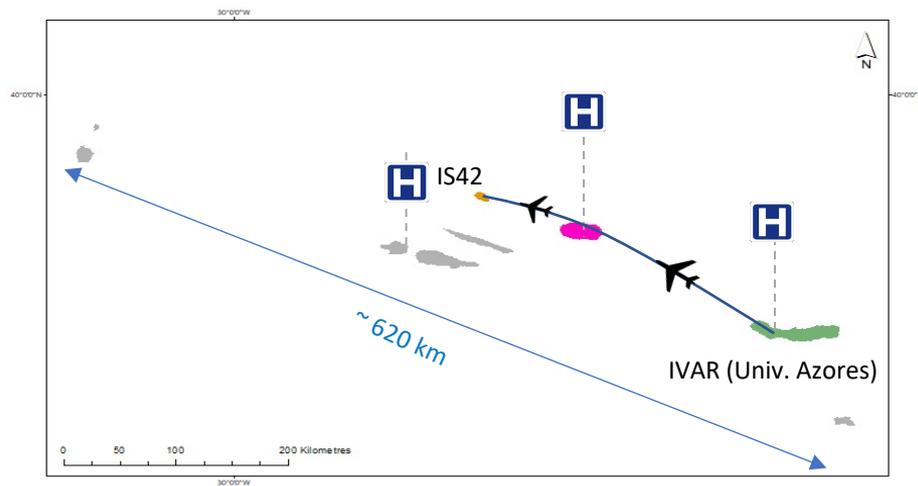


Figure 3 - Hospitals in the Azores Islands (3). To visit IS42 from IVAR headquarters a total of 1 hour flights are needed with a stopover on Terceira Island (pink).

Covid-19 - Data collection

Analysing the COVID-19 situation in the islands that could affect IS42 O&M: São Miguel, Terceira, and Graciosa, data were collected based on the daily reports submitted by the Azorean Regional Government.

Data were compiled and organized in order to determine daily active cases, considering the number of a) new cases; b) recoveries; and c) deaths, shown in a time series diagram for the period between 14-03-2020 and 10-06-2021 (Figure 4).



Figure 4 – Time series distribution of daily active cases between for the period between 14-03-2020 and 10-06-2021, for the Azores (red), São Miguel (green), Terceira (purple), and Graciosa (orange) islands.

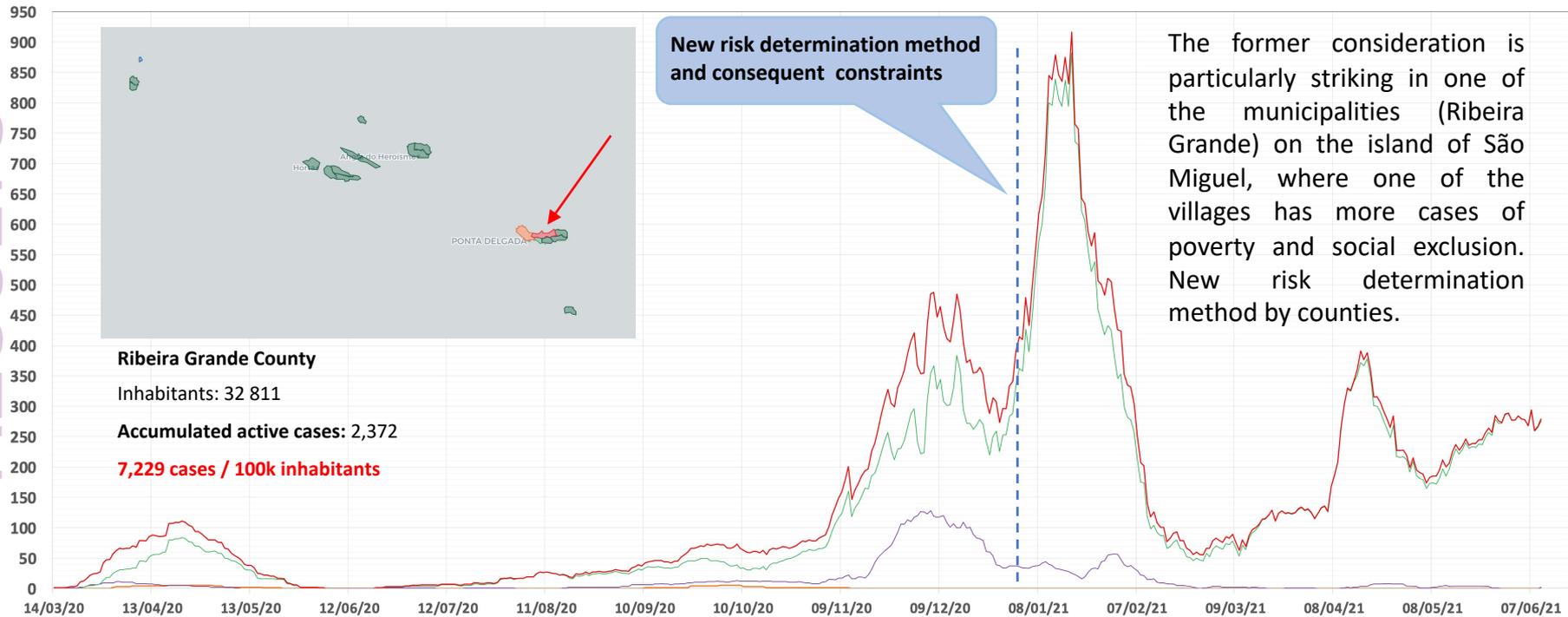
Covid-19 - Data collection

	Max. daily active cases (N/Day)			Nº of notified Deaths	Lethality (%)	Accumulated active cases (N)		
	N/Day	% (Population)	N/100k Inhabitants			N	% (Population)	N/100k Inhabitants
Azores	916	0.38	377	33	0.57	5,808	2.39	2,392
São Miguel	882	0.64	642	28	0.55	5,128	3.73	3,738
Terceira	128	0.23	232	5	1.03	487	0.88	883
Graciosa	5	0.12	119	0	0.00	11	0.26	261
Portugal	16,432	0.16	160	17,043	1.99	855,432	8.31	8,308

Taking into account similar living habits and if we look at the total number of accumulated cases for the period under study, we can see that the Azores have a significantly lower number of cases per 100k inhabitants than mainland Portugal.

On the contrary, if we consider maximum numbers of active cases per day, we can see that the numbers in the Azores are much higher and concentrated in time and space, with special incidence on the most populated island, São Miguel.





RESULTS

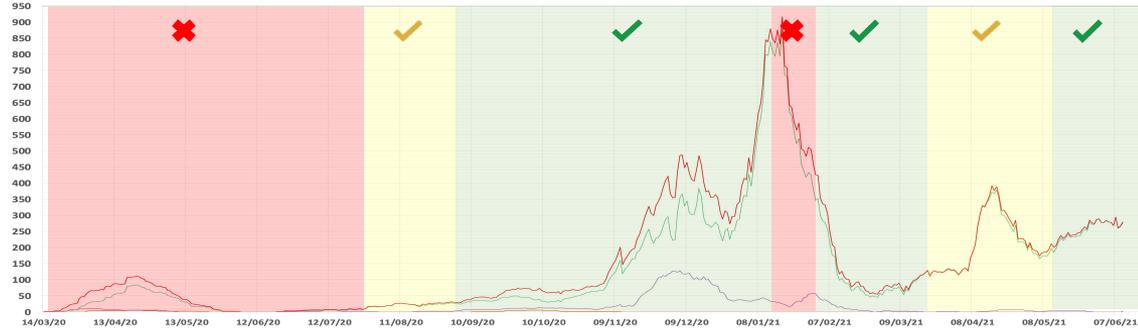
Access restrictions

According to the evolution of active cases of Covid-19 in Azores and its risk level, the main restrictions impacting the IS42 O&M applied, were:

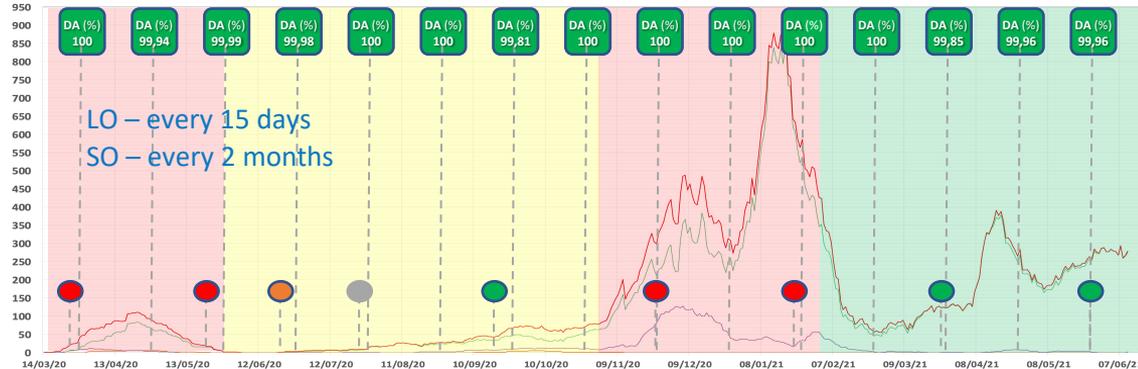
- interdiction (pink) and limited access to the Lab (yellow);
- a ban (pink) or severe restrictions with due justification (yellow) on inter-island flights. When allowed, they implied previous negative COVID test results and later confinement,

Planned bimonthly visits to IS42 by the SO were cancelled (grey and red circles) or postponed (orange circles). From the 8 planned visits, only three were performed in the expected dates (green circles). LO performed part of the tasks due on the cancelled visits.

Access to the Lab



Visits to IS42

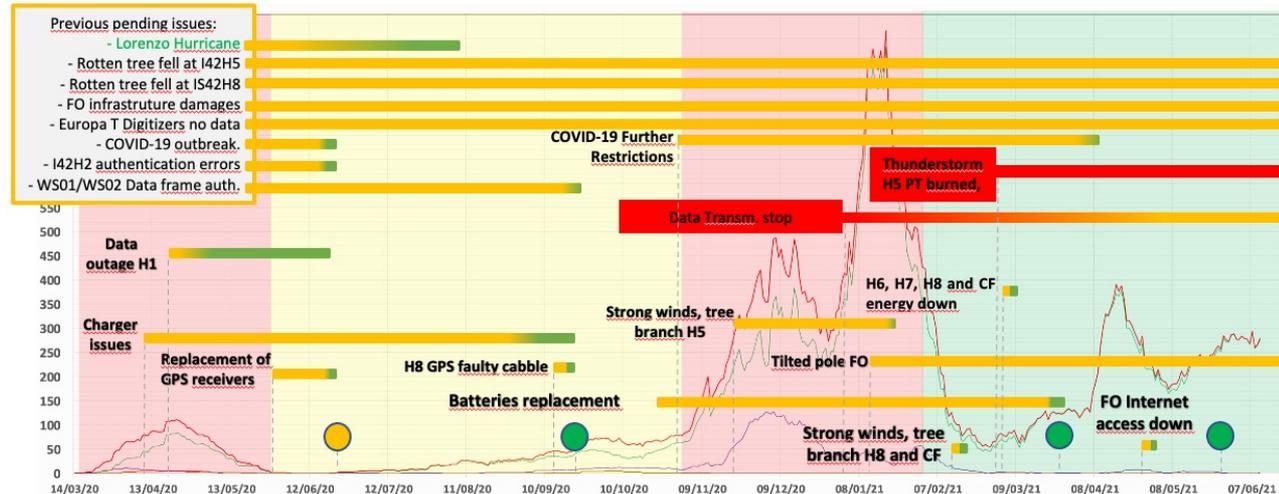


Problems and pending issues

Several pending issues and the occurrence of new demand extra efforts from the IS42 team to plan a new strategy to troubleshoot them when possible. Some of them had a quick solution, even from home with actions from the LO and the support of the PTS.

We present here three pending issues (boxed on the left) and the main problems that affected the station. The horizontal bars represents the time duration to solve the problems, from orange to green (when solved). In red the two major problems that can lead to a Non-Mission capability status.

All the troubleshooting processes, namely the ones that implied visits to the station, were delayed by the COVID-19 constraints, although we managed to keep excellent DA values (over 99.81% - see previous diagram). In 2021 the PTS was less responsive, especially MFS, as it is understandable facing the pandemic restrictions.



- IS42 is located in the Azores Islands, an outermost region of the EU, with a great territorial discontinuity and with important constraints in terms of accessibility and health resources;
- These limitations have been particularly experienced during the pandemic of COVID-19, forcing the authorities to take severe decisions of confinement and restriction of mobility, to face the risk of losing rapid control of the situation;
- The approaches made by the authorities allowed the occurrence of new cases to be concentrated in time and space. With the emergence of the alpha variant (from UK), the situation became dominated by communitarian transmission;
- The restrictions imposed by the response to COVID-19 on the O&M activities of the IS42 station can be divided into 2 levels: The limitation of access to the laboratory, working from home; and the limitation to travel to visit the station;

- Operators had to spend several intermittent months working from home and several bimonthly visits to the station were canceled or postponed. The canceled visits were substituted by partial tasks performed by the LO. Nevertheless, DA never went below 99.81% (from March 2020 to May 2021);
- We had to deal with several pending issues and new problems that occurred during this period. Some of them had a quick solution, but most of them are still pending. In 2021 occurred two serious (still pending) problems that may lead to a station Non-Mission capability state;
- Some delays and extra work team efforts were needed to overcome the problems due to the COVID-19 pandemic restrictions. All the processes were slower. From the PTS and as expected, we noted a slower response during this period, in particular from MFS in 2021.
- We believe that some of these problems can be solved faster and with less workload to MFS with a different approach in the PCA contract Optional expenses category.