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THE NEW CAGLIARI TERMINAL AIRPORT

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Introduction

All territories that for their geographical position or physical conformation are difficult or too far to be reached, often owe their economical, social and cultural development to the quantity, efficiency and quality of the aerial connection.

Islands, big or small, are even more penalized due to their physical distance from continental areas and the consequent transportation dependency on sea conditions and meteorological events.

Sardinia, second bigger island of Mediterranean, has a population of about 1,500,000 inhabitants. Before the modern era all transportation of both people and goods, was run by naval means: only recently the long times needed by boats have started to be considered unacceptable so that aerial transportation has become more frequent and necessary.

Cagliari, situated on the southern part of the island, is the capital: its airport, serving a basin of about 500,000 residents, has grown importance after the intense economical and administrative development of this part of the island. The importance of its airport is also joined to the extraordinary development of tourism during the last decade, becoming almost the first economical activity and with a big potential future growth.

Concerning air traffic from 1990 to 2000 the total annual number of arrivals and departures grew from 1,400,000 to almost 2,100,000 passengers, which forecasts an increment up to 4,000,000 within 2010. These considerations have made necessary the construction of a new air terminal which should guarantee despite higher comfort levels, fastness of the operations and security, also the future needs of the infrastructure.

History and Development Program

The flights between Cagliari and Ostia (Rome), starting in 1928, were initially run by Savoia Marchetti S55 planes (Fig.1) and later with the S66, and lasted about 3 1/2 hours. The first part of the civilian airport, built beside the military structures on the western side of the town, along the pond of Santa Gillia, was opened in 1937. The commercial flights were run by sea-planes which used the shallow waters to take-off and land safely. The sea-plane station was used also at the end of the '20s by Italo Balbo and Francesco De Pinedo for their transoceanic flights. These actions actually led to declare the Cagliari airport as strategically very important in the connection programs with other Mediterranean Countries.

![Fig. 1 – Savoia Marchetti](image1)

![Fig. 2 – Fiat G12](image2)

After the end of Second World War the definitive location for the military structured was set at the opposite side of the runway where they are still now. The development of air transportation, to and
After the end of Second World War the definitive location for the military structured was set at the opposite side of the runway where they are still now. The development of air transportation, to and from Sardinia improved in the '50s according to the growing necessity of mobility of the residents and to the upcoming tourism; the connections were made with DC3s and Fiat G12s (Fig.2) flying 1 1/2 hours between Cagliari and Rome.

The space available altogether became soon insufficient and improper, although the first real airport was built just in the middle of the '70s, after a project by Gianfranco Marras which previewed a functionality that had to last until 1995.

In those years the airport of Cagliari became the 6th in Italy by national air-traffic number of passengers, though the route Cagliari-Rome was in second position just after Rome-Milan.

During the '90s, in the years of the MD80s, the program for the development of the structure in the next 20 years gets started in order to fulfil the demand related to the increase of the number of passengers and guarantee higher standards concerning comfort, quality and flexibility. This program took care of the growing questions related to the passengers' safety and the recent Schengen agreements requiring more strict boarding procedures.

The amount of 65.000.000 Euros appropriated by the European Community together with the Italian Ministry of Transportation, has the aim to include Cagliari in the elite of the last generation middle and long range airports.

Architecture

Forms
The architectural project (Fig.3-4-5) has been worked out by SOGAER, a society that at the moment runs the airport, with the consultancy of Prof. Eng. Arch. Giovanni Maciocco of the University of Cagliari.

![Fig 6 - Plan of the roofs](image)

The complex has been set on a square figure having each side 180 m long; the plan of the buildings has the shape of a big T (Fig.6) with one side parallel to the runway and the other perpendicular, the runway laying on a north-west south-east axis according to the dominant wind, the Mistral.

It is easy to spot the significant elements that form the composition: a shelter, a longitudinal body and a cross one, all covered with a bended roof whereas a third volume joining the first two is covered with a terrace.
The façades are worked in a way that points out their relation to the facing space: the perception of the building is perceived in a different way from the people departing and arriving. It is easy to recognize a land side and an air side (Fig.7). The first one is characterized by a metallic bodywork made by an alloy of zinc-lithium, the same material Daniel Libeskind used for the Jewish Museum in Berlin, which shades the entrance recalling, with its geometry and material, the wing of a plane; the air side introduces to the passengers the town of Cagliari with the sand stone covering of its basement, of which the most important historical buildings are made (the towers, the wall, some of the most significant religious and administrative buildings).

From outside the overall perception is rather influenced by the wrapping of the curved roofs that remind with shape, material and colour aeronautical elements; the view of the runway allows at the same time the crystal volume with inclined wall which contains the control tower, that clearly recalls the control post of an air-carrier. Another significant element is the arch footbridge that connects the air-station with the existing multi-level garage forming a kind of a portal on the north side of the buildings.

The space inside is characterized by the strong personality of the load covering truss structure and the huge transparent surfaces. The structures are particularly visible in the entrance hall where the height (almost 14,00 m.) allows an interesting observation (Fig.8) while the modest height of the Finger (ca. 7,00 m.) offers a less effective flat view. The large windows allow, already during the check-in operation, the observation of the planes on the runway giving through the continuous vision of the planes manoeuvring and parking a psychological encouragement with the flying experience.
The project - Numbers

The terminal airport has a 37.000 m² covered surface of which ca. 25.000 are occupied by the hall, 2.800 by offices, 5.000 by commercials and 4.700 by areas for the luggage treatment. The check-in operations will run on 42 desks, the access to the planes will be either direct through 5 loading bridges, or remote, across 13 gates especially studied for this kind of boarding.

Compared to the old structure the new spaces represent a remarkable increase of the equipment: the area for the luggage treatment for example has been enlarged 20 times compared to the preexisting surface, the only one bar open now will be replaced by 7 new snack-bars and restaurant, the waiting seats will grow from 700 to 1700.

Functions

![Fig 9 - Plan of second floor](image)

Functions are distributed in the two main levels. The lower one, at the same level of the runway, contains the arrival and the luggage treatment areas, while the second level (at a height of 5,60 m.) is the most representative (Fig.9), hosting the check-in and departures areas: at this height also visitors, contrary to it generally happens into others airports, have the chance to see safely the runway through the armoured glass windows of the main bar. A third level is occupied by a business center, a panoramic restaurant, offices of different flying companies and administration. There is also a fourth level at about 18,00 m. from the ground, not accessible to the public, where the air traffic control office is located in a position from which all surrounding areas are visible.
The study made on the paths covered by arriving and departing passengers is particularly interesting: they can be walked without ever finding a climbing slope or a staircase. The whole building is accessible also by people with handicap, from the garage to the boarding and vice versa.

Structures

General characteristics

Structures have been planned with the supervision of Prof. Eng. Barbara De Nicolò, of the Department of Structures in the University of Cagliari, Faculty of Engineering.

The most evident structural characteristic is the total independency of the roofing system from the remaining of the building (including walls and floors).

Fig 10 – Plan of the structure
The roof of the hall, the finger and the viaduct (Fig. 10) have a structure composed with Vierendeel-type lattices, formed by couple of arches with triple hinge, connected among each other by a system of tubular lattice beams laid transversally (Fig. 11): the cross of arches constitutes a complex structural joint. The arches in the hall and those of the finger are quite different one from the another both in geometry and in dimensions: in both cases the part of the arch coming out from the volumes and connecting to the pillars is coated with a zinc titanium sheet like the one used for the roofs.

All other bearing structures at the interior of the airport are realized with a classic system of pillars and double T steel beams: the span of the secondary beams frame is extremely reduced so that it has been possible to use intermediate horizontal closures with a span of just 3,00 m made with Predalle type floors.
Entrance hall

All 32 arches of the entrance hall (Fig. 12) have a span of about 37,00 m, except the two ones at the joint with the finger arrivals and departures having a span of 50,00 m. (Fig. 13-14) and the two at the extremities.

Fig 13 – Smaller arch of the entrance hall

Fig 14 – Bigger arch of the entrance hall

The great trusses of this space lay, on the road side, on 6,40 m RC pillars, having a trapezoidal vertical section posed on a 100 and 150 cm base: on the runway side the same lattice beams are joined to double T steel pillars 16,50 m tall. These arches reach a maximum height of about 1900 mm and are constituted by tubular steel elements with a diameter of 170 or 220 mm; each beam arrived at the construction site cut in four parts and assembled later with screw bolted flanges. Being the two supports at a different height they design an asymmetric rampant arch (Fig. 15).

Fig 15 – Abacus of the secondary beams of the entrance hall
Finger arrivals – departures

The eighteen three-joints arches of the finger arrivals and departures (Fig. 16) have a span of about 34.00 m, are laid at the extremities on 4.10 m tall RC pillars which have a vertical tapered section on bases having a diameter of 75 and 125 cm (Fig.17-18).

Fig 17 – Joint of the finger structure to the pillar
The arches have a maximum height of 1450 mm and are realized with tubular steel elements 170 mm wide; each beam arrived at the construction site divided in the two sections forming the three joints arch. The symmetric placement gives the structure a camber arch geometry. In this area the footbridges leading out after the arrival at the loading bridges are hung on tension rods to the above floor of the departure area.

**Shelter**

The structure carrying the shelter on the road is formed by 32 arches having a span of 19,00 m made with tubular steel elements 120 and 170 mm wide; the height of the structure is about 1000 mm: each beam arrived at the construction site divided in the two sections later assembled with screw bolted flanges. On the garage side the beams are directly joined to RC pillars which have a vertical tapered section on bases having a diameter of 175 and 280 cm; on the side towards the building the joint is located on top of a steel column, 5.70 m tall and with a diameter of 300 mm, joined itself on a concrete pillar exactly like to the ones mentioned before: the system formed by the curved beam and the strut results also in this case in a three centered arch. The mutual position of the two joints at the extremities gives the structure the geometry of a very depressed rampant arch.

**Materials**

All external shells, walls and roofs, are designed with the classic ventilated coat system. The substantial difference between the different elements composing the building skin is due to the material used for the most superficial coating: the walls are thus made of stone (Pietra d’Istria, a pale sand stone with fine granulometry) or of transparent white or cobalt-blue crystal slabs; the big curved roofs are made of zinc-titan slabs (Rheinzink) 8/10 laid on phenol-plywood panels.

The internal walls have been finished with sand stone slabs coming from north Sardinia (Biancone di Orosei) and plasticized steel panels (skin plate). All floors are made out of Sardinian grey granite: a material used world wide for the cladding of important buildings, employed is in this airport in a massive way.

The perception of the internal spaces is very much conditioned by the view of the grid structure bearing the roof: the white colour (used also for the pipes of the air-conditioning system) gives a particularly bright atmosphere.

A significant observation is related to the three colours given to the airport: the dark grey of the zinc titanium alloy of the metallic roofing, the pale yellow of the sand stone and the blue (colour of the Sogaer S.p.A. trade mark, the society administrating the airport) used for all other finishes.

A very important role is given to the outside areas along the land side included between the road and the arrival area, mediation between external and internal spaces. Even if the former plan included the use of palm trees, climatic requirements and exposure conditions led to the use of Mediterranean typical plants: myrtle, lentisk, arbutus and others, symbolizing a kind of a welcome for the arriving passengers and a goodbye for the departing ones.

The terminal airport will be opened in June 2003.
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