THE NEW MUNICH AIRPORT

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INTRODUCTION

If one word could describe the process of building the new Munich Airport, it would be persistence.

Capacity limits of the single-runway Munich-Rheim Airport, became a major problem the early 1960s. In addition to capacity problems, the airport was a major environmental concern for the surrounding communities. Munich-Rheim was encroached on three sides by urban development, and the main aircraft approaches were over densely populated areas, raising issues of safety and aircraft noise

In 1960 the West German government initiated the process of planning a new Munich airport. The basis of the planning was that the old Munich-Rheim Airport would be closed when the new airport opened. The new airport would replace, not supplement, the existing airport.

As the Germans like to say, West German airport law is the most citizen-friendly in the world. This project was a testament to that, in terms of how long it took to complete the studies, obtain public acceptance, and construct the airport. The law required an extensive environmental impact analysis by the City of Munich and the West German government. It took nine years of investigation and public hearings to select the final site — a process that involved extensive coordination and interaction with the many authorities, commissions, and citizen action groups with an interest in the airport.

In 1969, the Erding-North/Fresing site, 29 kilometers (18 miles) northeast of Munich, was selected as the site for the new Munich Airport. Years of litigation followed and numerous environmental studies were undertaken. In 1979, 10 years after the site was selected, the West German government gave the designation order to begin construction of the new Munich Airport. Construction began in 1980, but once again, legal and financial actions and environmental impact reviews delayed construction intermittently. The longest delay lasted four years while legal and environmental problems were worked out.

Finally, in 1986, construction was resumed with a goal of completion by 1992. In May, 1992, more than 30 years after the start of planning, the new Munich Airport, with its pair of parallel, staggered runways, was open for business; and the old Munich-Rheim Airport was closed. The airport has been operating quite successfully for about a year and a half.

AIRPORT OVERVIEW

The area of the new Munich Airport is 1,500 hectares (about 4,000 acres.) This is not a large site compared to U.S. airports like the new Denver Airport and Dallas-Ft. Worth. However, given the amount of land available in the Munich area and the fact that the site was surrounded by rural development, a balance had to be maintained.

The basic runway planning was done first. Two runways 4,000 meters (about 13,100 feet) in length were laid out. One of the reasons for runways of this length was to minimize use of reverse thrust in the interest of noise abatement. This was the first of many accommodations in the airport layout to minimize noise impacts to the surrounding towns.

Considerable effort was devoted to determining the best stagger and separation between the runways to minimize the ground noise impacts of aircraft operations on both runways simultaneously. The runways have a lateral separation of 2,300 meters (7,500 feet), and the thresholds are staggered by 1,500 meters (4,900 feet). The runways are actually "imbedded" in the terrain to minimize their impact on the surrounding areas. (Figure 1)

The basic concept in planning the site was to locate all airport facilities between the runways, creating a noise protection barrier between activities on the airport and the communities on both sides of the airport. The airport is designed so that each of the functional areas (airfield, terminal, cargo, etc.) can be expanded in very small increments adjacent to already constructed facilities. An area for a potential third runway is identified adjacent to the northeast portion of the site.

The terminal is located in the middle of the area between the two runways. It includes a central terminal facility, where the transit system links with the terminal area and where meeters and greeters are concentrated, and four unit terminals. The number of unit terminals can be increased on the east side of the terminal roadway, in a mirror fashion to the existing ones. Other facilities in the terminal area can also be expanded in small increments. As with other aspects of the airport plan, significant consideration was given to limiting the potential community and environmental impacts of airport expansion.

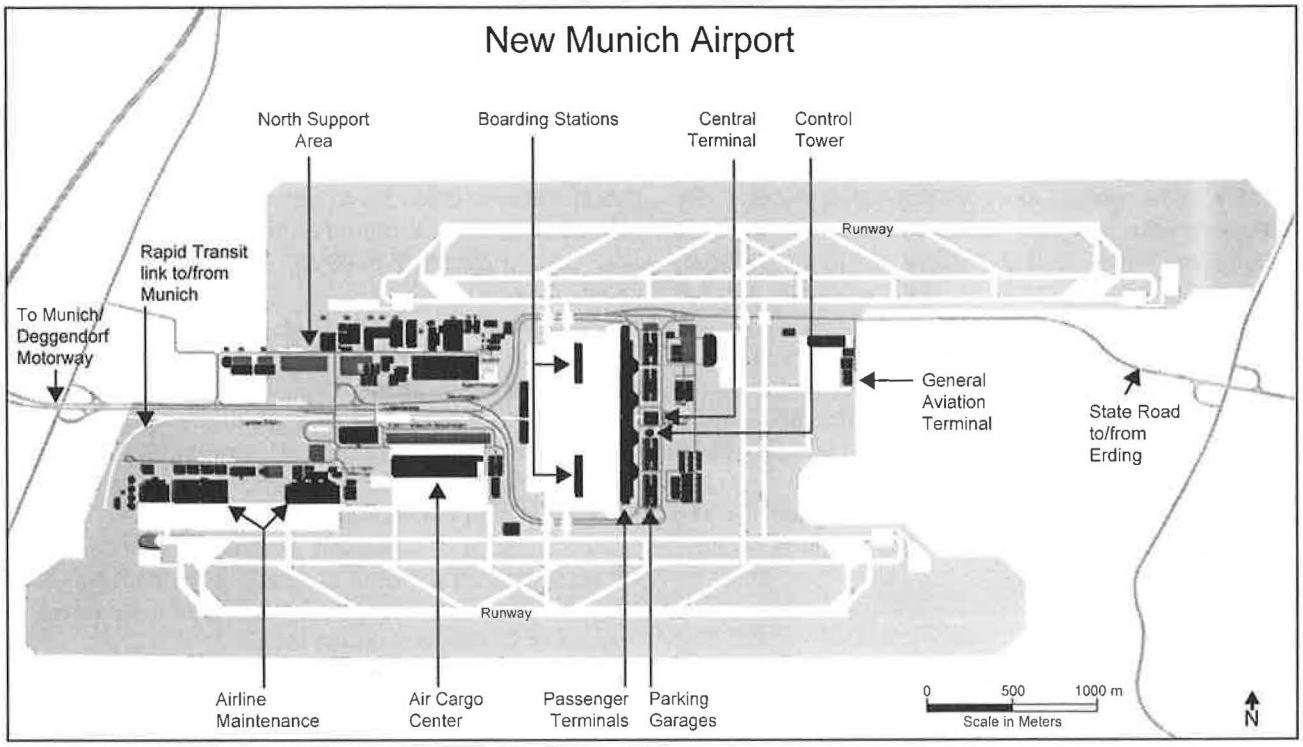

FIGURE 1 New Munich Airport layout plan.

The cargo area, known as the Munich Air Cargo Center, is also located between the runways. Aircraft maintenance facilities are located between the runways to the west of the terminal area. North of these facilities is the north support area, where flight kitchens, airport maintenance facilities, and the airport administration offices are located. Each of these functional areas can be expanded in small increments.

One of the goals in planning the airport was to bring together three modes of transport — aircraft, train, and automobile — at a central point. There are two major rail stations on the airport. One is in the central terminal area; the other provides access to the support area for airport employees and serves the cargo and maintenance facilities.

The control tower is at the center of the terminal area and is one of the landmark features of the airport.

In designing the airport, one of the overriding principles was to blend the airport architecture into the environment. White buildings and glass, not bright colors, were used for exterior building finishes. Emphasis was placed on landscaping, so that the airport would not intrude on the rural character of the surrounding area. To mitigate noise impacts, runways and flight tracks were planned to avoid overflight of nearby towns.

The type of service to be provided by the new Munich Airport was an important consideration in the planning and design process. The airport is basically an international hub airport, but with a substantial amount of local origination and destination traffic. The unit terminal concept, which minimizes walking distance from automobiles or trains to the aircraft gates, evolved based on these roles. The one drawback of this concept is the long distances between gates for connecting passengers.

Most of the international traffic to and from Munich is to southern Europe, the Near and Middle East, the Far East, Africa, and South America. An important consideration in the building design was handling connections between international flights within a secure area of the airport.

A separate ramp area is provided east of the main terminal area for parking aircraft that pose security risks. Aircraft can park remotely and be serviced separately from aircraft at the terminal area. General aviation facilities are located at the eastern edge of the developed area between the runways.

A ring-shaped road system was developed for circulating passenger cars and other ground traffic into and around the terminal area. The ring road provides access to the regional highway system from both the east and west. The direct rail link to the internal 400-

kilometer Munich rail network is currently from the west, with a possible future link to the east.

Government approval of the airport came with a set of environmental conditions, including restrictions on nighttime flights. A maximum of 28 flights are permitted at night. No flights are allowed from midnight to 5:00 a.m. for arrivals and 6:00 a.m. for departures. By 1996, only the quietest airline aircraft — those in compliance with United States Federal Aviation Regulations Part 36 Stage 3 and International Civil Aviation Organization Annex 16 — will be allowed to use the airport. In addition, minimal use of reverse thrust on landing is dictated, with the long runways providing for this capability. Land use restrictions designate areas where residential or noncompatible development will be prohibited.

The land utilization and functional plan for the airport, which became known as the "Munich Model", includes seven components:

- Terrain flexibility,
- Handling facilities in built-up area between runways,
- A decentralized terminal layout with short distances for passengers,
- A ring road around the passenger handling area,
- Integration of the airport into the landscape,
- Economic construction using modular elements, and
- Environmental protection considerations in the runway layout.

Each of these components of the airport plan are discussed in more detail in the following section.

AIRPORT COMPONENTS

Airfield

The two runways, 4,000 meters in length, have a lateral separation of 2,300 meters, with a 1,500-meter stagger in the thresholds. Each runway is served with a full-length parallel taxiway system and a series of high-speed exit taxiways.

All four runway ends have Instrument Landing System Category IIIb approach capabilities to allow for operations with the cloud ceiling at ground level and with minimum forward visibility of 50 meters (170 feet). This means that the airport will almost never have to close due to weather conditions.

Terminal

The terminal complex includes four unit terminal nodes, with above- and below-ground parking structures located across from each. Local passengers can drive their cars directly to their desired terminal node and park a very short distance from the aircraft gates. In the middle of the terminal area, centered on the four unit terminals, is the central terminal building, directly adjacent to the control tower.

The central terminal includes most of the passenger convenience facilities, including restaurants, travel agents, the main greeter area for the airport, and the station of the main rail line coming into the airport. Passengers entering the airport by rail disembark in the main terminal area and ride a series of moving sidewalks to the gates in the four unit terminals.

Each of the four unit terminals includes small concessions areas, such as snack bars and duty free shops. To have a meal in a restaurant, it is necessary to return to the main terminal area.

Twenty aircraft positions at the four unit terminals are accommodated with loading bridges. In addition, there are 14 remote boarding areas of a unique design on the apron. These consist of a series of loading bridges attached to "floating holding rooms." Access to these areas is provided by a bus from the unit terminals. Passengers board the bus at a ticket lift position in the unit terminal and then exit the bus under cover and enter a ground level boarding area, where they take a loading bridge onto the aircraft.

One of the compromises of the linear layout of the four unit terminals is that it results in a very long terminal of approximately 1,500 meters (4,900 feet) end to end. A passenger connecting from a gate at the most southerly unit terminal to a gate at the most northerly one must travel a very long distance. There is a Passenger Transport System (PTS) connecting the unit terminals. The PTS is basically a series of moving sidewalks. There are two PTS levels that carry passengers the length of the terminal area. One is in the secured area at the top level of the terminal; the other is at the baggage claim level.

The four terminal nodes contain 189,000 square meters (2 million square feet) of terminal space, and the central terminal area provides another 47,000 square meters (500,000 square feet). There are 142 check-in positions located throughout the four terminal nodes.

Each of the unit terminal modules is 230 meters (750 feet) long and can accommodate 3 to 4 million annual passengers. The four modules provide the airport with

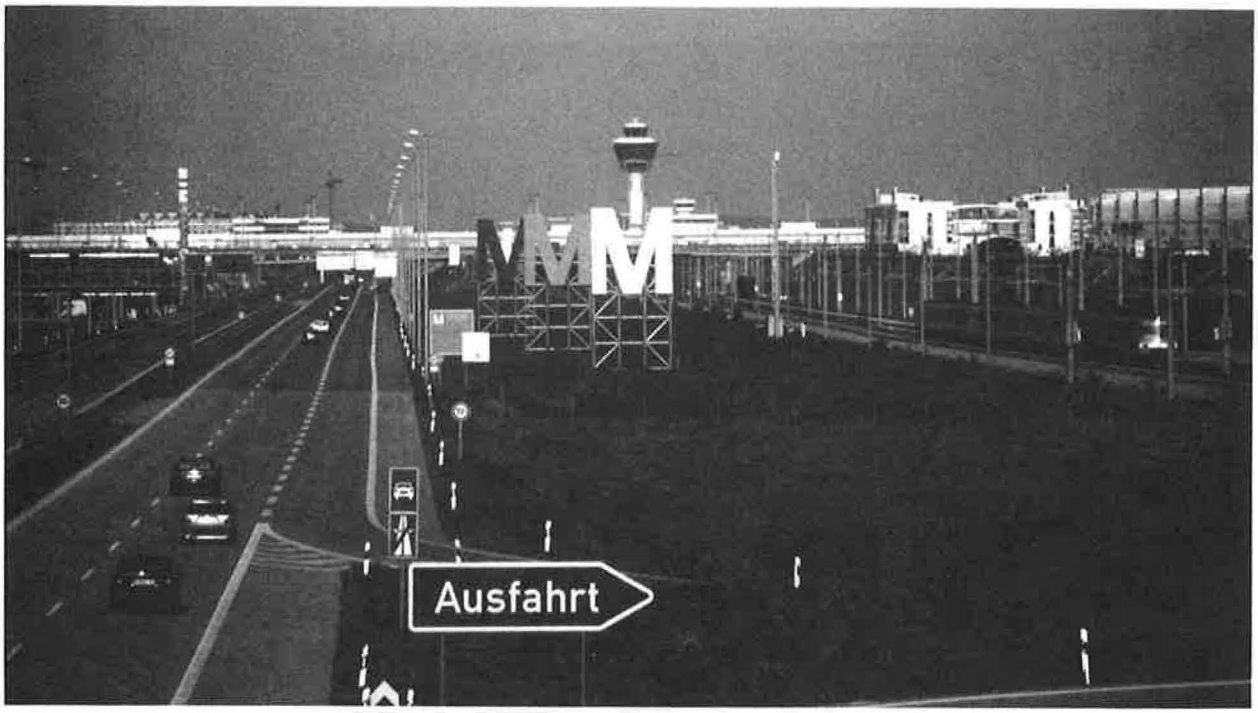

FIGURE 2 Main access road to the new Munich Airport.

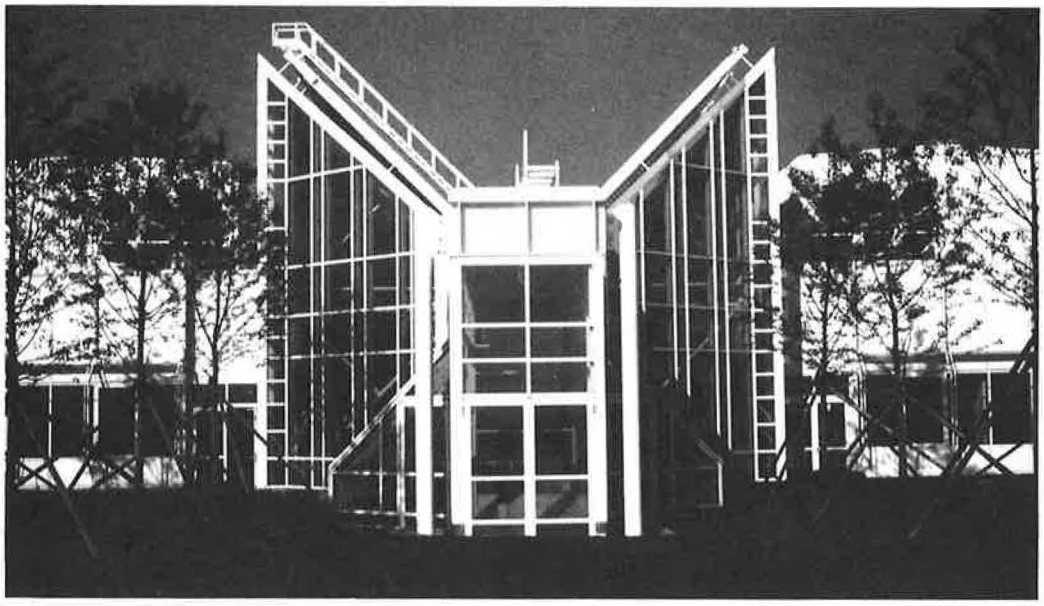

FIGURE 3 Terminal building, new Munich Airport.

the capacity to handle 15 million passengers per year. The entire passenger complex can be mirrored on the east side of the road system, to nearly double the capacity.

The main terminal apron is 614,000 square meters (7.9 million square feet). There is a total of 34 gates — 20 with loading bridges attached to the terminal building and 14 others with remote bridges. An additional three

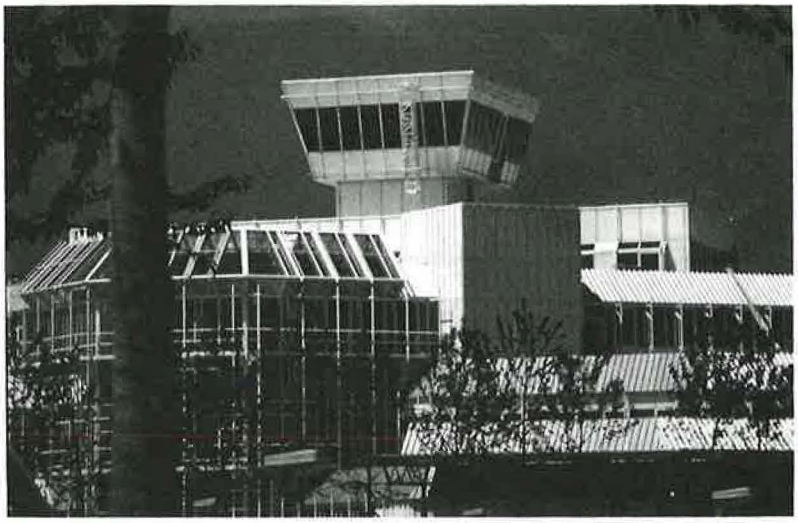

FIGURE 4 Control tower, new Munich Airport.

FIGURE 5 Terminal check-in area.

FIGURE 6 Baggage claim area.

aircraft can be accommodated on the special handling ramp. The gates can handle a combination of widebody and narrowbody aircraft. Most of the gates are designed for widebody Boeing 747 and Airbus 340-type aircraft.

There is parking on the airport for 10,000 cars. Three five-story parking structures are above ground, and between those structures and the unit terminals are three underground parking structures for short-term parking closer to the terminal buildings.

Sixty percent of airport passengers arrive by car, 40 percent by public transportation. These percentages are typical for a European facility. A very strong emphasis is placed on mass transit; airport buses and trains connect with the rest of the Munich public transit system.

The terminal is configured with departures on a single level. Departing passengers arrive at the curbside at the ticketing level and have a straight-through connection to the loading bridge onto the airplane without changing levels.

An arriving passenger exits the airplane, goes up one level over the departures, and then goes down to baggage claim. A passenger changing terminals goes down to the baggage claim level and takes the main PTS through the linear unit terminals.

A large number of signs is required inside the terminal building. The four terminal modules are almost identical in appearance, so signs are needed to help orient the passenger. Many other airports employ some type of visual coding (such as color) to differentiate terminals. The Munich unit terminals are all white and glass. Without extensive signage, passengers could easily become disoriented, particularly during the 1,500-meter journey through the linear unit terminals.

The baggage system for the Munich Airport automates baggage transfer between check-in and aircraft gates, and from the gates back to the baggage claim area. There are 1,800 motors driving the system, which is capable of moving 14,000 pieces of luggage per hour. The system is continuously monitored by the airport computer system.

Support Facilities

There are two support areas on the airport, both to the west of the terminal area between the runways. The north support area has facilities for police, airport maintenance, fueling, flight kitchens, the power plant, and the Munich Airport Authority offices. The second train station for the airport is also located in this area. The south support area includes air cargo facilities and aircraft maintenance facilities. The control tower, adjacent to the central terminal building, is 78 meters (255 feet) high.

Munich Airport is highly automated, relying on computer technology for systems monitoring and baggage system monitoring. All of these systems are

tied together in a master control area, called the Central Technological Command Center.

The aircraft maintenance facilities on the airport were built by the Munich Airport Authority. They include three large hangars in the built-up area west of the terminal area. The largest hangar, used by Lufthansa, is capable of accommodating six Boeing 747s. It is 305 meters (1,000 feet) long, with a 22-meter (72-foot) clear door height. About 125,000 square meters (1.35 million square feet) of apron area are provided for maintenance facilities.

The cargo area, which also is in the built-up area between the runways west of the terminal area, is called the Munich Air Cargo Center. It is a very important aspect of the airport because of the amount of freight that moves into and out of the Munich area by air. The center can accommodate about 250,000 tons of cargo per year; with expansion it could handle up to a million tons per year.

The 68,000 square meters (720,000 square feet) of apron in front of the cargo building can accommodate seven Boeing 747 positions. The cargo center building — 490 meters (1,600 feet) long, 100 meters (330 feet) wide, and 12 meters (40 feet) high — has the latest in sorting equipment technology. There are numerous rooms in the cargo facility to handle special cargo, including high security cargo or cargo that needs refrigeration, freezing, or heating. There is an extensive truck interface to handle the large volume of freight distributed throughout the area.

General aviation was another important component in planning the airport. The terminal building has an area of 3,800 square meters (360,000 square feet) built exclusively for general aviation purposes, as well as an apron of about 110,000 square meters (1.2 million square feet) to accommodate 250 aircraft. The general aviation facilities are located at the eastern end of the built-up area between the runways.

ENVIRONMENTAL CONSIDERATIONS

Landscape planning was an important consideration in designing all of the airport facilities. Almost every building is surrounded by trees, with the landscape plan blending the facilities into the landscape.

Water quality was another key issue in the design of the airport. The airport site is in an area with a high water table. A considerable amount of work was necessary to lower the ground water level through use of dikes and hydraulics. All water from the airport is discharged directly into a nearby treatment facility.

Another important and innovative feature of the airport is the deicing facilities. The airport uses a system of gantries located on the taxiways near the ends of the runways. These gantries are 70 meters (230 feet) wide and 25 meters (82 feet) high and can apply deicing agents to aircraft as large as the Boeing 747 as they taxi through them. The deicing agents are then recycled and reutilized on the airport.

An innovative aspect of the deicing facility is a recovery system for chemicals that drain off the runways. Large foil sheets 20 meters (65 feet) wide lie 1 meter below ground level along the runway edges to contain runoff and seepage. The system is designed to allow only water to seep back into the groundwater. The deicing agents either biodegrade on the foil sheets or are carried away for treatment. This system demonstrates a very high regard for environmental protection, specifically the protection of the ground water system. The total expenditures for the deicing facilities were about $78 million.

THE AIRPORT TODAY

The New Munich Airport has been open for business since May 1992. In its current configuration, it stands ready to accommodate 15 million passengers a year. While not a large airport compared to some of the new airports built in the United States, it provides a very important balance between airline and airport needs on one hand and community and environmental needs on the other. The German government can be very proud of the results of its persistent efforts to build this world-class facility.