

The Large-Format Reserve - XXL

The museum saw the completion of a major project in 2024, with the commissioning of the new large-format storage area. More than 3,000 m² are now reserved for the conservation of fragile or stored aircraft pending exhibition, particularly those of very large size. Thanks to a double-envelope system creating a "thermos" effect, the building's interior atmosphere is very stable at lower energy costs, thus meeting the initial objective of a sustainable project.

The completion of this project, launched three years ago and overseen by the Buildings and Infrastructure Maintenance (BMI) team until its completion on March 20, 2024, is excellent news for the health of the aircraft, particularly the metal ones. Aircraft preserved in poorly insulated hangars or on the tarmac will be able to be stored in good conditions and will be better protected. The large-format reserve, located in Dugny, is connected to the museum and the runways at Le Bourget via a pre-existing taxiway nearby. An innovative building, at first glance, the RGF looks like a metallic gray parallelepiped placed on a piece of land, like a warehouse. Except that upon closer inspection, it is much more than that. The building, which is over 50 meters wide and 60 meters long, was designed by architect Hugues Fontenas, who has designed various conservation centers, including those at the National Maritime Museum and the Poitiers museums. The building was designed and designed to meet all the needs and constraints gathered from internal teams prior to the project: protecting rare collector's items, being as environmentally friendly as possible, being durable and easy to use, among other things.

Thanks to its monumental 40-meter-wide and 12-meter-high [hangar door](#) with sliding-turning panels, allowing for a full-width opening, the RGF can accommodate aircraft of all sizes, including XXL. This is the case, for example, with the Constellation, a legendary aircraft from 1943 to 1958, which boasts a wingspan of 37.62 meters. Once through the threshold, the space is perfectly insulated: "The envelope of this reserve was designed as a double skin, similar to what is done for refrigerated rooms," explains Christel Meyre, Head of Buildings and Infrastructure Maintenance. It covers both the sides of the building and its roof, forming a completely watertight whole. The structure supporting the building, posts and lattice beams, is sandwiched between two plates: the first, in contact with the exterior, is clad with cladding in the form of an undulating metal curtain; the second, facing inward, is clad with white insulated panels. The intermediate space serves as a thermal buffer and houses, in addition to the structure, the electrical and fire-fighting systems, providing a streamlined interior. "The thermos effect allows for passive climate control: temperature variations between the exterior and interior are smoothed out without the need for air conditioning, which is very energy-intensive."

This project was designed with an eco-responsible approach," adds Agnès Mirambet Paris, Chief Heritage Curator and Head of the Department of Management, Restoration, Preventive Conservation, and Collections Maintenance. On the ground, "a concrete screed hides a pipe used to circulate a fluid heated or cooled by a heat pump," explains Guido Boroli, Building

Project Manager. For a building of this type, this is an innovation. "Generally, heating ducts are placed high up and require additional equipment to propel the air downward," explains Christel Meyre. "It always seemed a little strange to us to heat a building this way, since hot air tends to rise! Hence the idea of emitting it through the ground so that it is naturally diffused throughout the building." » Finally, along the interior walls, a long walkway will allow visitors to admire the planes and immobilized objects, particularly during European Heritage Days (EHD).

Precious Objects

Achieving good climatic inertia was given great attention, as it is essential to the optimal preservation of the parts that will be housed in this reserve, particularly the metal aircraft. When these aircraft are not properly protected, corrosion damages the fuselage and can cause it to disintegrate in certain areas. Once the process begins, it is irreversible, and preserving the aircraft becomes urgent.

"The reserve project was imperative in terms of preserving our collections," explains Christel Meyre. At the same time, the team is participating in a C-Ader research program aimed at improving the conservation of aeronautical aluminum alloys, whose composition has changed very little over time. Launched in 2023 with other partners, including the French Museum Research and Restoration Center (C2RMF), this four-year project aims to develop products to stop corrosion that are environmentally acceptable and as inexpensive as possible.

In the meantime, the Department of Management, Restoration, Preventive Conservation and Collections Maintenance has drawn up an initial list of the vehicles and objects to be protected as a priority. Indeed, despite the building's large surface area, not all collections can be housed there, and a selection process is necessary. This is based on a combination of several criteria: the historical interest of the pieces, their uniqueness, and their state of preservation. "The list is not fixed," warns Agnès Mirambet-Paris. "It will evolve over the years, with future acquisitions and development projects. Some aircraft will remain at the RGF for preservation purposes or to make them available to researchers and curators restorers and historians. Others will only be placed there temporarily. Several large-scale aircraft and objects (engines, models) will await the completion of construction of the hall dedicated to civil, commercial, light, and sports aviation. This is the case, for example, of two new acquisitions made in 2024: VariEze, a home-built aircraft, and a large-scale model of the Solar Impulse, a solar-powered aircraft. In total, around thirty aircraft of very different sizes are expected to be preserved there, along with large-scale objects. Following the month-long "dry run" regulatory period following the commissioning of a vessel, several aircraft have already been placed in reserve in 2024. These include a Douglas A26 Invader and a Heinkel 162, two aircraft from World War II; the Bernard 191, known as the Canary Bird, which enabled France's first non-stop crossing of the North Atlantic in 1929; the Lynx helicopter, which dates from the 1970s; a TB30 Epsilon propeller-driven aircraft for military training; as well as four light pleasure aircraft and a microlight, an autogyro, a replica of the Potez 25, a French observation and bombing biplane designed in 1924; and a Farman 190 for transport. built in France in the 1920s and 1930s, and the Lockheed Constellation (1947), one of the major objects.

Q&A

Christel Meyre, Head of the Buildings and Infrastructure Maintenance Department

How did the building delivery go?

It took place in March, but the project kept us busy throughout 2024. Every building delivery comes with a phase called "perfect completion guarantee returns," which involves reporting any problems or anomalies within one year of delivery, so that the builder can remedy them. We therefore reviewed all the new equipment and installations to identify any defects and address any concerns. We checked the operation of the heat pump, the sliding of the monumental door and its insulation with foam, the finish and strength of the concrete slab on the ground, the anti-theft and fire protection devices, and more. But what required the most work was validating the site's climatic inertia.

What is the significance of this climatic inertia, and how is it verified?

The expected temperature and humidity levels within the building were defined from the beginning of the project, as they determine the preservation of the collections. The temperature must be constant, around 20°C, and the humidity level between 50 and 55%. The preservation of the metal aircraft, which are very fragile, depends in particular on these thresholds. To verify the quality of the insulation, we monitored these two variables daily for several months. We quickly observed very good temperature stability, around the expected 20°C, which returns to this level within 24 hours after the monumental door is opened in the event of a vehicle entering or exiting.