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smartflying is a concept for a modular airport. Considering present developments in simplifying passenger travel a passenger terminal is designed. The wide span membrane roof provides an open view and an image of lightness.

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contents

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situation

- increase of air traffic
- limited space in urban centers
- conversion of former military airports
- boomtown in asia profit from aviation

germany

The most important international airports are at the limit of their extension. In urban population centres they have to cope with restriction of pollution and noise emission as well as limited space. The conversion of former military airports , e.g. the airport Hahn between Koblenz and Trier in Germany, could be important for the future airport development. These areas have already been used for transshipment of materials and persons and via highway and railroad have a traffic infrastructure. The generous arrangement of the system enables a new use for modern aviation. „smart flying " is the conception of a peripheral location combined with the possibility of a modular expandable development. The economic advantages in relation to the existing systems are sufficiently large surfaces for runway, terminal, trade and a 24h-service.

international

Boomtowns in China, India, South America and Africa try to be part of globalisation by getting connected to the international air traffic. A traffic infrastructure with rails and roads is often not developed due to topographic conditions. "smart flying" could be an alternative reducing initial costs.

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1. optimizing the baggage system
To reduce costs „smartflying " eliminates a fully automatic cross-connection between the gates. An automatic transfer terminal does not exist. The terminal is developed for non-stop flights. Transit passangers have to claim their baggage and to check-in again.

2. reservation - internet
The ticket sale is exclusively done by internet.

3. smartcard
The Smartcard is a combination of credit card, mobility ticket and pass. The check-in system is simplified and thereby less time needed. This system reduces employees and therefore costs.

4. terminals - one level concept
The primary functions of the terminal are arranged on the ground floor. The arrangement of escape routes is substantially simplified in relation to multi-storey systems. An interior clear height of 7m regulates the necessary smoke security, which is controlled only by cross ventilation.

5. terminals - extension
The floor space of a smart flying terminal-module is about 5000 sqm. Thus, the module has a capacity of approximately 1 - 1.5 million passengers annually. An important point in the conception is the linear expandability of the structures. The total conception of runway, terminal, air cargo consists of an extension to a maximum of 10 modules.

6. aircraft - frontal system
The airplanes are located directly in front of the gate. The passengers have direct access to the airplanes.

7. parking areas
The parking lots are placed on ground level parallel to the terminal in order to avoid complex infrastructure systems. There are two categories: chargeable parking lots directly in front of the terminal and large areas free of charge in the back. Experiences show that passengers do not mind walking the long distances from car to terminal in order to save money.

8. public transport system
Shuttle-busses connect the airport to the urban centers. The connection to the railroad-system extends the attractiveness of the peripheral location.

9. cargo
Passenger traffic and air cargo are strictly separated. Both areas are operated separately in time and location. The cargo centers are parallel to the runway. Between midnight and 4 a.m. the entire air cargo is dealt with.

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summary

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Due to new technology simplifying passenger travel people benefit from a one-step check-in. The gate is placed directly at the airside facade of the terminal, thus the public area reaches almost to the aircraft. Passenger can walk to their aircraft. Baggage is checked in automatic units with touchscreens. Only the arrival and baggage area are seperated through glass partition wall.

design

The open atmosphere is composed with a membrane roof. The one-level terminal has a modular structure for economic extension. Vrml-models and an animation are integrated in an international export-concept for smartflying terminals.

architecture

This study was conducted by Thomas Schielke within a diploma in the field of architecture at the Department of Building Design and Technology of
Prof. Karl-Heinz Petzinka at Darmstadt University of Technology, Germany.

smart cards combine tickets, credit cards and more

Smart card technology offers a possibility to identify customers, deliver services and accept payment.

With the growth of electronic ticketing world-wide e.g. via internet, it has become evident that new technology for customer interaction at airports and other facilities must be found.

It is expected that all smart cards are multi-functional, i.e. they can be used as bank or credit cards and are used for all airlines. The smartcard therfore replaces all international credit cards such as Mastercard, Visa etc.

for more information:
Simplifying passenger travel
http://www.simplifying-travel.org

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Tickets by Internet
Ticket sale is exclusively done by Internet. The reservation is made by travel smart card via PC or directly at the terminal.
Thus, the passenger's personal information, including nationality, age, etc., is automatically saved and can be used for initial controls such as the need for a visa, or details about health problems in order to prevent medical emergenies.
The card will also contain ohter necessary information e.g. the passenger's preferences (business class), frequent flyer memberships and other related travel information.

Many features such as seat selection, check-in location and time, document requirements, conditions of contract, ticket notices and other necessary travel information will be provided by internet.

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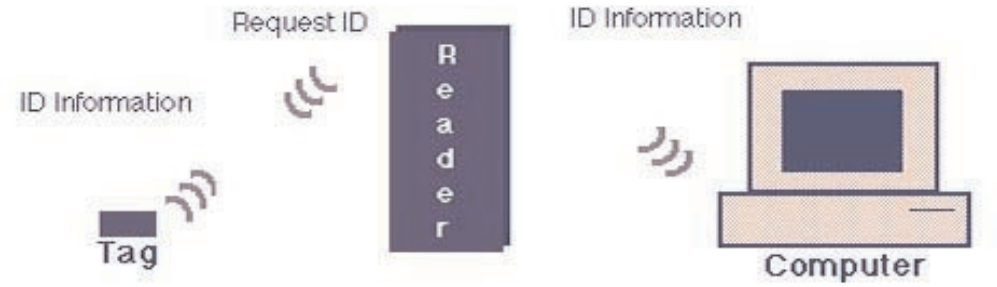
Radio Frequency Identification

General Information
A basic RFID system consists of three components:
- An antenna or coil
- A transceiver (with decoder)
- A transponder (commonly called an RF tag) that is electronically programmed with unique information

The reader sends a request for identification information to the tag. The tag responds with the respective information, which the reader then forwards to the data processing device. The tag and reader communicate with one another over an RF channel. In some systems, the link between the reader and the computer is wireless.

New Airport Technology
1. The bar code on airport baggage will be replaced by tags with something hidden in the paper that also performs other tasks such as recording security checks and club membership
2. smart cards can be read and provided with new information from a distance.
3. Remotely verifiable and cancellable tickets eliminate queues.



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GPS leads to the parking place
The GPS (Global Position System) display in your car helps you to find the best way to the airport. With the information on the smartcard it will lead the driver to the terminal and the nearest parking lot.

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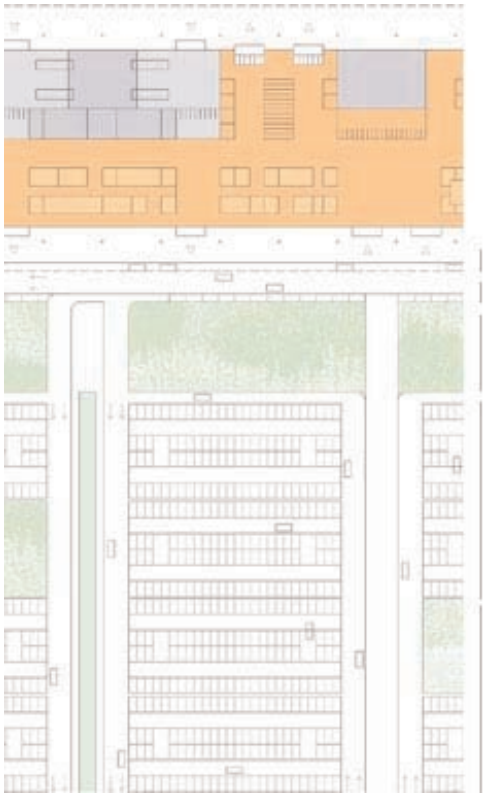
Parking Areas

The parking lots are placed on ground level parallel to the terminal in order to avoid complex infrastructure systems. There are two categories: chargeable parking lots directly in front of the terminal and large areas free of charge in the back. Experiences show that passengers do not mind walking the long distances from car to terminal in order to save money.



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Departure

1. The Passenger enters the airport and proceeds to the one-stop gate where his smartcard is read by RFID.

2. In some countries it might still be requested that exit control authorities communicate with the passengers. This process will be integrated into the one-stop check. The passenger's details are automatically passed to the control authority's system for review. If more extensive information is required the passenger will be moved into a separate area controlled by the authorities adjacent to the one-stop check for examination.

for more information:
Simplifying passenger travel
http://www.simplifying-travel.org

3. In general, the check-in will automatically provide passenger and flight details to the control authorities at destination. This may require some interaction between the passenger and the destination control authority, in which case the passenger will respond to a series of on-screen questions in the airplane. This will fast track the majority of the passengers at the destination airport.

4. The passenger will enter the final check-in gate with his smartcard and complete a biometric scan. A successful match shows he is where he should be and lets him pass into the aircraft.
Simultaneously, the automated baggage reconciliation system is informed that the passenger is aboard the aircraft and the checked baggage is authorized to travel. If the passenger does not board the aircraft the baggage will be off-loaded.

Arrival

1. The passenger will claim his baggage in the baggage hall. Then he proceeds to an electronic exit gate, the only barrier to exiting the airport, unless he needs to be controlled or if there is some discrepancy with his bags. At the gate he will be verified by a biometric check via his smartcard. At the same time the RF chip in or attached to his baggage will be read and matched to his airline record to ensure he has all his correct bags.

2. If none of the control authorities wishes to interview the passenger, the screen will show a note and then he can proceed through the gate leading to the arrivals hall. If an interview with the control authorities is required the gate will not open and the passenger will be directed to a special area for a sec-

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Baggage with RF-chip
If the passenger has baggage that has not already been checked he places it on an automated device which registers the number of pieces/weight and produces a baggage tag containing a Radio Frequency (RF) chip which will be used to track the bag to destination. The system will also assess any excess baggage charge, which is paid automatically by the smartcard.

If the passenger wishes to check his baggage earlier he can take it to a designated off-airport secure baggage check-in facility. He will insert his travel smart card into a reading device.

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Biometric scan
Biometric identification is a powerful facilitation tool capable of delivering important benefits for air travel. The rapid growth in air traffic, coupled with cost and budgetary pressures, calls for continuous improvements in facilitation and more efficient services for air travellers to avoid congestion and delays. This poses a major challenge when combined with the general emphasis on improving quality of service and maintaining the highest standards of security at airports around the world.
Automated biometric processes will ensure that the bearer of the document matches the biometric data printed or stored on the smartcard or other document when presented to control units.

Eye ticket
EyeTicket™ developed a solution using iris recognition to expedite the passenger travel. Directed primarily to frequent fliers, the EyeTicket™ service provides instant check-in, automated baggage check, and boarding without the need for conventional tickets, plastic cards or other means of identification.
This proven technology uniquely identifies anyone enrolled in the database in one second, when the person looks into an ordinary digital camera.

for more information:
http://www.eyeticket.com

Walking from gate to plane

The terminal has no passenger bridges to reduce costs. The passengers have direct access to the aircrafts in front of the terminal after they the have checked in at the automatic gates. Unless the planes are in the parking position on the apron the passengers are taken to the airplanes by bus..

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The Design of the A380 is focused on full flexibility: flexibility in terms of the variety of models available, a flexible balance between passengers and cargo, flexibility to modify cabins overnight.
The A380 has two wide-body cabins running full length along the aircraft with wide stairs both forward and aft. The twin-aisle, twin-deck concept, together with the wide, dual-lane stairs, allows distinct passenger flows to be directed to and from each cabin.
A380 ground manoeuvering will be possible on today's airports.

For further information contact
http://www.airbus.com

Span 79,8m
Length 67,9-79,4 m
Height 24,1m
Seating capacity 481-656
Range 14000-16000 km
Max Payload 73-95 t
Freighter
Range 10410 m
Max Payload 150 t

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Cryoplane
The CRYOPLANE has a completely new approach in aircraft technology: the production of hydrogen from renewable energy sources to be used as aviation fuel ; thus making the aircraft compatible with the environment and protecting sustainable long term growth of air traffic.

Airport Infrastructure
In the beginning of the transition process from kerosene to liquid hydrogen when only relatively small amounts of liquid hydrogen are required fuel production and liquefaction can be centralised; the fuel can be carried to the airport by means of conventional tank trailers. It can be dispensed to the aircraft via a mobile refuelling station.
In the fully developed system, hydrogen can be delivered to the airport in gaseous form via pipelines, or it can be produced by electrolysis directly at the airport . There it will be liquefied, will be stored in large tanks, and distributed by a local system of well insulated pipes.

For further information contact:
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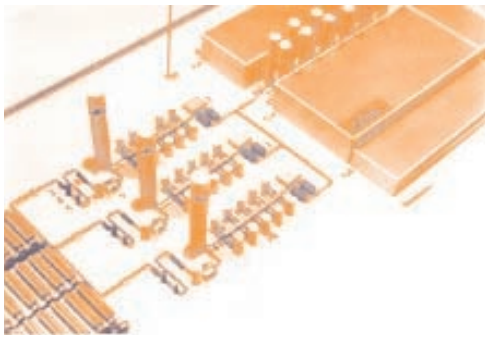
Dept. EZX4
Dr. Heinz G. Klug
Hamburg - Germany
email:
heinz-guenter.klug@airbus.dasa.de



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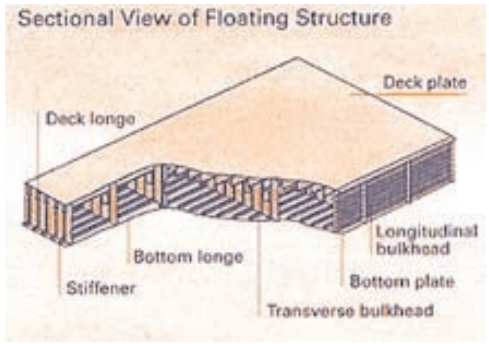
Pontoon-Airport

Current experiments by Megafloat Technological Research Association, supported by the Japanese Ministry of Transport, utilise pontoons to form a structure which is 1,000 m long and 200 m wide. However, a floating airport with two runways will need a steel platform measuring approximately 4,700 × 1,600 m which would represent a major technological achievement. The pontoons with titanium covered steel are 300 m long, 60 m wide, and 3 m high. According to promoters of the project - including steelmakers and shipbuilders - the floating island would be a much cheaper alternative to using reclaimed land and would have less impact on the marine environment since the water flow underneath the structure is unrestricted.



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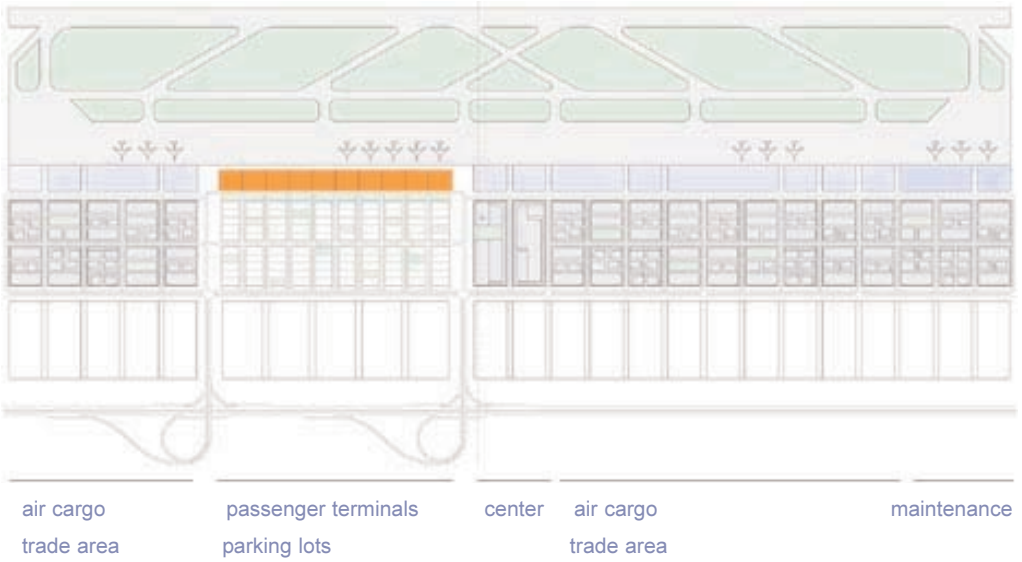
terminal - frontal system
The airplanes are located directly in front of the gate. The passengers have direct access to the airplanes. One runway has a sufficient capacity for 10 - 15 million passengers.



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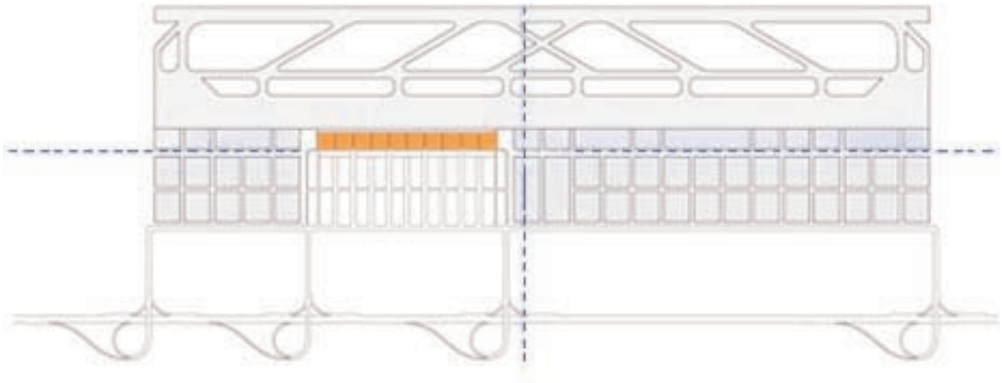
Highway
The airport has four highway-exits. The middle exits provide direct access to the passenger terminal. The other are used for cargo facilities. The parking lots are placed on ground level parallel to the terminal in order to avoid complex infrastructure systems. There are two categories: chargeable parking lots directly in front of the terminal and large areas free of charge in the back.



Public Transport
Public transport is located at the curbside under the terminal-roof.

Railroad
Railroad stations can be positioned in front of the terminal at sublevel or at the airport center.
The cargo centers at the apron have direct rail connection in the back.

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The passenger terminal with the parking lots is in the center of the site and can be extended if a new module is built. 10 modules have an annually capacity of 10 - 15 million passengers. The terminals are directly connected and profit from a long shopping and service zone.

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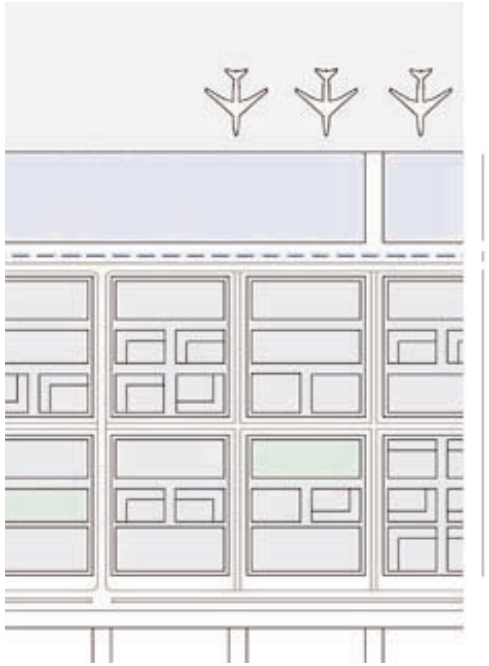
The air cargo has also a modular structure. Direct access is supplied by highway and railroad. Areas for manufacturers and offices can be built next to the cargo terminals.



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Hangars for maintenance are located on the right side of the apron and provide the necessary infrastructure for aircrafts.

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If required a module area can be used for general aviation.

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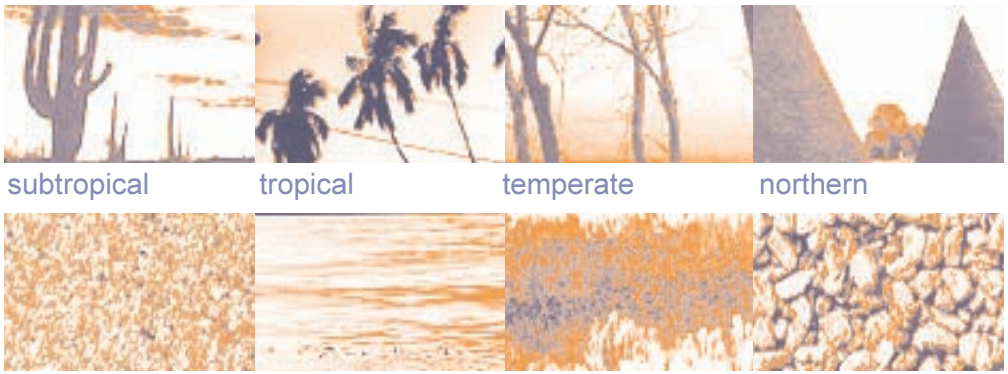
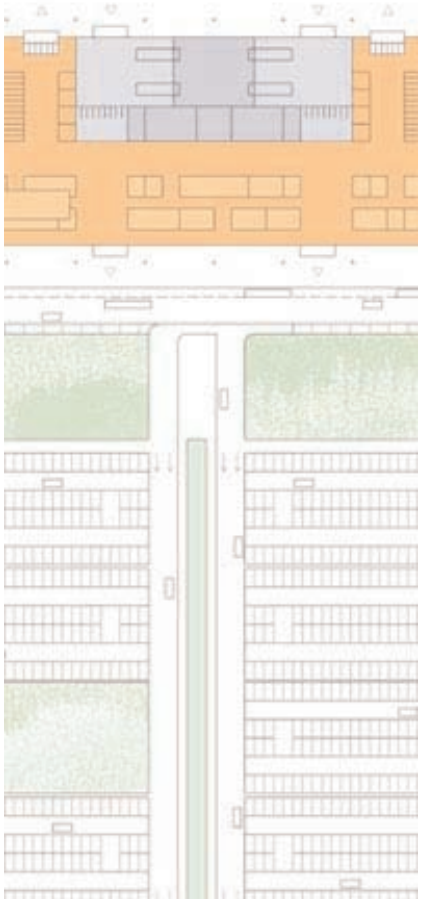
Local plants in general structures
The landscape design orientates on local and climate conditions. Parks for recreation are placed in the office area. Their ponds are also used for the drainage system.
Lines of trees are arranged rectangular to the terminal to divide the large parking lots and provide an open view to aircrafts and apron.



subtropical tropical temperate northern



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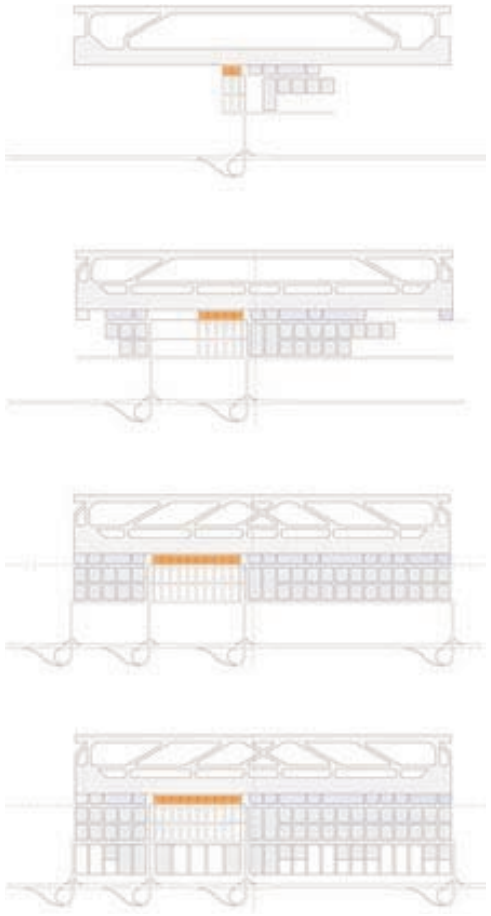
layout - module system

The layout of the airport has a modular structure which can cope with the increase of the passenger and cargo traffic.



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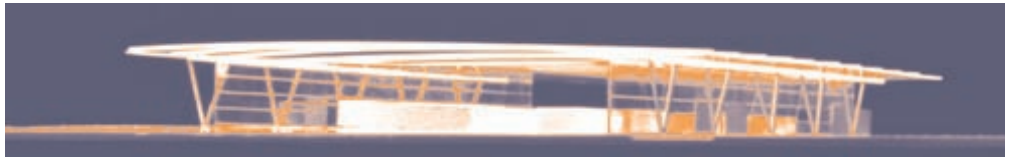
automation - architecture - module



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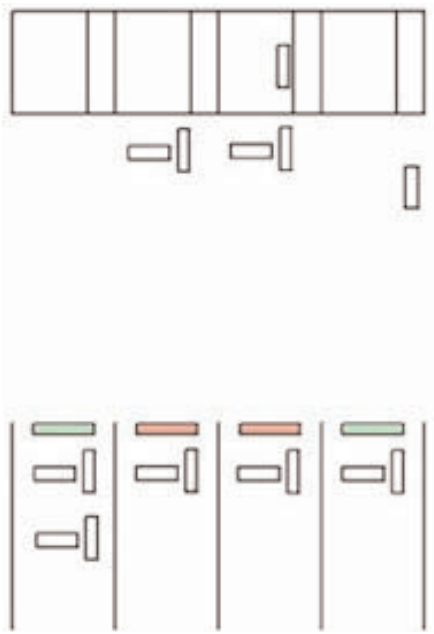
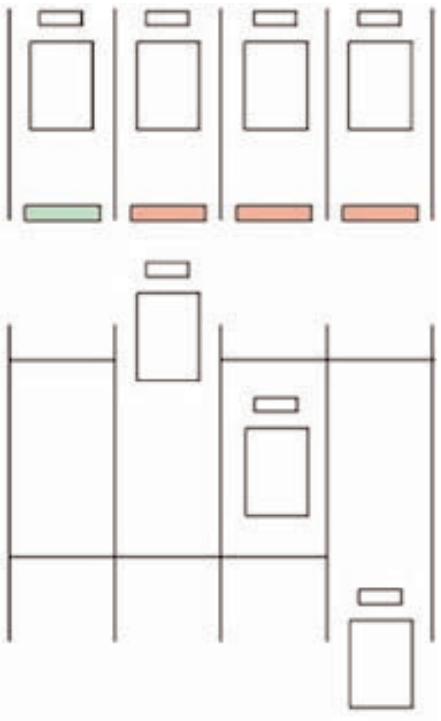
check-in
1. green light for automatic check-in
2. touchscreen
3. registration of baggage producing a tag with rf-chip
4. leaving for gate

check-out
1. green light for automatic check-out
2. verification with biometric scan
3. rf-chip of baggage is matched with airline records
4. leaving entrance hall





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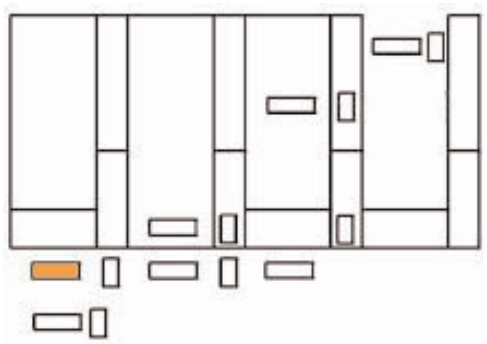
One-step gate
The smartcard will be equal to the passport. The passenger will enter the final check-in gate with his smartcard without direct contact due to RFID completing a biometric scan. A successful match shows he is where he should be and allows him through the door to the aircraft.



Time
the gate is set at an interval of 25 seconds
- smartcard 2 sec
- biometric scan 1 sec
- security 15 sec
- change 7 sec

The 12 gates have a capacity of 300 passengers in 10 minutes

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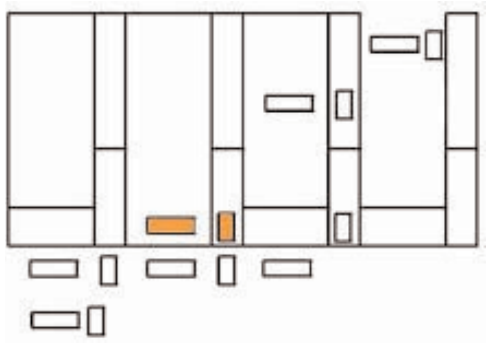
The baggage will be controlled at the automatic check-in facilities. The hand luggage will be checked at the final gate parallel to the bio-metric scan.



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Online-Custom

In general, the check-in will automatically provide passenger and flight details to the control authorities at destination. This may require some interaction between the passenger and the destination control authority. The passenger will respond to a series of simple on-screen questions in the airplane.
The interaction with destination authorities will facilitate and fast track the majority of passengers at the destination airport.

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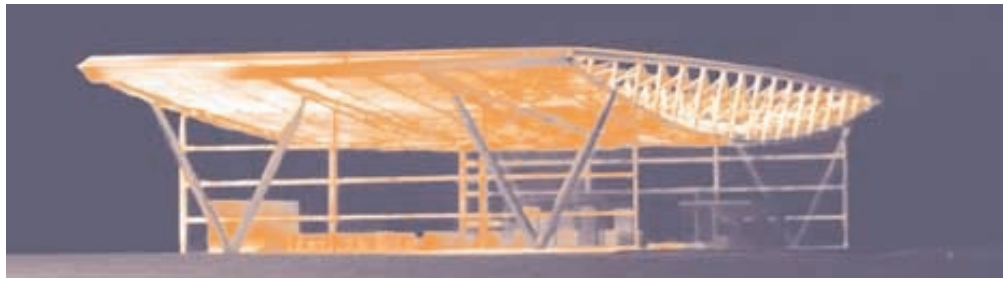
Light membrane roof
A vector active structure system is built on the V-columns. The trusses with cantilevered ends have a cantilevered free-span structure.
Membrane cushions are fixed under the flat trusses.
Stabilization in the meaning of bracing against lateral loading is provided by diagonal tubes at the columns or at the ends of the terminal with retaining cables linked to the top chord.
The secondary construction for the membrane roof is a tension system.



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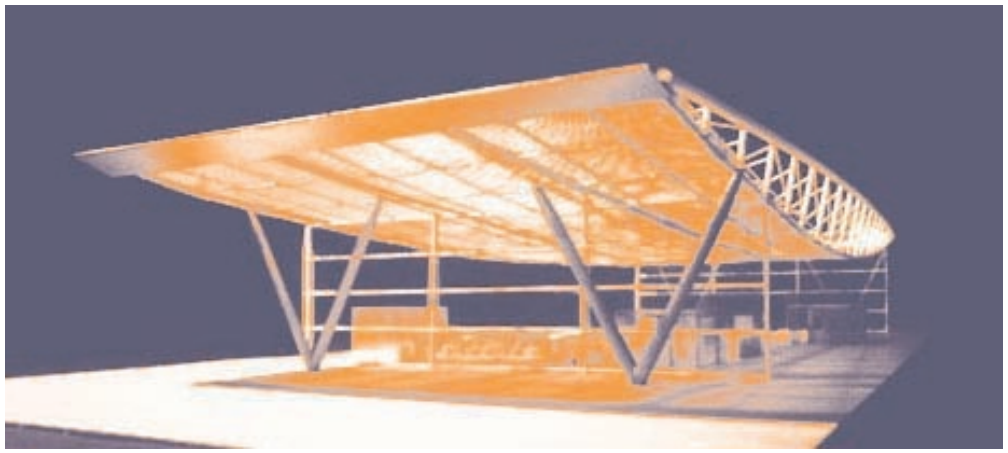
The wide span roof provides an open view and the image of lightness.

The curved roof with ends pointing to the sky will become the symbol for smartflying terminals.

Through the transparent facade the aircraft can be seen at all times from the moment the passenger arrives. By means of colored entrances the passenger is enabled to find his way very quickly.

The roof in a one level terminal attracts most attention and for that reason is designed with a translucent printed membrane which changes its light characteristic with the course of the sun.

The public area which connects the terminals has a flexible structure for shops and service facilities. The design corresponds to the specific traditions of the location.



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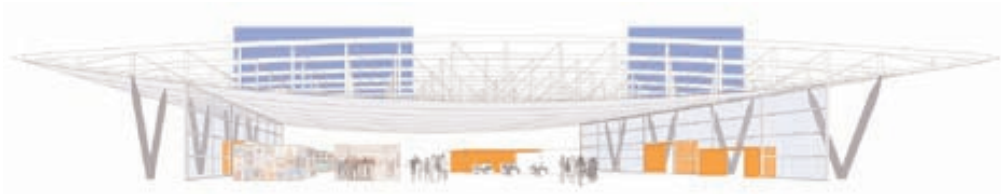
The wide span roof serves for sun protection and avoids unintended warming of the building. At tropical locations the roof also functions as a rain shelter.

The inside of the terminal provides a sufficient air supply. Cross ventilation reduces the need of ventilation systems. If required they can be added to in the central zone on top of the infrastructure boxes.

For special needs the facade can be adapted to the local situation. For example the u-value can be adjusted by the layers of sheets and the light transmission with an adequate print on the sheets.



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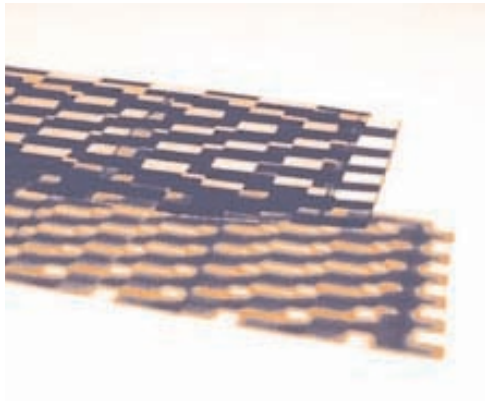
ethylene sheeting

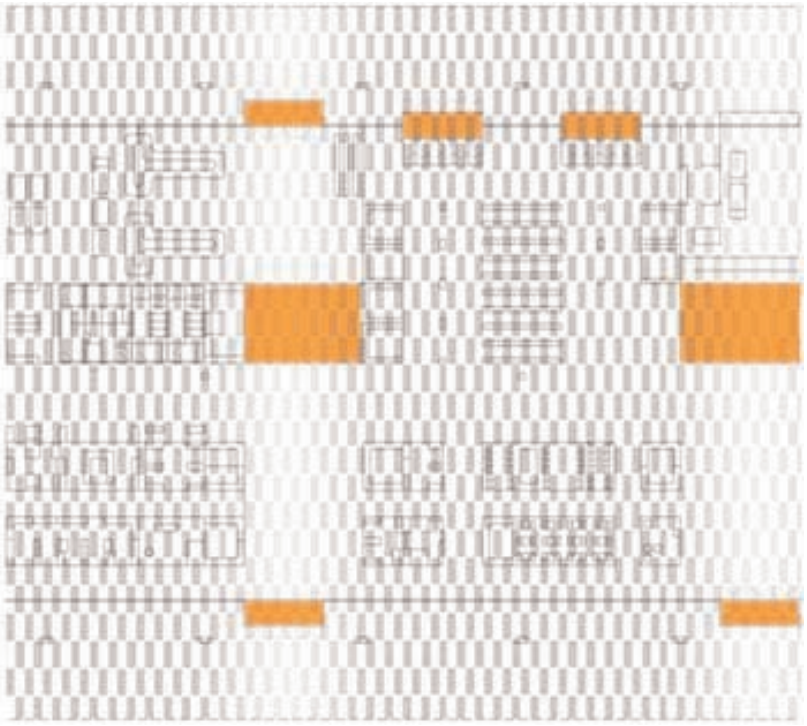
light transmission	0,95
u-value	1-18 - 2,94 depending on number of layers
fire grading	b1, hard inflammable
melting temperature	275 °C ± 10
surface quality	selfcleaning
acoustics	20 % absorption
ecology	energy for production of sheets is much less in comparison to other roof material (surface-specific energy)
recycling	the sheets can be returned to the manufacturer for recycling

for more information contact:
foiltec



Night
In the night uplights will put an focus to the roof so that the terminal can be seen as a landmark. Additional lighting of the drainage tube in the hall emphasizes the sculptural element in the service zone as a lighting element.

Day
Due to the transparent membrane a diffuse light is characteristic for the atmosphere of the terminal.



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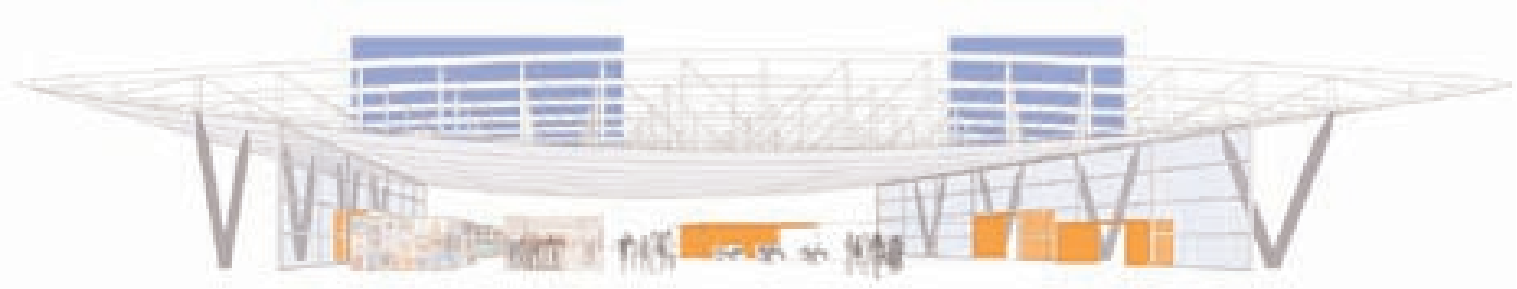

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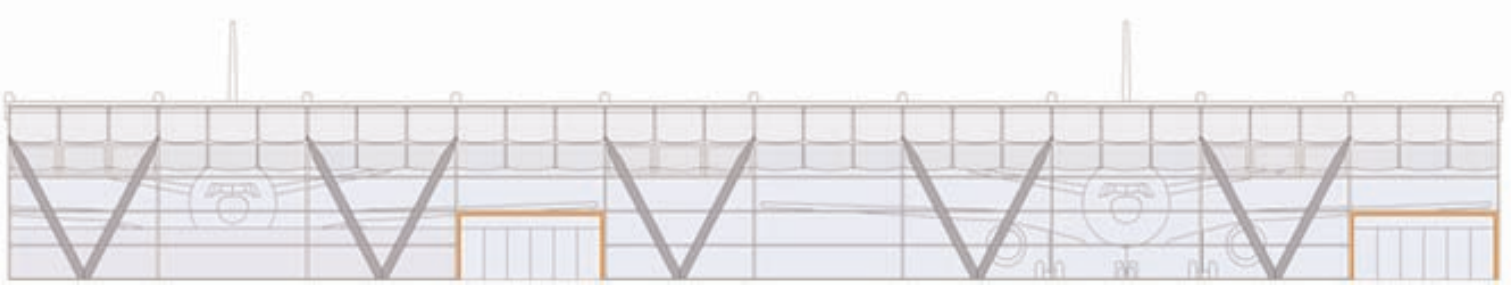

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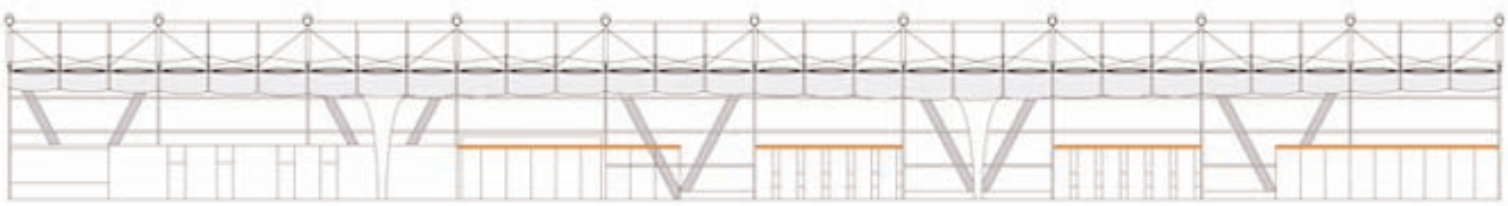

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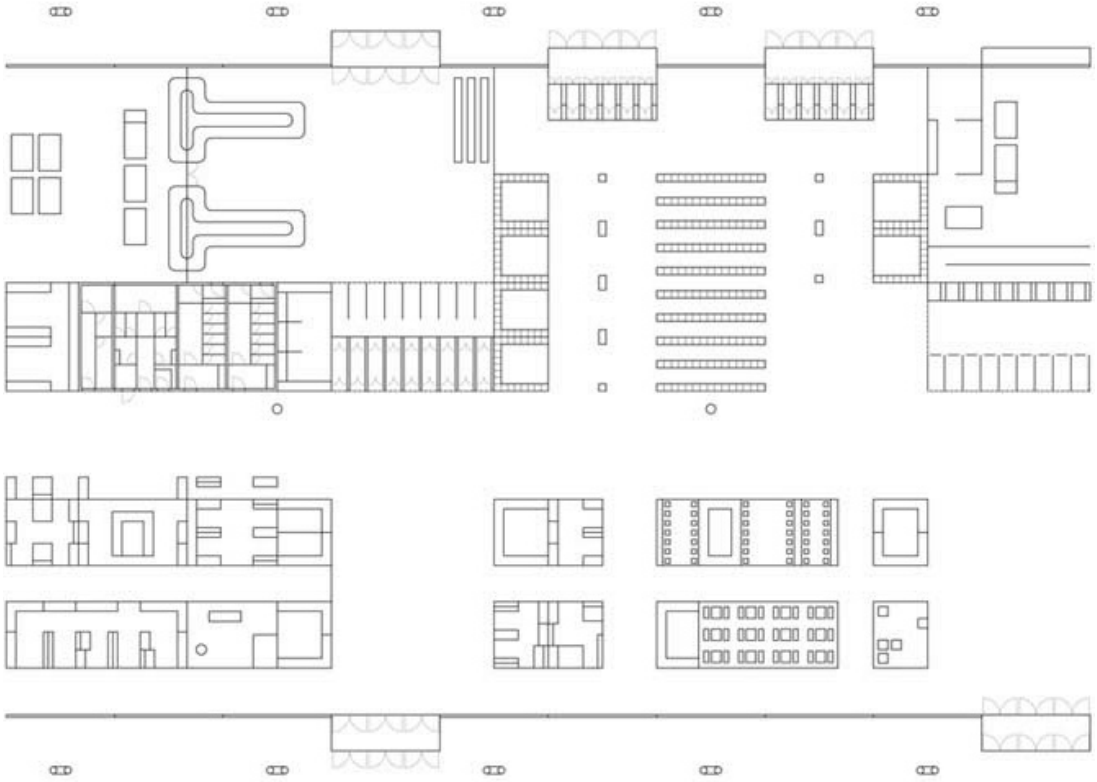

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The module has a linear structure system rectangular to the apron. It can be extended on both sides. The system consists of two 9m wide lines: one with a V-column and a normal without column. The module starts with a V-column line and is added with the next two lines.

terminal 1 terminal 2 terminal 3 terminal 4

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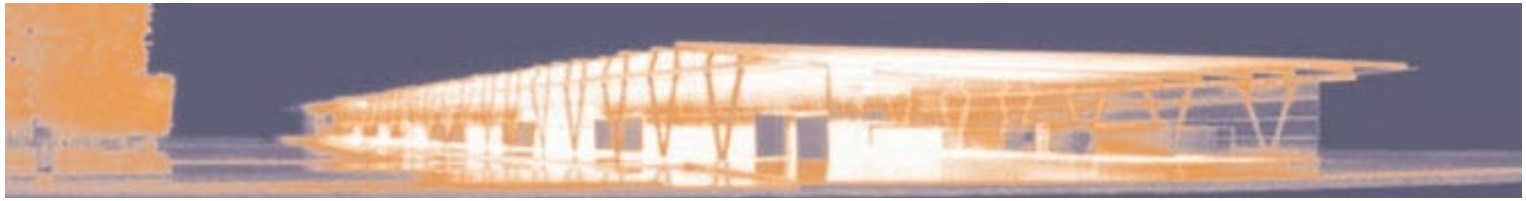

A continuos structure system provides an economic way to built up low-cost terminals. Producing high numbers of terminals can lead to an even more efficient construction. The roof consists of membrane cushions which are 30 - 50 % cheaper than a comparable glass constructions.

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The structure system of external construction provides high flexibility for the layout of the floor area. A standard or a quick check-in system can be realized. A reuse for cargo needs is also possible.

- public area
- service facilities
- baggage claim
- infrastructure

standard layout

quick layout

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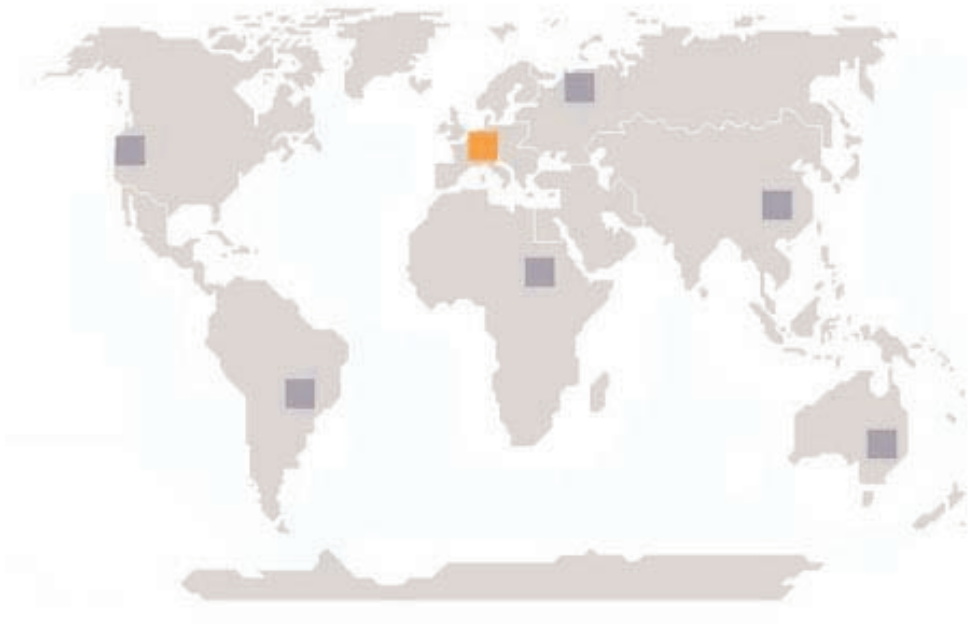

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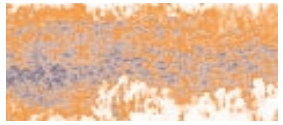
climate	subtropical	tropical	**temperate**	northern
	high temperature	high humidity		cold
facade	membrane	membrane	membrane multi-layer	membrane/ sandwich panels
light transmission	low	low	medium	high
heat transmissibility	low	low	medium	high
u-value	low	low	medium	high
ventilation	high	high	medium	low
landscape design				
trees				
ground				
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	Terminal	Cargo	Hangar	Office	Industry	Airport Layout
property	55 x 90 m	100 x 200 m	100 x 300 m	125 x 50 m + x	125 x 50 m + x	
material	steel construction membrane, glas	steel construction membrane, sandwich	steel construction membrane	steel construction	steel construction	
service	planning, construction, management	cargo management, transportation	technical support aviation ground service	facility managment, communication service	cargo development, equipment	investments traffic and terminal management
choose for further details						

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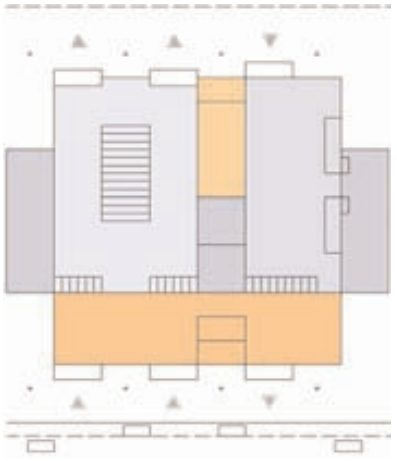
grondfloor layout

Choose between
standard or quick layout
for a rough estimate of costs

standard
+ high percentage of public space
+ attractive service facilities
+ spacious waiting area



quick
+ optimation of people´s flow
+ internet-shopping
+ reduction of space

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rough estimate of costs

floor area (indoor)	90,0 x 54,0	=	4860 sqm
cubature	4.860 m" x (6,5 + 8,0)1/2	=	35235 sqm
roofage	83,35 x 90,0	=	7500 sqm
facade	54,0 x (6,5 + 8,0) x 1/2 + 2	=	783 sqm
	90,0 x 8,0 x 2	=	1440 sqm
			2223 sqm
total			16.012.465 Euro
			454 Euro/sqm indoor

detail

site installations	35.235 m³ x 60,00	=	2.114.000,00 DM
carcass	35.235 m³ x 40,00	=	1.410.000,00 DM
speial carcass foundation		=	300.000,00 DM
trench ground work, drainage system		=	500.000,00 DM
steel consdtruction, roof + columns	225 kg/m² x 7.500 m² = 1.700 t		
	1.700 t x 5.500	=	9.350.000,00 DM
facade	2.223 x 450,-- = 2.112,--		
	entrance etc. = 400,--	=	2.512.000,00 DM
roof	7.500 m² x 650,-- = 4.875,--		
	extra costs, drainage =750,--	=	5.625.000,00 DM
general completion	4.860 m² x ca. 750 DM/m²	=	3.645.000,00 DM
mechanical engineering	4.860 m² x 1.000,--	=	4.860.000,00 DM
other installations		=	1.000.000,00 DM
estimated total amount			31.319.000,00 DM

without construction extra costs, development work, outside constructions
estimated construction period about 15 month

with friendly support by Hochtief Frankfurt

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vrml - animation - plug-in

vrml-model
(plug-in: cosmoplayer)

animation
(plug-in: quicktimeplayer)

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aviation
International Civil Aviation Organization -
International Air Transport Association - IATA
Airports Council International
Arbeitsgemeinschaft Deutsch. Verkehrsflughäfen

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SAC - Stuttgart Airport City
University of Art and Design Helsinki - project
IL Institut für leichte Flächentragwerke
Institut für Textiltechnik der RWTH Aachen
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Department of Architecture

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smartflying is a process of development designed by Thomas Schielke.

This study was conducted within a diploma in the field of architecture at the Department of Building Design and Technology of Prof. Karl-Heinz Petzinka at Darmstadt University of Technology, Germany.

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with university studies and cv