W. I. A.

Washington International Airport

A New Concept in Airport Design

by Javier Krasuk

Thesis submitted to the Graduate Faculty of Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

MASTER OF ARCHITECTURE

August 1992
Alexandria V.A.

Approved:

Gregory Hunt **Jaan Holt** **Dennis Jones**
Chairman

W. I. A.

Washington International Airport

A New Conc[illegible]n Airport Design

To my parents,
who taught me the values of life.

ACKNOWLEDGEMENT

To professors Dennis Jones, Jaan Holt and Gregory Hunt
for their unconditional support and thoughtful advice
since the beginning of this project until its conclusion

Special Thanks

The National Air and Space Museum
Ridgway's

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ABSTRACT

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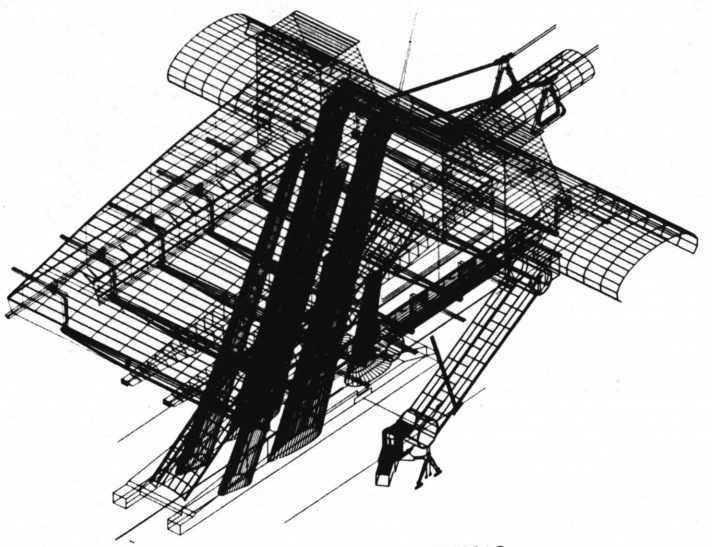
A New Concept in Airport Design

In the past two decades the increase in passengers and frequency of flights has caused commercial air transportation to suffer. The system in current use was designed to satisfy different needs than the contemporary ones. Airports have failed to keep up with increased demands. Movement of passengers and aircraft have not kept pace with advances in technology. Many aircraft arriving and departing simultaneously create unnecessary delays and monetary loss to commercial airlines. The present solutions were based on new additions to existing airports as well as the creation of new airports so that metropolitan flights could arrive to different locations, e.g. JFK, La Guardia and Newark in the New York area; National and Dulles in the Washington D.C. area.

The concept of the traditional airport is obsolete and needs to be completely rethought, not modified.



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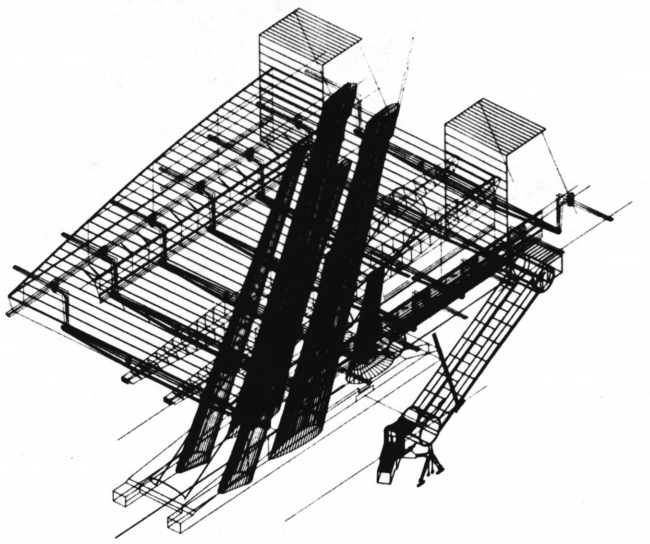
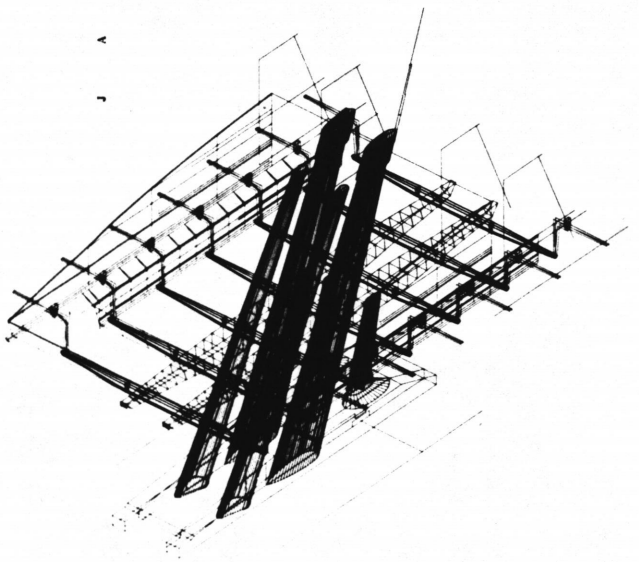


4 TH



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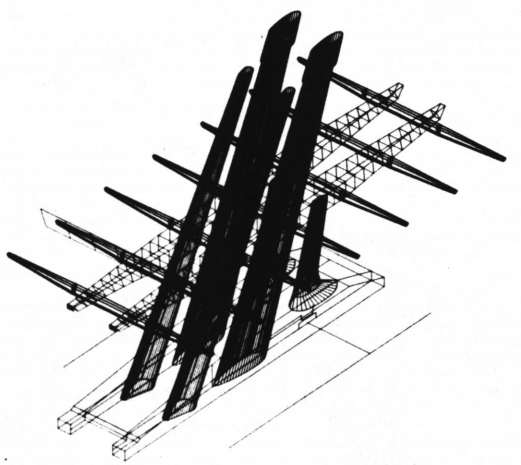

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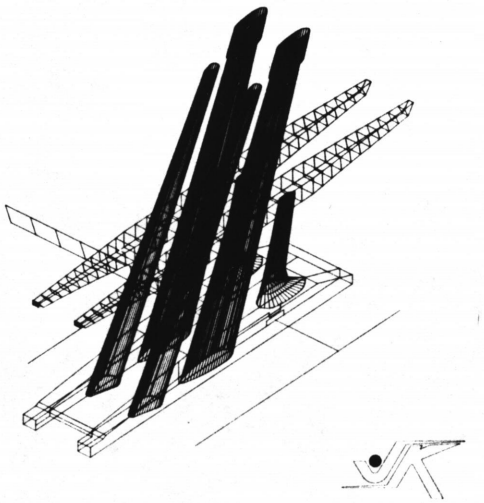

FIRST

An Architecture of Flight

From man's fist upward gaze that glimpsed a bird profiled against a luminous sky, the world of flight has captivated our most fertile imagination. Science and technology have together served this imagination well, as both sky and space have succumbed to the earliest desire to fly. Victories of spirit and invention, our means of flight--from Leonardo da Vinci's remarkable flying apparatus to today's 747s--have been creative testaments to human will--a will that continues to refine, transform, and invent anew.

The design of airports, on the other hand, has not equalled the inventiveness and imagination of the design of the aircraft that are called upon to serve. With few exceptions (Dulles International Airport among them), these designs constitute an "airport architecture" that has produced a remarkably prosaic array of efficiently-planned but generally uninspired works. Conceptually bereft of any larger ideas, these often highly serviceable complexes, used by staggeringly large numbers of passengers and visitors, are but architecturally mute responses to the exhilaration and beauty of the act of flight.

Grounded in extensive research dealing with the movement of people, planes, and goods, the proposed design postulates an innovative circulation system for the planes, multi-level terminals that promise a spatial sequence of architectural richness, and a scale of building that truly recognizes an appropriate reciprocity with the scale of contemporary airplanes.

From its reconsideration of these important aspects of airport design to its mega-structural form language, this project offers us some intriguing new possibilities for an Architecture of Flight.

G.K.H.
August, 1992

Computer-Aided Design

The use of the computer in the design and material allocation of any architectural project will offer a potentially new reality. Because the computer can locate large numbers of points in space coherently and without error or memory faults, it becomes possible to seek shapes and compositions far too difficult to control or build without this tool. This extension of the control scale has already altered flight in new planes, and is altering the very shape of planes possible to fly. The same extended reality will occur in the field of architecture.

An architecture utilizing computer methods will become as easily recognizable and differentiated as the architecture of modern mass production was recognizable from its craft antecedent.

Nevertheless, the necessity of achieving meaningful human significance in an architecturally poetic sense will remain the same.

J.H.
August, 1992

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A New Concept in Airport Design

As time goes by ,constant changes are required to fulfill the necessities and infrastructures of today's airports. The systems currently used have not changed in their essence since the beginning of Air Commercial Transportation, except in capacity and flight frequencies. The results of these transformations to the system (usually additions) are only producing temporary solutions. In the standard system, aircraft, while in the ground, are dependent on auxiliary ground transportation sub-systems. The double directional taxi line system (DDS), used since the beginning of the air transportation, produces high monetary losses to the air companies which are reflected in fuel expenses and ground delays. When the air traffic of an airport with a conventional DDS system runs under air rush hours, its functionality and efficiency begin to collapse creating unnecessary and unexpected delays. These delays are produced by the density of passengers accumulated in the Main terminals and Gates, and the inefficient and obsolete movement of the aircraft through the bidirectional taxi lines. The airplanes suffer from the implementation of a system where they need to be pulled back by an external ground sub-system that moves the aircraft to the bi-directional taxi lanes where they can finally move on their own. On the other hand, the arriving aircraft need to delay their access to the gates while waiting for the leaving airplanes to reach the main taxi drives, producing conflicts to the flight programs of arrivals, departures and flight connections schedules. All these variables are essential components of a non-efficient system that, if it is not abruptly changed in the upcoming years, with the growing evolution of air traffic, will end up in an air industry collapse.

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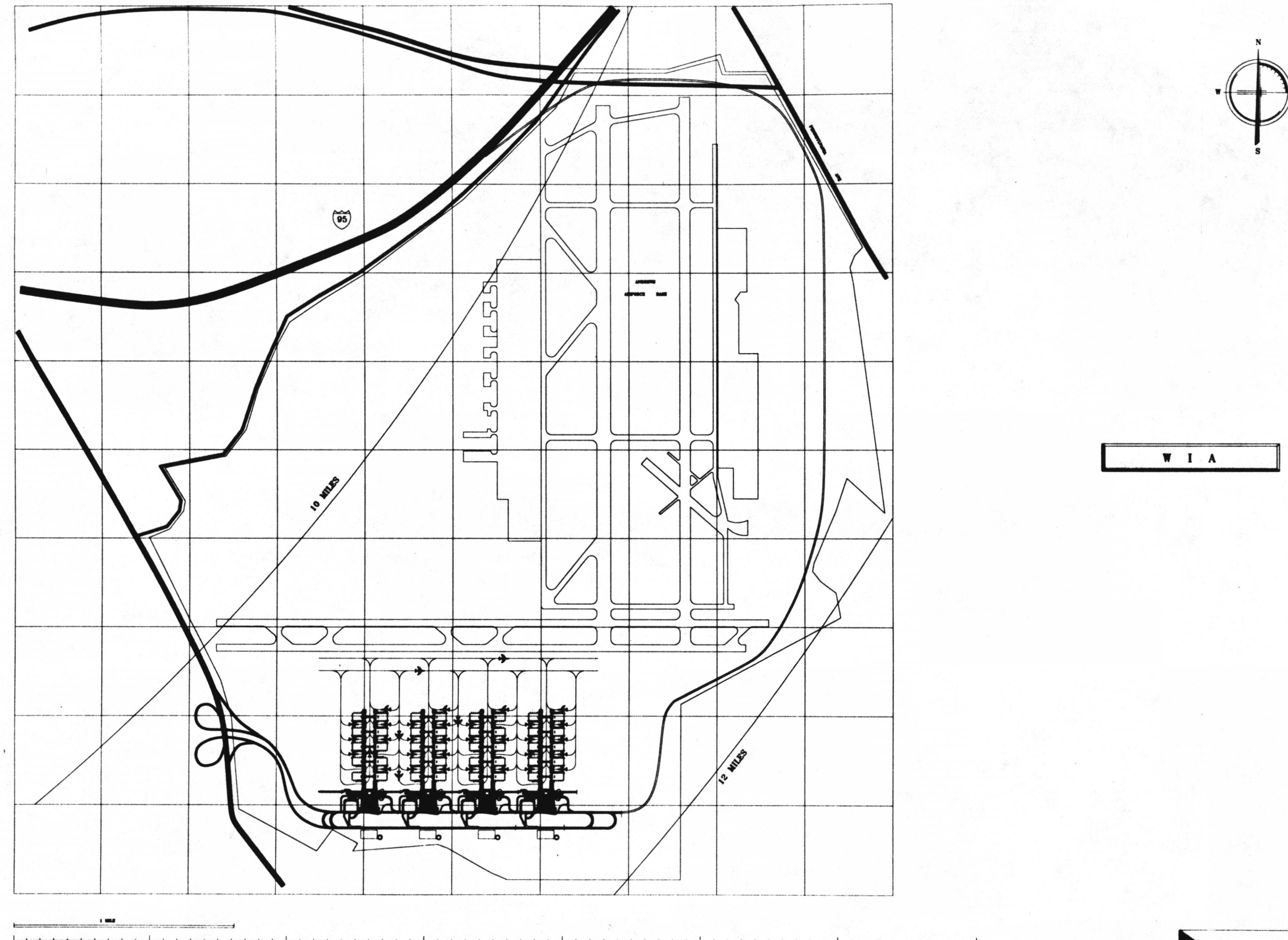
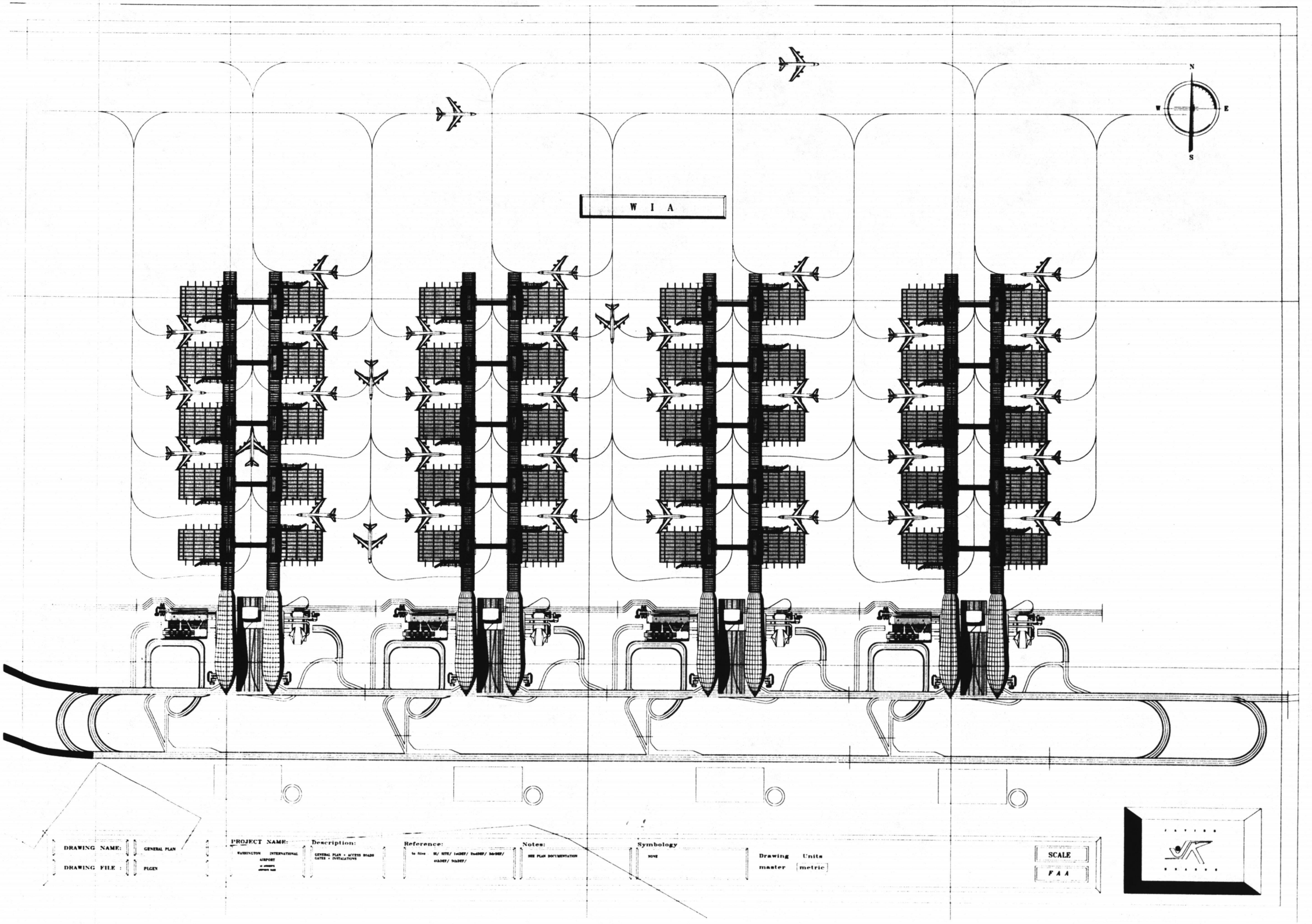
W.I.A. and OFS

W.I.A represents a possible solution to the needs of future airports. The project's site is the present Andrew's Air Force Base. This Military Base is located next to Interstate 95 between Washington D.C. and Baltimore, Md. within a 12 miles radius of the Capitol. This site offers the proper dimensions to install a new International Airport using the innovative OFS (Only Forward System) in replacement of the DDS (Double Directional Taxi lane System) used since the beginning of Commercial Air Transportation. W.I.A. is conceived as a suspended mega structure, where the planes can freely move forward using their own propulsion power, not being restricted by the use of secondary ground sub-systems. The OFS uses a new concept of unidirectional taxi lanes instead of the old and inefficient bidirectional concept. This system allows the planes to reach the gates from the taxi lanes and to leave them without running into unnecessary double-crossing delays. The system is conceived under the standardization of suspended gates, ready to hold planes from a DC9 to a 747-400. The gates were designed with flexible dimensional margins, to accommodate future aircraft under development, such as the Boeing project for a 800 person airplane. W.I.A was designed to hold up to 96 gates with a primary stage of 56 gates. Responding to the functional needs of contemporary airports, the infrastructure was divided into 4 Main Terminals, each one holding up to 12 OFS gates in a primary stage, upgradeable to 96 Gates with the implementation of 4 additional Main Terminals. The OFS Gates are interconnected to each other and to the Main Terminals by linear connectors 29 meters above the ground, leaving 10 additional meters of space between the top of the back wing of a Boeing 747-400 and the connectors base, in order to hold future larger aircraft, like the Boeing previously mentioned. Also the wing separation holds an extra margin of 15 meters on each side, between the wing of the 747-400 and the 6 super columns supporting each of the OFS Gates.



DRAWING NAME: GENERAL PLAN	PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT	Description: GENERAL PLAN + ACCESS ROADS GATES + INSTALATIONS	Reference:	Notes: SEE PLAN DOCUMENTATION	Symbology NONE	Drawing Units	SCALE
DRAWING FILE : PLGEN						master metric	F A A



DRAWING NAME: GENERAL PLAN

DRAWING FILE : PLGEN

PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT

Description: GENERAL PLAN - ACCESS ROADS GATES - INSTALLATIONS

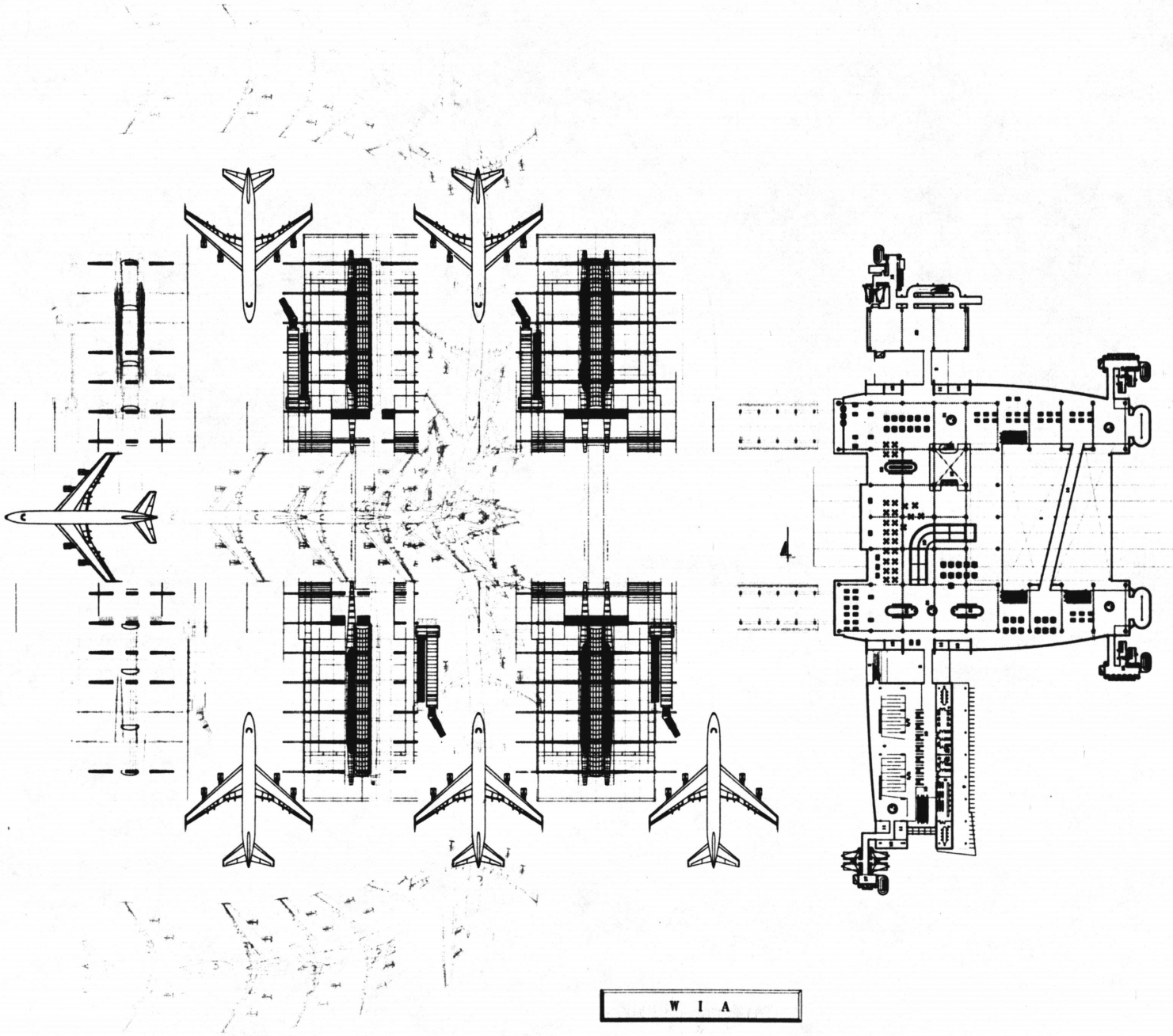
Reference: to files SU/ SITE/ 1st2027/ 2nd2027/ 3rd2027/ 4th2027/ 5th2027/

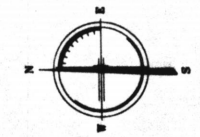
Notes: SEE PLAN DOCUMENTATION

Symbology: NONE

Drawing master Units: metric

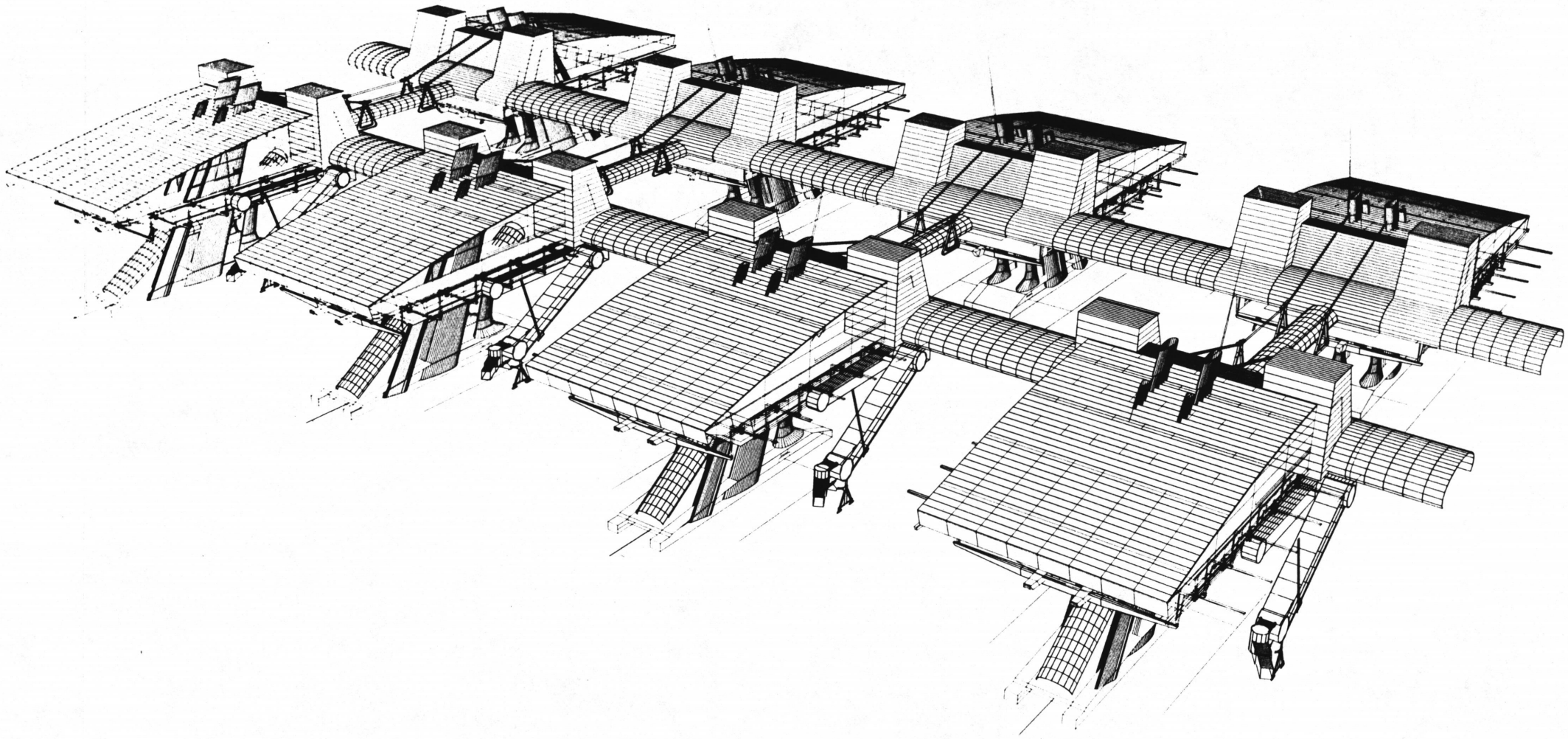
SCALE: FAA



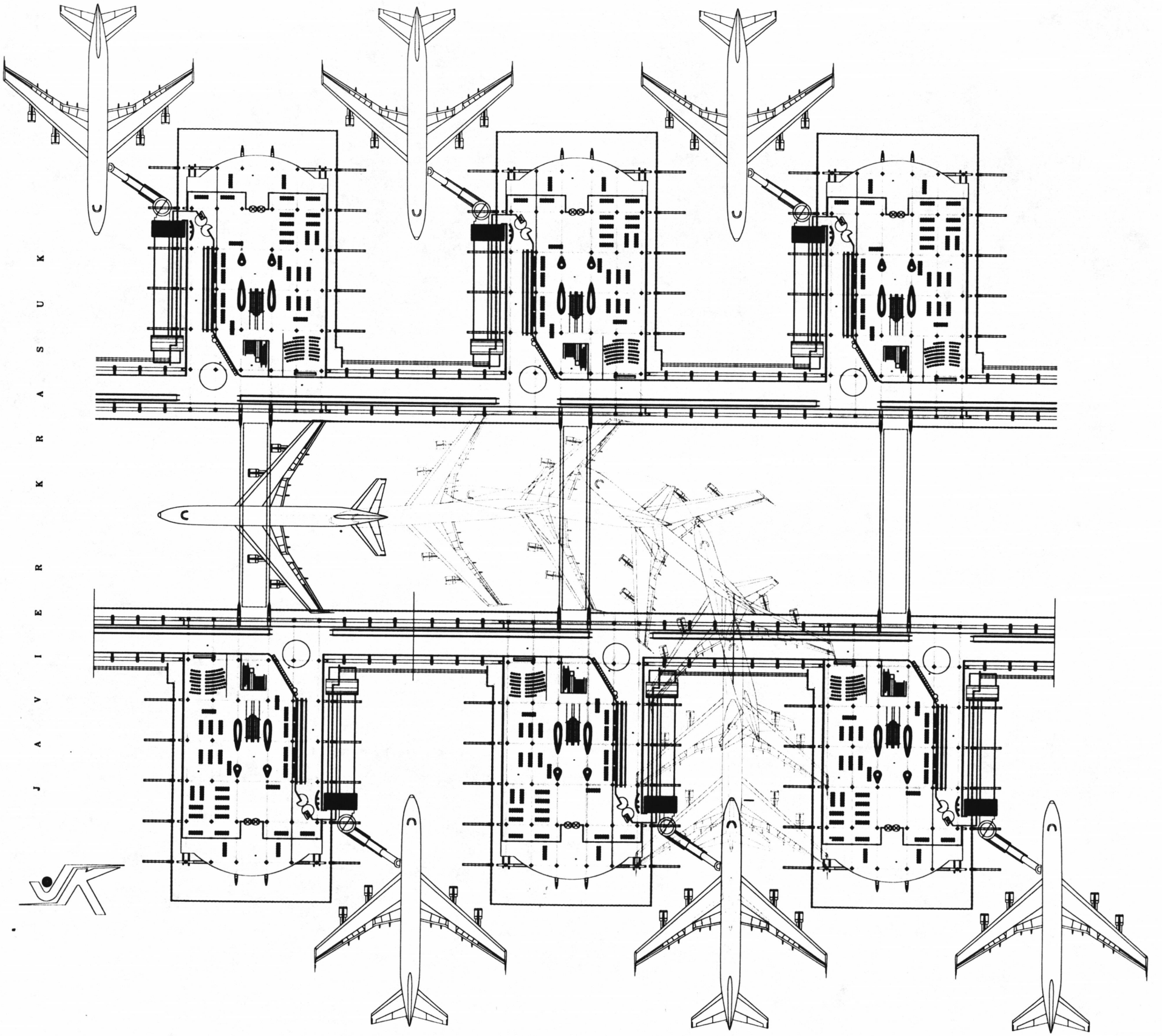


W I A

DRAWING NAME:	2nd LEVEL PLAN PRO	PROJECT NAME:	Description:	Reference:	Notes:	Symbology	Drawing master	Units metric	SCALE FAA
DRAWING FILE :	DGA2D07								



JAVIER KRASUK



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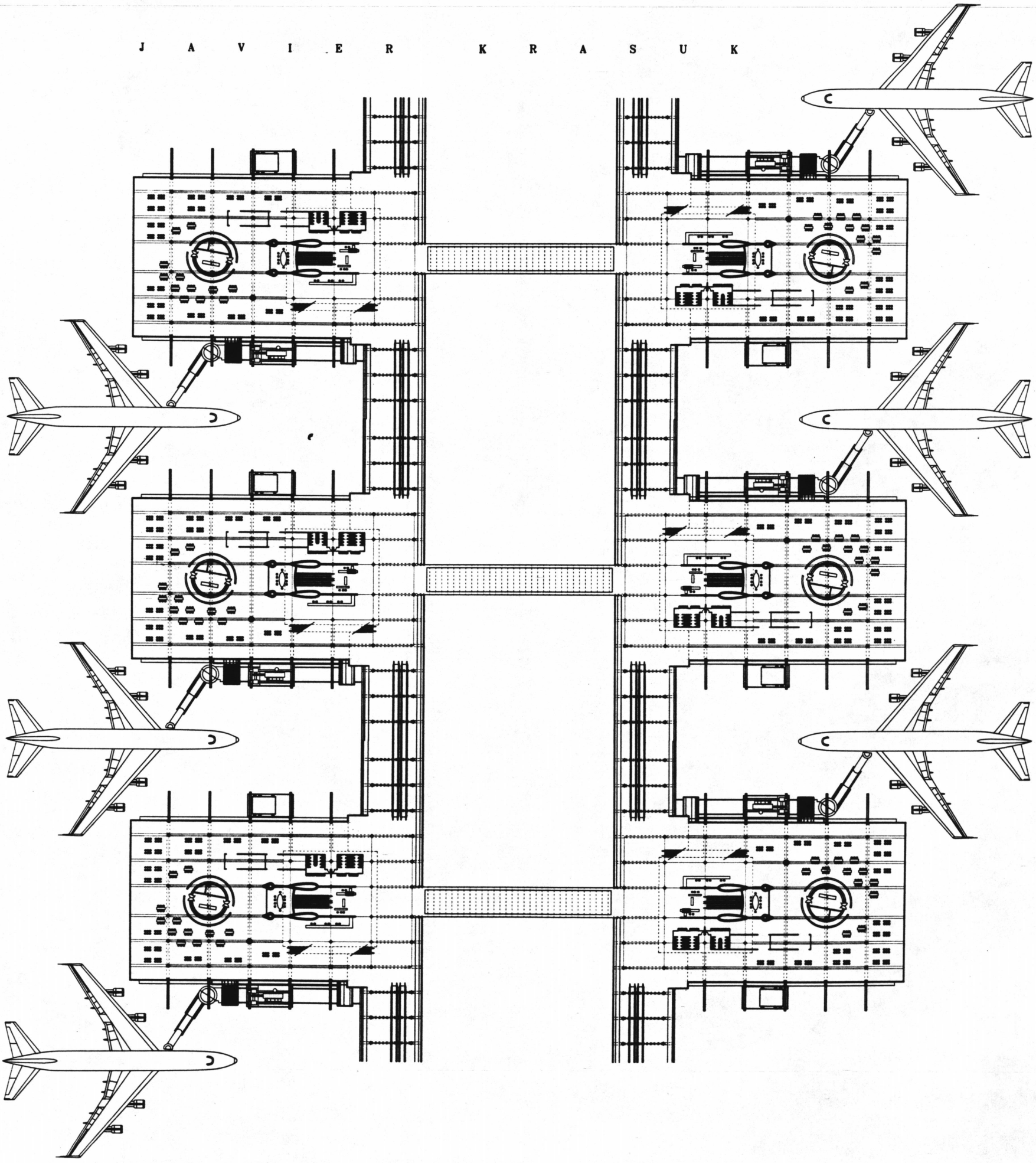

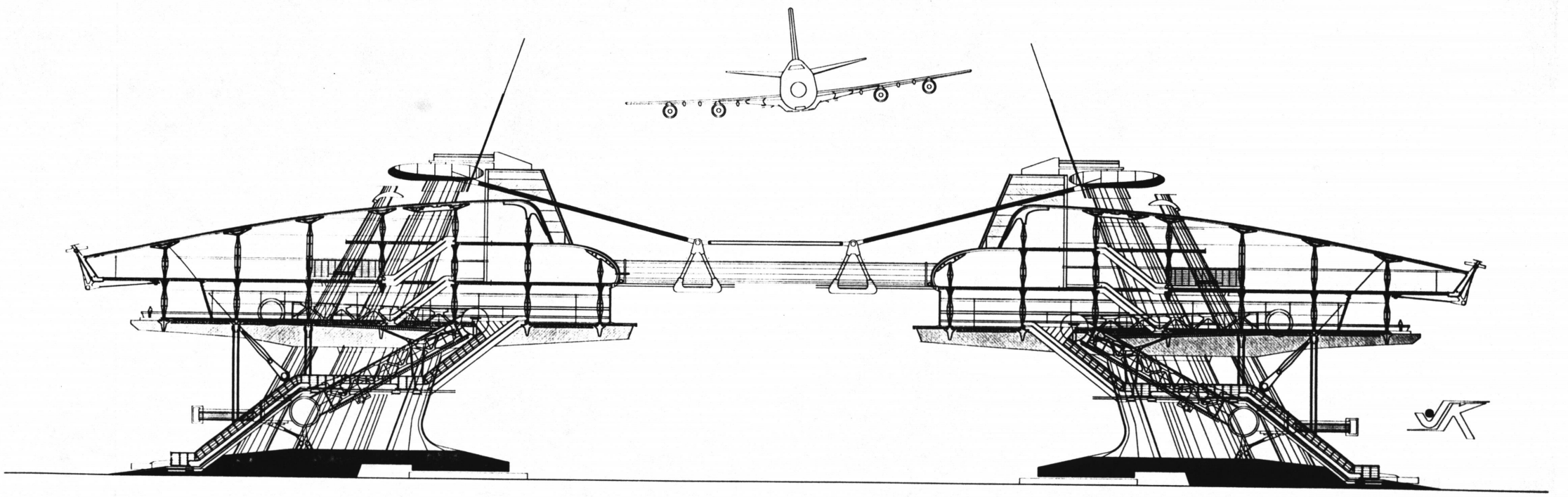

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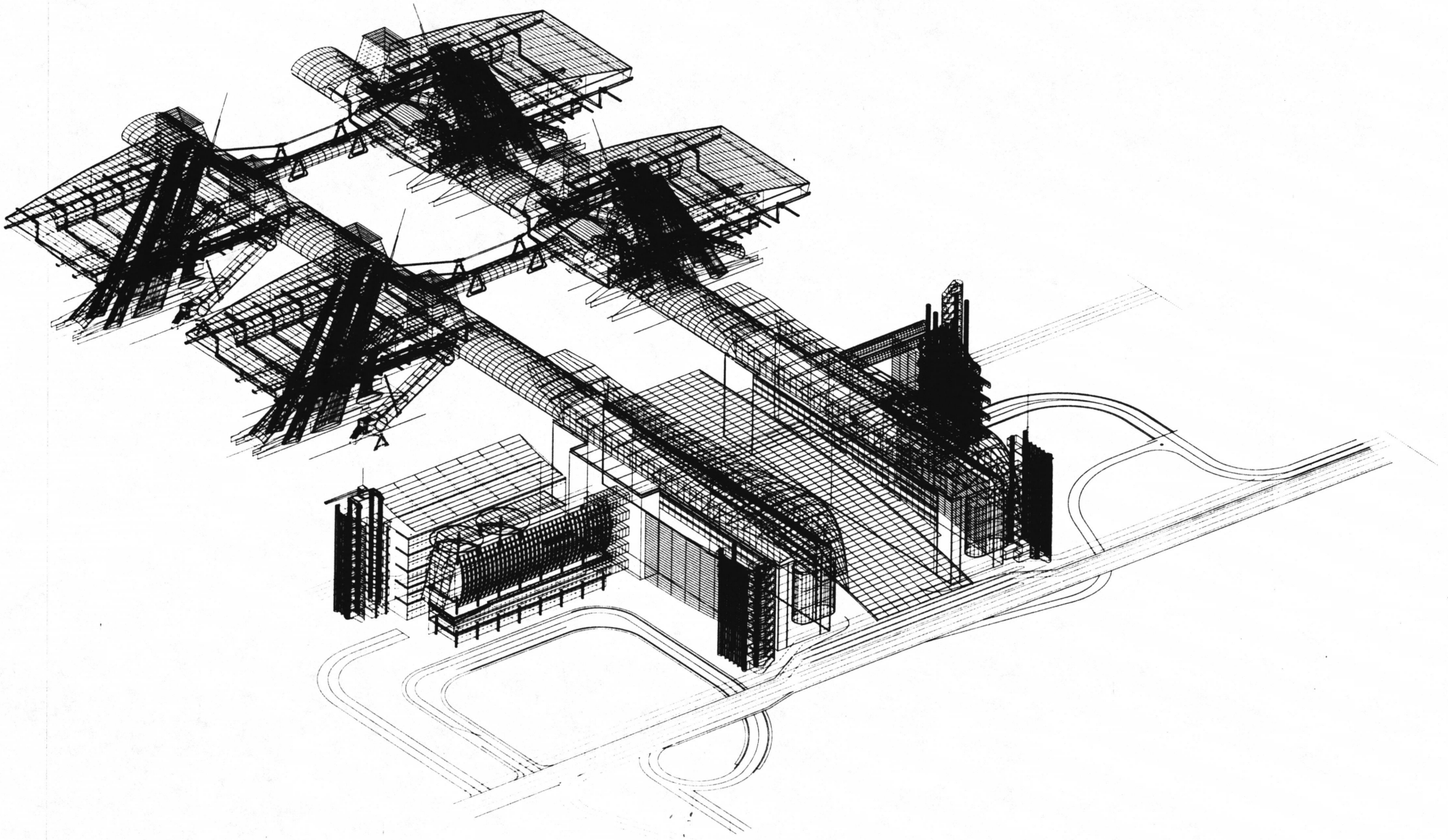
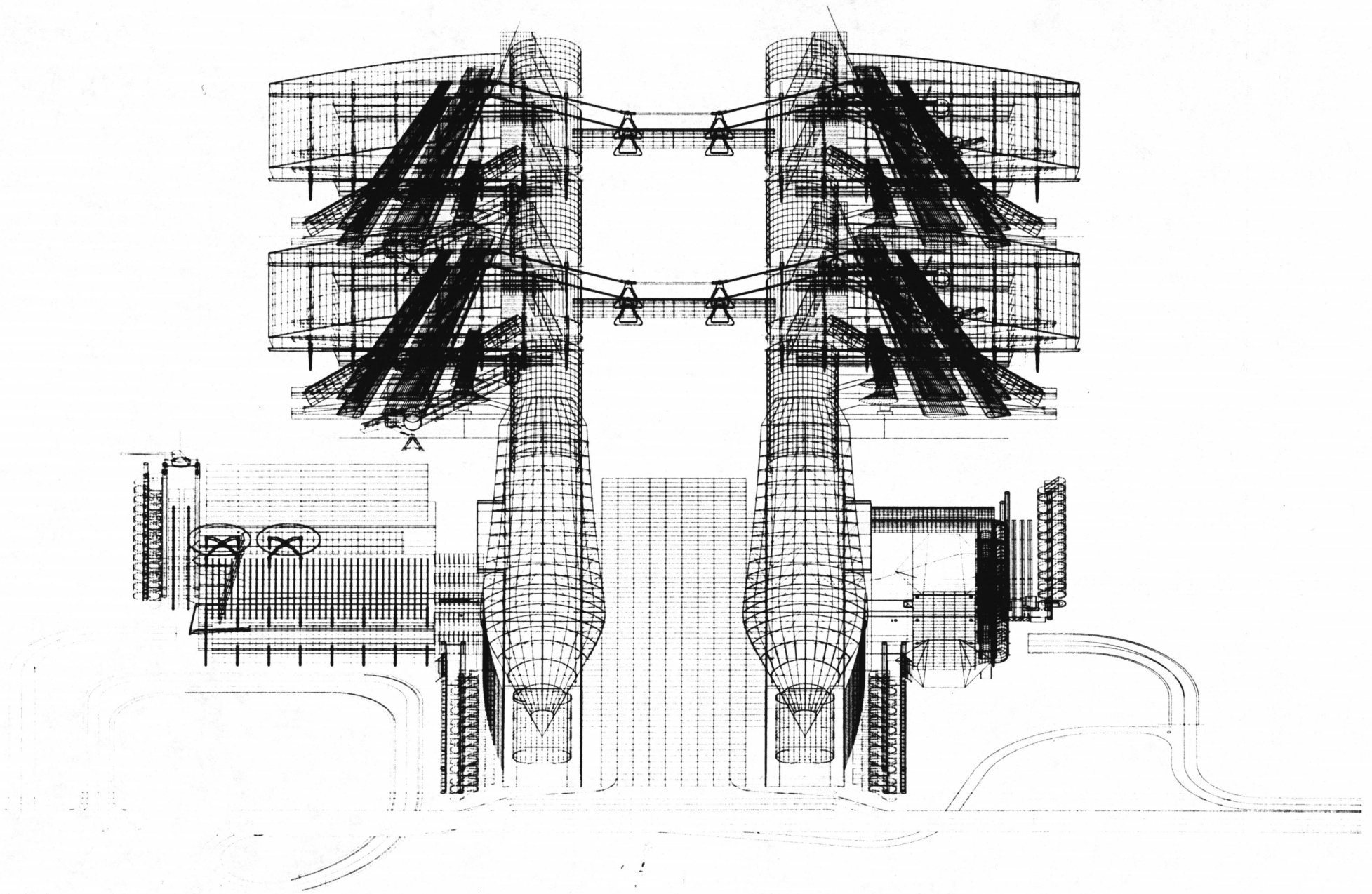
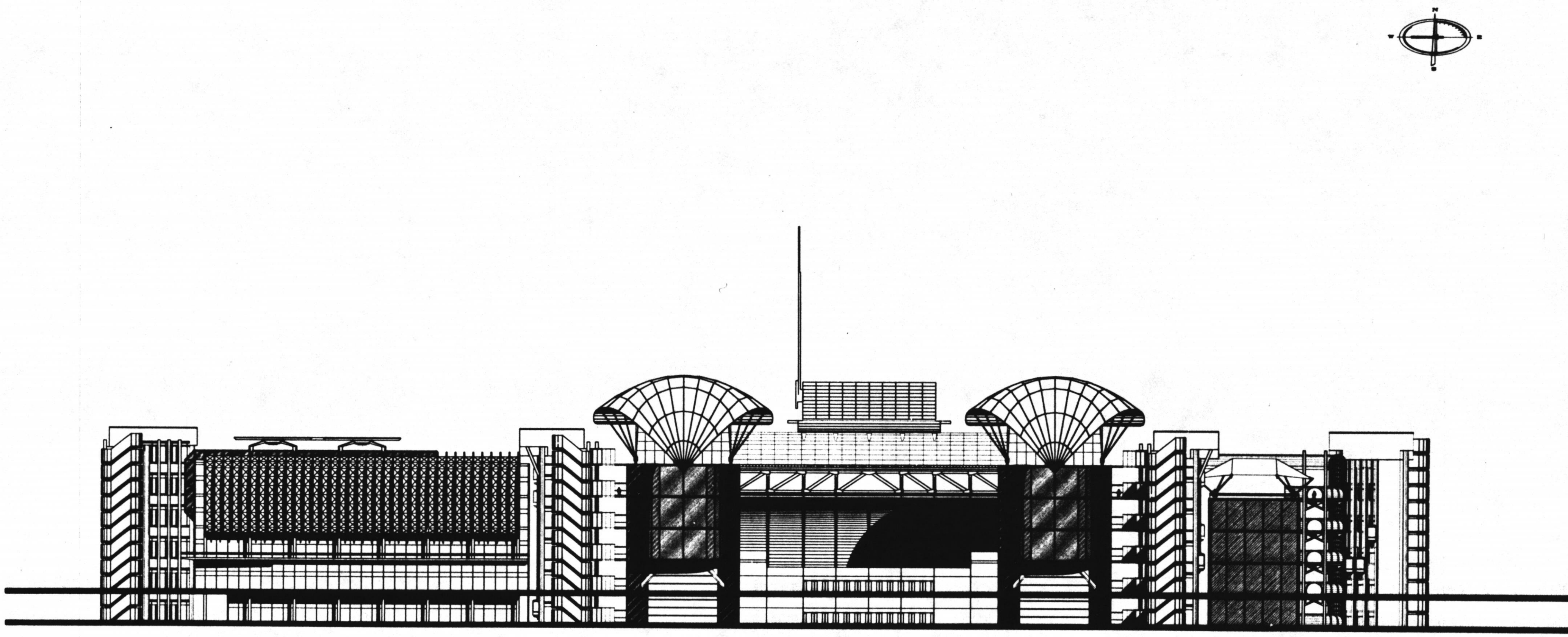






W I A

DRAWING NAME:	FRONT SIDE VIEW	
DRAWING FILE :	VISMAIN	

PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT

Description: Front side view of Main Terminal prototype

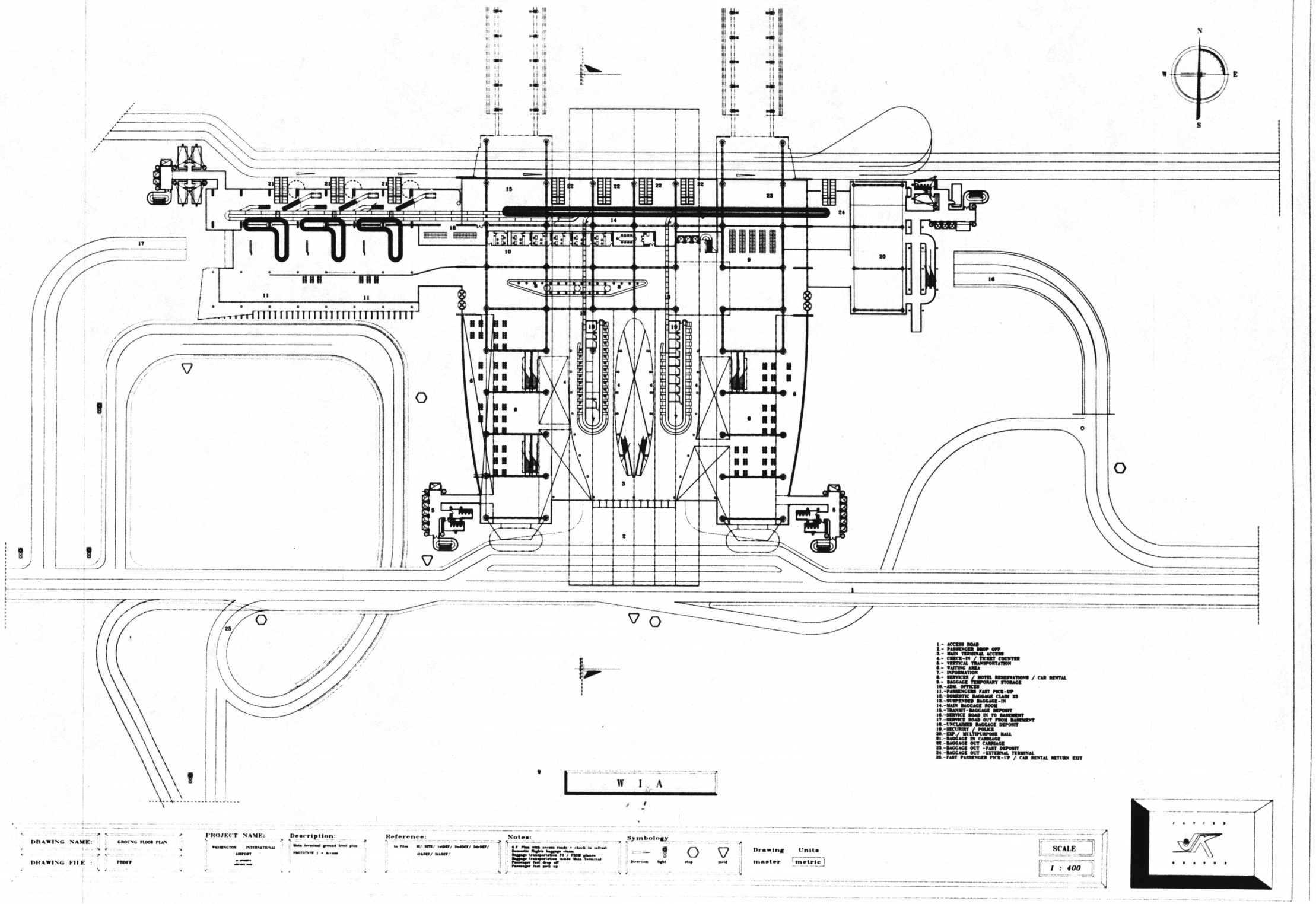
Reference:

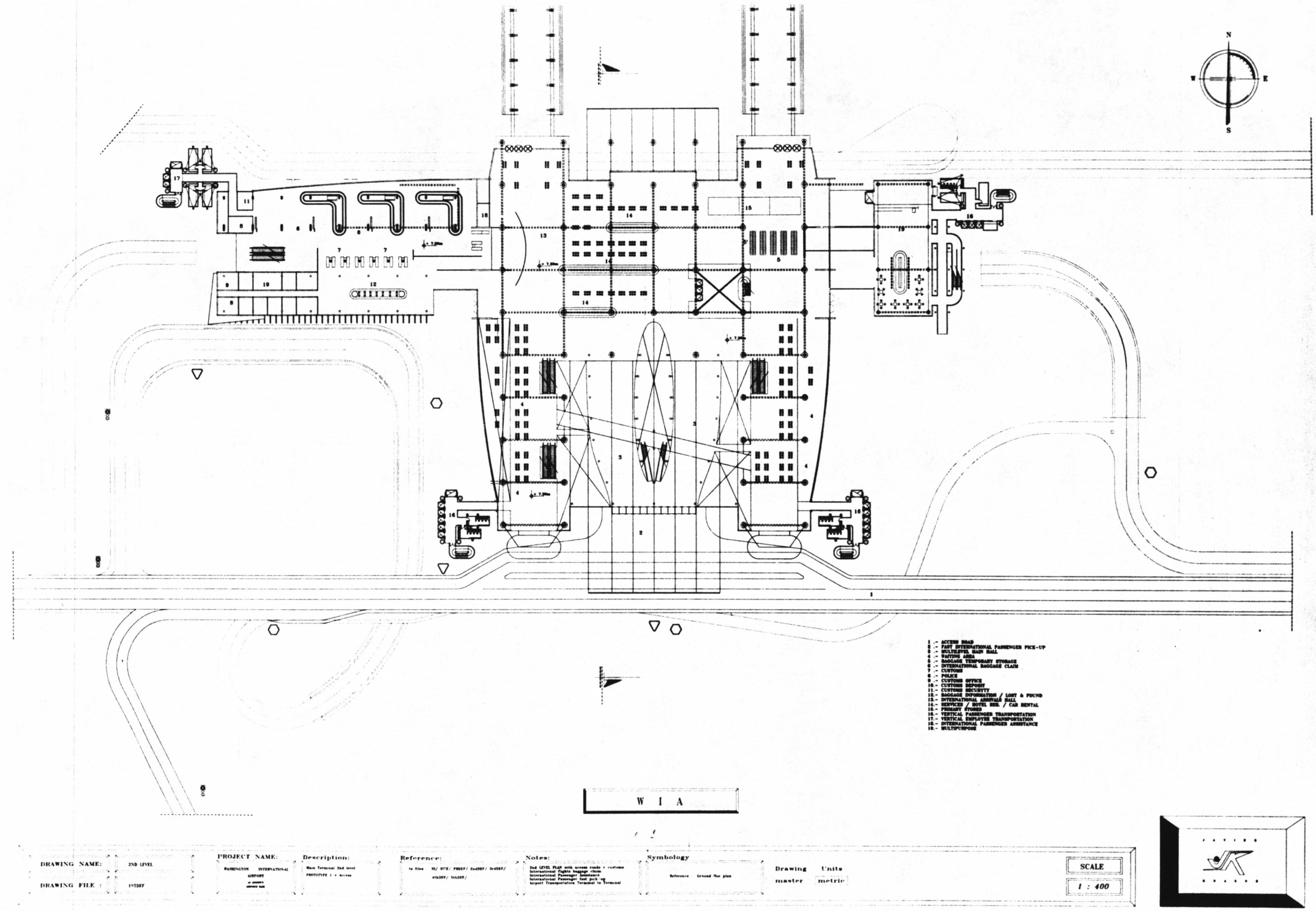
Notes: Main terminal front view +access roads / west bound / east bound / passenger vertical transportation / front roof profile / --

Symbology NONE

Drawing Units
master metric

SCALE
1:320 FAA


N
W
E
S
1.- ACCESS ROAD
2.- PASSENGER DROP OFF
3.- MAIN TERMINAL ACCESS
4.- CHECK-IN / TICKET COUNTER
5.- VERTICAL TRANSPORTATION
6.- WAITING AREA
7.- INFORMATION
8.- SERVICES / HOTEL RESERVATIONS / CAR RENTAL
9.- BAGGAGE TEMPORARY STORAGE
10.-ADM. OFFICES
11.-PASSENGERS FAST PICK-UP
12.-DOMESTIC BAGGAGE CLAIM X3
13.-SUSPENDED BAGGAGE-IN
14.-MAIN BAGGAGE ROOM
15.-TRANSIT-BAGGAGE DEPOSIT
16.-SERVICE ROAD IN TO BASEMENT
17.-SERVICE ROAD OUT FROM BASEMENT
18.-UNCLAIMED BAGGAGE DEPOSIT
19.-SECURITY / POLICE
20.-EXP./ MULTIPURPOSE HALL
21.-BAGGAGE IN CARRIAGE
22.-BAGGAGE OUT CARRIAGE
23.-BAGGAGE OUT -FAST DEPOSIT
24.-BAGGAGE OUT -EXTERNAL TERMINAL
25.-FAST PASSENGER PICK-UP / CAR RENTAL RETURN EXIT
W I A
DRAWING NAME:
GROUNG FLOOR PLAN
DRAWING FILE :
PRDFF
PROJECT NAME:
WASHINGTON INTERNATIONAL AIRPORT
Description:
Main terminal ground level plan
PROTOTYPE 1 - Access
Reference:
to files W/ SITE/ 1stDEP/ 2ndDEP/ 3dr/DEP/ 4thDEP/ 5thDEP/
Notes:
G.F Plan with arrows roads + check in infront
Domestic flights baggage claim
Baggage transportation TO / FROM planes
Baggage transportation inside Main Terminal
Passenger fast drop off
Passenger fast pick up
Symbology
Direction
light
stop
yield
Drawing Units
master
metric
SCALE
1 : 400



W I A

DRAWING NAME: 2ND LEVEL

DRAWING FILE : 1STDEF

PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT

Description: Main Terminal 2nd level PROTOTYPE 1 + Access

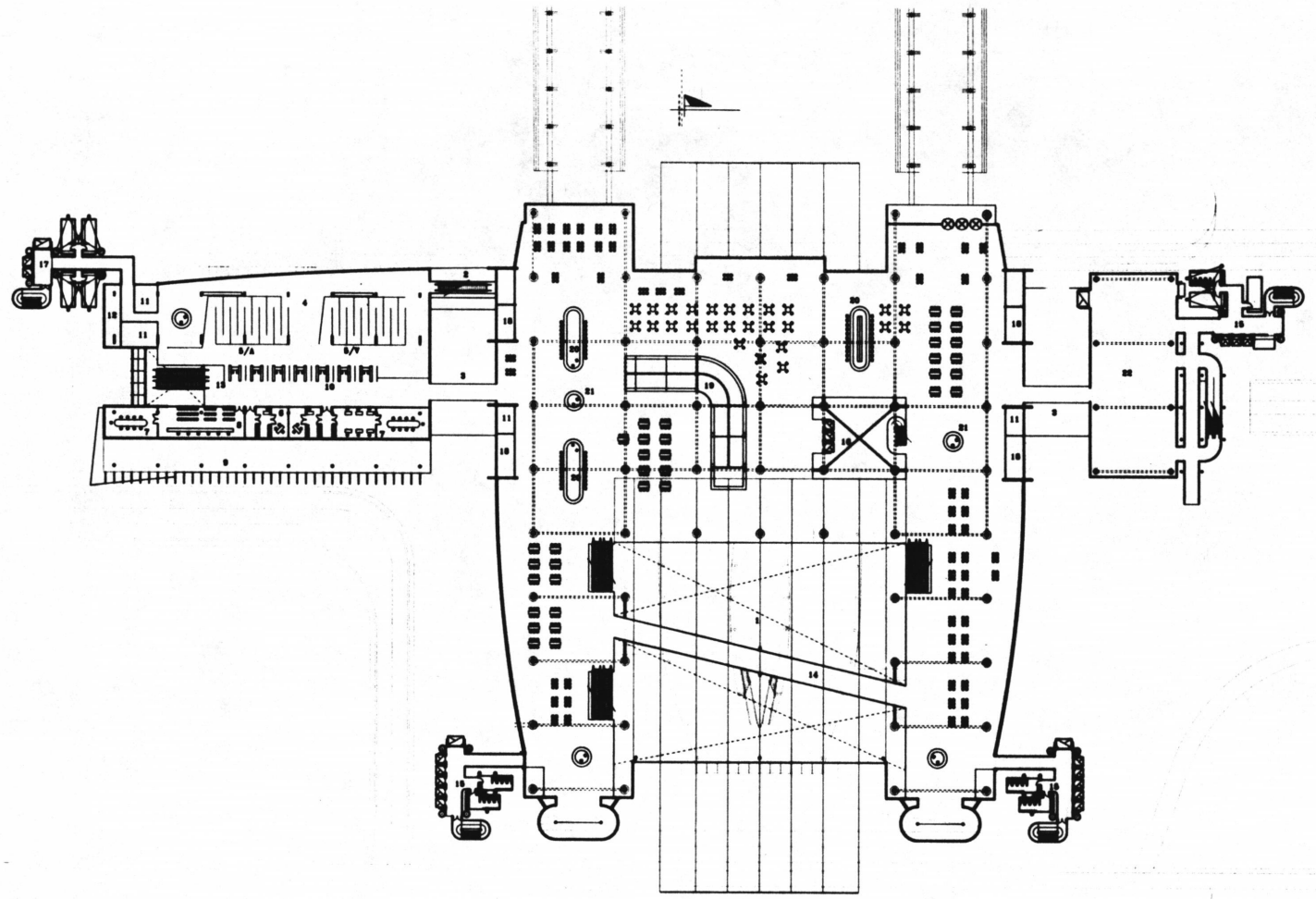
Reference: to files SI/ SITE/ PRDEF/ 2ndDEF/ 3rdDEF/ 4thDEF/ 5thDEF/

Notes: 2nd LEVEL PLAN with access roads + customs International flights baggage claims International Passenger Assistance International Passenger fast pick up Airport Transportation Terminal to Terminal

Symbology: Reference Ground flor plan

Drawing Units: master metric

SCALE 1 : 400



W I A

DRAWING NAME:	3rd LEVEL FLOOR PLAN
DRAWING FILE :	3rdlvl

PROJECT NAME:

Description:

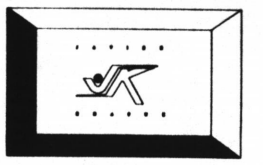
Reference:

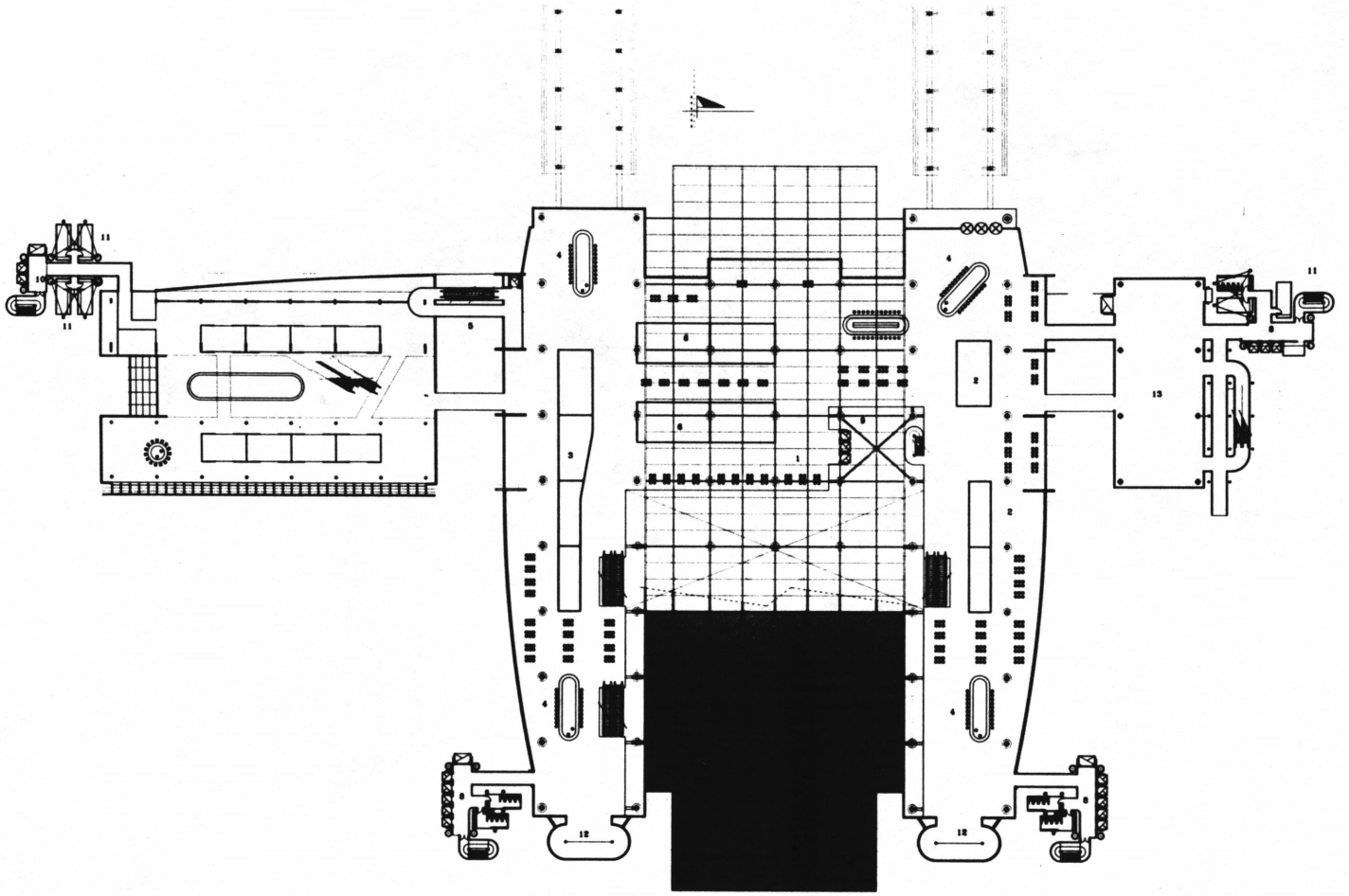
Notes:

Symbology

Drawing master — Unite: metric

SCALE 1 : 400

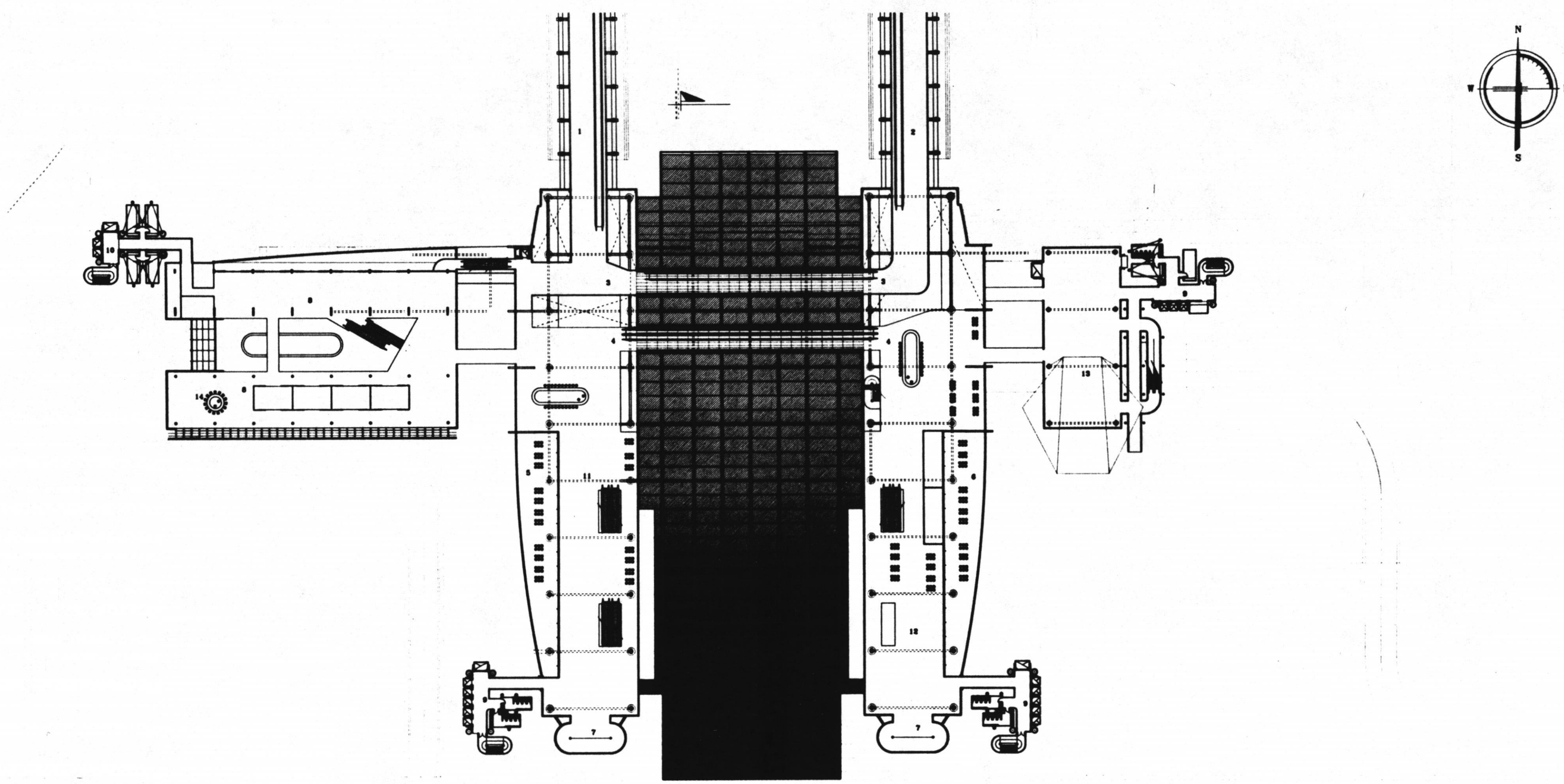




1 .- MAIN HALL
2 .- EAST BOUND SHOPS
3 .- WEST BOUND SHOPS
4 .- CAFFETERIA
5 .- INTERNATIONAL ARRIVALS CONNECTOR TO MIGRATIONS FROM GATES
6 .- DUTY FREE SHOPS (CENTRAL COURT)
7 .- MULTY LEVEL WEST HALL
8 .- VERTICAL PASSENGER TRANSPORTATION / EXT. TOWER
9 .- VERTICAL PASSENGER TRANSPORTATION /INT.
10.- VERTICAL EMPLOYEES TRANSPORTATION/ TOWER
11.- SERVICE ROOM
12.- SOUTH DECKS
13.- EXPANSION / MULTIPURPOSE

W I A

DRAWING NAME:	4TH LEVEL PLAN	PROJECT NAME:	Description:	Reference:	Notes:	Symbology	Drawing master	Units metric	SCALE 1 : 400
DRAWING FILE :	3r4DGF		4th Level Floor Plan + shops court		4th Level floor plan + shoping / exposition / waiting area & services / cafeteria.-	none			



1 .- WEST BOUND CONNECTOR
2 .- EAST BOUND CONNECTOR
3 .- INTER GATES CONNECTOR (MIGRATIONS)
4 .- INTER BOUDS CONNECTOR (MAIN TERMINAL)
5 .- WEST DECK
6 .- EAST DECK
7 .- FRONT DECKS
8 .- WEST HALL / SHOPS
9 .- VERTICAL PASSENGER TRANSPORTATION / EXT. TOWER
10.- VERTICAL EMPLOYEES TRANSPORTATION / EXT. TOWER
11.- WEST BOUND SHOPS / MAIN HALL
12.- EAST BOUND SHOPS / MAIN HALL
13.- MULTY PURPOSE
14.- SECURITY
15.- INFORMATION

W I A

DRAWING NAME: 5TH LEVEL FLOOR PLAN

DRAWING FILE : 4thDXF

PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT

Description: Main Terminal 5th level plan
PROTOTYPE 1

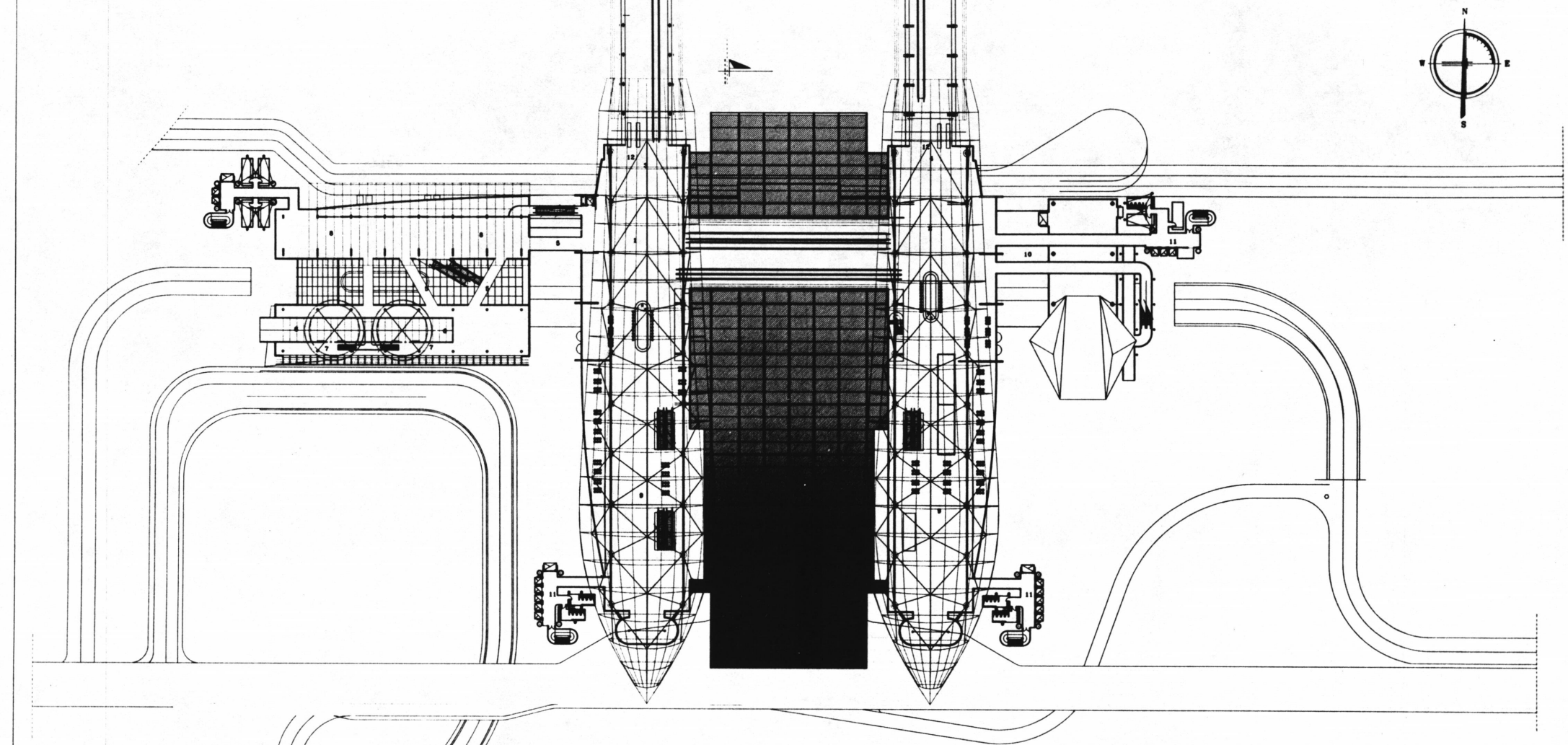
Reference: to files : ...

Notes: 5th Level Floor Plan
Gates exit to migrations connector
Expansions / shops
EAST & WEST BOUND SEPARATION

Symbology: none

Drawing Units
master metric

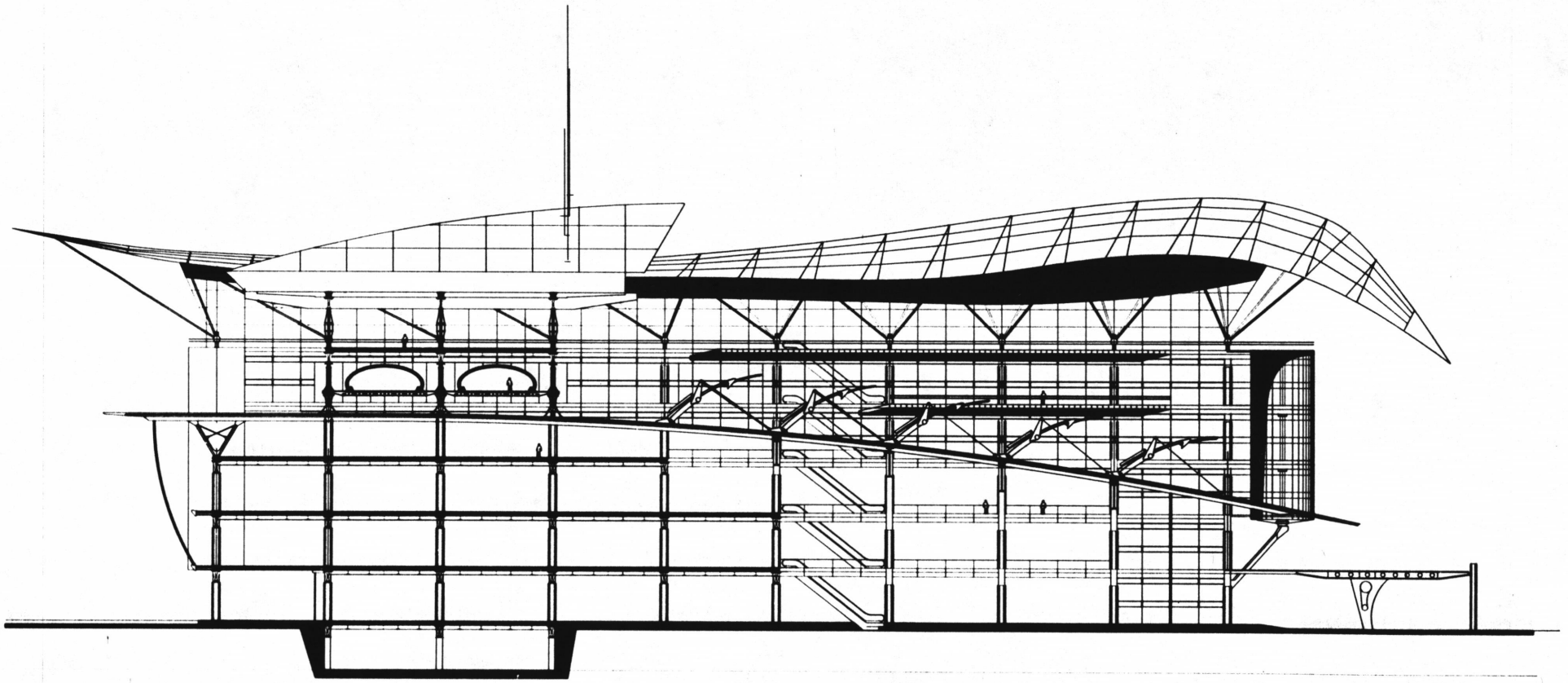
SCALE
1 : 400



1 .- WEST BOUND MAIN DECK (INDOOR)
2 .- EAST BOUND MAIN DECK (INDOOR)
3 .- WEST CHECK POINT (GATES ACCESS)
4 .- EAST CHECK POINT (GATES ACCESS)
5 .- HELICOPTER LOUNCHER CONNECTOR
6 .- HELICOPTER LOUNCHER WAITING ROOM
7 .- HELICOPTER LOUNCHER ACCESS
8 .- WEST TERRACE (OUTDOOR)
9 .- VIP
10.- EXPANSION BUILDING CONNECTORS
11.- VERTICAL PASSENGER TRANSPORTATION
12.- VERTICAL EMPLOYEES TRANSPORTATION
13.- SECURITY

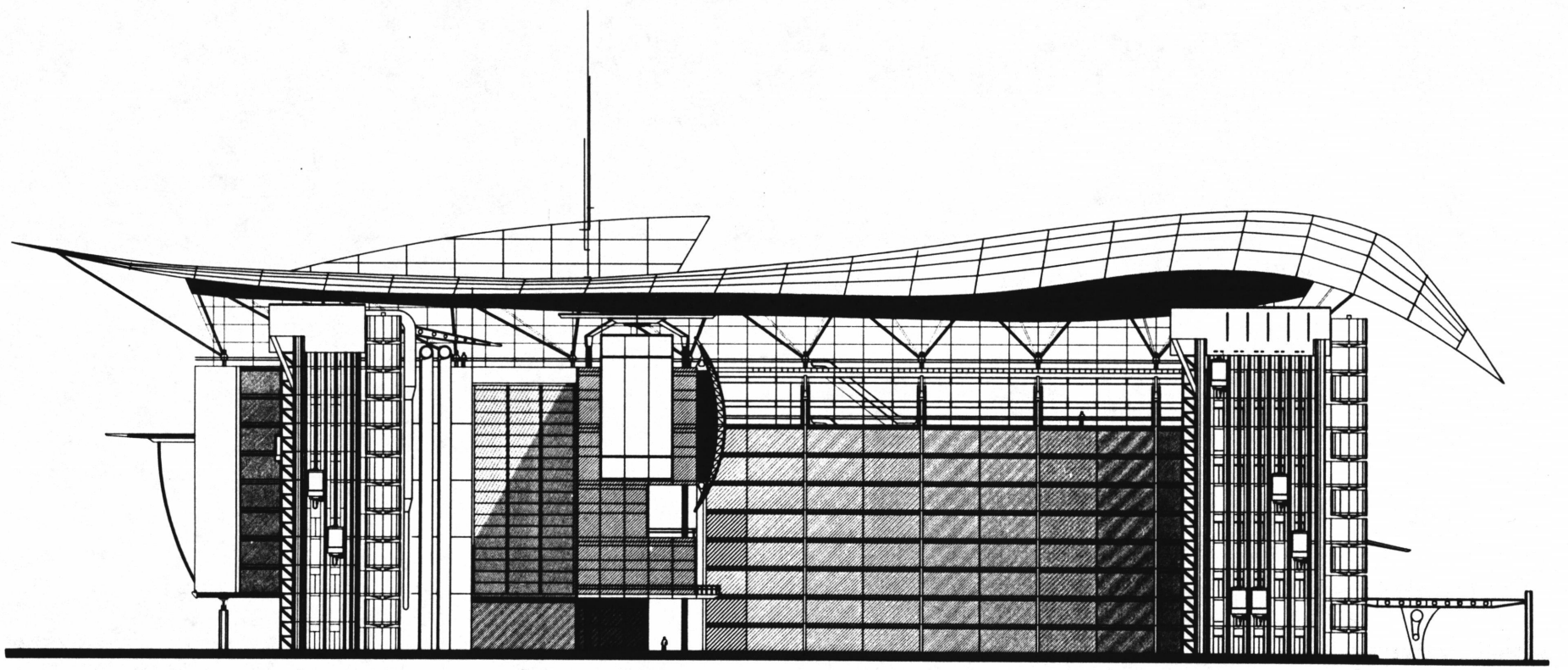
W I A

DRAWING NAME:	TOP LEVEL FLOOR PLAN	PROJECT NAME:	Description:	Reference:	Notes:	Symbology	Drawing master / Units metric	SCALE 1 : 400
DRAWING FILE :	9th					NONE		



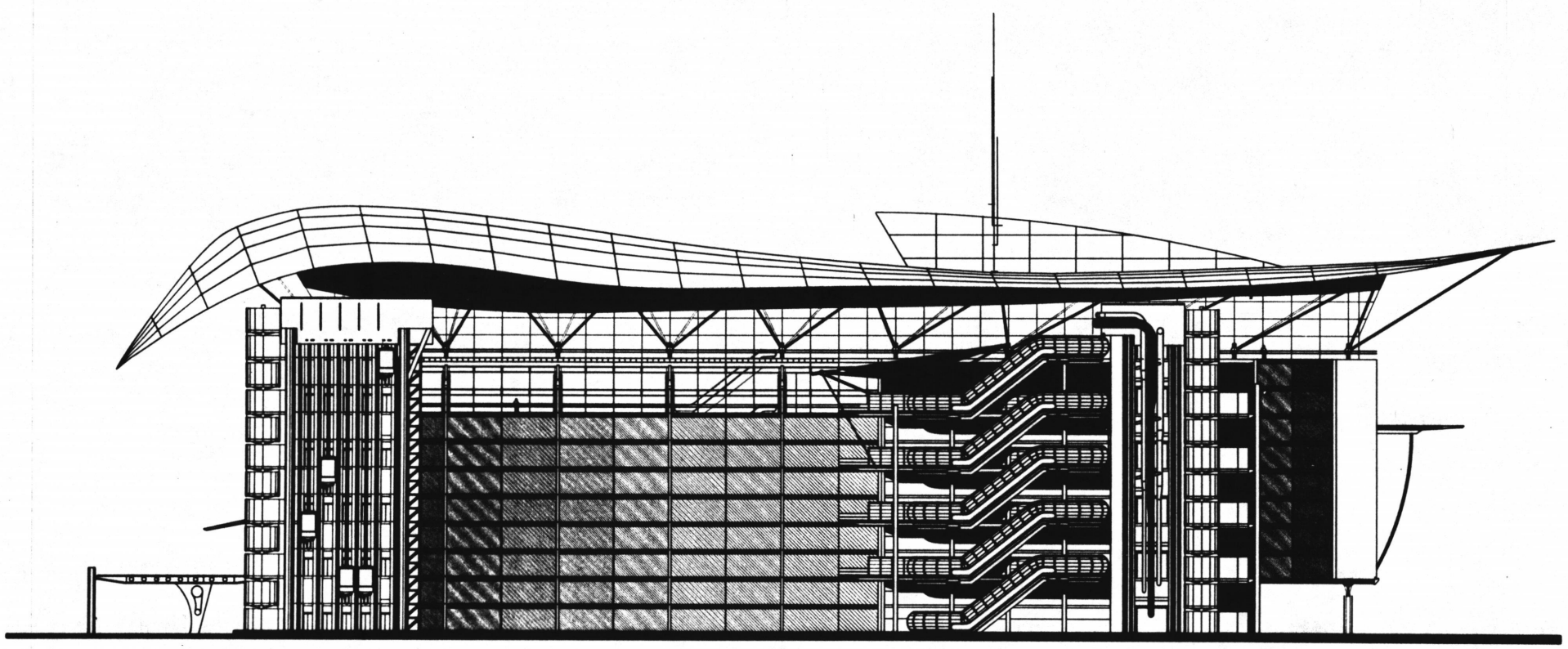
W I A

DRAWING NAME: MAIN TERMINAL SECTION	PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT	Description: SECTION ACROSS MAIN HALL	Reference: to files : VERSER/ VERSAT/	Notes: Section showing levels and roofs shapes reference transformations / multiplexes hall	Symbology NONE	Drawing master	Units [metric]	SCALE 1:200
DRAWING FILE : COUPMAIN								



W I A

DRAWING NAME:	WEST VIEW	PROJECT NAME:	Description:	Reference:	Notes:	Symbology	Drawing Units master metric
DRAWING FILE :	VISWEST		West side view of PROTOTYPE MAIN TERMINAL				SCALE 1 : 200



W I A

DRAWING NAME:	EAST SIDE VIEW	PROJECT NAME:	Description:	Reference:	Notes:	Symbology	Drawing master Units metric	SCALE 1 : 200
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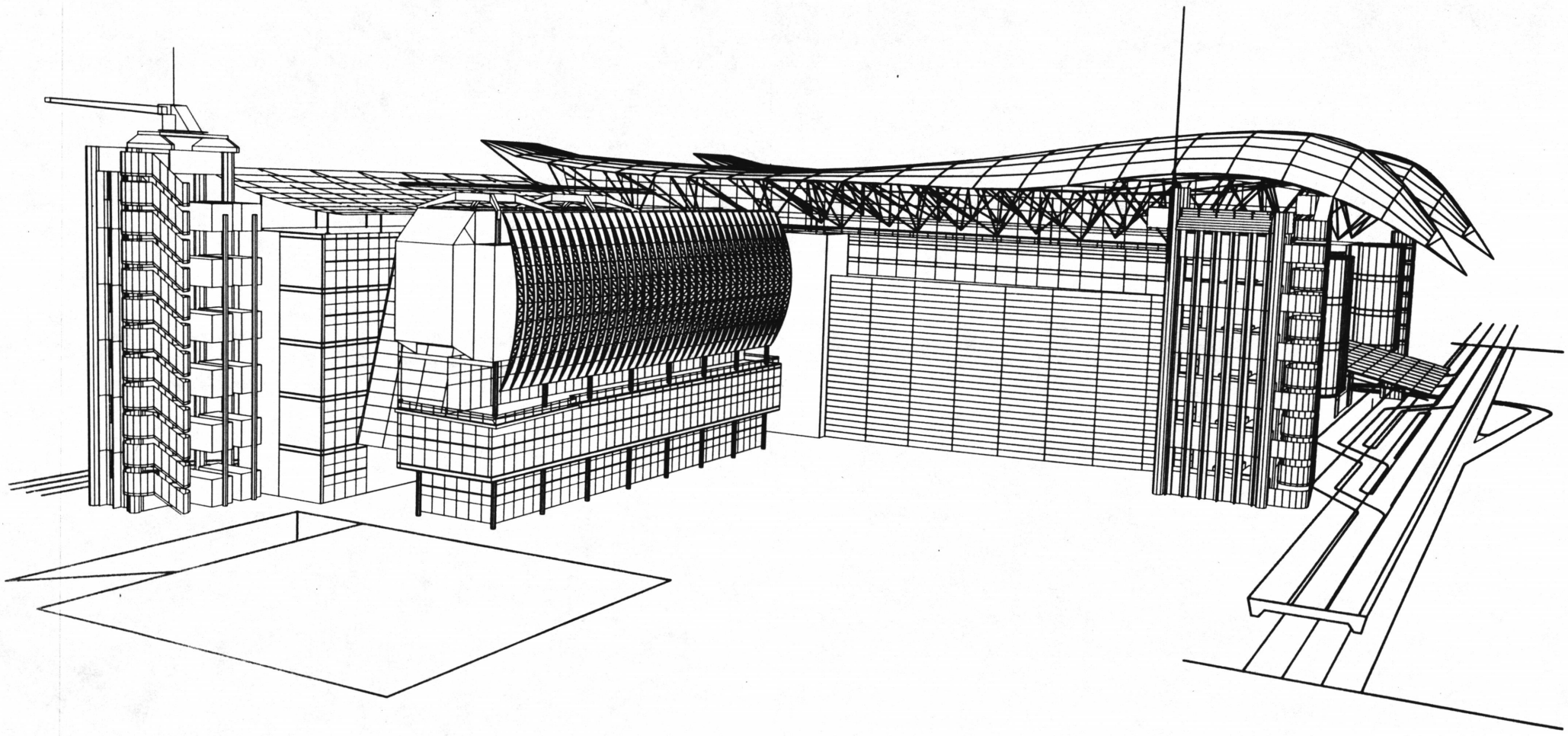
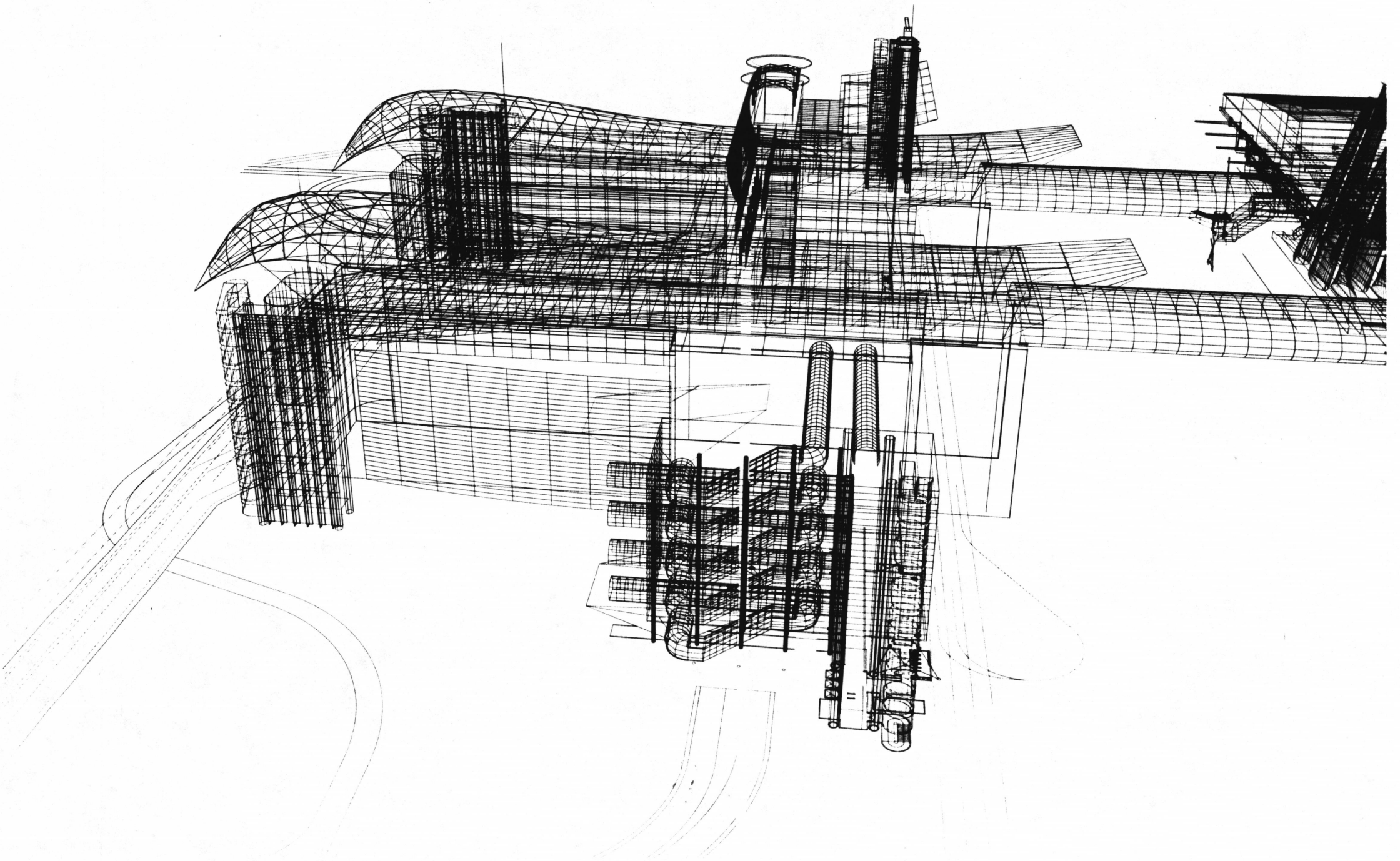
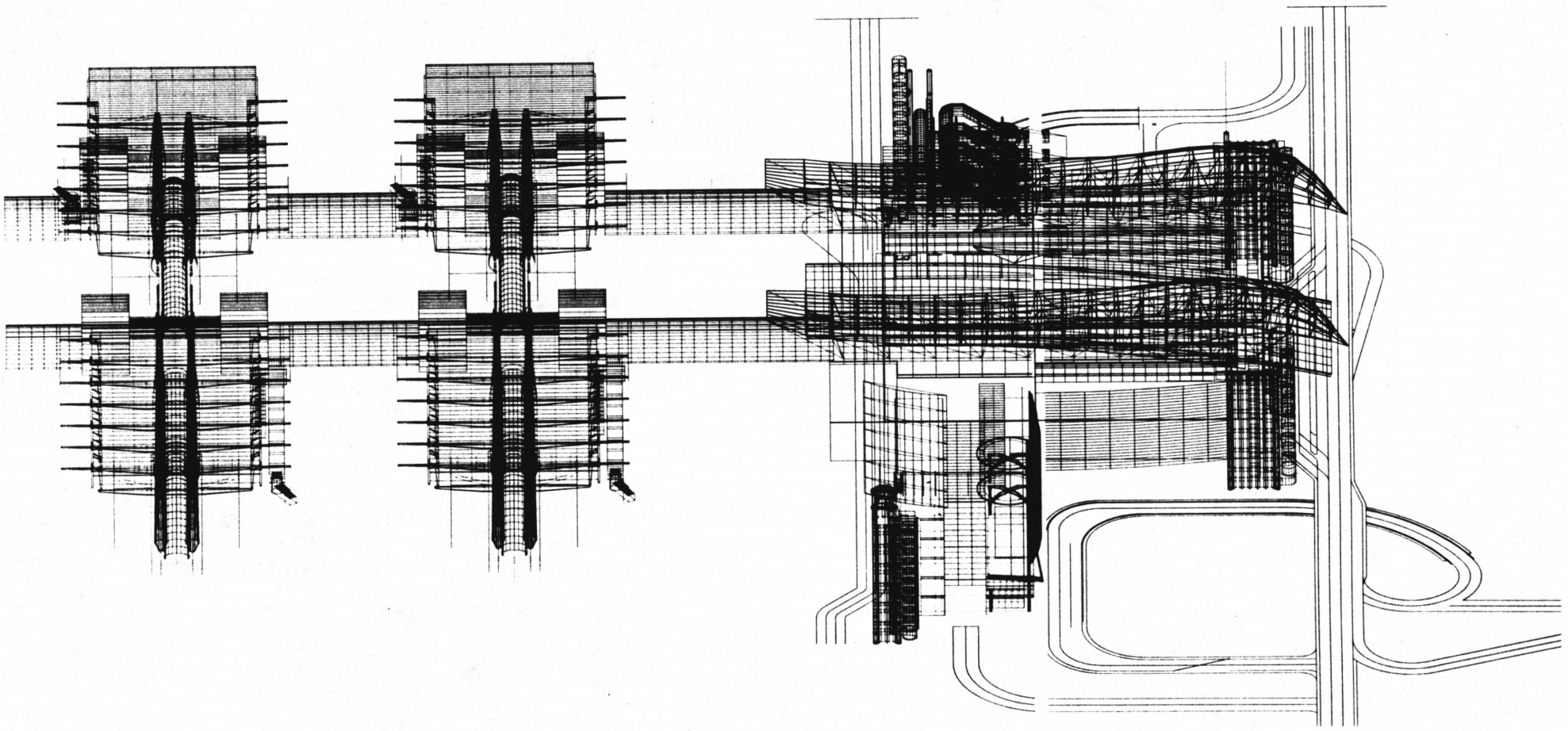
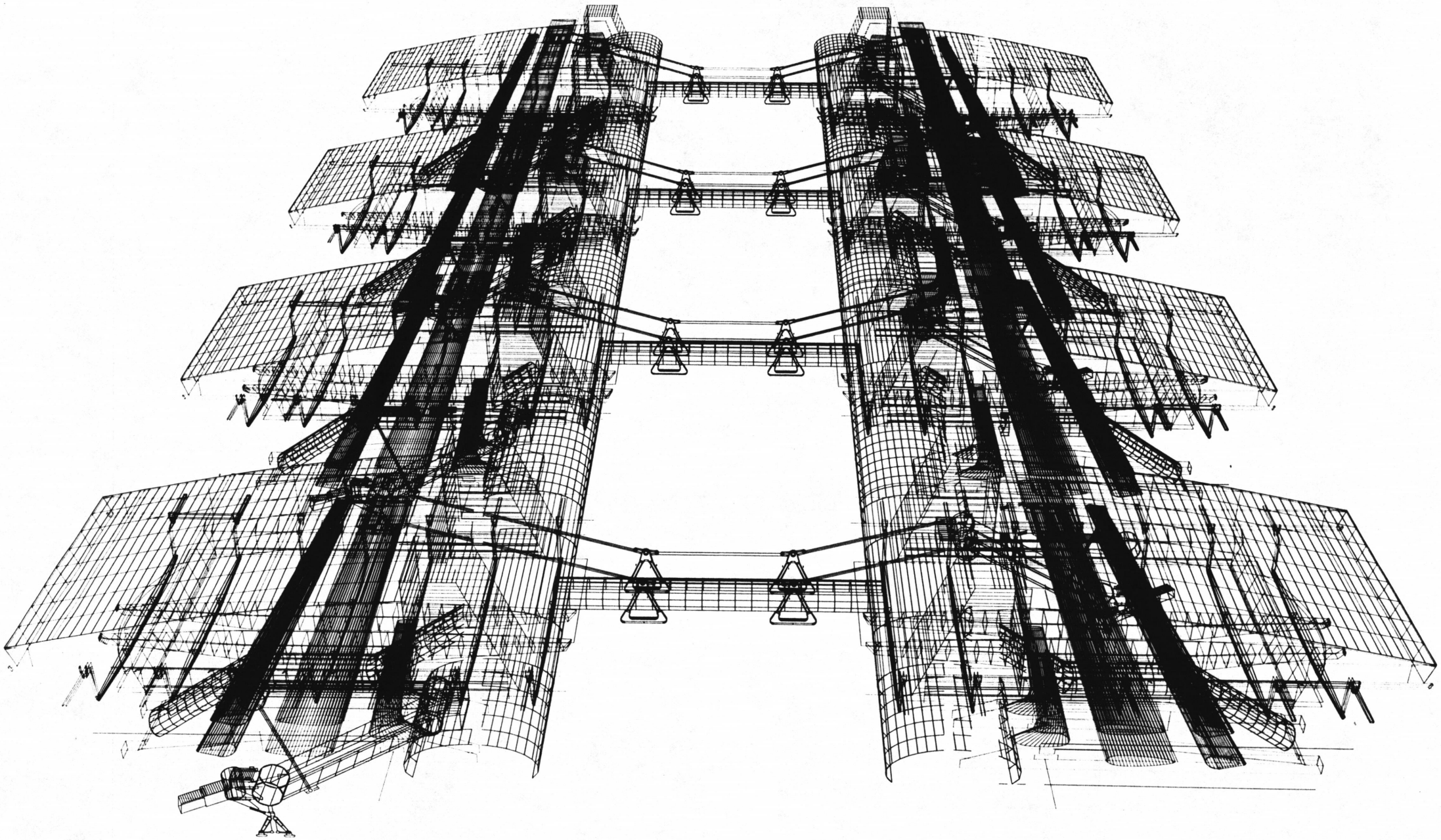
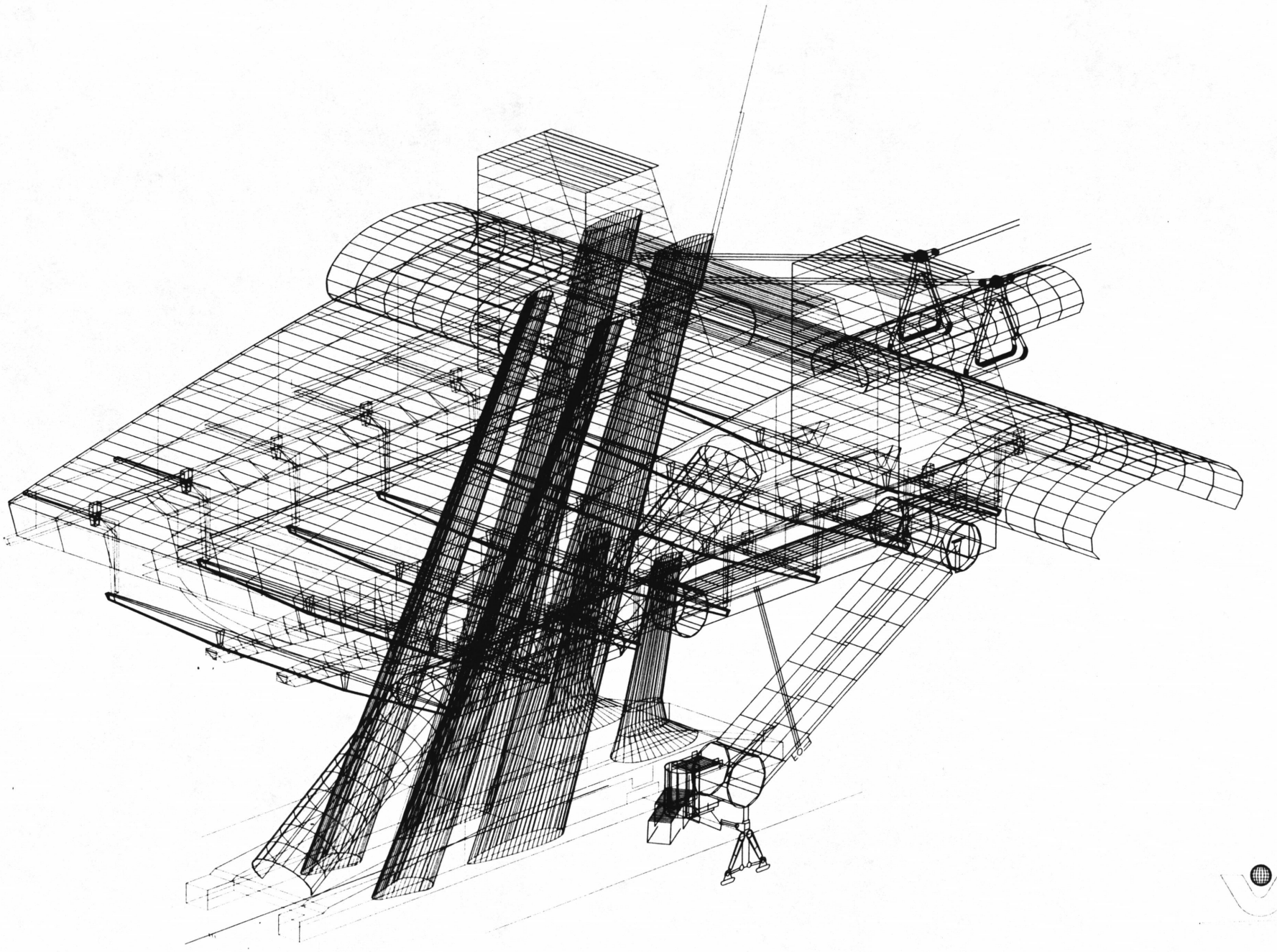


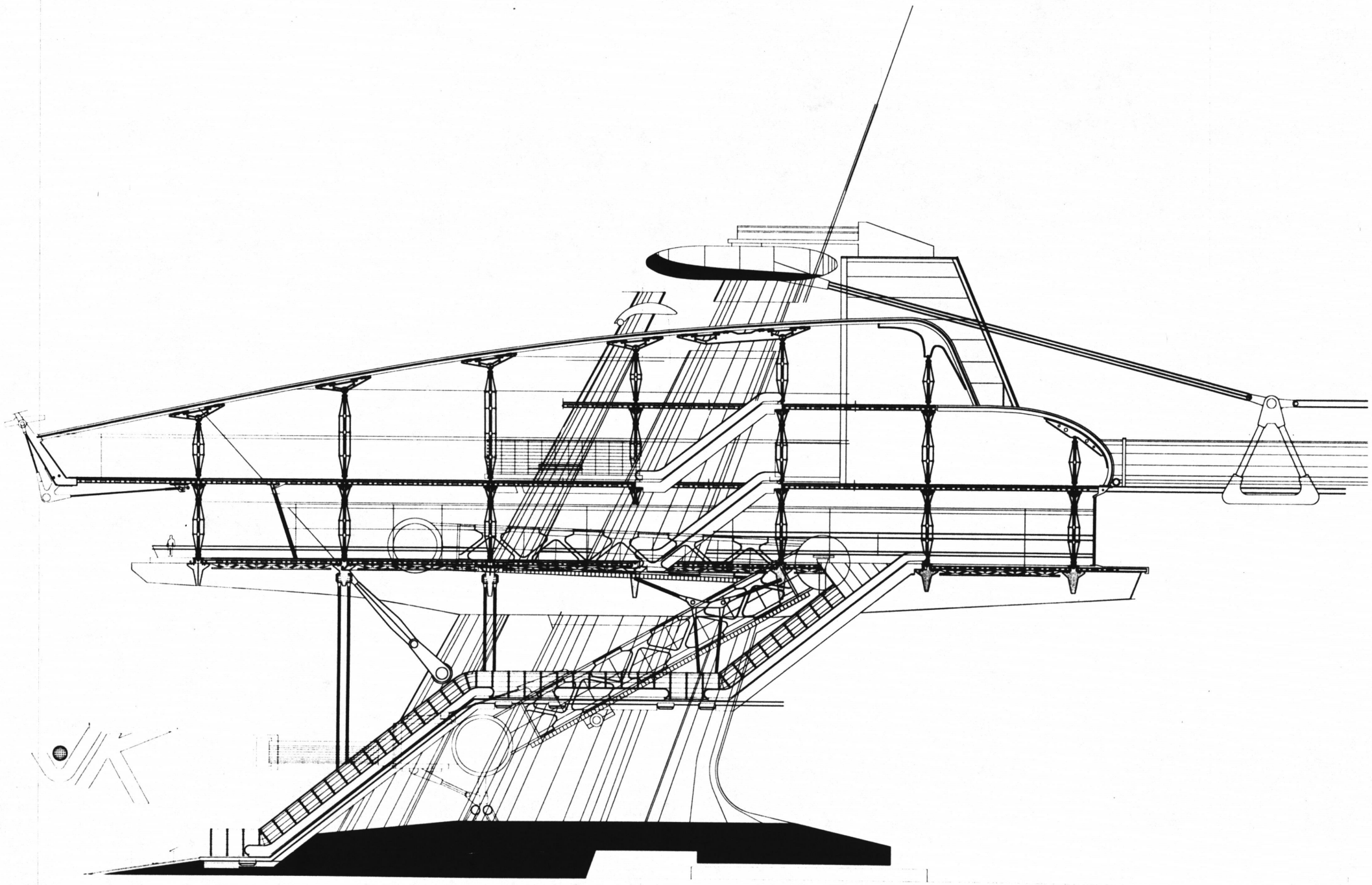




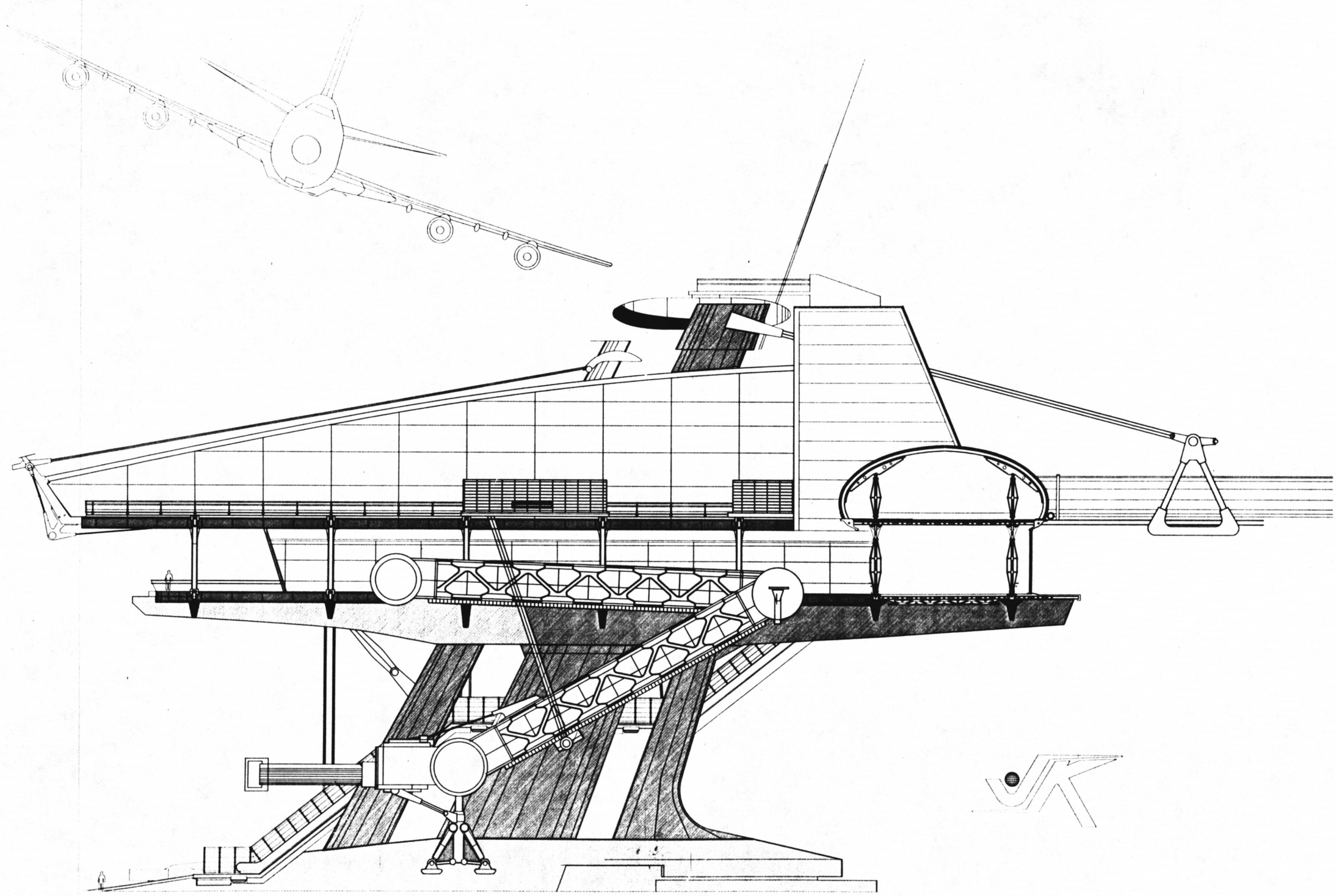


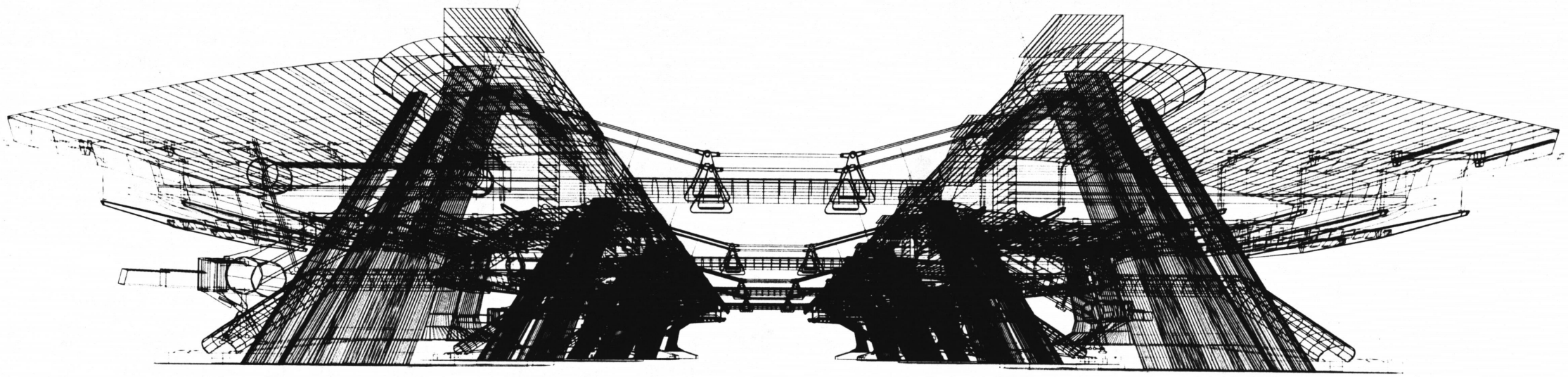
JAVIER KRASUK

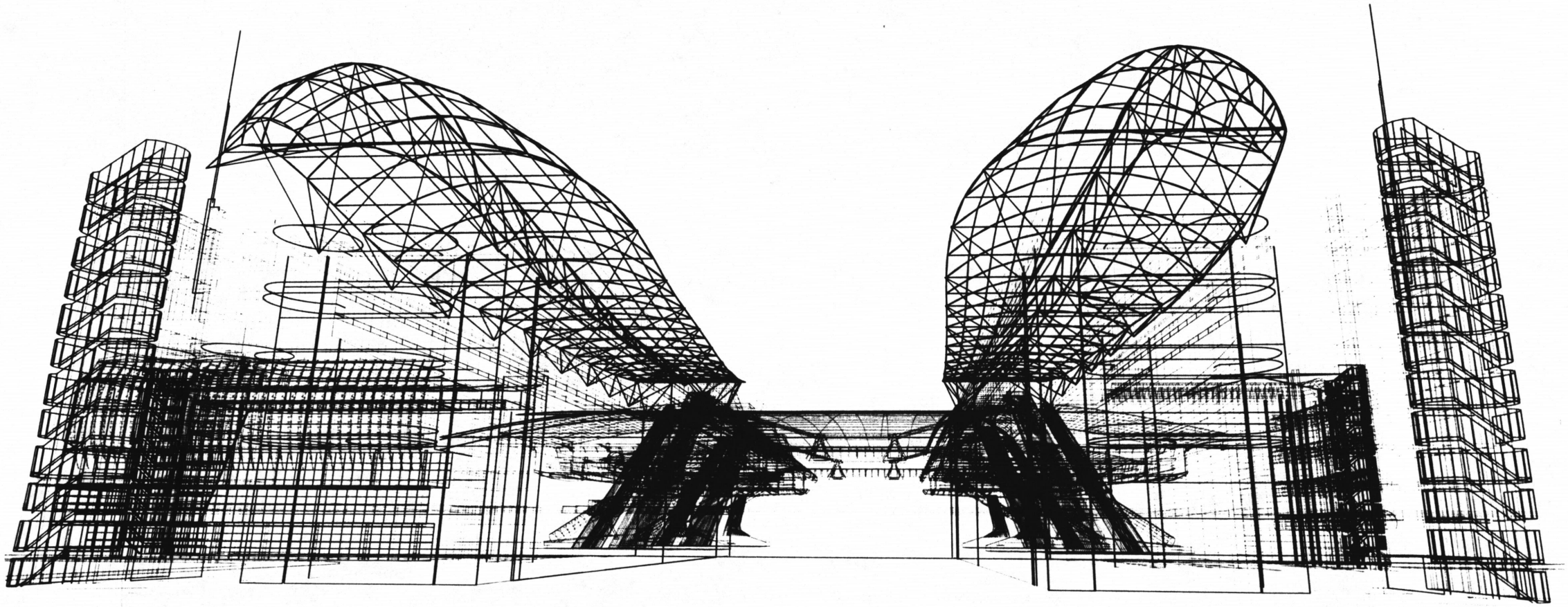




J A V I E R K R A S U K







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