MECAINE, J.M.

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DESIGN CRITERIA AND CONCEPTS

For

INTEGRATED MISSION CONTROL CENTER MANNED SPACECRAFT CENTER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Clear Lake, Harris County, Texas

Prepared For

U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS Fort Worth, Texas

September 1962



OAKLAND · CALIFORNIA

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I INTRODUCTION

This report presents preliminary facility design criteria and concepts which were developed for the initial structural steel, roof deck and foundation design of the Integrated Mission Control Center, NASA Manned Spacecraft Center, Clear Lake, Harris County, Texas. It is submitted for review and approval by the U.S. Army Engineer District, Fort Worth, Texas, and NASA.

Although the principal effort was in structural and architectural design, substantial civil, mechanical and electrical design, was performed to the extent necessary to assure validity of design. Additional concept work will be performed, as necessary, to complete detail design of the Integrated Mission Control Center.

The facility functional requirements and basic criteria were obtained from the Philco Corporation, Western Development Laboratories Technical Report (WDL-TR-E112-2) dated 1 July 1962 and further supplemented through discussions with WDL, Corps of Engineers, Houston, and NASA-MSC engineering staffs.

The design concepts are shown on the drawings included in this report. The report contains design criteria and description of the facilities.

II SCOPE

A. Name and Location of Facility

The facility will be known as the "Integrated Mission Control Center", Manned Spacecraft Center, National Aeronautics and Space Administration, Clear Lake, Harris County, Texas.

The IMCC building designated as Building No. 30, will be located within complex J-3 at the Clear Lake site with the southwest corner of the Administration Wing at modular coordinates N 1038 + 76 ft and E 1062 + 1 ft 4 in.

An adjacent Emergency Power Building, designated as Building No. 48, will be located approximately 40 ft west and 20 ft north of Building No. 30.

B. Description of Buildings

The IMCC building No. 30 will be a three-story structure divided into a Mission Operations Wing, an Administration Wing, and an interconnecting Lobby Wing.

The Mission Operations Wing, with approximately 117,000 sq ft total floor area, will contain the operational facilities for control of manned spacecraft and direction of the Ground Operational Support System (GOSS).

Provision will be made for a covered passageway connection from the third floor of the Mission Operations Wing to an adjacent antenna support structure.

The Administration Wing, with approximately 116,000 sq ft total floor area, will contain the office, laboratory, technical and administrative support functions of the Flight Operations Division.

The Lobby Wing, with approximately 14,000 sq ft total floor area, will provide interconnection between the two main wings and will contain space for a lobby, security control, reference room, and additional offices.

The Emergency Power Building No. 48, a single-story structure with approximately 11,000 sq ft total floor area, will contain

17000

uninterruptible and standby power-generation equipment and standby air-conditioning for the Mission Operations Wing. A steam boiler, an integral part of the standby air-conditioning system, can provide heating during initial IMCC operation and will revert to standby basis after the MSC central heating plant is in operation. The building has reserve space for mechanical equipment to support special standby air conditioning requirements of Building No. 12.

An extension will be made to south end of the existing Central Heating Building No. 24 to permit the inclusion of additional steam and chilled water equipment. The increased service capacity will be required for the IMCC facility.

Site development, including roads, parking areas, and utilities, will be included as necessary to support the IMCC facility.

III FACILITY FUNCTIONS

A. Primary Mission

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The Integrated Mission Control Center (IMCC) will direct the ground and flight operations required for manned spacecraft programs. Included are the following primary functions:

- 1. Communication with spacecraft during missions to furnish information and advice to astronauts.
- 2. Directing the Ground Operational Support System (GOSS) during actual and simulated missions.
- 3. Managing the ground support system prior to and during simulated or actual missions.

Electronic equipment will be used for transmitting, processing, and displaying data needed by flight controllers and console operators for conduct of spacecraft missions. The facility design will be based upon this electronic equipment concept to perform data processing so displays will permit flight controllers to observe trends and predict contingencies in advance.

B. Preflight Operations

- 1. Prepare mission and staffing plans.
- 2. Plan ground network operations and support.
- 3. Conduct preflight briefings.
- 4. Simulate missions and perform training exercises.
- 5. Analyze problems affecting the mission.
- 6. Check out the IMCC and monitor the network checkout.
- 7. Monitor checkout of the booster missile and spacecraft.
- 8. Alert the recovery control center to prepare for spacecraft recovery.

C. Mission Operations

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- 1. Monitor telemetry from spacecraft.
- 2. Analyze real time telemetry data.
- 3. Maintain communication and data links with:
 - a. GOSS remote sites
 - b. Spacecraft
 - c. Launch Site
 - d. Tracking and Guidance Facility
 - e. Range Safety
 - f. Recovery Control Centers
- 4. Display the mission progress and actions for flight controllers.
- 5. Provide GOSS network communication switching and data processing.
- 6. Perform computation, data processing, and display of the spacecraft's orbital parameters, impact point, actuation times, system status, and biomedical status.
- 7. Transmit data to spacecraft directly or via remote sites.
- 8. Maintain an ephemeris for the missions.
- 9. Provide mission status information to visitors.
- 10. Maintain status information on the GOSS elements.
- 11. Perform debriefing functions.
- D. Nonmission Operations
 - 1. Plan and prepare for future missions.
 - 2. Analyze prior missions.
 - 3. Simulate missions and equipment systems for training, qualification, and checkout of the GOSS network.

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4. Maintain IMCC and GOSS status information.

5. Evaluate techniques and components for future missions.

6. Maintain IMCC system.

E. Nonoperational Support

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1. Administer security, finance, travel, etc.

2. Maintain utilities supporting the IMCC.

3. Prepare and release information to public media.

IV OPERATION

A. Functions

The primary function of the IMCC is to exercise operations direction and technical management for Manned Space Flight Programs in all aspects of ground support. The specific functions of the IMCC, to effect necessary direction and control, are:

- 1. Pre-mission operations which relate primarily to planning, simulation, testing and checkout.
- 2. Mission operations which include pre-launch, flight (including recovery) and de-briefing operations.
- Non-mission operations which include planning, analysis, maintaining Ground Operational Support System cognizance, systems development and training.

Non-operational supporting functions in support of the IMCC include supporting administration, public relations, documentation and maintenance of support utilities.

The IMCC Building No. 30 will be organized functionally to minimize traffic between and within the Mission Operations and Administration wings. The Mission Operations Wing will provide the operation and simulation functions and will include support functions which require close contact with the operations areas. The Administration Wing will supply the technical support to Mission Operations not requiring physical location in the operations areas and the functions of nonmission operations.

The primary operational function of Emergency Power Building No. 48 will be to provide electrical and mechanical service support to the IMCC building.

B. Security

Visitors to the IMCC will be processed at the reception lobby on the ground floor of the Lobby Wing of Building No. 30.

Security control will be directed from a security office located in the reception lobby and maintained at each of the entrances into the Mission Operations Wing from the Lobby Wing. There will be no other entrances. The major cross traffic between the Mission Operations Wing and the Administration Wing will be through the ground floor lobby with a minimum of cross traffic on the second and third floors.

The Mission Operations Wing elevators and stairwells will be located within the security controlled entrances. Vertical and horizontal traffic between the Lobby Wing and the Administration Wing will not be security controlled.

No security control will be required for traffic between the IMCC Building No. 30 and the Emergency Power Building No. 48.

V POSSIBLE FUTURE EXPANSION

The IMCC Building No. 30 design will be based on anticipated future needs and accordingly will provide capability for internal rearrangement of operational facilities. However, should additional expansion be required in the future, the building configuration and location will be such that expansion to the north will be feasible.

The design configuration of the Emergency Power Building No. 48 will be directly influenced by the possible future needs of standby power equipment for Building No. 12. The Emergency Power Building will be designed to facilitate future expansion to the north.

VI DESIGN CONTROLS

A. General Design Controls

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The latest issue of the following design standards, codes, and specifications will be used as a reference and adhered to whereever applicable:

All applicable Corps of Engineers Engineering Manuals All applicable Federal specifications

Factory Insurance Association Standards

Illuminating Engineering Society Handbook

(National Building Code

National Plumbing Code

National Electrical Code

National Electrical Manufacturers' Association Standards American Concrete Institute Building Codes and Standards American Water Works' Association Standards Heating, Ventilating, and Air Conditioning Guide, ASHRAE American Institute of Steel Construction Manual Underwriters Laboratories, Inc. Standards American Welding Society Code

American Standards Association Code for Pressure Piping ASME Code for Unfired Pressure Vessels ASME Boiler Construction Code

National Fire Code (National Fire Protection Association)

Β. Special Design Controls

The following special design controls were used in developing design criteria:

- Philco Corporation, Western Development Laboratories 1. Technical Report No. WDL-TR-Ell2-2 dated 1 July 1962 and subsequent revisions.
- 2. Standards developed for facilities at the Manned Spacecraft Center, Clear Lake, Harris County, Texas.

 Documented Design Criteria developed during meetings, conversations and correspondence between Kaiser Engineers and one or more of the following:

Corps of Engineers NASA Philco-WDL

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VII SITE DEVELOPMENT

A. Siting Requirements

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Using the NASA Site Coordinate System, the modular column lines of 19 and D, Building No. 30, will intersect at coordinate N 1038 + 76 ft. E 1062 + 01 ft 4 in. The southeast corner of Building No. 48 will be located 20 ft to the north and 40 ft to the west of the northwest corner of Building No. 30.

B. Site Preparation

The top six inches of soil will be removed from the building area prior to placing fill. Approximately 2 ft of fill will be placed for the Emergency Power Building (Building No. 48) and the Administration and Lobby wings of Building No. 30. Approximately 1 ft of excavation will be made for the Missions Operations Wing of Building No. 30.

All fill will be compacted to 95% maximum density at optimum moisture content. Berms will be provided around buildings according to site standards. Spoil and borrow area will be provided.

C. Grading, Excavation and Backfill

Open area grading will be in accordance with MSC site standards.

Excavation and backfill will be performed to MSC site standards and will be provided as required for the storm sewer, sanitary sewer system, utilidor and the utility access tunnel to Building No. 48 and Building No. 30.

D. Storm Sewers

The storm sewer will be based on the Rational Method of computing drainage and the 10-year storm curve as shown in Figure VII-1. It will be sized and sloped to maintain a minimum flushing velocity of 3 fps. The storm sewer will tie into existing 54 in. diameter storm sewer lines at manholes.

E. Sanitary Sewer

The sanitary sewer will be based on a fixture unit probability use rate and sloped to maintain a minimum velocity of 2 fps.

(N 10 40+ 45) = GITHER 15 0K \$ The sanitary sewer will tie into an existing sewer line at coordinate N 1042 + 33 ft, E 1062 + 08 ft.) 🔈 🌭

F. Utilidor

An 8 ft 6 in. wide utilidor will extend to the south from the intersection of 2nd Street and Avenue C to coordinate N 1041 + 10 ft along which a 6 ft 6 in. minimum width utilidor will extend to the east to Building No. 30 with a short, north-south access tunnel into Building No. 48. Utilidor design will follow existing tunnel design on the MSC site.

G. Roads, Parking Areas and Walks

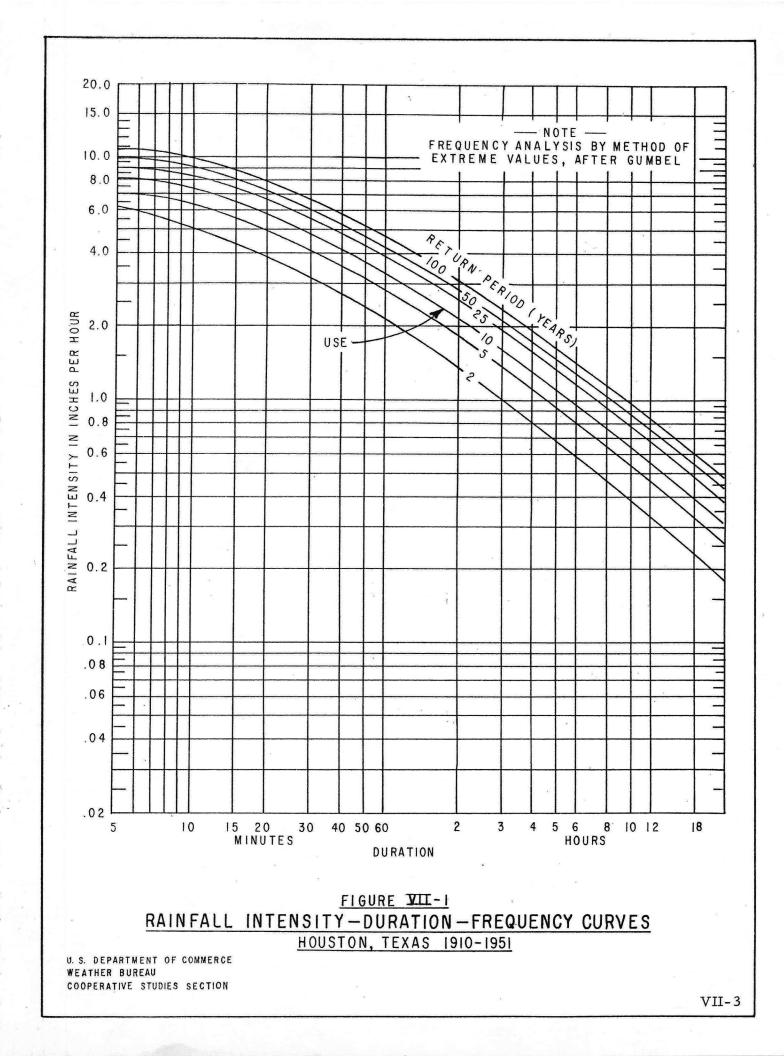
An access road to the IMCC will be provided from Avenue C. Parking lot access also will be available from Avenue C; Building No. 48 access will connect with the road to Building No. 30.

Parking space for 400 cars north of Building No. 30 will be provided for the IMCC facility. Grading and surfacing of access roads and the parking areas will be in accordance with standards for the MSC site.

Walks will be constructed of exposed aggregate concrete and will conform to existing site standards.

H. Landscaping

Landscaping will not be included in the design scope for the V IMCC facility. ROUGH GRADE ONLY



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VIII ARCHITECTURAL

A. Criteria and Design Concepts

IMCC Building No. 30 will be a three-story structure consisting of a Mission Operations Wing with a total floor area of 116,844 sq ft, an Administration Wing with a total floor area of 115,845 sq ft and an interconnecting Lobby Wing containing a total of 13,916 sq ft floor area. Building No. 48, the Emergency Power Building, will be single-story structure with 11,417 sq ft.

The architectural exterior appearance of the buildings will conform with MSC window-wall with sun shade design, and the solid precast concrete panels with exposed aggregate face design. For Building No. 30 the window-wall will be used on the Administration and Lobby wings, and precast concrete panels will be used on the Mission Operations Wing. Building No. 48 will have the exposed aggregate precast concrete panels.

The first floor of the Mission Operations Wing will provide mission operational support such as communications, data processing equipment, equipment control and equipment maintenance. The second and third floors will be mission operation floors except for support areas on the second and third floors consisting of a meteorological center and display equipment maintenance room, and a telemetry, tracking and data equipment area, respectively.

The Administration Wing will contain division offices and office space in support of mission operations. Also included in the Administration Wing will be files, briefing auditorium, conference rooms, support laboratories and computer facilities in support of mission planning.

The first floor of the lobby wing will contain the receptionist's desk, security control office and visitor's telephone area. The second floor will include an operations technical library and offices. The third floor will consist of office space only.

The Emergency Power Building will provide space for the power generation and air conditioning equipment as well as office, control room, shop and toilet. The exterior wall to the east will enclose the diesel engine exhaust silencers and air intakes.

B. Space Allocation

1. Floor Area

Following is a tabulation of the areas of the buildings by floors not including outside walkways.

Wing	Floor	L	W	Area (sq ft)
Administration		272'-4'' 281'-8'' 281'-8''	132'-4'' 141'-8'' 141'-8''	36,037 39,904 39,904
Total				115,845
Lobby	lst 2nd 3rd	84'-0'' 84'-0'' 84'-0''	49'-0'' 58'-4'' 58'-4''	4,116 4,900 4,900
Total				13,916
Mission Operations	2nd	227'-4'' 227'-4'' 227'-4''	171'-4'' 171'-4'' 171'-4''	38, 948 38, 948 38, 948
Total				116,844
Emergency Power Building	lst	147'-0''	77'-8''	11,417

Facilities will be provided for a population of 375 persons per floor in the Administration and Lobby wings and 200 persons per floor in the Mission Operations Wing. Occupancy of the Mission Operations Wing will be 85% male and 15% female, and in the Administration Wing 75% male and 25% female.

C. DESIGN FEATURES

1. General

The structural design of Building No. 30 Lobby Wing requires that this building element be structurally independent of the two adjoining wings but jointed at the exterior and interior with suitable expansion joint systems. Architecturally, this requirement will be expressed at the four re-entrant corners by 9 ft 4 in. wide precast concrete panels which will intersect at the vertical continuous exterior expansion joints. This design application will permit locating the Mission Operations Wing stair at the southeast corner and provides the proper exterior expression of the basic window wall with sun shade design at these interior corners.

2. IMCC Building Floor to Floor Heights

Building No. 30

Admission Wing		- 15	5 ft	
Lobby Wing		- 15	5 ft	
Mission Operations Wing 1	lst to 2nd floor	- 20) ft	
Mission Operations Wing 2	2nd to 3rd floor	- 22	l ft	8 in.
Mission Operations Wing 3	3rd floor to top of roof steel	- 20	ft	

Building No. 48

The floor to floor height of the Admission and Lobby wings of Building No. 30 were set in accordance with MSC site standards for this type of structure. Floor to floor height of the Mission Operations Wing of Building No. 30 was based on ceiling heights as established by Philco-WDL requirements and structural and mechanical space requirements above the ceiling. Building No. 48 height was based on equipment removal clearance requirement. Security may be maintained between the two wings by control of the doors on the lobby wing side of the elevator-stair

3. Floors

The Administration Wing and Lobby Wing will have the structural floors finished with vinyl asbestos floor tile generally, and ceramic tile in the toilet rooms. In the laboratory and computer areas of the second and third floors there will be a raised modular

arrangement in the Mission Operations Wing.

- 22 ft l in.

floor with removable panels for access to cables.

For the Missions Briefing and Observation Auditorium on the first floor, the floor slab will be depressed to give maximum viewing of the projection screen or platform.

The Missions Operations Wing will have a cavity floor system for portions of the first floor and throughout the second and third floors. This system is made up of a lowered structural floor with a superimposed raised modular floor system most of which will have removable panels for cable access. The finish floor level for each floor will be constant. Finish floor materials will be vinyl tile or ceramic tile as required. The Mission Operations Control Room and Visitors Viewing Area floors of the second and third floors will be carpeted.

4. Partitions

Interior partitions in general will be as follows:

Office divider partitions will be steel, movable.

Corridor and floor to floor partitions will be metal stud / with two layers of 3/8 in. gypsum board on each side.

Toilet room enclosures, elevator shafts and stair enclosures will be hollow tile with plastic finish.

5. Ceilings

1.

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Ceilings will be suspended incombustible removable acoustical panels except for toilet and mechanical rooms which will be suspended plaster. No ceilings will be provided in the electronic equipment areas. Finish ceiling heights will be as follows:

- 8 ft 6 in.
- 17 ft 0 in.
- 13 ft 6 in.
- 13 ft 0 in.

6. Elevators

Five elevators will be provided in Building No. 30. Passenger elevators will be 2,500 lb capacity with a platform size of 7 ft by 5 ft. In the administration Wing, the two cab bank of elevators will provide a wait interval of approximately 31 seconds. At all single cab locations, the wait interval will be approximately 62 seconds.

The north passenger elevator in the Administration Wing will serve as the freight elevator. The Mission Operations Wing will have a freight elevator of 8,000 lb capacity and platform size of approximately 8 ft by 10 ft.

7. Vault

A security vault with a 4-hour fire resistive rating will be provided in the Administration Wing.

IX STRUCTURAL

A. Type of Construction

The buildings will be of steel frame construction. Main girder to column connection will be welded and beam to girder connection will be field bolted utilizing high strength bolts.

The structural frame will be fireproofed in accordance with the following ratings:

Columns	and beam	IS -	2	hour	fire	rating
Stairs		-	2	hour	fire	rating
Roofs		-	2	hour	fire	rating

Building foundations will consist of cast-in-place belled caissons carried to a depth of approximately 16 ft.

The precast exposed aggregate facing panels for the administration and lobby wings will be attached to the window wall support trusses. The exterior wall panels of the Emergency Power Building No. 48 and Operations Wing will be supported on a reinforced concrete grade beam and anchored laterally to the building frame.

The second and third floors will consist of steel decking with lightweight concrete fill.

The roof will consist of steel decking with lightweight insulation fill.

- B. Design Guides
 - 1. The National Building Code 1961 Edition.
 - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, American Institute of Steel Construction, adopted November 1961.
 - 3. Building Code Requirements for Reinforced Concrete of the American Concrete Institute, ACI 318-56.

4.	Corps	of	Engineers	Manuals:
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2	a. Structural Design: Load Assumption for Buildings	EM-1110-345-141
t	D. Working Stresses for Structural Design	EM-1110-1-2101
C	. Engineering and Design - Design Analysis	EM-1110-345-700
d	. Concrete Structural Design for Buildings	EM-1110-345-142
e	. Load Assumptions for Buildings	EM-1110-345-141
f	Masonry Structural Design for Buildings	EM-1110-345-143
g	. Retaining Walls	EM-1110-2-2502
h	. Settlement Analysis	EM-1110-2-1904
i.	Structural Steel Joist and Light Gage Steel for Buildings	EM-1110-345-144
j.	Working Stresses for Structural Design	EM-1110-1-2101
k	. Working Stresses for Structural Design, Changes 1 through 3, 4 - 6 January 1958	EM-1110-1-2101
1.	Tunnels	EM-1110-2-2901
m	 Procedures for Foundation Design of Buildings and Other Structures (except Hydraulic Structures) 15 August 1961 	EM-1110-345-147
n	Standard Practice for Concrete Pavements 1 May 1959	EM-1110-345-307

C. Design Loads

Structural elements will be designed for the dead loads of the structures and for the live loads set forth.

1. Dead Loads

(1

Dead loads will include all of the materials composing the structure and utilities.

a. Roof Dead Loads

)	5-ply Built-up Roofing	lbs/square
	Primer	10
	5-ply felt	75
	Mop-on Asphalt	210
	Gravel	400
		695 ÷ 100 = 7 psf

(2) Roof Deck Insulation

Vermiculite Concrete	2.5 lb/in./sq ft
Foam Concrete	2.5 lb/in./sq ft

Thickness of insulating concrete varies from 8 in. at high ridges or outer line of columns to 4 in. at the roof drain.

l in. Rigid Insulation Asphalt 0.6 psf

Insulation 1.2 psf

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(3) Roof Metal Deck

		24 gage at 1-5/16 x 3-1/2 Cor Galvanized	rugated	1.4	psf
	(4)	Electrical Fixture and Wiring			
		4-light fluorescent tube at 4 ft	8 in. c/c	1.0	psf
	(5)	Duct and Air Conditioning		5.0	psf
	(6)	Piping, General		4.0	psf
	(7)	Fireproofing			
		1/2 in. Plastic Plaster		0.5	psf
	(8)	Ceiling			
		l in. Lightweight Plaster		7.0	psf
b.	Flo	or Dead Loads			
	(1)	Raised Floor		10.5	psf
	(2)	Free Access Floor		8.5	psf
	(3)	Floor Slab			
		Lightweight Concrete Fill		8.3	lb/in./sq ft
		Robertson Section 21-16 gage		4.5	psf
	(4)	Electrical Fixtures and Wiring	ý	1.0	psf

	(5)	Piping		4.0 psf	
	(6)	Ductwork and Air Condition	ing	5.0 psf	
	(7)	Fireproofing		0.5 psf	
	(8)	Ceiling		7.0 psf	
	(9)	Partitions			
		Gypsum Board		6.0 psf/floor	
		Steel Stud		4.0 psf/floor	
2.	2. Live Loads				
	Live loads in pounds per square foot will be assumed as follows:				
	a. Roof Live Loads				

	(1)	Basic Live Load		20 psf
b,	b. Floor Live Loads			
	(1)	Mission Operations Wing		125 psf
	(2)	Lobby Wing		100 psf
	(3)	Administration Wing		125 psf

Floor live loads include fixed and movable equipment.

3. Live Load Reduction

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No reduction will be made for live loads on roof.

No reduction will be made for floor live loads to supporting members except columns; the design live load on columns may be reduced 20%.

4. Seismic Loads

All structures will be designed to resist earthquake forces. The provisions of the Uniform Building Code for Seismic COMPARISON WODED Zone One will govern the design.

5. Wind Loads

All structures will be designed to withstand the horizontal pressures shown below, allowing for wind from any direction.

Height:	Below	30 ft	30 psf
	30 to	49 ft	40 psf
	50 to	99 ft	50 psf
	100 to 4	199 ft	60 psf

In general, wind loading and design will follow the provisions of the ASA-A58.1 1958 for wind pressure Zone 40.

Roofs will be designed and constructed to withstand pressures acting upward normal to the surface equal to 1.25 times those specified for the corresponding height zone in which the roof is located. Pressure is assumed for entire roof area.

D. Basic Working Stresses

1. Combined Stresses

Members will be proportioned for the maximum requirements of the following stress and load combinations:

Allowable stress increased 1/3 for dead load + live load + wind.

Note: Live load is floor loading.

2. Structural Steel

Structural steel will be designed in accordance with the specification for the Design, Fabrication and Erection of Structural Steel for Buildings, American Institute of Steel Construction, adopted 1961. The frames will be designed as AISC Type One, designated "Rigid Frame", with the assumption that the beam and girder to column connections have sufficient rigidity to hold virtually unchanged the original angles between the members.

Charles Martin

a. Moment Connections

All moment connections will be detailed fully on design drawings. All beam and girder to column connections will be welded to develop full continuity. Beam to girder connections will be field connected using high strength PULLET STEEL? bolts or rivets.

E. Foundation Design

1. Concrete

Reinforcement Stresses for Intermediate Grade Bars, fs = 20,000 psi.

Insitu Concrete (150 pcf) $f_C^i = 3,000 \text{ psi}$

Precast Concrete (150 pcf) $f_c^1 = 4,000 \text{ psi}$

2. Footings

Footings will be reinforced concrete belled base caissons, designed in accordance with the structural provisions of the ACI Building Code.

Table IX-1, developed by Philco-WDL, shows permanent equipment loads to be used in conjunction with dead load in proportioning footings.

Figure IX-1 shows anticipated settlement plotted against footing size and soil loading. The footings will be proportioned to limit total maximum settlement to 2 in. and maximum differential settlement to 1/2 in.

2. Structural Steel

Structural steel will be designed in accordance with the specification for the Design, Fabrication and Erection of Structural Steel for Buildings, American Institute of Steel Construction, adopted 1961. The frames will be designed as AISC Type One, designated "Rigid Frame", with the assumption that the beam and girder to column connections have sufficient rigidity to hold virtually unchanged the original angles between the members.

a. Moment Connections

All moment connections will be detailed fully on design drawings. All beam and girder to column connections will be welded to develop full continuity. Beam to girder connections will be field connected using high strength bolts or rivets.

E. Foundation Design

1. Concrete

Reinforcement Stresses for Intermediate Grade Bars, fs = 20,000 psi.

Insitu Concrete (150 pcf) $f'_{c} = 3,000 \text{ psi}$

0

Precast Concrete (150 pcf) $f_c^1 = 4,000 \text{ psi}$

2. Footings

Footings will be reinforced concrete belled base caissons, designated in accordance with the structural provisions of the ACI Building Code.

Table IX-1, developed by Philco-WDL, shows permanent equipment loads to be used in conjunction with dead load in proportioning footings.

Figure IX-1 shows anticipated settlement plotted against footing size and soil loading. The footings will be proportioned to limit total maximum settlement to 2 in. and maximum differential settlement to 1/2 in.

Caissons will extend to a minimum depth of 16 ft to obtain FINAL REPORT an allowable bearing pressure of 7,000 psf.

3. Floor Slabs on Grade

Existing grade in the areas of Buildings No. 30 and 48 varies approximately from elevation +19 to +20. First floor elevations will be +22. Ground floors will be designed as reinforced concrete slabs on grade. For tile floors, the ground floor will be designed as a suspended reinforced concrete slab supported by grade beams.

4. Grade Beams and Supporting Walls

Exterior grade beams on caissons will support the exterior P.E.A.F. panels of the Mission Operations Wing.

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Room No.	Area (sq ft)	Equipment Loads (lb/sq ft)(1)	Maximum Con- centrated Load (lb/sq ft) ⁽²⁾
101	1,000	23.65	96.00
103	7,317	23.38	204.00
105	1,568	10.77	140.00
107	2,613	23.38	204.00
107A	784	17.41	204.00
109	1,444	18.70	150.00
111	2,352	23.08	150.00
113	1,444	7.44	150.00
115	662	(3)	
117	672	10.08	(3)
119	1,024	(3)	
121	1,518	4.21	(3)
123	192	(4)	
125	192	(4)	
127	120	(3)	
129	168	11.90	50.00
131	1,300	5.11	150.00
133	3,536	19.00	150.00
135	522	5.36	70.00
137	3,136	23. 38	204.00
139	522	5.36	70.00
141	695	35.97(5)	(3)
201	1,632	3. 25	51.90
203	1,200	(4)	
205	80	15.63	(3)
207	80	15.63	(3)
209A ⁽⁷⁾ 209B ⁽⁸⁾	1,568 1,239	6.22 (4)	51.90

TABLE IX-1 PERMANENT EQUIPMENT LOADS BUILDING NO. 30 - MISSION OPERATIONS WING

		TABLE IX-1 (Cont'd)	
Room No.	Area (sq ft)	Permanent Equipment Loads (lb/sq ft) ⁽¹⁾	Maximum Con- centrated Load (lb/sq ft)(2)
211	1,840	1.85	(3)
213	1,974	1.79	51.90
215	788	7.44	(3)
217	2,352	4.34	150.00
219	480	2.54	51.90
221	1,152	(4)	
223	2,772	(3)	
225	1,024	(3)	
227	192	(4)	
229	192	(4)	
231	120	(3)	
233	2,178	(3)	
235	2,784	33.83	150.00
237 .	1,526	5.14	152.00
239	1,526	5.99	152.00
241	2,923	2. 39	51.90
243	437	3. 57	51.90
301 303	1,632 1,200	3, 25	51.90
305	80	15.63	
307	80	15.63	
309A	1,568	6.22	51.90
309B	1,239	(4)	
311	1,840	1.85	
313	1,874	1.79	51.90
315	798	7.44	
317	2,352	4.34	150.00
319	480	2.54	51.90

		TABLE IX-1 (Cont'd)	
Room No.	Area (sq ft)	Permanent Equipment Loads (lb/sq ft) ⁽¹⁾	Maximum Con- centrated Load (1b/sq ft) ⁽²⁾
321	1,152	(4)	
323	4,950	2.93	150.00
325	1,024	(3)	
327	192	(4)	
329	192	(4)	
331 333	120 (6)	(3)	
335	2,784	33, 83	150.00
337	1,526	5.14	152.00
339	1,526	5.99	152.00
341	2,923	2.39	51.90
343	437	3. 25	51.90

Notes: ((1)	Permanent Equipment Load = Total Equipment Weight Room Area
	(3) (4) (5) (6) (7)	Concentrated Load = Greatest Equipment Weight Base Area No information Negligible Based on storage for 5,000 reels Not applicable Console area Clear floor area
Philco-N Receive		L data 5 August 1962

00 5 10 15 ULTIMATE SETTLEMENT KIPS 001 0.5 COLUMN LOADS, 200 1.0" SUSTAINED 300 MAXIMUM TOTAL COLUMN LOAD PERMITTED FOR -ALLOWABLE SOIL PRESSURE 0F 7000 PSF 1.5" LEN 400 1 FOOTING DEPTH = 12 FT 2.5" 2.0" 1 500 5 10 15 DIAMETER OF ROUND FOOTING, FT. FIGURE IX - I MISSION CONTROL FACILITY ESTIMATED SETTLEMENT OF ROUND FOOTINGS PRELIMINARY DATA FROM MCCLELLAND ENGINEERS IX-12

X UTILITIES

A. Domestic Water

 Domestic water will be supplied from the MSC water distribution system to Buildings No. 30 and 48 and to the cooling tower. Water treatment will not be necessary except for the cooling tower and emergency boiler.

The existing MSC water distribution system is installed in a loop system with sectionalizing valves. The common service to Building No. 48 and the cooling tower will be connected to two of the loop sections to provide reliability of water supply.

B. Fire Water System

 The water supply for the fire water system will be connected to the present MSC water distribution system and extended as a loop around the IMCC area. Fire hydrants will be provided for coverage in accordance with National Fire Codes (N.F.P.A.).

C. Cooling Water System

1. A closed loop cooling water system will be provided for condenser water to the emergency water chilling unit and for the diesel engine jacket and lube oil cooling. The cooling tower for this system will be located near the west side of Building No. 48. The lube oil cooling and condenser water pumps will be located adjacent to the cooling tower. Evaporation and blow-down losses from the cooling tower will be made up from the domestic water system. Water treating equipment will be connected to the circulating lines in Building No. 48 to inhibit the formation of algae and corrosion.

D. Natural Gas System

1. Natural gas will be obtained from the existing MSC gas distribution system to supply the emergency steam boiler. Pressure reducing valves, pressure regulators, and controls will be provided to reduce the gas pressure as required for the burners. 2. Gas piping will be steel. Buried piping will be coated for corrosion protection.

E. Sewerage

 Sewer lines from the facility will be connected to the existing MSC sewer system mains. Sewers will be designed on a fixture probability use rate factor, and will be designed to maintain a velocity of 2 fps running half full.

F. Compressed Air Systems

- 1. Instrument Air
 - a. An instrument air compressor will be installed in the Administration Wing and the Mission Operations Wing of Building No. 30.
 - b. Compressors will be of the reciprocating type, equipped with a receiver, pressure reducing valve assembly, air dryer, oil trap, and controls for automatic operation.
- 2. Diesel Startup and Plant Air
 - a. A reciprocating type air compressor will be installed to provide air for shop tools and plant air.
 - b. A reciprocating type air compressor and receiver will be installed to provide startup air for the diesel engines. Individual air receivers will be provided for each engine.
 - c. Starting and plant air piping, fittings and valves, will be steel.

G. Diesel Fuel System

 A fuel system comprising storage, pumps, filters and controls will be provided for the diesel engines. An underground tank will provide fuel storage capacity for approximately 72 hours of full load operation. Day tanks will be provided as an integral component of each diesel engine. Positive displacement type fuel transfer pumps will be furnished. Steel piping between the buried storage tank and Building No. 48 will be coated and wrapped, and installed underground. Inside the building, steel piping will be routed in trenches and equipped with bronze valves. The emergency steam boiler will be equipped with a positive displacement type fuel oil pump, switching controls and valves, to permit transfer from natural gas to oil upon interruption of the gas supply.

H. Steam System

- Steam distribution system will be extended via utilidor to Building No. 30 and Building No. 48 to provide steam for normal operation of the heating and air conditioning systems. Condensate pumps will return condensate to Building No. 24 through return piping in the utilidors.
- 2. A boiler, equipped with a feed-water system and gas-oil changeover piping for emergency heating and air conditioning of Building No. 30, Mission Operations Wing, will be provided in Building No. 48. The boiler normally will be gas-fired with auxiliary oil-firing capability.

XI PIPING AND PLUMBING

A. Water Piping

Domestic water piping will be provided to all plumbing fixtures, water heaters, heating systems, air conditioning systems, drinking fountains and hose bibbs.

All underground piping will be corrosion-protected and/or cathodic-KE ON THIS! protected as required by local conditions.

B. Waste and Vent Piping

Sanitary waste and vent piping will be provided for all plumbing fixtures and floor drains.

C. Plumbing Fixtures

The number and arrangement of toilet fixtures will be based on building occupancy.

D. Drinking Fountains

Unit drinking water coolers will be provided on each floor.

E. Fire Protection

Fire hose cabinets will be provided on each floor of each building as required by the National Board of Fire Underwriters. CO2 fire 🗸 extinguishing equipment will be installed in areas containing CO2 or DRY POWDER? CK FOD \$ OR PHILCO REPT'S. electronic equipment.

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XII HEATING, VENTILATING AND AIR CONDITIONING

A. General Design Concept

- 1. Air conditioning, heating and ventilating will be provided for all buildings to ensure clean, comfortable working conditions and controlled air movement.
- 2. Ventilation air will be filtered and areas containing electronic equipment will be slightly pressurized to prevent infiltration of dust or dirt particles.
- 3. Upon the completion of the addition to Central Heating and Cooling Building No. 24 and utilidor extension, chilled water and steam will be routed to the IMCC facility. Chilled water and condensate return will follow the same route. Prior to the availability of Building No. 24 steam, steam requirements for the IMCC may be supplied from an emergency boiler located in Building No. 48. This boiler will revert subsequently to a standby basis. Chilled water, if required prior to the operation of Building No. 24 service, also could be supplied initially from Building No. 48 standby equipment. CREEBERY WILL BE
- 4. Heating, ventilating and air conditioning systems normally will be controlled locally from the areas served. For critical systems, operation running lights and overriding start-stop controls will be located in the instrumentation area.
- 5. Air conditioning design will be in accord with existing MSC approved systems.

B. Heating and Ventilating

1. IMCC Building

The heating and ventilating systems for Building No. 30 are included in the air conditioning section.

2. Emergency Power Building

For use during the winter season, heating and ventilating equipment will be provided to maintain a minimum of 65 F in the building with a 20 F outdoor temperature. Outside air will be filtered, tempered with heated air and distributed. Roof ventilators will be provided to draw air through wall louvers for ventilation during the summer season.

C. Air Conditioning

1. Building No. 30 - Administration Wing

a. Design Conditions

(1)	Summer				
	Outdoor	-	95 F DB,	80 F WB	(ASHRAE)
	Indoor	-	77 F DB,	50% RH	(CARR)
(2)	Winter				
	Outdoor	-	20 F		(ASHRAE)
	Indoor	-	72 F		(ASHRAE)
(3)	Air Char	nges	3		
	Cycles p	er :	Hour - 8	(Based on 12	ft ceiling height)
	Outdoor	Air	- 20) cfm/person	or l change per

b. Air Conditioning System

The Administration Wing will be air conditioned using a high velocity dual duct system providing air to various zones through constant volume mixing valves. A separate system will be provided for each floor. Air conditioning units will draw return air from the ceiling plenum and outside air from the ventilation air shaft through filters and discharge air through heating and cooling coils to the high velocity duct system. Outside air will be preheated before entering the air conditioning system.

hour, whichever is greater.

Two general exhaust and toilet exhaust systems will collect foul air and excess ventilation air and discharge to the outdoors. A separate exhaust system will be provided for the projection room. A ventilation fan will be provided for each mechanical equipment room.

Steam will be converted to hot water in one mechanical equipment room and circulated to the heating coils.

Chilled water will be circulated in a loop system to the cooling coils throughout the wing by circulating pumps located in the mechanical equipment room on the first floor.

2. Building No. 30 - Mission Operations Wing

- a. Design Conditions
 - (1) Summer

Outdoor	-	95 F DB, 80 F WB (ASHRAE)	
Indoor	-	areas with electronic equipment sensitive to environment: 70 F DB <u>+5</u> F, 55% RH <u>+</u> 10% (WDL)	
		Other indoor areas: 77 F DB, 50% RH (ASHRAE)	

(2) Winter

Outdoor - 20 F

Indoor - areas with electronic equipment sensitive to environment: 70 F DB +5 F, 55% RH +10% (WDL)

Other indoor areas: 72 F.

(3) Air Changes

Cycles per Hour	-	8 (Based on 12 ft ceiling height)
Outdoor Air	-	20 cfm/person or 1 change per hour, whichever is greater.

b. Air Conditioning System

The Mission Operations Wing will be air conditioned by a dual duct high velocity system. Hot and cold air will be supplied to each of several zones per floor through constant volume mixing valve controllers for control in each zone. Air conditioning units on each floor will draw return air from the plenum above the ceilings along the east and west side of the first floor and outside air through high efficiency filters. The units will discharge to the ducts through heating and cooling coils arranged to form a hot deck and a cold deck. Outside air will be preheated before entering the air conditioning system.

Return air from the electronic equipment rooms which have no ceilings will return through wall registers into the plenum space above ceilings of the perimeter rooms.

Four package type air conditioning units will be located in each mechanical equipment room. Three units operating meet 100% of the air conditioning requirements. One unit, capable of providing one third of the total floor load, will be maintained on a standby basis.

The Operations Wing mechanical equipment arrangement, shown on drawing SK-M-5, is subject to modifications with further development of the heating and ventilating requirements for the electronic equipment.

Electronic equipment areas on the first floor will be equipped for both overhead and under floor air supply distribution. Humidity control for areas containing environment sensitive electronic equipment will be provided by steam or hot water humidifiers.

The exhaust system will collect general exhaust and toilet exhaust air and discharge to out-of-doors. A ventilation fan will be provided for each mechanical equipment room.

Steam will be converted to hot water in the Emergency Power Building and distributed to the heating coils.

Chilled water will be circulated in a loop system to the cooling soils. Two circulating pumps will be located in the Emergency Power Building.

c. Sound Control

Sound absorbers and attenuators will be provided in duct systems to provide attenuation in accord with the following table:

Area	Maximum NC Level (db)
Rooms 209, 213, 239, 241, 309, 313, 339, 341	30
Rooms 203, 205, 207, 219, 211, 221, 303, 305, 319, 311, 307, 321	35
Rooms 217, 215, 223, 233, 235, 201, 315, 317, 331, 337, 301	40
Rooms 101, 103, 141, 105, 107, 107A, 109, 111, 113, 115, 117, 131, 135, 139, 137, 133	4 5
Room 121	60
Halls and Corridors	55
Lavatories	50

Sound will be attenuated in accordance with ASHRAE Guide recommendations.

d. Mission Operations Wing - Emergency Air Conditioning

The following equipment will be provided in and adjacent to Building No. 48 to provide emergency back-up for the air conditioning system in the Mission Operations Wing.

(1) Electric motor driven centrifugal water chiller.

(2) Standby chilled water pump.

(3) Standby steam boiler.

- (4) Boiler feed-water system.
- (5) Two hot water heat exchangers
- (6) Two hot water circulating pumps
- (7) Duplex condensate pump.
- (8) Cooling Tower
- (9) Condenser water and diesel engine cooling pumps.
- (10) Valves and controls for air conditioning change-over.

e. Building No. 12 - Emergency Air Conditioning

Space will be allocated in Building No. 48 for future installation of equipment to provide emergency air conditioning r. DIESEL? backup to meet Building No. 12 requirements. Space for the following equipment will be required:

- (1) Electric motor driven centrifugal water chiller.
- (2) Standby chilled water pump.
- (3) Standby steam boiler.
- (4) Boiler feed-water heater and pumps.
- (5) Fuel oil pump.
- f. Building No. 48 Air Conditioning

The office, shop and control rooms will be air conditioned to maintain comfort conditions as specified for the Administration Wing. A unit type air conditioner using chilled water from the tunnel supply system and hot water from heat exchangers will be furnished for this purpose.

XIII ELECTRICAL SYSTEMS

A. General

The electrical power system will be designed to provide commercial power to all noncritical and interruptible critical loads and diesel power, backed up with diesel power, for all noninterruptible loads.

B. Power Requirements

TO BE DETERMINER,

The design of the electrical power system will be arranged to supply the loads listed in the tabulation below.

LOAD ESTIMATE

	Cate	gorie <mark>s</mark> c	of Loads	in KW
Facility	$\underline{al}^{(1)}$	a2(2)	<u>b</u> (3)	(4)
1. Mission Operations Wing				
Operations Equipment Lighting and Miscellaneous Air Conditioning (part in Bldg. No. 48)	200(5)	₃₄₈ (5)	344(5) 410 870	
2. Antenna Structure				
Mission Operations Equipment Lighting and Miscellaneous Air Conditioning		130 ⁽⁵⁾	15	15
3. Administration Wing				
Lighting and Miscellaneous Ventilation Technical Equipment				410 350 200
4. Emergency Power				
Lighting and Miscellaneous Engine Auxiliaries and Cooling Water			20 120	
Ventilation			50	
Total Connected Loads	200	478 1	,829	975
 (1) +10% v; +1% normal - F; +1 cps tr (2) +10% v; +5% F (3) +10% v; +5% F; 20 sec off (4) +15% v (5) From Philco-WDL report 	ansient ·	- F		

C. High Voltage Power Distribution

All power loads except the critical "no-break" (category "a") loads in the IMCC building will be supplied from two existing circuits which presently carry power at 12. 47 kv from the 138-12. 47 kv substation to Buildings No. 3, 4, 7, 8 and 12. These circuits will be tapped in the utilidor adjacent to Building No. 12 and extended to the new high-voltage load-break switches which will be located in the Emergency Power Building. The power will be distributed from this point at 12. 47 kv to the 12 kv-480 v transformers which will be located in the Emergency Power Building and in the Administration Wing of the IMCC building.

D. Power Generation

Diesel-engine driven generators will be provided to generate the necessary power for the critical "no-break" loads in the IMCC building. Additional units will be provided to back up the commercial power system for the critical power loads in the facility on which momentary power interruptions are permissible. Power will be generated at 480 v and will be interconnected with the commercial power system as indicated on KE Drawing No. SK-3E.

During periods when a mission is not in progress, the facility can draw all the required power from the commercial power system. During missions, the "no-break" loads will be served from two 480 v power systems, each operating independently of the commercial power system. Each of these power systems will be served from two 300 kw diesel driven generators operating in parallel. The units normally will operate at approximately 60% load and will be arranged so either can carry the entire load upon failure of the other. The frequency and voltage variation will not be greater than indicated in the table above.

The critical loads designated as "b" loads in the preceding table normally will be supplied from the commercial power system. Two of the three 1,000 kw diesel units will provide backup power for these loads and will start and pick up the load automatically in the event of commercial power failure. Power interruption to these loads thus will be limited to approximately 20 seconds. These 1,000 kw diesel driven generators will also serve as backup for the 300 kw units, thereby providing dual backup for the critical "no-break" loads. The diesel units will be equipped with load-sensing type governors and will have an output frequency of 60 cps $\pm 1\%$ and an output voltage of 480 v $\pm 10\%$. One additional 1,000 kw diesel driven unit will be provided so one of the 1,000 kw units can be out of service for "maintenance" for extended periods without sacrificing backup capability of the system.

If additional reliability and freedom from transients is required for specific operational components, a local battery(s) can be supplied, and inverters or MG sets used to obtain the required 120 v 60 cycle a-c power. These inverters should be located as close to the critical loads as practical to minimize the possibility of power failure due to cable failure.

E. Facility Power Distribution

Power will be distributed within the IMCC building and in the Emergency Power Buildings at 480 v and 120 v. The 12 kv to 480Y/277 v load centers that are required for serving loads in the Mission Operations Wing of the IMCC building and in the Emergency Power Building will be located in the Emergency Power Building. The transformers required for serving loads in the Administration Wing of the IMCC building will be located in the Administration Building.

All motors will be supplied from the respective 480Y/277 v power systems. In addition, the fluorescent lights within the IMCC building will be supplied from the 480Y/277 v power systems. Incandescent lighting will be supplied from local 120/208 v power systems which will be supplied from the 480 v power systems through dry-type step-down transformers.

Receptacles will be provided in the various work areas of the facility and in the offices for 120 v and/or 480 v power.

The 480 v power systems will be supplied from 12 kv to 480 v indoor-type unitized power centers. These power centers will contain a dry-type transformer and a low voltage distribution panel. The unit will receive power from the 12.47 kv power system and will have the rating and number of low voltage circuit breakers as indicated on the one-line diagram.

F. Lighting

Lighting will be provided in each room and area of the facility. In general, lighting levels will be selected to permit performance of required tasks without additional light from portable fixtures.

The lighting levels in the Mission Operations Wing of the IMCC building will be as specified in the Philco report. The maintained lighting levels in the Administration Wing will be as specified in the tabulation below.

Offices	70 ft-c
Corridors and hallways	20 ft-c
Laboratories	50 ft-c
Rest rooms, closets, etc.	15 ft-c
Mechanical and electrical equipment rooms	20 ft-c

The maintained lighting levels in the Emergency Power Building will be 20 ft-c.

Exterior lighting will be provided for access roads, parking lot, building entrances and building perimeter sidewalks. Lighting levels in these areas will be selected on the basis of accepted practice and IES recommendations.

G. Alarm and Communication Systems

The fire alarm system will be similar to and compatible with the system presently installed at the MSC complex.

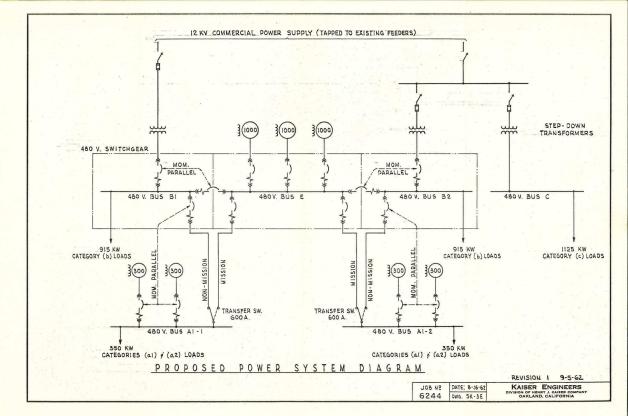
A telephone system and an intercommunication system will be provided for the IMCC building and the Emergency Power Building. Telephones on this system will be connected with the base telephone exchange. Telephone outlets will be provided for all offices and in other areas as designated by NASA. Conduit only will be provided for telephones. The telephone equipment and cables will be provided by others.

H. Addition to Central Heating Building No. 24

Power for the addition to Building No. 24 will be taken from the existing 12.47 kv feeder to the building by adding a unit to the existing fused interrupter switch lineup. The necessary number of 12 kv to 480 v load centers will be provided to supply the new loads.

In general, the equipment used for the building addition will be of the same type as that used for the existing section of the building.

Lighting levels and types of lighting fixtures will be selected to match those provided in the existing section of the building.



XIV DRAWINGS

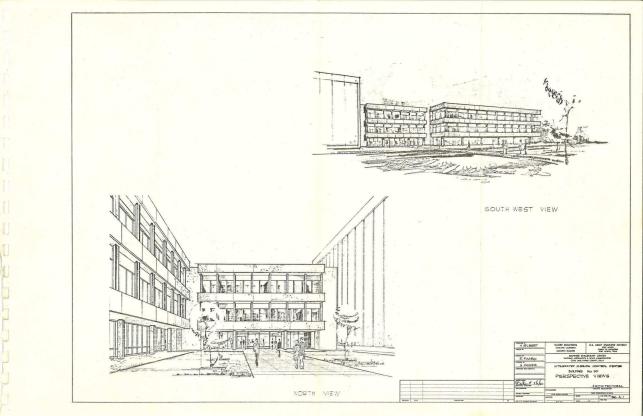
The following concept drawings in this section illustrate the principal configurations for the Integrated Mission Control Center buildings.

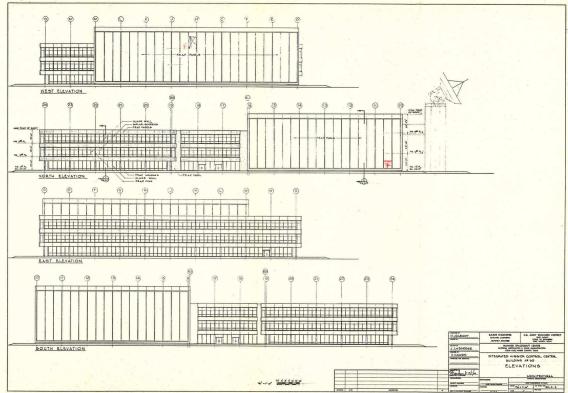
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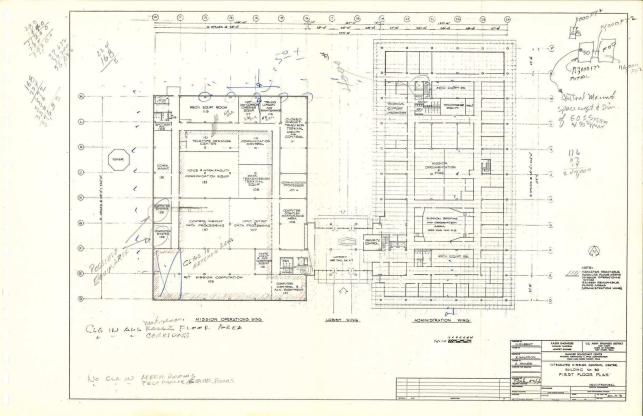
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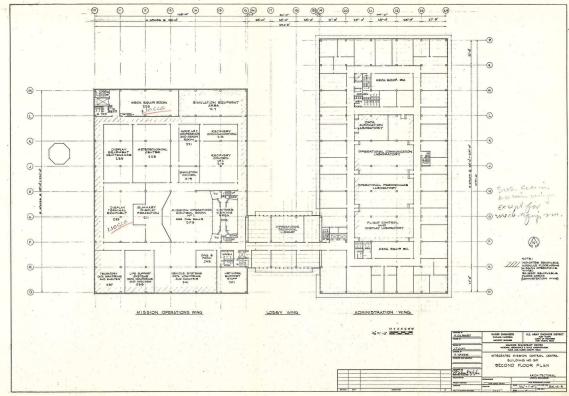
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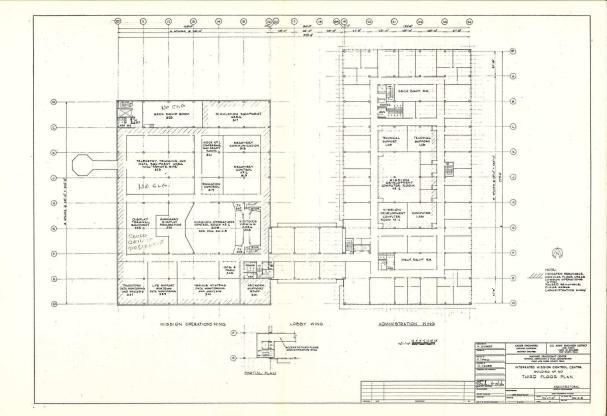
SK-A-1	Building No. 30 - Perspective View
SK-A-2	Building No. 30 - Building Elevations
SK-A-3	Building No. 30 - 1st Floor Plan
SK-A-4	Building No. 30 - 2nd Floor Plan
SK-A-5	Building No. 30 - 3rd Floor Plan
SK-A-6	Building No. 30 - Roof Plan
SK-A-7	Building No. 30 - Lobby Wing - Plans
SK-A-8	Building No. 30 - Auditorium & Display Room - Plan & Sections
SK-A-9	Building No. 30 - Wall Construction Details
SK-A-10	Emergency Power Building No. 48
SK-M-1	Yard Plan & Tunnel Profile
SK-M-2	Building No. 30 - Air Conditioning Schematic
SK-M-3	Building No. 30 - First Floor Plan
SK-M-4	Building No. 30 - Second and Third Floor Plans
SK-M-5	Building No. 30 - Mechanical Room Layouts
SK-M-6	Emergency Power Building - Arrangement
SK-E-1	Electrical One Line Diagram
SK-E-2	Power Distribution Layout














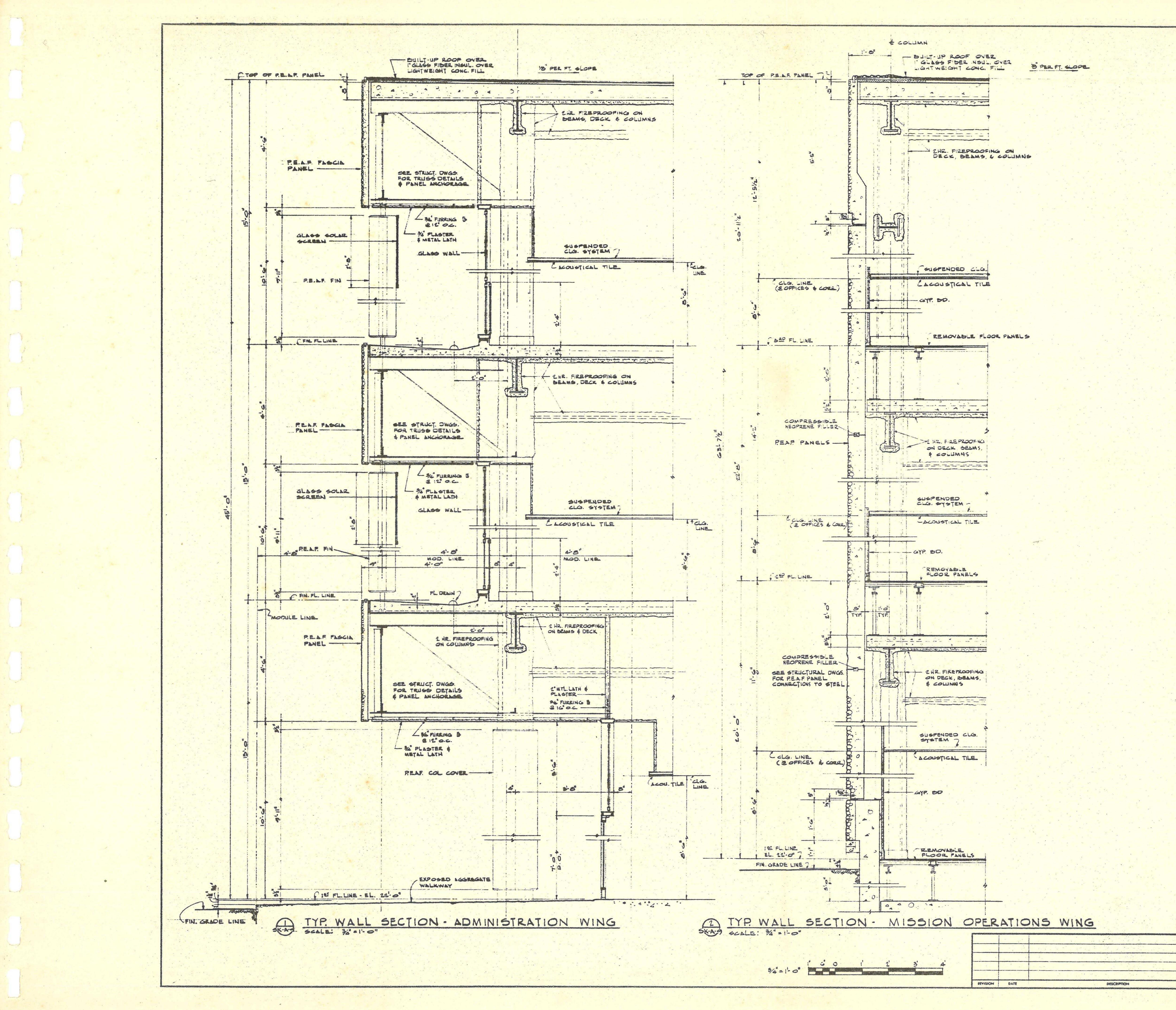


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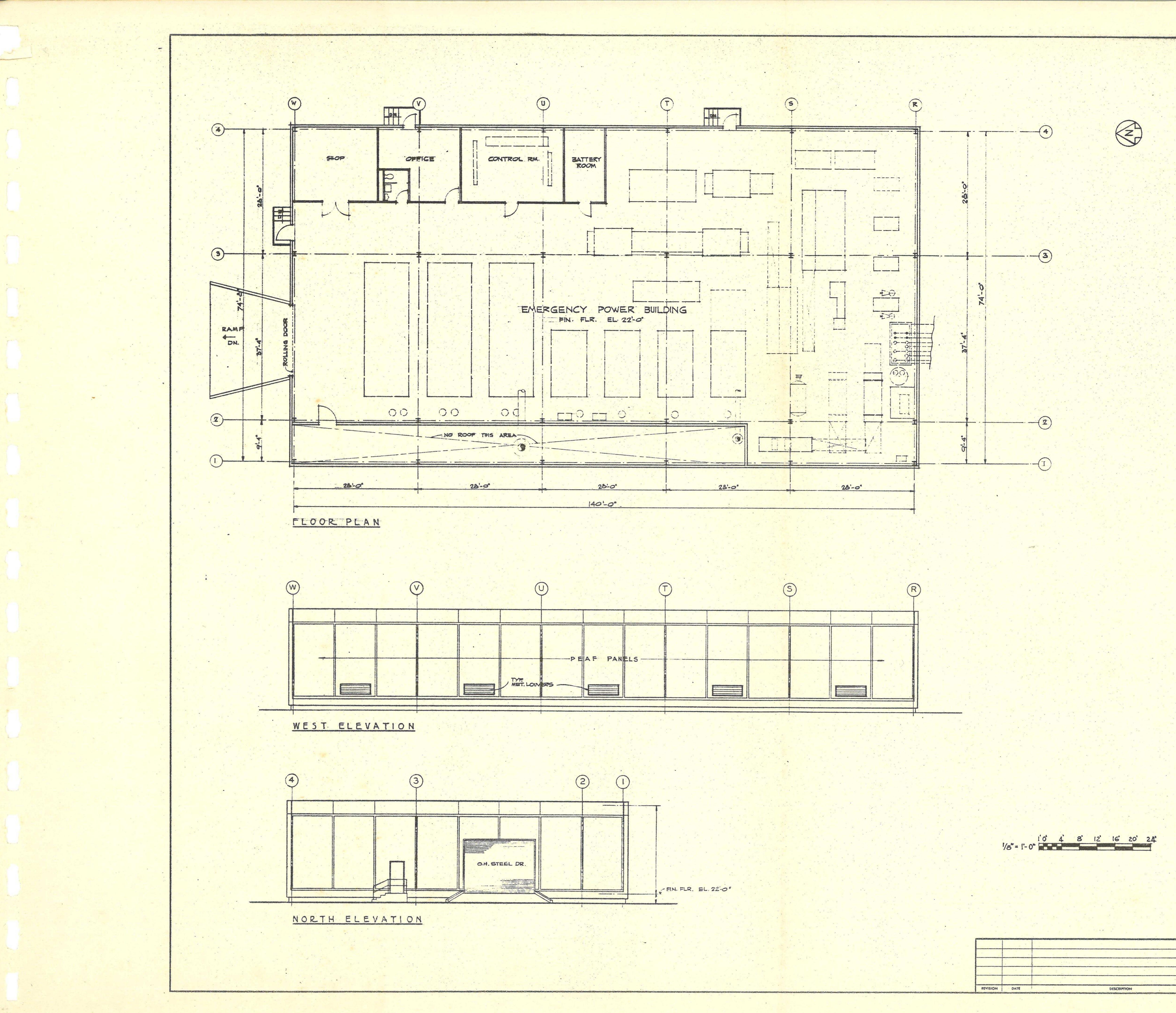




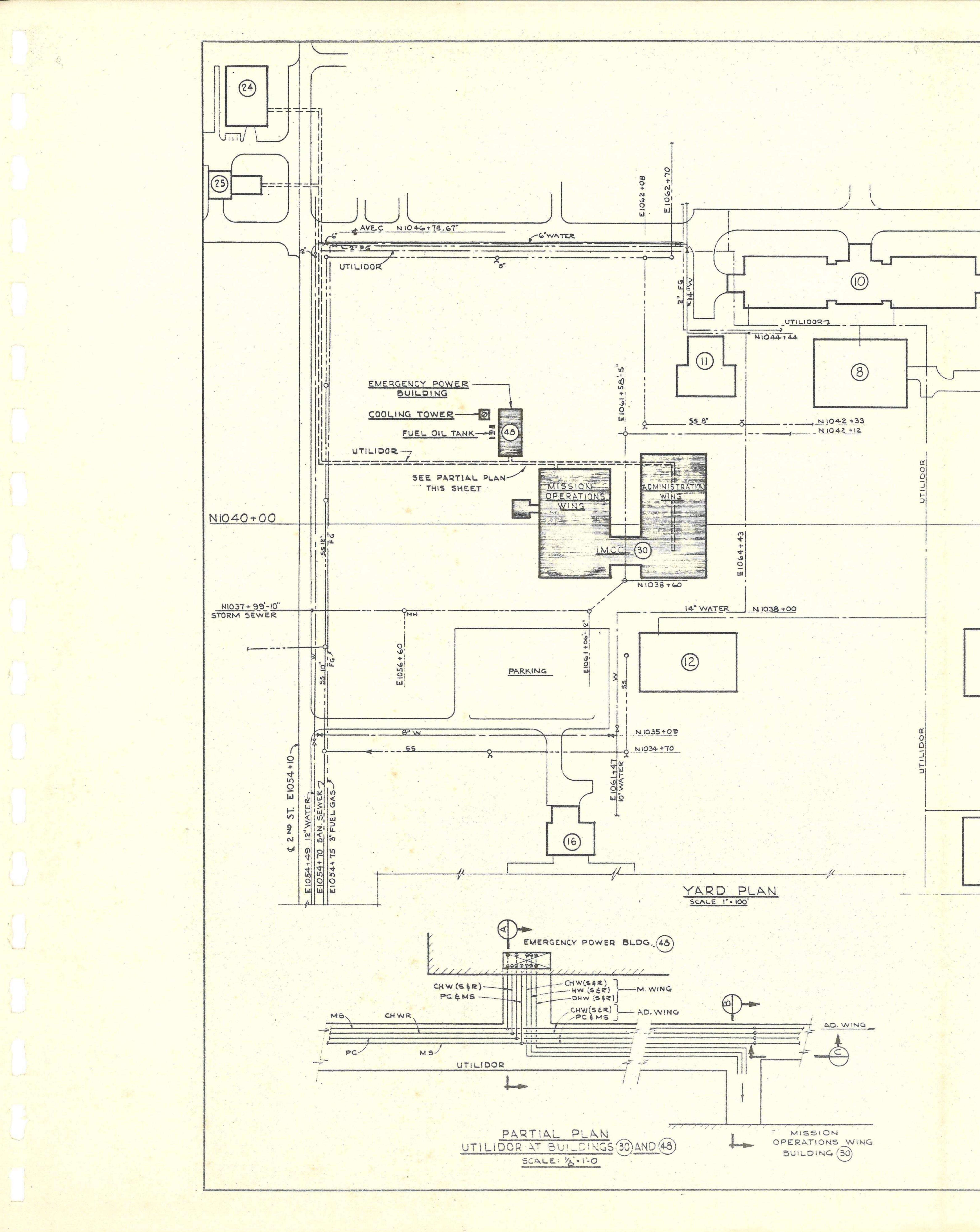
J. La BARBER CLEAR LAKE, MARRIS COUNTY, TEXAS				
H. HAWES		D MISSION CONTROL CENTER		
APPROVED FOR SUBMETTAL		DING NO. 30		
	AUDITORIUN	\$ DISPLAY ROOM		
De cu + 9/7/22	PLAN	& SECTION ARCHITECTURAL		
RECOMMENDED	RECOMMENDED	APPROVAL RECOMMENDED		

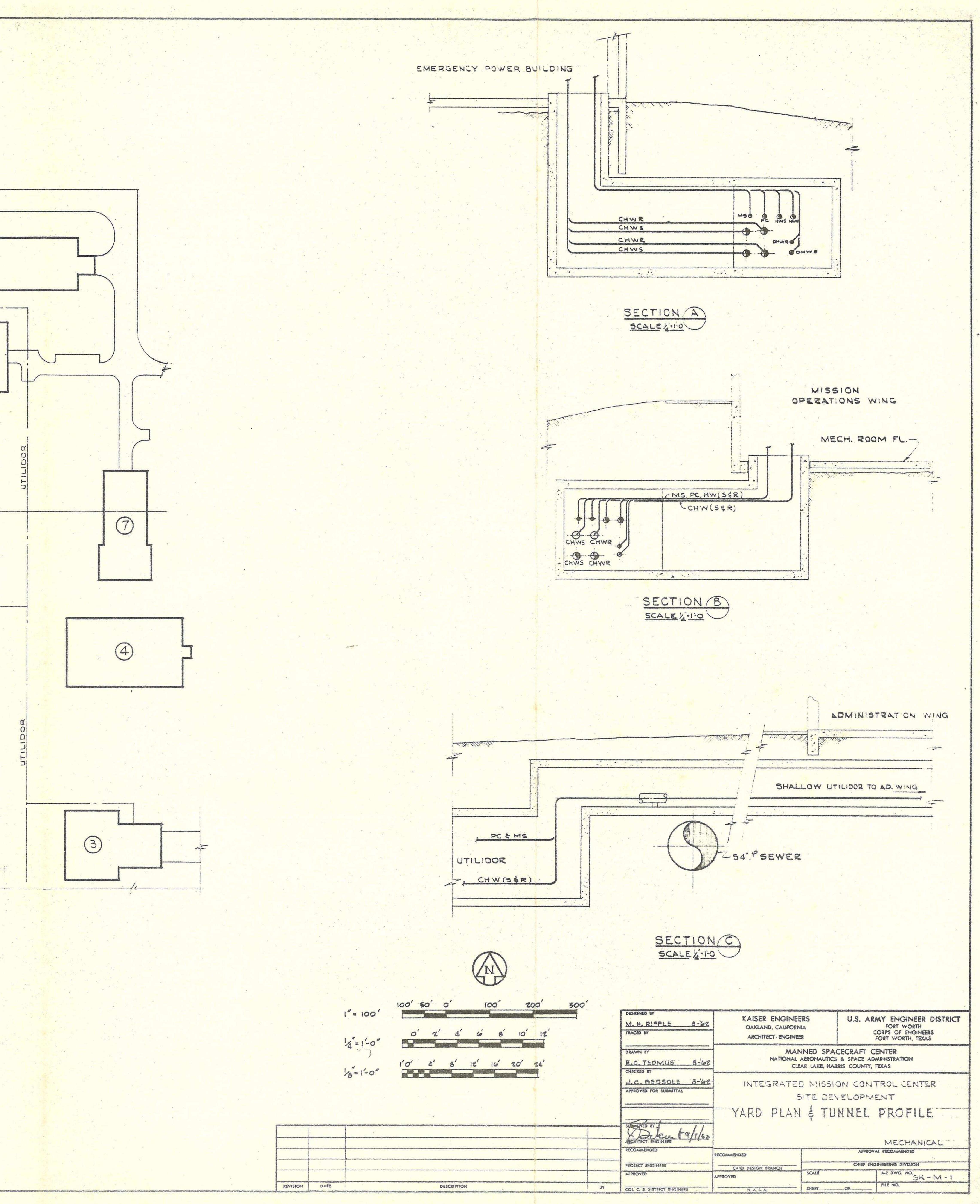



	H. GILBERT	KAISER ENGINE OAKLAND, CAUFOR ARCHITECT-ENGINE	ORNIA FORT WORTH CORPS OF ENGINEERS				
2	DRAWN BY P. TONG CHECKED BY	MANNED SPACECRAFT CENTER NATIONAL AERONAUTICS & SPACE ADMINISTRATION CLEAR LAKE, HARRIS COUNTY, TEXAS					
	H.HAWES	INTEGRATED MISSION CONTROL CENTER BUILDING NE 50 WALL CONSTRUCTION DETAILS					
	Dia 7/2/2			AR	CHITECTURAL		
	RECOMMENDED	RECOMMENDED	AL RECOMMENDED				
	PROJECT ENGINEER	CHIEF DESIGN BRANCH		ONEP ENGINEERING DIVISION			
	APPROVED	AFFROVED	SCALE %	1-0"	A-E DWAL NO. SK-A-9		
	COL C. E. DISTRICT ENGINEER	MASA	SN-EET		PILE NO.		




H. GILBERT	KAISER ENGINE OAKLAND, CALIFOR ARCHITECT - ENGINE	RA .	S. ARMY ENGINEER DISTRICT FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS				
J. La BARBER	MANNED SPACECRAFT CENTER NATIONAL AERONAUTICS & SPACE ADMINISTRATION CLEAR LAKE, HARRIS COUNTY, TEXAS						
H. HAWES	EMERGENCY POWER BUILDING Nº 48						
SURMITECT - ENGINEER			ARCHITECTURAL				
PROJECT ENGINEER	RECOMMENDED CHIEF DESIGN BRANCH						
APPROVED COL. C. E. DISTRICT ENGINEER	N. A. S. A.	SHEET OF	ON ALE DWG. HO. SK-A-10 PILE NO.				







J.BODNAR 3 TRACED BY	CAKLAND, CA	UPORNIA	U.S. A	RMY ENGINEER DISTRICT FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS	
W.G.JACKSON B	-62 NAT	MANNED SPACECRAFT CENTER NATIONAL AERONAUTICS & SPACE ADMINISTRATION CLEAR LAKE, HARRIS COUNTY, TEXAS			
		INTEGRATED MISSION CONTROL CENTER BUILDING Nº 30 AIR CONDITIONING SCHEMATIC			
SUBLICATED BY Sile Cu. (9/2) ARCHITECT- ENGINEER	7			MECHANICAL	
PROJECT ENGINEER	CHIEF DESIGN BRANCH			NGINEERING OIVISION	
COL C. E. DISTRICT ENGINEER	APPROVED	SCALE SMEET	OF	ALE DWG. NO. SK-M-Z	



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		LEGEND	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		HIGH VELOCITY AIR SUPPLY	11. 20
		LOW VELOCITY AIR SUPPLY	
		LOW VELOCITY EXHAUST	1911
		CEILING AIR DIFFUSER	
		AIR MIXING & CONSTAINT VOLUME CONTROL VALVE	6
		VOLUME DAMPER	100
		CEILING EXHAUST REGISTER W/DUCT	
	Peel .	THERMOSTAT	
FFUSER CEILING OUCT		CEILING EXHAUST REGISTER	
NNECTIONS FOR SUPPLY	Ę	COMBINATION LIGHT-AR	
		COMBINATION LIGHT-AIR DIFFUSER (RETURN)	
FFUSER FOR RETURN	CHWS	CHILLED WATER SUPPLY	
	CHWR	CHILLED WATER RETURN	
CHEME FOR OFFICES	CHWRR	CHILLED WATER REVERSE RETURN	
\mathbf{i}	HWS	HOT WATER SUPPLY	
LEU LELOCITY HOT ALC	HWR	HOT WATER RETURN	
AN DUCT	HWRR	HOT WATER REVERSE RETURN	
HIGH VELOCITY COLD AIR MAIN DUCT	SA.	SUPPLY AIR	
	R.A.	RETURN AIR	
	0.A.	OUTSIDE AIR	
	DHWS	DOMESTIC HOT WATER SUPPLY	
REANCH DUCT SEE TYPICAL	DHWR	DOMESTIC HOT WATER RETURN	

MS

PC

- TYPICAL LOW YELDCITY BRANCH DUCT. SEE TYPICAL ZONE ABOVE FOR AIR DISTRIBUTION

VOLUME DAMPER V.D DESIGN CONDITIONS SUMMER WINTER AREA OR ROOM Nº MISSION OPER-ATIONS WING, 70° 50% 95° 80° 70° 50% 20° 103,107,11,137, $\pm 5^{\circ} \pm 10\%$ $\pm 5^{\circ} \pm 10\%$ $\pm 5^{\circ} \pm 10\%$ ALL OTHER ROOMS IN MISSION OPER-ATIONS WING

770

ADMINISTRATION 770 WING

MEDIUM PRESSURE STEAM

STEAM CONDENSATE (PRESSURE)

50% 95° 30° 72° - 20°

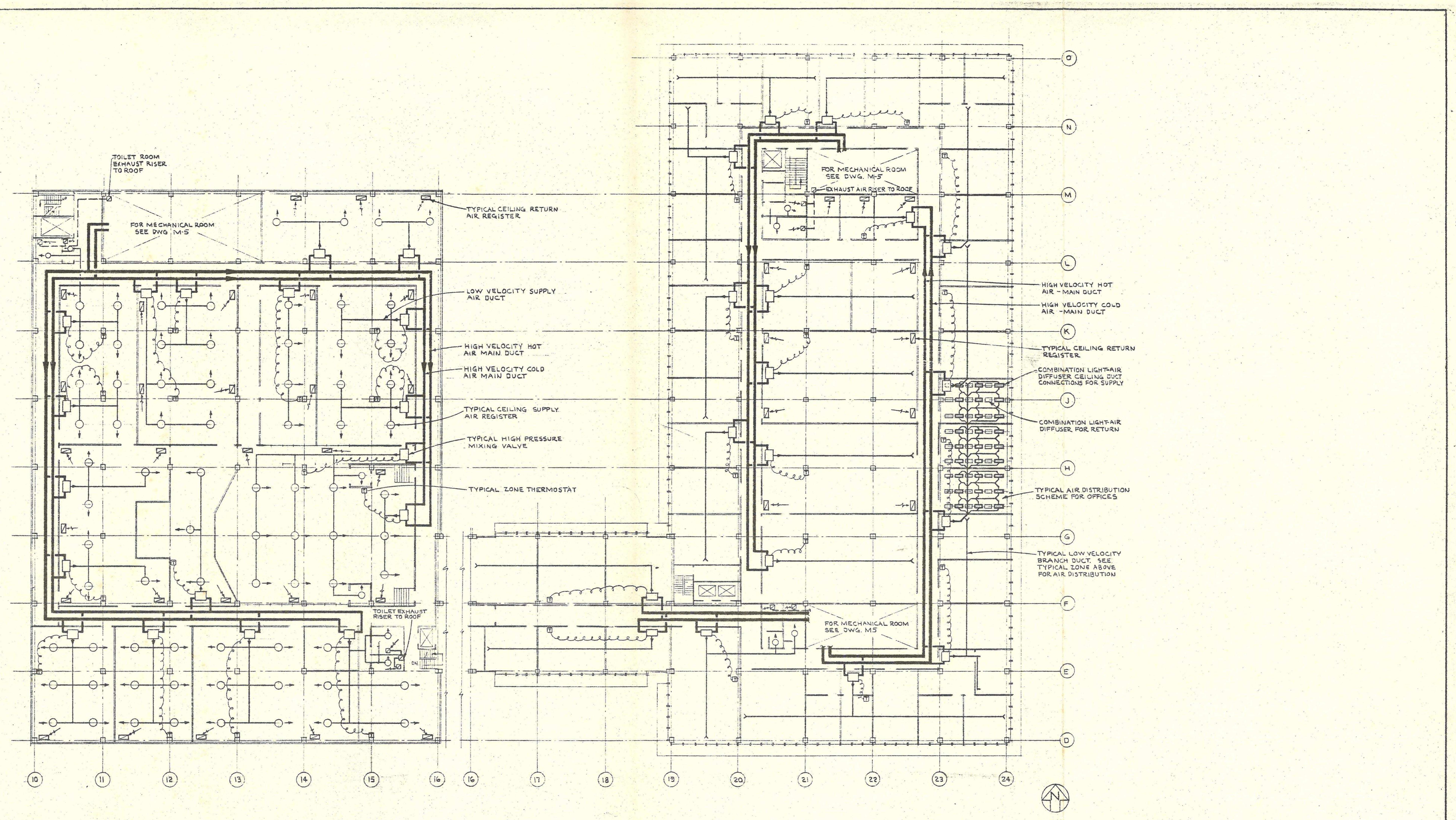
DESIGNED BY J.B.C.D.N.A.R. 3-'62 TRACED BY	KAISER ENGINEERS OAKLAND, CALIFORNIA ARCHITECT - ENGINEER	U.S. ARMY ENGINEER DISTRICT FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS			
DRAWN BY W.G. JACKSON 3-62	MANNED SPACECRAFT CENTER NATIONAL AERONAUTICS & SPACE ADMINISTRATION CLEAR LAKE, HARRIS COUNTY, TEXAS				
LEBEDSOLE 8-52		NG Nº 30			
summer in a li	FIRST	FLOOR PLAN			
RECOMMENDED RECO	MMENDED	APPROVAL RECOMMENDED			
PROJECT ENGINEER	CHIEF DESIGN BRANCH	CHIEF ENGINEERING DIVISION			

A-E OWG. NO.

CHIEF DESIGN BRANCH

N.A.S.A. SHEET

ST COL C. E. DISTRICT ENV



MISSION OPERATIONS WING SECOND FLOOR SHOWN - THIRD FLOOR SIMILAR

and the second second

-5-

(4 A)

S67. 1

ADMINISTRATION WING

SECOND FLOOR SHOWN - THIRD FLOOR SIMILAR

manufactor of the or states were provided and the the

REVISION DATE

DESCRIPTION

AIR - MAIN DUCT -HIGH VELOCITY COLD AIR -MAIN DUCT

TYPICAL CEILING RETURN REGISTER

DIFFUSER CEILING DUCT CONNECTIONS FOR SUPPLY


- COMBINATION LIGHTAIR DIFFUSER FOR RETURN

SCHEME FOR OFFICES


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
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
DESIGNED BY U.S. ARMY ENGINEER DISTRICT FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS KAISER ENGINEERS J. BODNAR 8-62 OAKLAND, CALIFORNIA ARCHITECT - ENGINEER MANNED SPACECRAFT CENTER NATIONAL AERONAGERICS & SPACE ADMINISTRATION CLEAR LAKE, HARRIS COUNTY, TEXAS W.G. JACKSON 8-62 APPEOVED FOR SUBMITTAL INTEGRATED MISSION CONTROL CENTER BUILDING Nº 30 the second s SECOND & THIRD FLOOR PLANS SUBANATED BY ARCHITECT - ENGINEER MECHANICAL RECOMMENDED APPROVAL RECOMMENDED RECOMMENDED CHIEF ENGINEERING DIVISION PROJECT ENGINEER I ALE DWG. NO. SK -M-4 CHIEF DESIGN BRANCH APPROVED APPROVED FILE NO. SHEET____OP____ COL. C. E. DISTRICT ENGINEER N. A. S. A.



	and the second	and a second				
J. BODNAR 8-62	ARCHITECT - ENGIN	INIA	U.S. ARMY ENGINEER DISTRICT FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS			
M.PISCITELLO. 8-6	MANNED SPACECRAFT CENTER NATIONAL AERONAUTICS & SPACE ADMINISTRATION CLEAR LAKE, HARRIS COUNTY, TEXAS					
J. C.BEDSOLE 3-"	INTEGRATED MISSION CONTROL CENTER BUILDING Nº 30					
	MECHANICAL ROOM LAYOUTS					
SUBJECTIED BLANDER 9/1/k			MECHANICAL			
RECOMMENDED PROJECT ENGINEER	CHIEF DESIGN BRANCH		CHIEF ENGINEERING DIVISION			
APPROVED	APPROVED	SCALE	ALE DWG. NO. SK-M-S			
COL C & DISTRICT ENGINEER	MASA	SHEET O	38			







DESIGN CRITERIA & CONCEPTS/IMCC 1. BOB JONES 2. SITTEL 3. ROMERO 4. BLAIR S. ZBONEK NASA 6. BAYNE 1 N 7. CONGER 8. CRABTREE 9. ERICKSON 10. ROBERTS Cent 11 11, HOOVER 12. FACILITIES (EXTRA) 13, FOD 14, HELSEM 15. Mª CAINE 16. POLLOCK 17. MILLS 18. CONGER 7 Jan 63 MM 19. J.J. WOOD 1 Ju 20.

B. Space Allocation

1. Floor Area

Following is a tabulation of the areas of the buildings by floors not including outside walkways.

Wing	Floor	L	W	Area (sq ft)
Administration	lst 2nd 3rd	272'-4'' 281'-8'' 281'-8''	132'-4'' 141'-8'' 141' <mark>-</mark> 8''	36,037 39,904 39,904
Total				115, 845
Lobby	lst 2nd 3rd	84'-0'' 84'-0'' 84'-0''	49'-0'' 58'-4'' 58'-4''	4,116 4,900 4,900
Total				13,916
Mission Operations	lst 2nd 3rd	227'-4'' 227'-4'' 227'-4''	171'-4'' 171'-4'' 171'-4''	38,948 38,948 38,948
Total				116,844
Emergency Power Building	lst	147'-0''	771-811	11,417

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