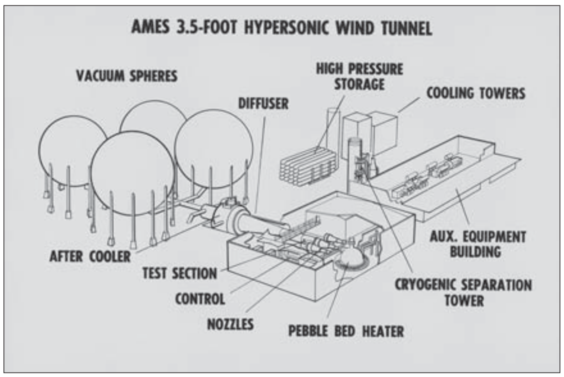
Additional Images:

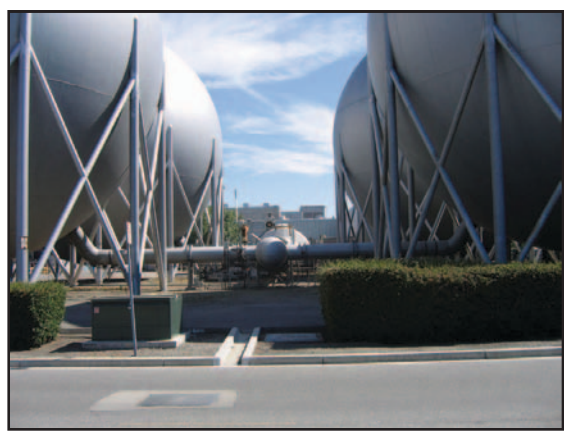
N-229: Experimental Fluid Dynamics Facility



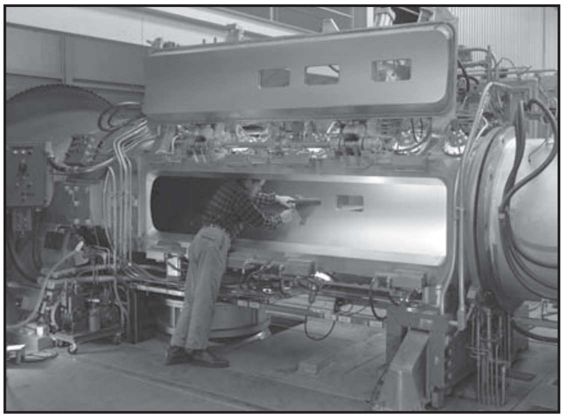
N-229, Drawing of Ames 3.5-Foot Hypersonic Wind Tunnel, 6 November 1961 (Source: NASA Ames Research Center, A-28418)

N-229, Aerial photograph, 5 July 1977 (Source: NASA Ames Research Center, AC77-0846-43)

N-229, south facade, main entry (Source: Page & Turnbull)

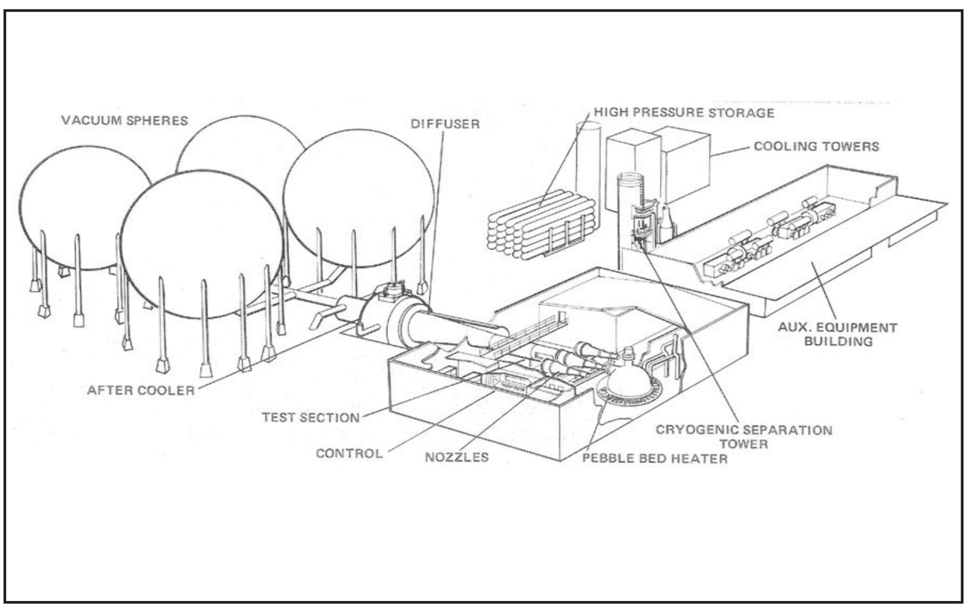


N-229, north facade, vacuum spheres (Source: Page & Turnbull)



N-229, M-1 Model of Reentry body in 3.5-Foot Hypersonic Wind Tunnel throat, 21 March 1962 (Source: NASA Ames Research Center, A-29007)

N-229, Space Shuttle Orbiter Model 140A/B-0A87 testing in 3.5-Foot Hypersonic Wind Tunnel, 19 October 1973 (Source: NASA Ames Research Center, AC73-5027)



N-229, Diagram of 3.5-Foot Hypersonic Wind Tunnel (Source: *NASA Ames Facilities Summary*, 1974)

Architectural Drawings for N-229

3.5-Foot Hypersonic Wind Tunnel, Test Chamber, Perspective
Architect: John Sardis & Associates, Engineers
Date: 30 October 1958
Sheet: A 112 DO
NASA EDC # 229-5901-A1

3.5-Foot Hypersonic Wind Tunnel, Test Chamber, Plot Plan
Architect: John Sardis & Associates, Engineers
Date: 30 October 1958
Sheet: A 112 D1
NASA EDC # 229-5901-A2

3.5-Foot Hypersonic Wind Tunnel, Test Chamber, First Floor Plan and Schedules
Architect: John Sardis & Associates, Engineers
Date: 20 October 1958
Sheet: A 112 D2
NASA EDC # 229-5901-A3

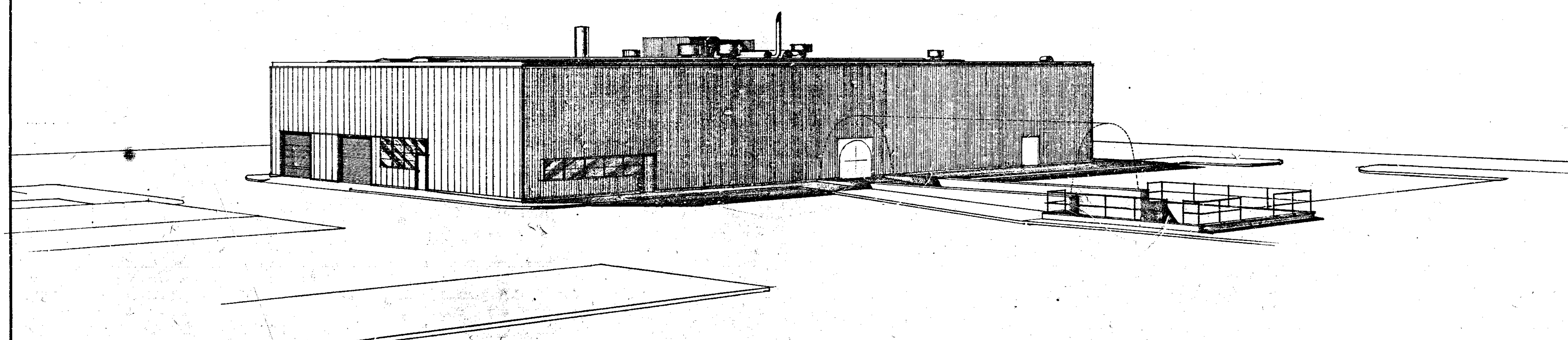
3.5-Foot Hypersonic Wind Tunnel, Test Chamber, Elevations and Sections
Architect: John Sardis & Associates, Engineers
Date: 30 October 1958
Sheet: A 112 D6
NASA EDC # 229-5901-A7

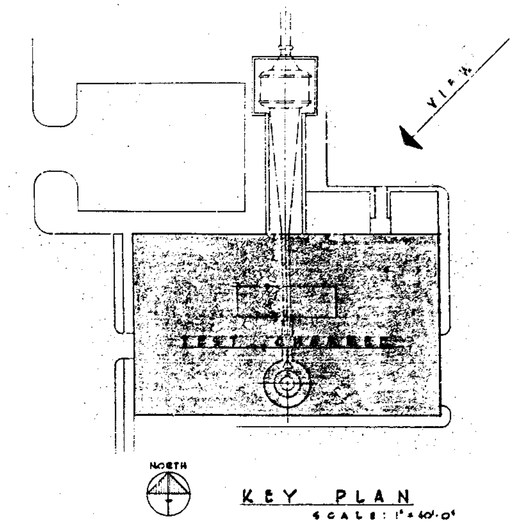
3.5-Foot Hypersonic Tunnel Office Building, Perspective
Architect: Rosener Engineering Incorporated
Date: 12 June 1958
Sheet: A11262-D1
NASA EDC # 229-5902-A1

3.5-Foot Hypersonic Tunnel Office Building, First Floor Plan and Schedule
Architect: Rosener Engineering Incorporated
Date: 2 December 1958
Sheet: A11262-D2
NASA EDC # 229-5902-A2

3.5-Foot Hypersonic Tunnel Office Building, Second Floor & Roof Plans & Schedule
Architect: Rosener Engineering Incorporated
Date: 2 December 1958
Sheet: A11262-D3
NASA EDC # 229-5902-A3

3.5-Foot Hypersonic Tunnel Office Building, Exterior Elevations and Cross Sections
Architect: Rosener Engineering Incorporated
Date: 2 December 1958
Sheet: A11262-D4
NASA EDC # 229-5902-A4





SCALE: NONE	
MATERIAL	
HEAT TREAT	
PROTECT FINISH	
QUAN.	ASSEM. DRWG. NO.
INDEX	

LET	DATE	REVISIONS	CKR.	APP.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.

3.5 FOOT HYPERSONIC TUNNEL
TEST CHAMBER
PERSPECTIVE

DESIGN ENG.	BRANCH	DESIGN J. O.
DRAWN BY ROS	DIVISION	CONST. J. O.
CHECKED BY	A 11261 - DO	REV.
RESEARCH ENG.		
APPROVED BY 10-30-58		
APPROVED BY 10/30/58		

LIMITS ON DIMENSIONS UNLESS OTHERWISE NOTED
FRACTIONAL ±
DECIMAL ±
ANGULAR ±

JOHN SARDIS & ASSOCIATES
64 PINE STREET
SAN FRANCISCO
ENGINEERS

229-5901 A - - 1

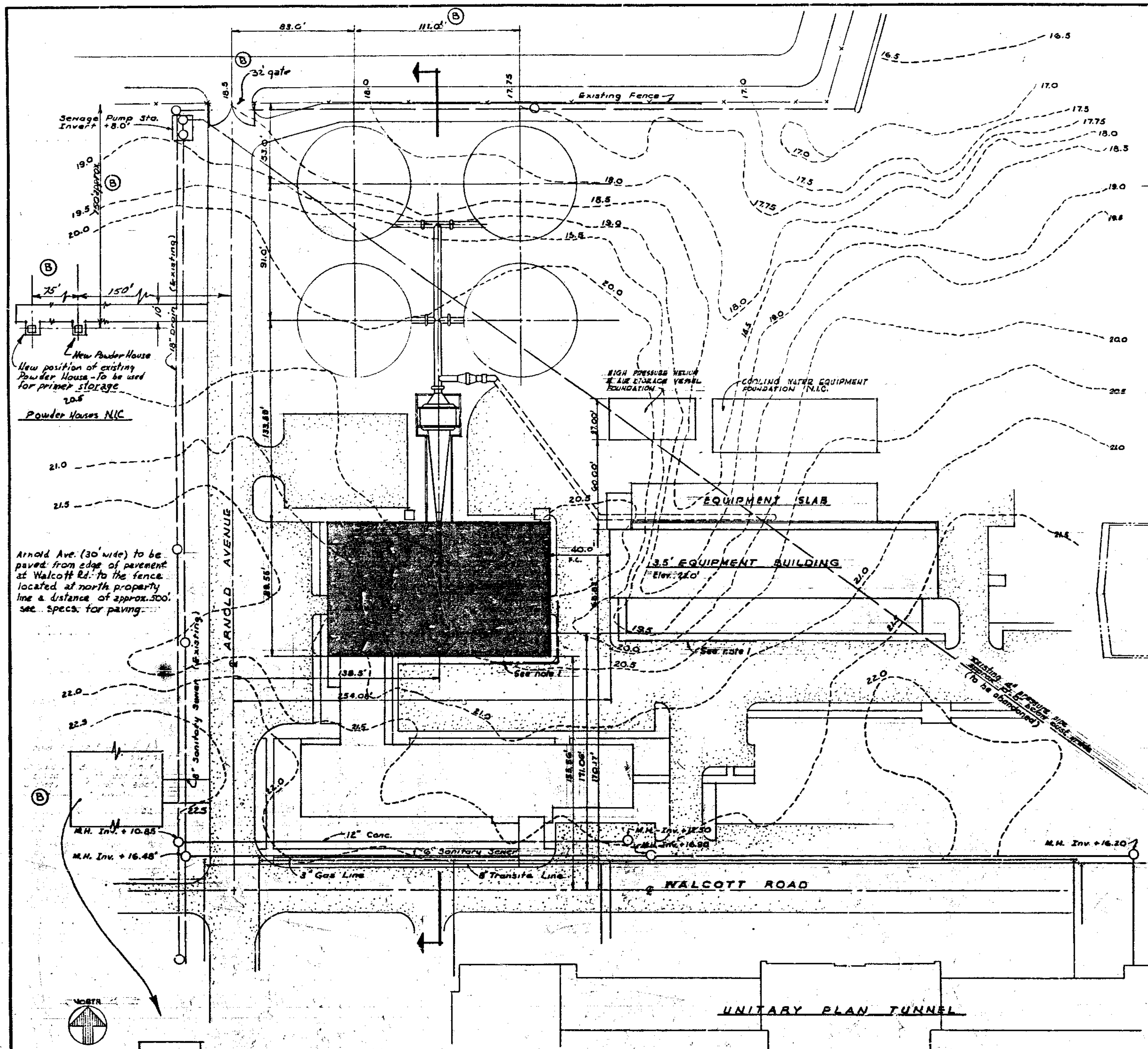
A

GPO

EASI FILE CORP. COSTA MESA, CA HANGER EFHSM

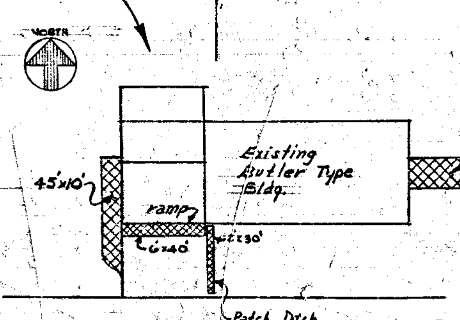
229-5901 A-1

3.5 FT HYPERSONIC TUNNEL TEST CHAMBER PERSPECTIVE

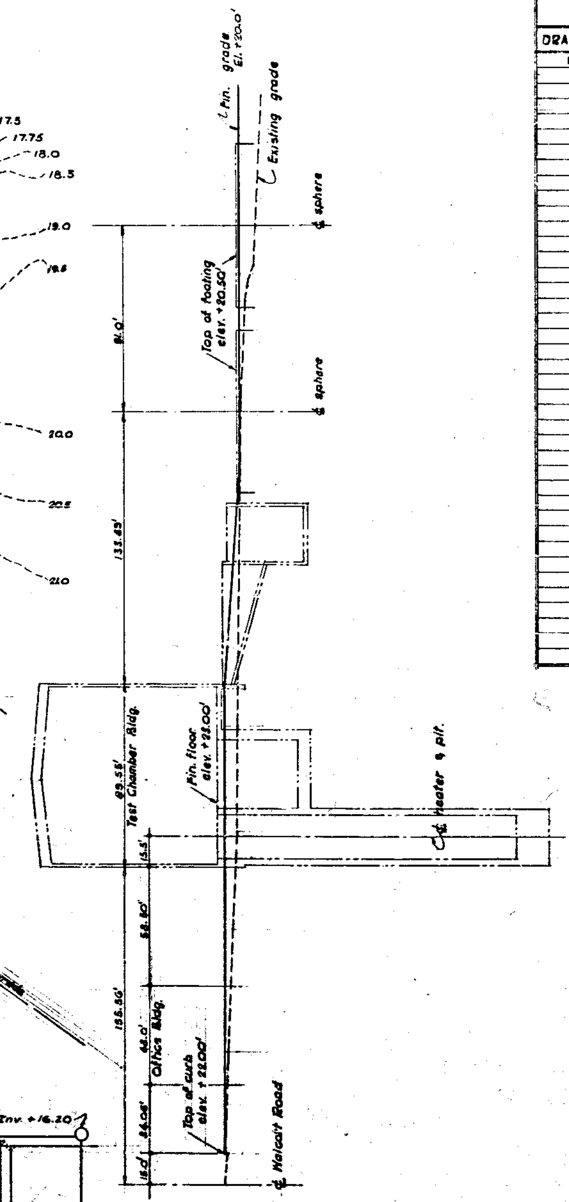


PLOT PLAN

Note:
1. Engineered Fill under buildings and 6'-0" beyond.



Detail of "G.E" Bldg.

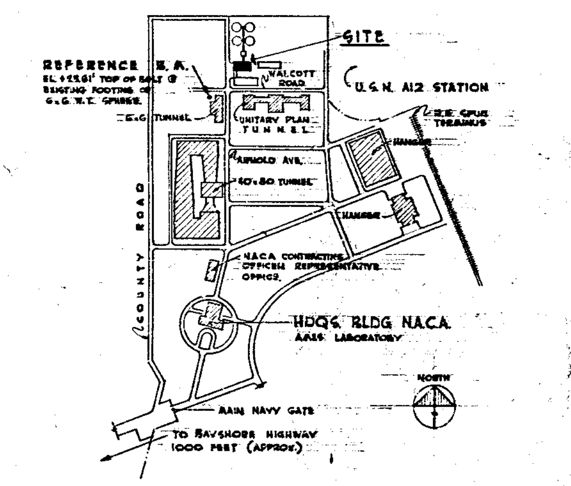


℄ PROFILE

SCALE: HORIZ. - 1" = 40'
VERT. - 1" = 10'

LIST of DRAWINGS

DRAWING NUMBER	REVISION	DESCRIPTION
11261 D 1	G	PLOT PLAN
D 2	C	FIRST FLOOR PLAN AND SCHEDULES
D 3	D	FOUNDATION PLAN
D 4		MEZZANINE PLAN AND SCHEDULES
D 5	A	ROOF FRAMING PLAN AND DETAILS
D 6	D	ELEVATIONS AND SECTIONS
D 7	A	STRUCTURAL DETAILS
D 8	C	FOUNDATION AND BASEMENT DETAILS
D 9	E	HEATER PIT AND TUNNEL - PLAN AND SECTION
D 10	C	ANCHORAGE DETAILS
D 11	C	PIT ERECTION AND TUNNEL DETAILS
D 12	C	MISC. CONCRETE DETAILS
D 13		TYPICAL CONCRETE DETAILS
D 14		STAIR DETAILS
D 15	A	DOOR AND WINDOW DETAILS
D 16		TOILET AND MISC. DETAILS
D 17	A	MISC. DETAILS
D 18	C	AIR CONDITIONING, VENTILATING, PLUMBING PLAN & DETAILS
D 19	A	MEZZ. AIR COND., VENTILATING, PLUMBING PLAN & DETAILS
D 20	A	MECHANICAL ROOF PLAN AND DETAILS
D 21	B	MISC. MECHANICAL DETAILS
D 22		MISC. MECHANICAL DETAILS
D 23	B	FIRST FLOOR ELECTRICAL PLAN
D 24	E	UNDERGROUND DUCT LAYOUT
D 25	A	AFTERCOOLER ELECTRICAL PLAN AND DETAILS
D 26	A	MEZZANINE POWER PLAN
D 27		MEZZANINE AND HEATER PIT LIGHTING
D 28	A	COMMUNICATION SYSTEM
D 29	C	AFTERCOOLER FOOTINGS AND PIT - PLAN AND SECTION
D 30	D	AFTERCOOLER FOOTINGS - SECTIONS AND DETAILS
D 31	C	SPRAY PIPING AND CANOPY SUPPORT DETAILS



VICINITY MAP

SCALE IN FEET 0 1000 2000

NOTES:

1. As of October 1, 1958 the National Advisory Committee for Aeronautics, Ames Aeronautical Laboratory is redesignated the National Aeronautics and Space Administration, Ames Research Center, and all reference to the former designation either in these drawings or the accompanying specifications shall be construed to mean the new designation.
2. N.I.C. - not in contract.

LET	DATE	REVISIONS	CKR.	APP.
G	9/20/59	D1, D2, D3, D5, D6, D9, D11, D12, D18, D20, D29 & D31 REVISED		
F	7/8/59	Revised - D1, - D23, - D24, - D26	CMS	
E	4-3-59	D1, D3, D8, D9, D10, D12, D18, D25, D24, D29 & D30 Revised		
D	2/20/59	D1, D2, D3, D8, D9, D11, D12, D15, D17, D18, D19, D20, D21, D23, D24, D28, D29, D30, D31 Revised		
C	3/3/59	REVISED D23, D24	CMS	
B	1/22/59	MISC. PAVING AT EXIST. BUTLER TYPE BLDG. ADDED. POWDER HOUSE ACCESS RD ADDED. GATE ADDED. 18'-0" WAS 10'-0"		
A	11/21/58	A CHANGES MADE	AS	

SCALE: 1" = 40'
MATERIAL
HEAT TREAT
PROTECT FINISH
QUAN. | ASSEM. DRWG. NO.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.

3.5 FOOT HYPERSONIC TUNNEL
TEST CHAMBER
PLOT PLAN

DESIGN ENG. | BRANCH | DESIGN J.O. 5431X
DRAWN BY V.C., HKO. | DIVISION H.S.R. | CONST. J.O.
CHECKED BY
RESEARCH ENG.
APPROVED BY 10-30-58
APPROVED BY 10/30/59

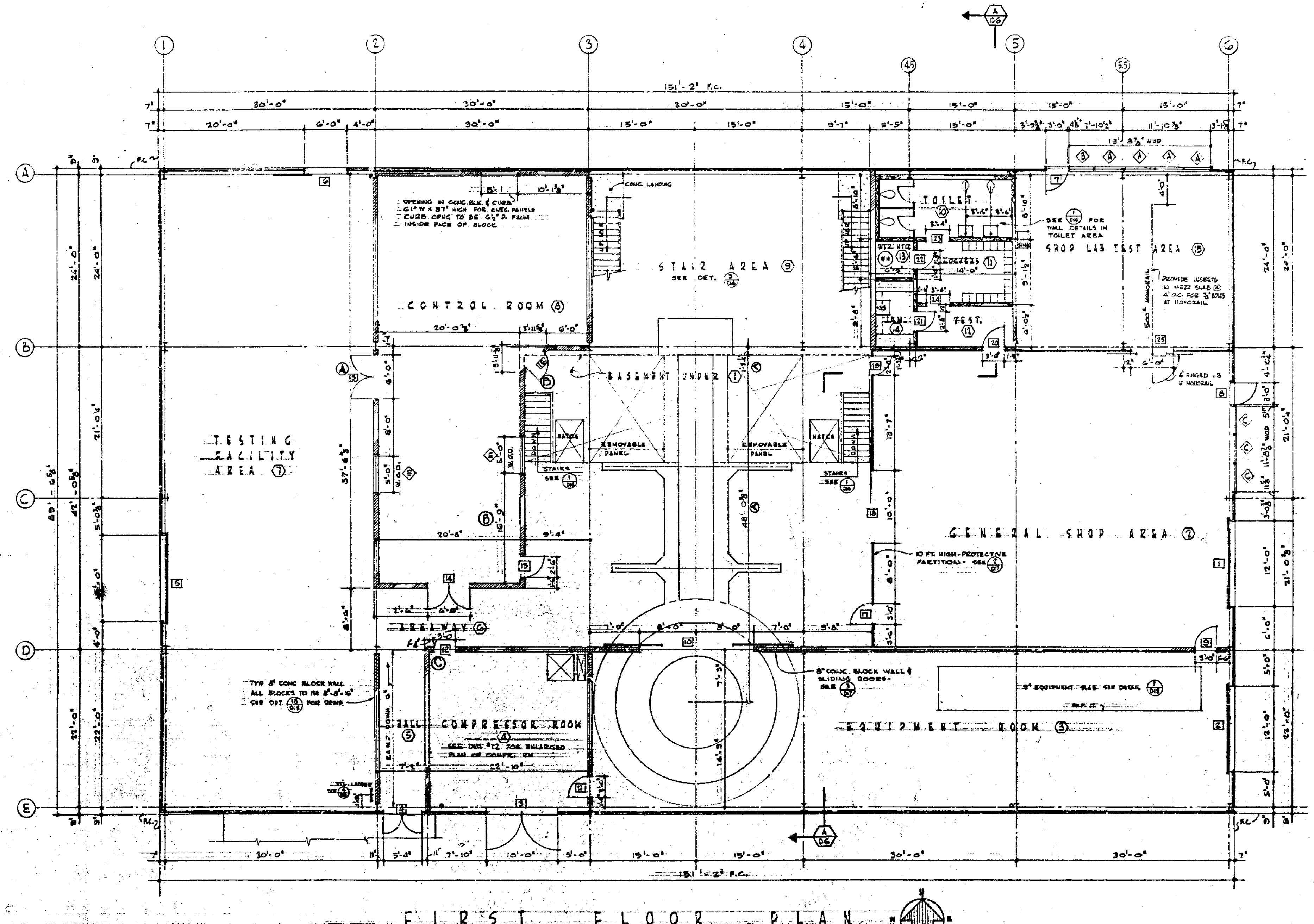
LIMITS ON DIMENSIONS UNLESS OTHERWISE NOTED
FRACTIONAL ±
DECIMAL ±
ANGULAR ±

A11261 D1 REV. G

JOHN SARDIS & ASSOCIATES ENGINEERS
64 PINE STREET
SAN FRANCISCO

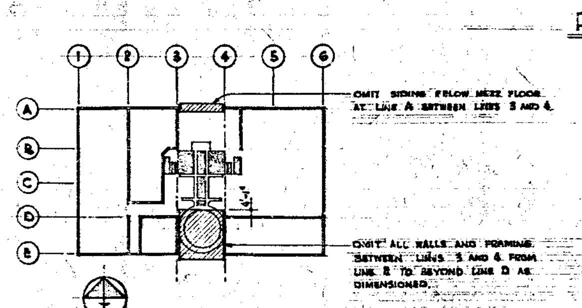
229-5901 A--2

229-5901 A-2 3.5 FT H.S. TUNNEL TEST CHAMBER PLOT PLAN



FIRST FLOOR PLAN

1/8" = 1'-0"



DELAYED CONSTRUCTION FOR HEATER ERECTION

DELAYED CONSTRUCTION PROCEDURE TO BE USED ONLY IF BUILDING IS BUILT BEFORE HEATER IS ERECTED.

DESIGN LOADS

ROOF LIVE LOAD .... 20 POUNDS PER SQUARE FOOT
MEZZANINE FLOOR LIVE LOAD .... 200 " " " "
OVER CONTROL ROOM .... 150 " " " "
MAIN FLOOR LIVE LOAD OVER BASEMENT .. 150 " " " "
GRATING AND CHKR. PLATE AREAS, CATWALK ... 150 " " " "
LATERAL LOADS:
SEISMIC .... 20% OF DEAD LOAD
WIND .... 20 POUNDS PER SQUARE FOOT

F.C. = FACE OF CONCRETE

DETAIL NUMBER / DWG. WHERE DET. IS SHOWN

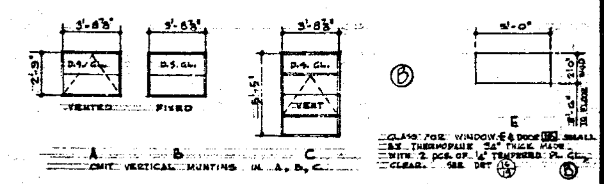
SECTION LETTER / DWG. WHERE SECT. IS SHOWN

DOOR SCHEDULE

TYPE – A (ROLL-UP), B, C (SWING OR SLIDE), D, E (SWING OR SLIDE), F

NO	TYPE	SIZE	DETAIL	HARDWARE GROUP	REMARKS
1	A	12° x 10°	[illegible]	—	
2	A	12° x 10°	[illegible]	—	
3	B	10° x 10° x 1¾	[illegible]	9	
4	C	5⁴ x 7° x 1¾	[illegible]	3	
5	A	17° x 10°	[illegible]	—	
6	D	6° x 7° x 1¾	[illegible]	11	
7	D	3° x 7° x 1¾	[illegible]	4	
8	D	3° x 7° x 1¾	[illegible]	3	
9	E	3° x 7° x 1¾	[illegible]	1	
10	F	16° x 9° x 1¾	[illegible]	SEE DET	FIT DOORS TO EQUIPMENT PROFILE
11	D	3° x 7° x 1¾	[illegible]	1	
12	D	3° x 7° x 1¾	[illegible]	1	
13	D	2⁶ x 7° x 1¾	[illegible]	5	
14	C	6° x 7° x 1¾	[illegible]	7	¼" WIRE GL. MISSISSIPPI GL. CO "POLISHED MISCO", OR EQUAL
(A) 15	C	6° x 8° x 1¾	[illegible]	7	"
(B) 16	E	3⁴ x 7° x 1¾	[illegible]	2	THERMOPANE -¾" THICK x 28" WIDE x 24" HIGH
17	E	3° x 7° x 1¾	[illegible]	1	
18	D	10° x 9⁴ x 1¾	[illegible]	SEE DET	
19	E	2⁸ x 7° x 1¾	[illegible]	1	
20	D	3° x 7° x 1¾	[illegible]	6	
21	D	2⁸ x 7° x 1¾	[illegible]	5	LOUVER
22	D	2⁸ x 7° x 1¾	[illegible]	5	LOUVER
23	—	3⁴ x 7° —	[illegible]	—	NO DOOR - FRAME ONLY
24	—	3⁴ x 7° —	[illegible]	—	NO DOOR - FRAME ONLY
25	B	6° x 7° x 1¾	[illegible]	11	NOTCH DOORS FOR MONORAIL.
26	E	4° x 7° x 1¾	[illegible]	2	¼" WIRE GL. MISSISSIPPI GL. CO "POLISHED MISCO", OR EQUAL.
27	E	3° x 7° x 1¾	[illegible]	2	
28	E	3° x 7° x 1¾	[illegible]	2	
29	E	3° x 7° x 1¾	[illegible]	2	
30	D	3° x 7° x 1¾	[illegible]	2	
31	D	3° x 7° x 1¾	[illegible]	1	
32	D	3° x 7° x 1¾	[illegible]	1	
33	B	6° x 7° x 1¾	[illegible]	12	NOTCH DOORS FOR MONORAIL, PROVIDE CHAIN GUARD

WINDOW SCHEDULE



OMIT VERTICAL MUNTINS IN A, B, C.

GLASS FOR WINDOW E & DOOR 16 SHALL BE THERMOPANE "A" THICK MADE WITH 2 PCS. OF ¼" TEMPERED PL. GL. CLEAR. SEE DET.

NOTES:
1. ALL STEEL SASH SHALL BE COMMERCIAL PROJECTED AS DESCRIBED.
2. GLASS FOR TYPES A, B, & C SHALL BE D.S. "A" CLEAR.
3. GLASS FOR TYPES D & E SHALL BE THERMOPANE OR EQUAL AS NOTED.
4. SEE DWG D15 FOR WINDOW DETAILS.

LET	DATE	REVISIONS	CHK.	APP.
C	2/4/59	DOOR 33 RELOCATED 1'-4 WAS 3'-3		
B	12/10/58	DOOR 16 RELOCATED, 3⁴ WAS 3°. THERMOPANE WAS WIRED GLASS. WINDOW D DELETED; WAS PLYWOOD.		
A	11/21/58	15-DR WAS 6'8, 7'-8 WAS 7'-1½. DOOR 16 WAS 7' HIGH.		

SCALE: 1/8" = 1'-0"

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.

3.5 FOOT HYPERSONIC TUNNEL
TEST CHAMBER
FIRST FLOOR PLAN & SCHEDULES

JOHN SARDIS & ASSOCIATES ENGINEERS
64 PINE STREET
SAN FRANCISCO

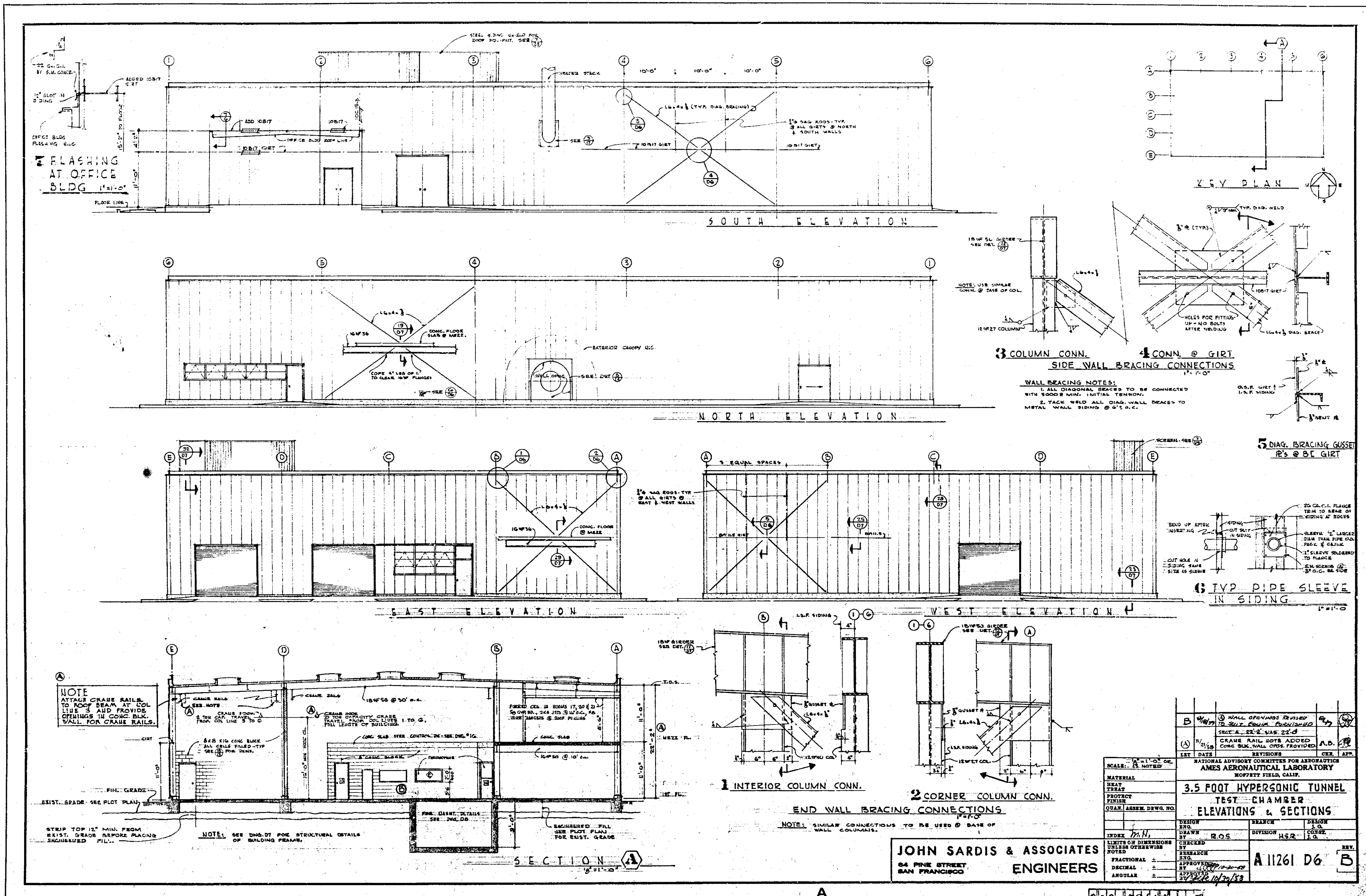
DRAWN BY R.O.S.
APPROVED 10-30-58

A 11261 D2 REV. C

A11261-D2

229-590-A-3

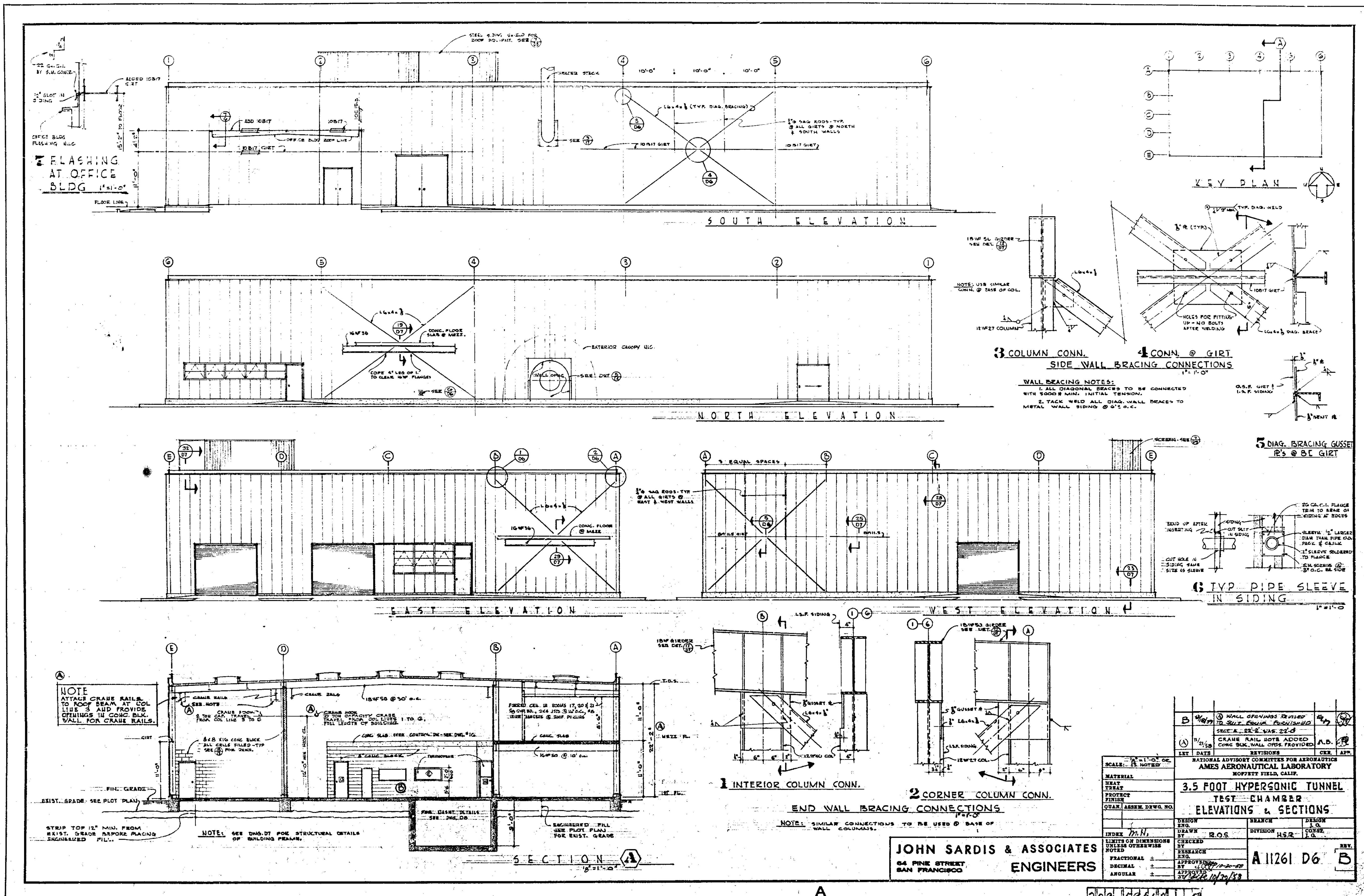
229-590 A-3 3.5 FT. H.S. TUNNEL TEST CHAMBER FIRST FLOOR PLAN & SCHEDULES



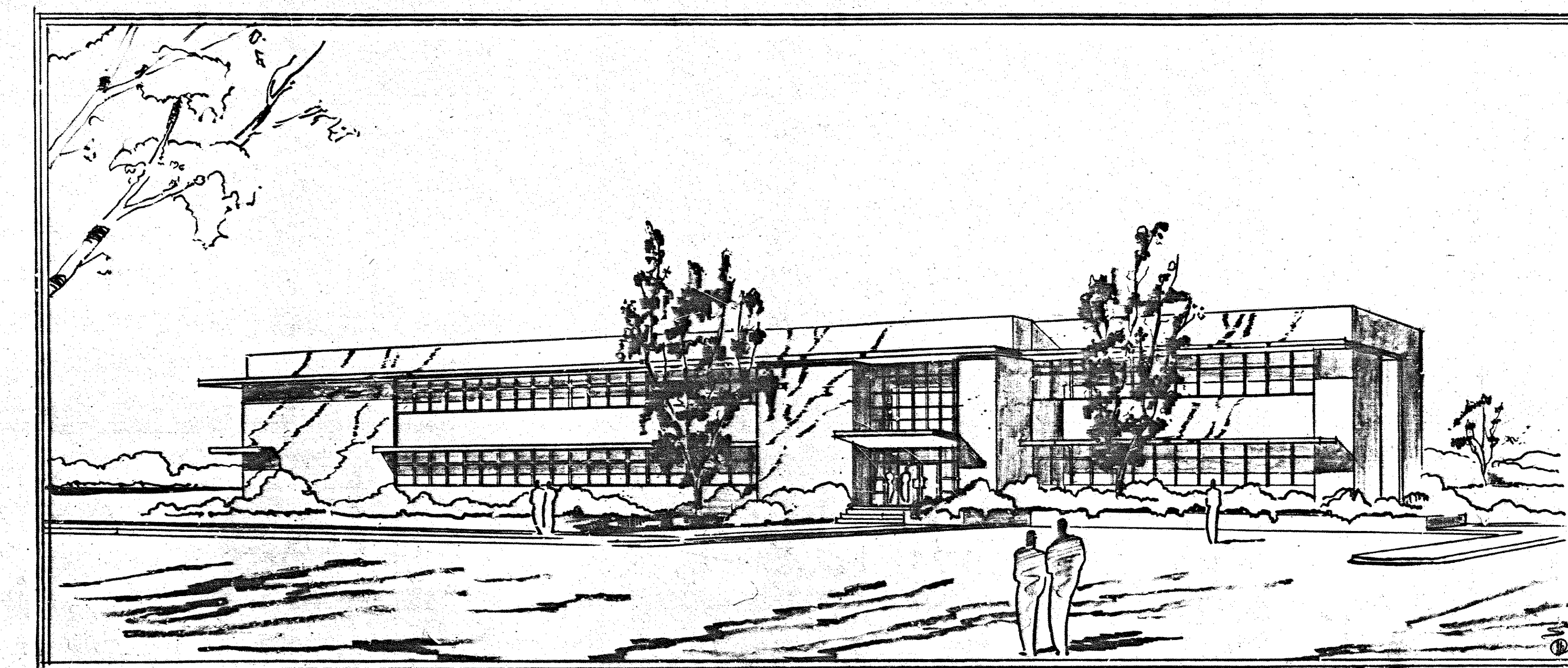
A

229 5901 A 7

229-5901 A-7
3.5 FT. H.S. TUNNEL TEST CHAMBER ELEVATIONS & SECTIONS



SOUTH ELEVATION
NORTH ELEVATION
EAST ELEVATION
WEST ELEVATION
SECTION A
7 FLASHING AT OFFICE BLDG 1"=1'-0"
KEY PLAN
3 COLUMN CONN.
4 CONN. @ GIRT
SIDE WALL BRACING CONNECTIONS
WALL BRACING NOTES:
1. ALL DIAGONAL BRACES TO BE CONNECTED WITH 5000# MIN. INITIAL TENSION.
2. TACK WELD ALL DIAG. WALL BRACES TO METAL WALL SIDING @ 6" O.C.
5 DIAG. BRACING GUSSET PL'S @ 8E GIRT
6 TYP PIPE SLEEVE IN SIDING
1 INTERIOR COLUMN CONN.
2 CORNER COLUMN CONN.
END WALL BRACING CONNECTIONS
NOTE: SIMILAR CONNECTIONS TO BE USED @ BASE OF WALL COLUMNS.
NOTE ATTACH CRANE RAILS TO ROOF BEAM AT COL LINE 3 AND PROVIDE OPENINGS IN CONC. BLK. WALL FOR CRANE RAILS.
NOTE: SEE DWG. D7 FOR STRUCTURAL DETAILS OF BUILDING FRAME.
STRIP TOP 12" MIN. FROM EXIST. GRADE BEFORE PLACING ENGINEERED FILL.
JOHN SARDIS & ASSOCIATES ENGINEERS
64 PINE STREET SAN FRANCISCO
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.
3.5 FOOT HYPERSONIC TUNNEL
TEST CHAMBER
ELEVATIONS & SECTIONS
B WALL OPENINGS REVISED TO SUIT EQUIP. FURNISHED. SECT. A 22'-2" WAS 22'-0"
A CRANE RAIL NOTE ADDED. CONC. SLK. WALL OPGS. PROVIDED
A 11261 D6 B
229-5901 A-7
3.5 FT. H.S. TUNNEL TEST CHAMBER ELEVATIONS & SECTIONS



229 5902A 1

JUNE 12, 1958

LET	DATE	REVISIONS	CKR.	APP.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.

3.5 FOOT HYPERSONIC TUNNEL · OFFICE · BUILDING ·

· PERSPECTIVE ·

SCALE:	
MATERIAL	
HEAT TREAT	
PROTECT FINISH	
QUAN.	ASSEM. DRWG. NO.

LIMITS ON DIMENSIONS UNLESS OTHERWISE NOTED
FRACTIONAL ±
DECIMAL ±
ANGULAR ±

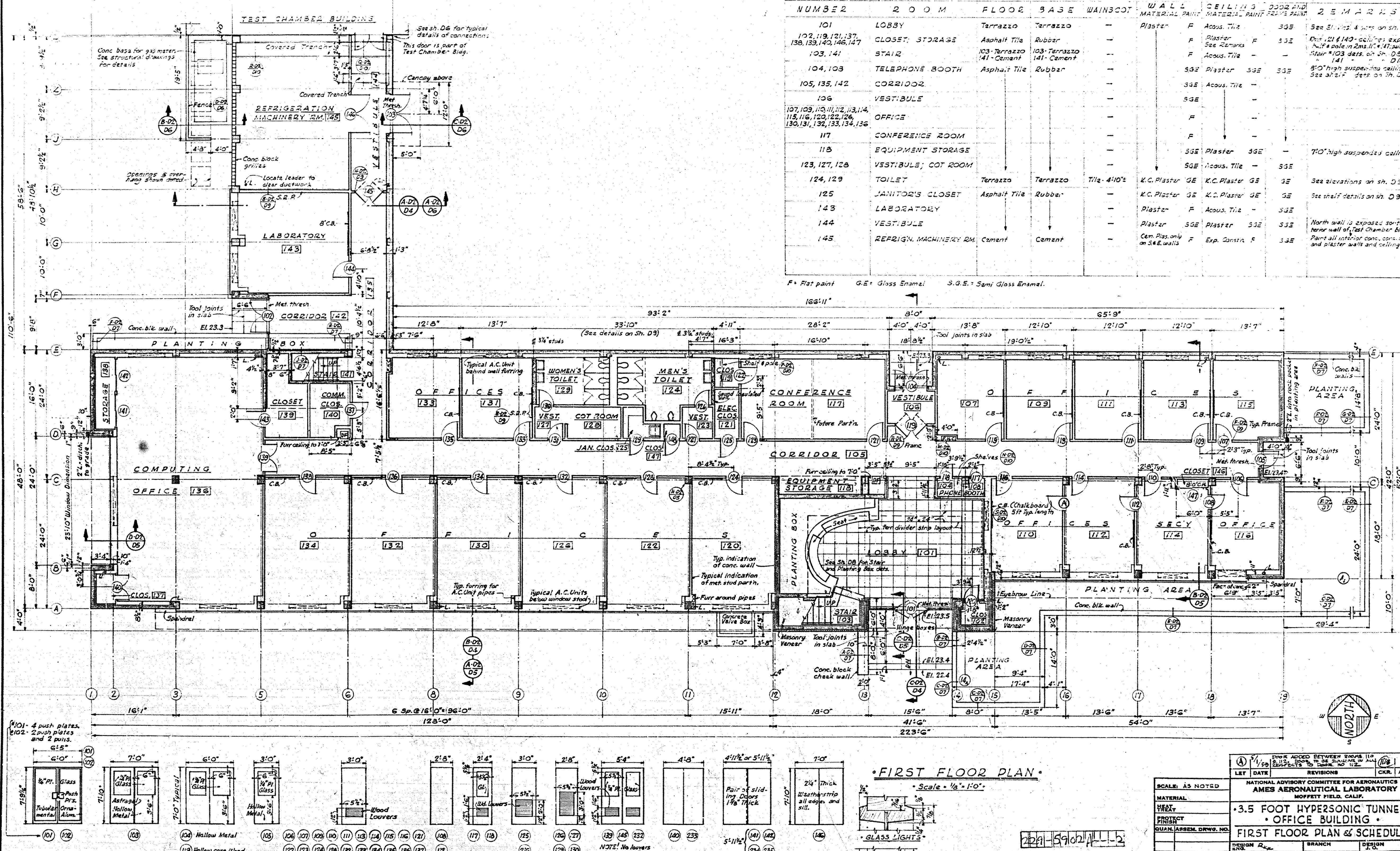
DESIGN ENG.	BRANCH	DESIGN J. O.
DRAWN BY	DIVISION 85R	CONST. J. O.
CHECKED BY		
RESEARCH ENG.		
APPROVED BY		
APPROVED BY		

A 11262 D1 REV. A

EASI FILE CORP. COSTA MESA, CA HANGER EFH34

229-5902A-1

3.5 FT. H.S. TUNNEL OFFICE BLDG. PERSPECTIVE



INTERIOR FINISH AND PAINT SCHEDULE

NUMBER	ROOM	FLOOR	BASE	WAINSCOT	WALL MATERIAL	WALL PAINT	CEILING MATERIAL	CEILING PAINT	DOOR AND FRAME PAINT	REMARKS
101	LOBBY	Terrazzo	Terrazzo	—	Plaster	F	Acous. Tile		SGE	See El. ... & dets on sh. D3
102, 119, 121, 137, 138, 139, 140, 146, 147	CLOSET; STORAGE	Asphalt Tile	Rubber	—		F	Plaster See Remarks	F	SGE	Rms. 121 & 140 - ceilings exposed; half & pole in Rms. 116 & 147; paint SGE
103, 141	STAIR	103-Terrazzo 141-Cement	103-Terrazzo 141-Cement	—		F	Acous. Tile	—	—	Stair #103 dets. on Sh. D8; " 141 " " " D10
104, 108	TELEPHONE BOOTH	Asphalt Tile	Rubber	—		SGE	Plaster	SGE	SGE	8'0" high suspended ceiling. See shelf dets. on Sh. D10
105, 135, 142	CORRIDOR			—		SGE	Acous. Tile	—		
106	VESTIBULE			—		SGE		—		
107, 109, 110, 111, 112, 113, 114, 115, 116, 120, 122, 126, 130, 131, 132, 133, 134, 136	OFFICE			—		F		—		
117	CONFERENCE ROOM			—		F		—		
118	EQUIPMENT STORAGE			—		SGE	Plaster	SGE	—	7'0" high suspended ceiling
123, 127, 128	VESTIBULE; COT ROOM			—		SGE	Acous. Tile	—	SGE	
124, 129	TOILET	Terrazzo	Terrazzo	Tile - 4'10"±	K.C. Plaster	GE	K.C. Plaster	GE	GE	See elevations on sh. D9
125	JANITOR'S CLOSET	Asphalt Tile	Rubber	—	K.C. Plaster	GE	K.C. Plaster	GE	GE	See shelf details on sh. D9
143	LABORATORY			—	Plaster	F	Acous. Tile	—	SGE	
144	VESTIBULE			—	Plaster	SGE	Plaster	SGE	SGE	North wall is exposed south exterior wall of Test Chamber bldg.
145	REFRIG'N. MACHINERY RM.	Cement	Cement	—	Cem. Plas. only on S.&E. walls	F	Exp. Constr.	F	SGE	Paint all interior conc., conc. block and plaster walls and ceilings

F = Flat paint G.E. = Gloss Enamel S.G.S. = Semi Gloss Enamel.

#101 - 4 push plates.
#102 - 2 push plates and 2 pulls.

•DOOR SCHEDULE•

All doors are 1¾" thick flush hollow core wood unless noted otherwise. Sizes shown are frame opening sizes. Actual door sizes are less to allow clearances for proper operation. See specs. for conditions where solid core wood doors are required.

•FIRST FLOOR PLAN•

•Scale = 1/8" = 1'-0"•

ROSENER ENGINEERING INCORPORATED
ENGINEERS AND ARCHITECTS
SAN FRANCISCO • CALIFORNIA

229-5902 A-1-2

LET	DATE	REVISIONS	CKR.	APP.
A	5/1/59	DOOR ADDED BETWEEN ROOMS 110 & 112. DOOR TO BE SIMILAR IN ALL RESPECTS TO DOOR NO 112.		

SCALE: AS NOTED
MATERIAL
HEAT TREAT
PROTECT FINISH
QUAN. | ASSEM. DRWG. NO.
LIMITS ON DIMENSIONS UNLESS OTHERWISE NOTED
FRACTIONAL ±
DECIMAL ±
ANGULAR ±

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.

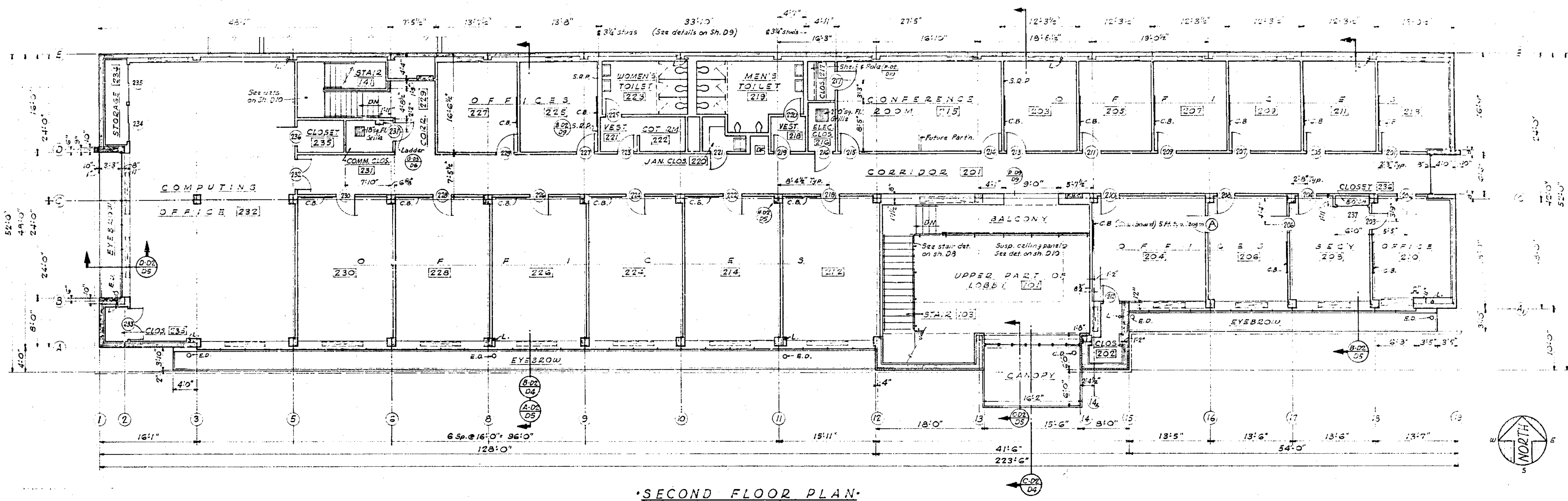
•3.5 FOOT HYPERSONIC TUNNEL• •OFFICE BUILDING•

FIRST FLOOR PLAN & SCHEDULE

DESIGN ENG. | BRANCH | DESIGN J.O.
DRAWN BY | DIVISION | CONST. J.O.
CHECKED BY
RESEARCH ENG.
APPROVED BY 12/3/58
APPROVED BY 12/2/58

A 11262-D2 REV. A

229-5902 A-2
3.5 FT. H.S. TUNNEL OFFICE BLDG. FIRST FLOOR PLAN SCHEDULE



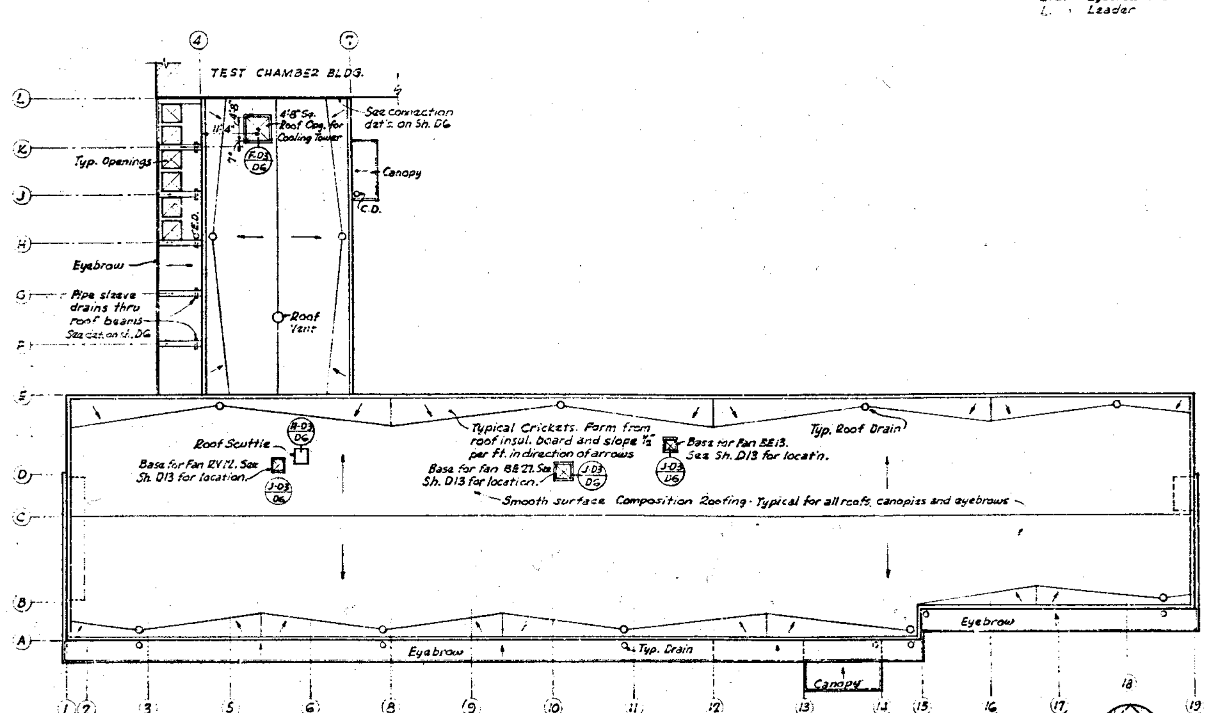
·SECOND FLOOR PLAN·

·Scale · 1/8" = 1'-0"·

C.D. = Canopy Drain
E.D. = Eyebrow Drain
L. = Leader

INTERIOR FINISH AND PAINT SCHEDULE										
NUMBER	ROOM	FLOOR	BASE	WAINSCOT	WALL MATERIAL	WALL PAINT	CEILING MATERIAL	CEILING PAINT	DOOR AND FRAME PAINT	REMARKS
201, 229	CORRIDOR	Asphalt Tile	Rubber	–	Plaster	SGE	Acous. Tile	–	SGE	
202, 216, 217, 231, 233, 234, 235, 236	CLOSET; STORAGE	↓	↓	–	↓	F	Plaster See Remarks	F	↓	Rms. 216 & 231 - ceilings exposed. Shelf & pole in Rms. 217 & 237; paint SGE
203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 224, 225, 226, 227, 228, 230, 232	OFFICE	↓	↓	–	↓	F	Acous. Tile	–	↓	
215	CONFERENCE ROOM	↓	↓	–	↓	F	↓	–	↓	
218, 221, 222	VESTIBULE; COT. ROOM	↓	↓	–	↓	SGE	↓	–	↓	
219, 223	TOILET	Terrazzo	Terrazzo	Tile - 4'10" ±	K.C. Plaster	GE	K.C. Plaster	GE	GE	See elevations on sh. D9
220	JANITOR'S CLOSET	Asphalt Tile	Rubber	–	K.C. Plaster	GE	K.C. Plaster	GE	GE	See shelf details on sh. D9

F = Flat paint G.E. = Gloss Enamel S.G.E. = Semi Gloss Enamel



NOTE! All roof drains are 3". All eyebrow and canopy drains are 2".

·ROOF PLAN·

·Scale · 1/16" = 1'-0"·

229-5902A---3

ROSENER ENGINEERING INCORPORATED
ENGINEERS AND ARCHITECTS
SAN FRANCISCO · CALIFORNIA

LET	DATE	REVISIONS	CKR.	APP.
A	5/1/53	DOOR ADDED BETWEEN RMS 204 & 206 - SIM. IN ALL RESPECTS TO DR. 206		

SCALE: AS NOTED
MATERIAL
HEAT TREAT
PROTECT FINISH
QUAN. ASSEM. DRWG. NO.
LIMITS ON DIMENSIONS UNLESS OTHERWISE NOTED
FRACTIONAL ±
DECIMAL ±
ANGULAR ±

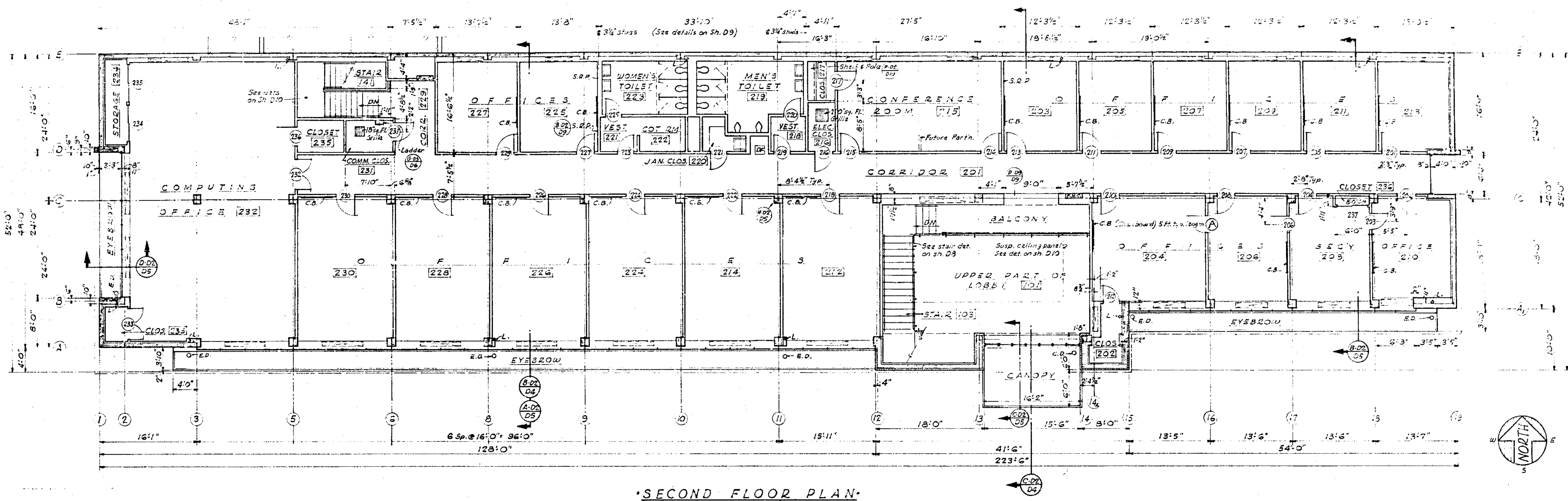
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.

·3.5 FOOT HYPERSONIC TUNNEL·
· OFFICE BUILDING ·
2ND FLOOR & ROOF PLANS & SCHEDULE

DESIGN ENG.
DRAWN BY
CHECKED BY
RESEARCH ENG.
APPROVED BY 12/2/53
APPROVED BY 12/2/53
BRANCH
DIVISION
DESIGN J.O.
CONST. J.O.

A 11262-D3 REV. A

229-5902A-3 3.5 FT H.S. TUNNEL OFFICE BLDG. 2ND FLOOR & ROOF PLANS



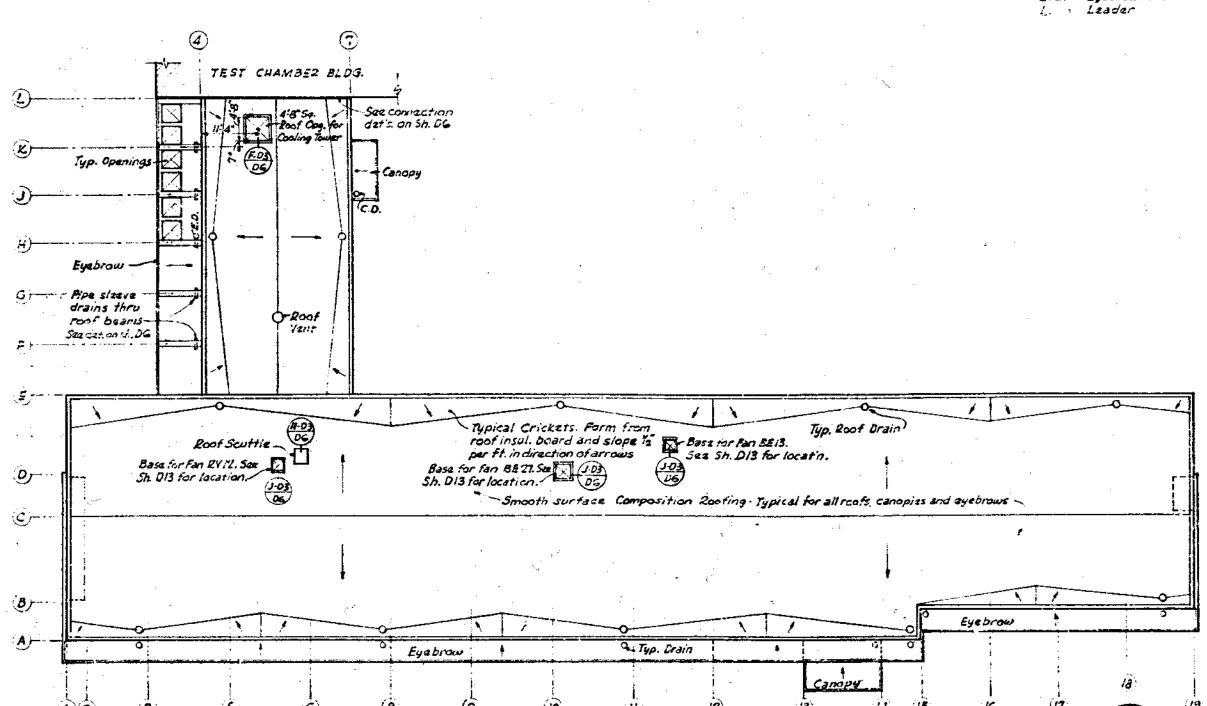
·SECOND FLOOR PLAN·

·Scale · 1/8" = 1'0"·

C.D. = Canopy Drain
E.D. = Eyebrow Drain
L. = Leader

INTERIOR FINISH AND PAINT SCHEDULE										
NUMBER	ROOM	FLOOR	BASE	WAINSCOT	WALL MATERIAL	WALL PAINT	CEILING MATERIAL	CEILING PAINT	DOOR AND FRAME PAINT	REMARKS
201, 229	CORRIDOR	Asphalt Tile	Rubber	–	Plaster	SGE	Acous. Tile	–	SGE	
202, 216, 217, 231, 233, 234, 235, 236	CLOSET; STORAGE	↓	↓	–	↓	F	Plaster See Remarks	F	↓	Rms. 216 & 231 - ceilings exposed. Shelf & pole in Rms. 217 & 237; paint SGE
203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 224, 225, 226, 227, 228, 230, 232	OFFICE	↓	↓	–	↓	F	Acous. Tile	–	↓	
215	CONFERENCE ROOM	↓	↓	–	↓	F	↓	–	↓	
218, 221, 222	VESTIBULE; COT. ROOM	↓	↓	–	↓	SGE	↓	–	↓	
219, 223	TOILET	Terrazzo	Terrazzo	Tile - 4'10"±	K.C. Plaster	GE	K.C. Plaster	GE	GE	See elevations on sh. D9
220	JANITOR'S CLOSET	Asphalt Tile	Rubber	–	K.C. Plaster	GE	K.C. Plaster	GE	GE	See shelf details on sh. D9

F. = Flat paint G.E. = Gloss Enamel S.G.E. = Semi Gloss Enamel



NOTE! All roof drains are 3". All eyebrow and canopy drains are 2".

·ROOF PLAN·

·Scale · 1/16" = 1'0"·

229-5902A---3

ROSENER ENGINEERING INCORPORATED
ENGINEERS AND ARCHITECTS
SAN FRANCISCO · CALIFORNIA

LET	DATE	REVISIONS	CKR.	APP.
A	5/1/59	DOOR ADDED BETWEEN RMS 204 & 206 - SIM. IN ALL RESPECTS TO DR. 206		

SCALE: AS NOTED
MATERIAL
HEAT TREAT
PROTECT FINISH
QUAN. | ASSEM. DRWG. NO.
LIMITS ON DIMENSIONS UNLESS OTHERWISE NOTED
FRACTIONAL ±
DECIMAL ±
ANGULAR ±

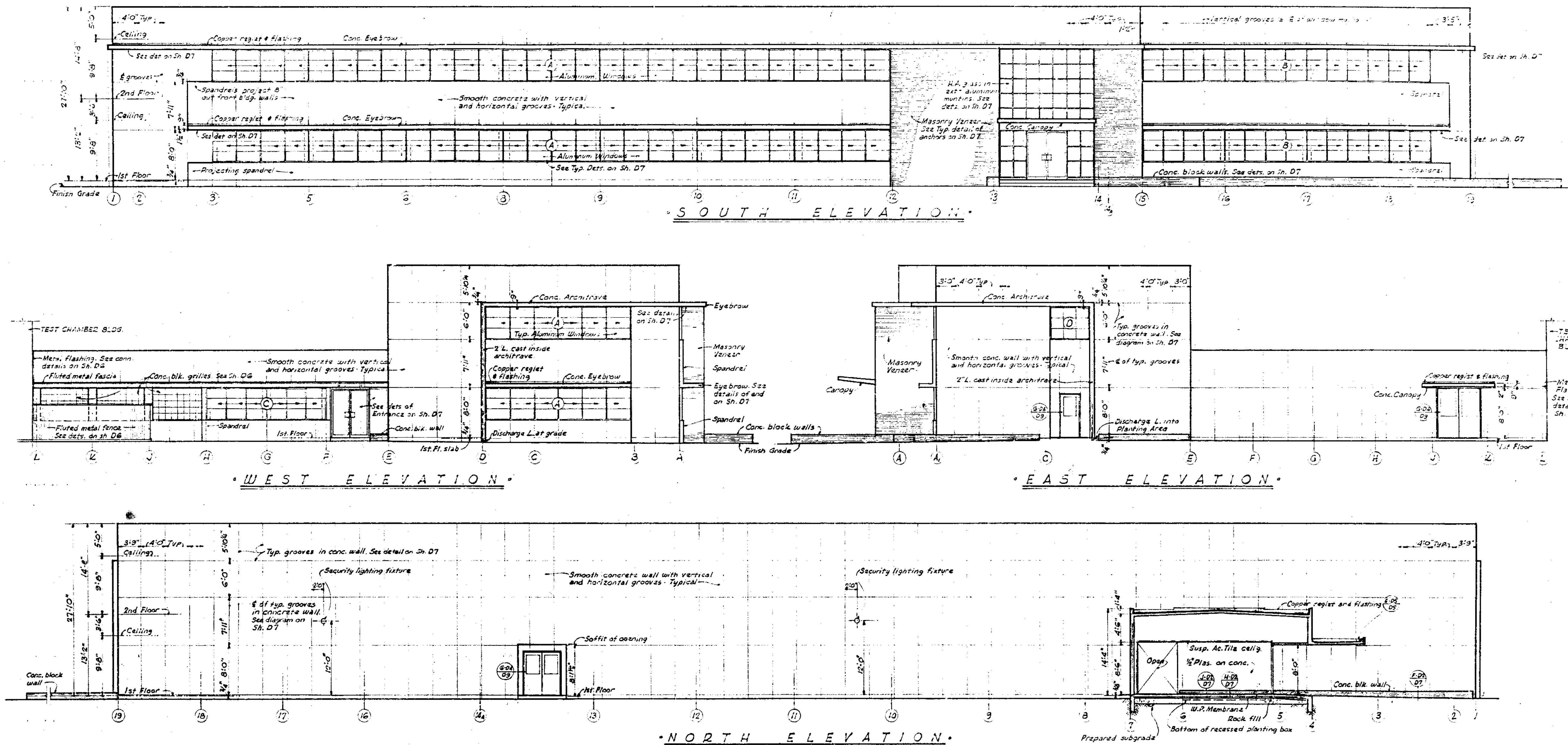
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.

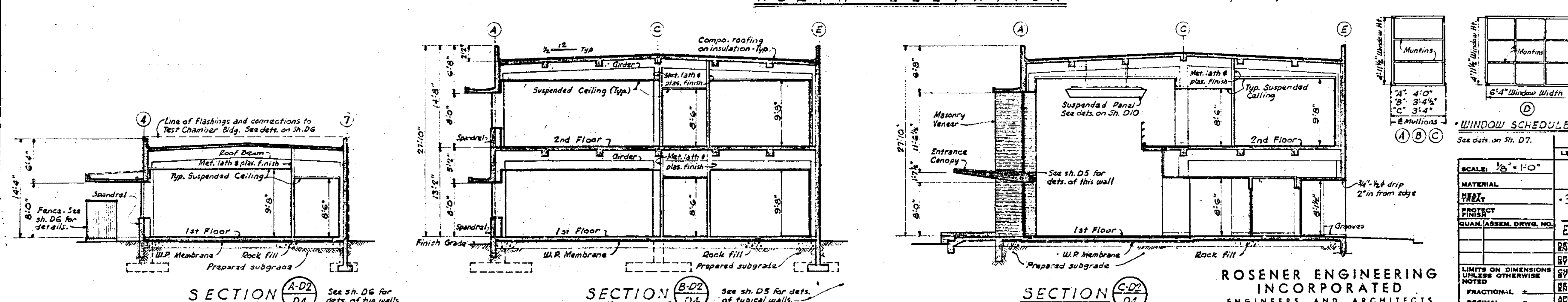
·3.5 FOOT HYPERSONIC TUNNEL·
· OFFICE BUILDING ·
2ND FLOOR & ROOF PLANS & SCHEDULE

DESIGN ENG.
DRAWN BY
CHECKED BY
RESEARCH ENG.
APPROVED BY 12/2/53
APPROVED BY 12/2/53
BRANCH
DIVISION
DESIGN J.O.
CONST. J.O.

A 11262-D3 REV. A

229-5902A-3 3.5 FT H.S. TUNNEL OFFICE BLDG. 2ND FLOOR & ROOF PLANS





229-5902 A-4

ROSENER ENGINEERING INCORPORATED
ENGINEERS AND ARCHITECTS
SAN FRANCISCO · CALIFORNIA

LET	DATE	REVISIONS	CKR.	APP.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.

3.5 FOOT HYPERSONIC TUNNEL OFFICE BUILDING

EXTERIOR ELEVATIONS & CROSS SECTIONS

SCALE: 1/8" = 1'-0"
MATERIAL
HEAT TREAT
PROTECT FINISH
QUAN. | ASSEM. DRWG. NO.
LIMITS ON DIMENSIONS UNLESS OTHERWISE NOTED
FRACTIONAL ±
DECIMAL ±
ANGULAR ±

DESIGN ENG. RKU
DRAWN BY R.C.H & RKU
CHECKED BY RKU
RESEARCH ENG.
APPROVED BY 12/2/53
APPROVED BY 12/2/53
BRANCH
DIVISION
DESIGN J.O.
CONST. J.O.

A 11262-D4
REV.

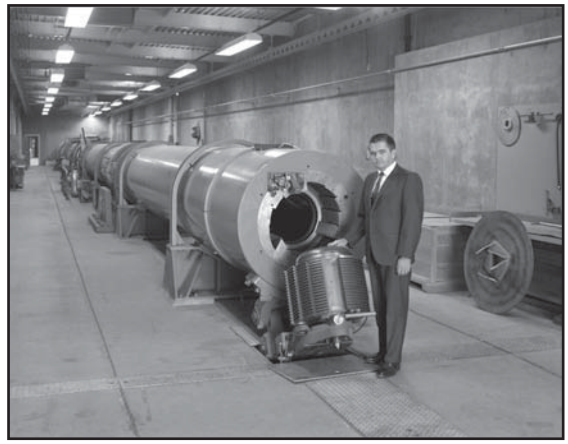
EAST FILE CORP. COSTA MESA, CA — HANGER EFH34

229-5902 A-4
3.5 FT H.S. TUNNEL OFFICE BLDG. EXTERIOR ELEVATIONS

Additional Images:

N-237: Hypervelocity Free Flight Facility

N-237, interior of Hypervelocity Free Flight Facility, test chamber (Source: Page & Turnbull)



N-237, Thomas N. Canning, Hypersonic Free Flight Branch Chief inspects breech of the counter flow section of the gun, 22 June 1966 (Source: NASA Ames Research Center, A-37250)

N-237, interior of Hypervelocity Free Flight Facility, test chamber (left) and cameras (right) (Source: Page & Turnbull)

N-237, Aerial photograph, 18 May 1989 (Source: NASA Ames Research Center, AC89-0234-153.1)

8. HYPERSONIC FREE-FLIGHT AERODYNAMIC FACILITY

DESCRIPTION:

The Hypersonic Free-Flight Aerodynamic Facility is used for research on gas dynamic problems of atmospheric entry. High relative speeds are achieved by launching models (in sabots if necessary) from high-speed guns into a countercurrent hypersonic air stream (14,000 ft/sec) driven by combustion-powered shock tube. Parameters derived from observations of model flights include lift, drag, static and dynamic stability, flow characteristics (including absolute spectral emissive power of shock layers and wakes), and model ablation. Models up to 37 mm in diameter and weighing 45 grams maximum can be accommodated. Shadowgraphs can be obtained at sixteen stations spaced every five feet along the test section.

PERFORMANCE:

Stream Mach Number	7.0
Stream Enthalpy	4,000 BTU/lb., maximum
Reynolds number	80×10^6 per ft., maximum
Stream static pressure	0.005 to 0.2 atmospheres
Model speed	30,000 ft/sec maximum
Model launching acceleration	1.5×10^6 g, maximum

DIMENSIONS:

Length	75.0 feet
Diameter	3.5 feet

STATUS:

Operational since 1965

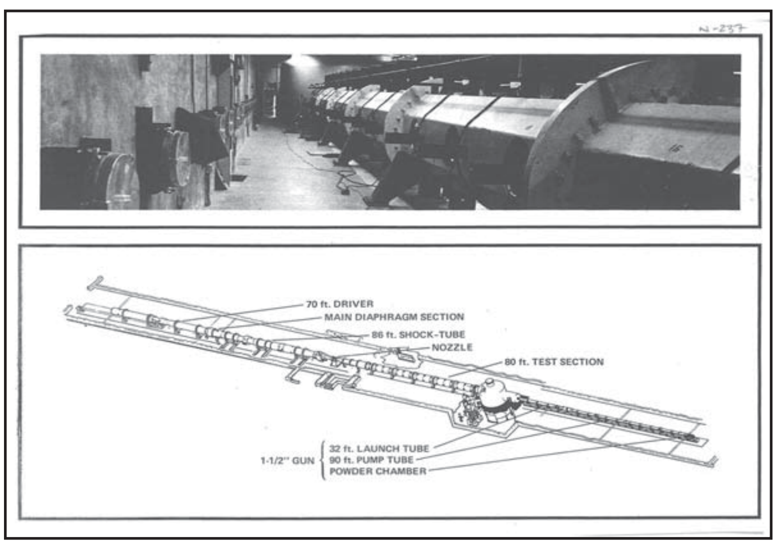
JURISDICTION:

Flight Project Development Division
Systems Development Branch
Thomas N. Canning

LOCATION:

Building N-237

N-237, Diagram of Hypersonic Free-Flight Aerodynamic Facility, 1974
(Source: *NASA Ames Facilities Summary*, 1974)



N-237, Diagram of Hypersonic Free-Flight Aerodynamic Facility, 1974
(Source: *NASA Ames Facilities Summary*, 1974)

Architectural Drawings for N-237

Hypervelocity Free Flight Facility Building, Perspective
Architect: B. L. Nishikian, Consulting Engineer
Date: 14 December 1962
Sheet: A12082 AR1
NASA EDC # 237-6204-A3

Hypervelocity Free Flight Facility Building, Plot Plan
Architect: B. L. Nishikian, Consulting Engineer
Date: 14 December 1962
Sheet: A12082 AR2
NASA EDC # 237-6204-A4

Hypervelocity Free Flight Facility Building, First Floor Plan - West
Architect: B. L. Nishikian, Consulting Engineer
Date: 14 December 1962
Sheet: A12082 AR3
NASA EDC # 237-6204-A5

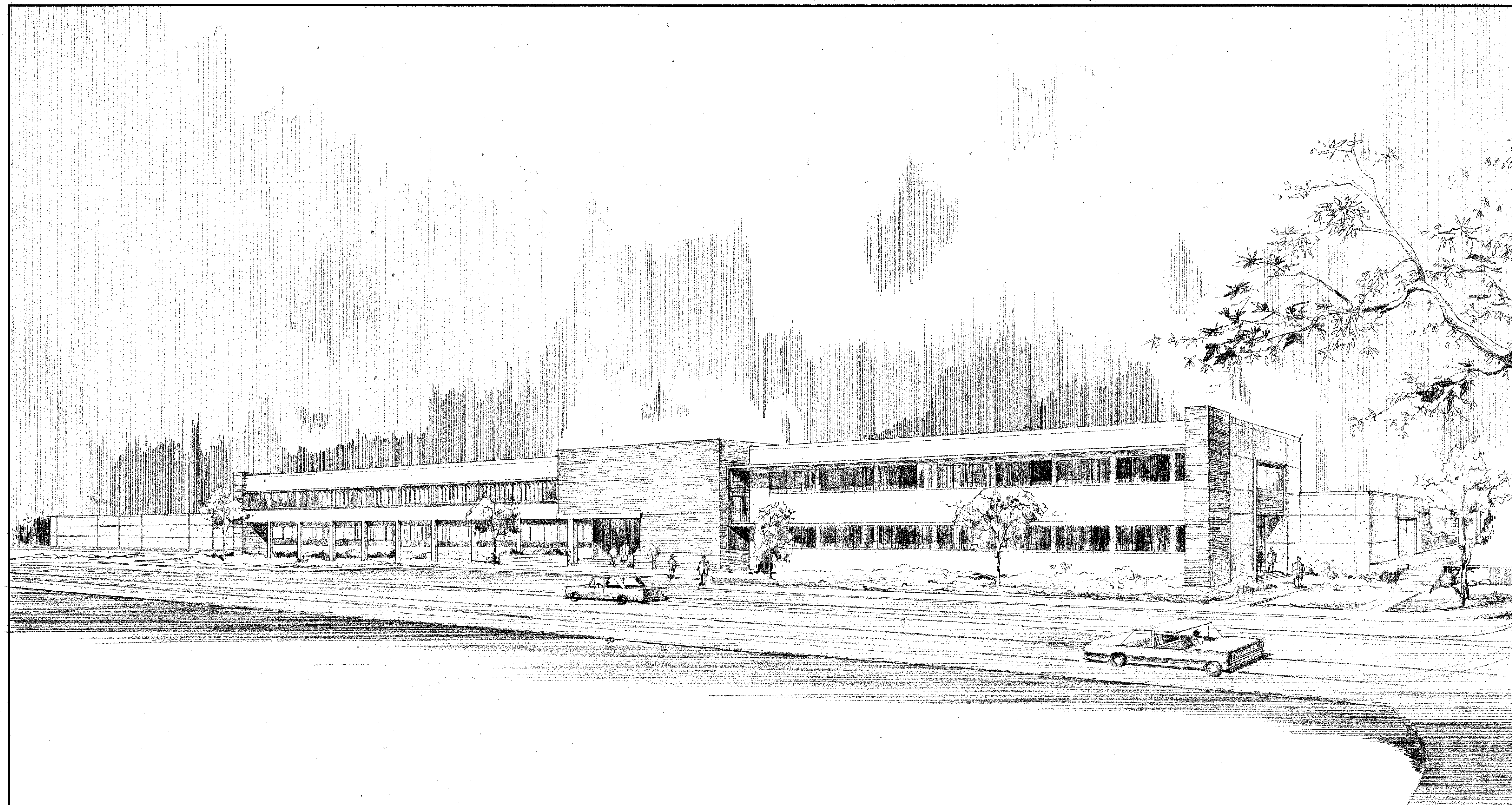
Hypervelocity Free Flight Facility Building, First Floor Plan - East
Architect: B. L. Nishikian, Consulting Engineer
Date: 14 December 1962
Sheet: A12082 AR4
NASA EDC # 237-6204-A6

Hypervelocity Free Flight Facility Building, Second Floor Plan – East and West
Architect: B. L. Nishikian, Consulting Engineer
Date: 14 December 1962
Sheet: A12082 5 AR5
NASA EDC # 237-6204-A7

Hypervelocity Free Flight Facility Building, Basement Plan
Architect: B. L. Nishikian, Consulting Engineer
Date: 14 December 1962
Sheet: A12082 AR6
NASA EDC # 237-6204-A8

Hypervelocity Free Flight Facility Building, Elevations
Architect: B. L. Nishikian, Consulting Engineer
Date: 13 December 1962
Sheet: A12082 AR8
NASA EDC # 229-6204-A10

Hypervelocity Free Flight Facility Building, Sections
Architect: B. L. Nishikian, Consulting Engineer
Date: 14 December 1962
Sheet: A12082 AR9
NASA EDC # 237-6204-A11



HYPERVELOCITY FREE FLIGHT FACILITY

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

HYPERVELOCITY FREE FLIGHT FACILITY
BUILDING

PERSPECTIVE

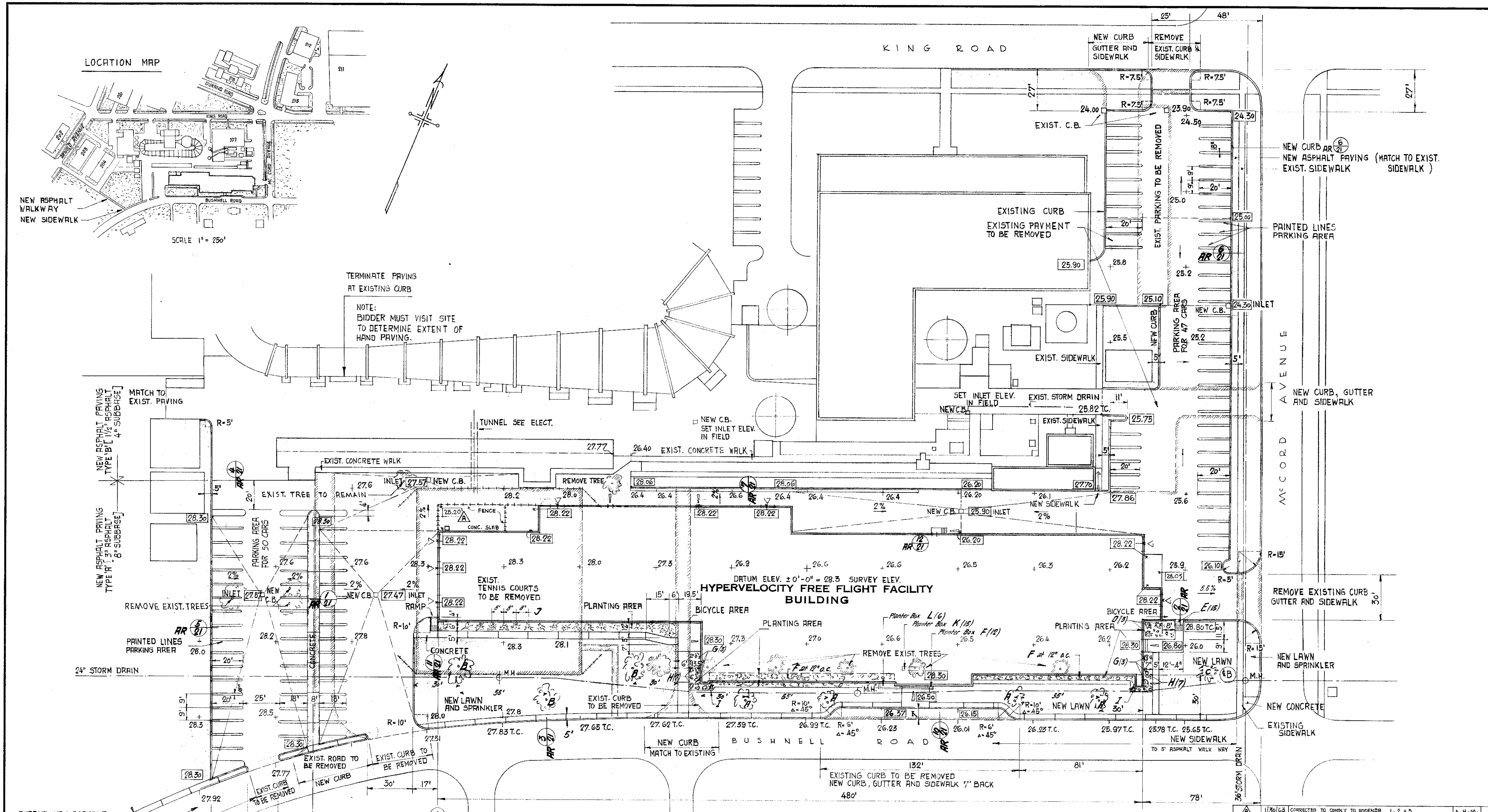
B. L. NISHKIAN
CONSULTING ENGINEER
812 HOWARD STREET
SAN FRANCISCO 3 CALIFORNIA
2873 12-14-62

DRAWN	CHECKED	INDEX	MATERIAL	LIMITS UNLESS NOTED		
D.W.						
DESIGN ENGINEER	BRANCH			FRAC.	DEC.	ANG.
	S.S.F.F		1 OF 96			
APPROVED	ASSM. DWG. NO.					REV.
APPROVED	SCALE		A 12082 AR1			

A

H.F.F.F. BLDG. PERSPECTIVE

PRINTED ON DIETZGEN 197M DURAVEL



PLANTING LEGEND

- A: OLEA EUROPA (OLIVE) 8÷10 FT.
- B: LAURIS NOBILIS (BAY TREE) 8÷10 FT.
- C: PRUNUS THUNDERCLOUD (RED FLOWERING PLUM) 8÷10 FT.
- D: JUNIPERUS TORULOSA (HOLLYWOOD JUNIPER) 5 GAL.
- E: RAPHIOLEPIS, CORTES CRIMSON - 5 GAL.
- F: JAPANESE BOXWOOD - 1 GAL.
- G: GRISELINIA - 5 GAL.
- H: TRACH. JAS. (STAR JASMINE) - 1 GAL.
- I: CALISTEMON. LANCEOLATUS (BOTTLE BRUSH) - 5 GAL.
- J: ABELIA GAUCHERI - 5 GAL.
- K: HAHNS IVY - 1 GAL.
- L: JUNIPERUS PROSTRATA - 5 GAL.

NOTES:

- BIDDER MUST VISIT SITE TO DETERMINE EXTENT OF HAND PAVING.
- CURB AND GUTTER TO MATCH EXISTING
- SCORE ALL WALKS TO MATCH EXISTING. PLACE EXPANSION JOINTS AT 20' ± O.C.

PLOT PLAN

1" = 30'

LEGEND

- NEW ASPHALT PAVING TYPE 'A'
- NEW ASPHALT PAVING TYPE 'B'
- T.C. Top of Curb
- 26.72 EXISTING GRADES
- 26.72 NEW FINISH GRADES
- TO BE REMOVED
- NEW CURB

B. L. NISHKIAN
CONSULTING ENGINEER
812 HOWARD STREET
SAN FRANCISCO 3 CALIFORNIA
2873 12-14-62

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APR
A	1/30/63	CORRECTED TO COMPLY TO ADDENDA 1, 2 + 3	A.H.M.	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

HYPERVELOCITY FREE FLIGHT FACILITY BUILDING

PLOT PLAN

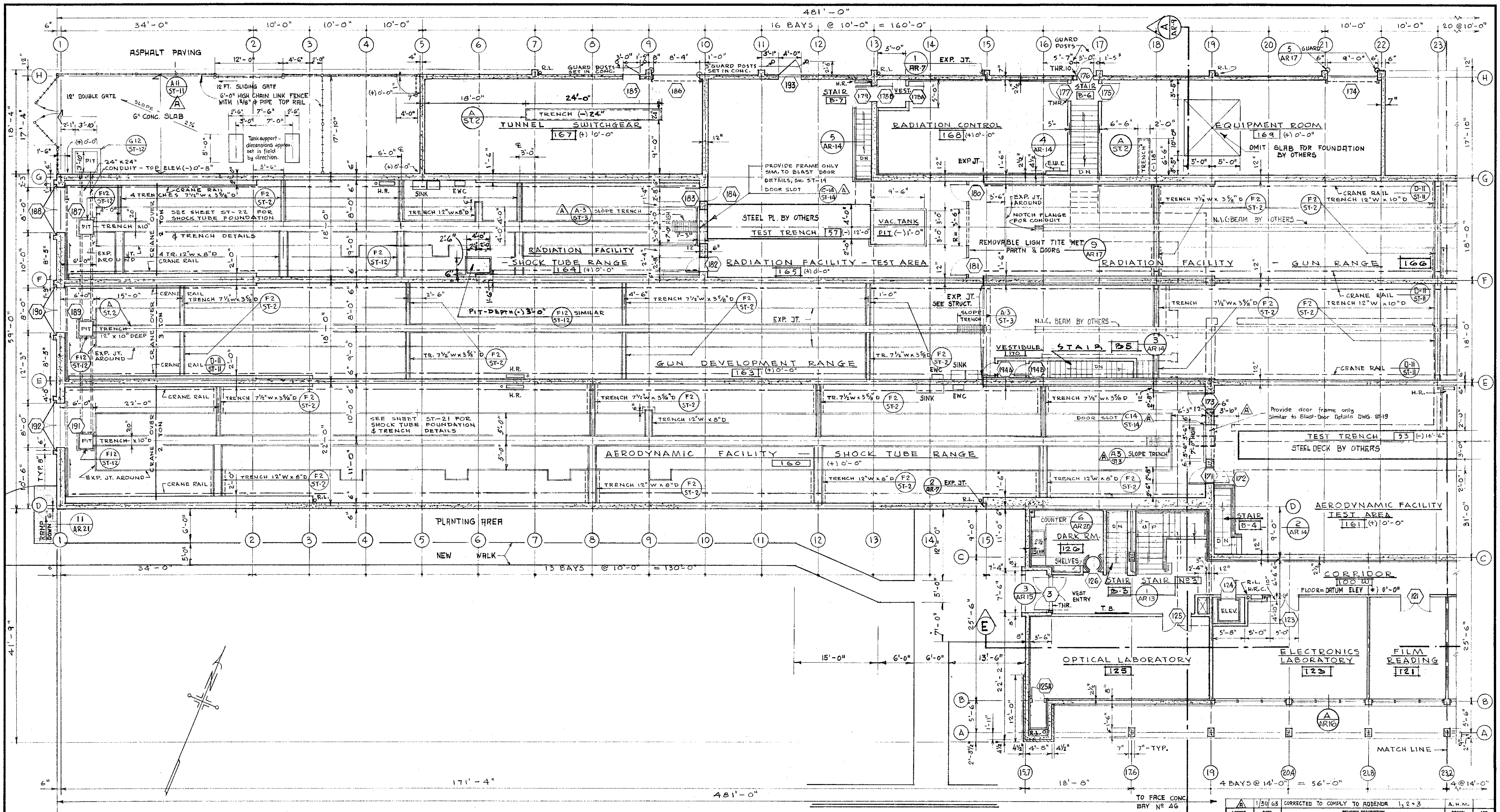
DRAWN: A.H.M. & T.E. · CHECKED · INDEX · BRANCH: S.S.F.F. · 2 OF 96 · SCALE: AS NOTED

A-12082 AR 2 A

A

237-6204A-4

237-6204 A-4 H.F.F. BLDG. PLOT PLAN



FIRST FLOOR PLAN - WEST

1/8" = 1'-0"

ABBREVIATIONS:

- E.W.C. — ELECTRIC WATER COOLER
- N.I.C. — NOT IN CONTRACT
- R.L. — RAIN LEADER
- H.R. — FIRE HOSE REEL
- H.R.C. — HOSE REEL CABINET
- THR. — THRESHOLD
- EXP. JT. — EXPANSION JOINT
- TYP. — TYPICAL
- T.B. — TACK BOARD 6'-0" x 3'-6" UP 3'-6" FROM FLR.

LEGEND

- — CONCRETE
- — SPLIT BLOCK VENEER
- — MET. STUD & PLASTER
- — DOOR Nº
- — DETAIL Nº / — SHEET Nº

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.
A	1/30/63	CORRECTED TO COMPLY TO ADDENDA 1, 2 + 3	A.H.M.	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

HYPERVELOCITY FREE FLIGHT FACILITY BUILDING

FIRST FLOOR PLAN - WEST

B. L. NISHKIAN
CONSULTING ENGINEER
812 HOWARD STREET
SAN FRANCISCO 3 CALIFORNIA
2873 12-14-62

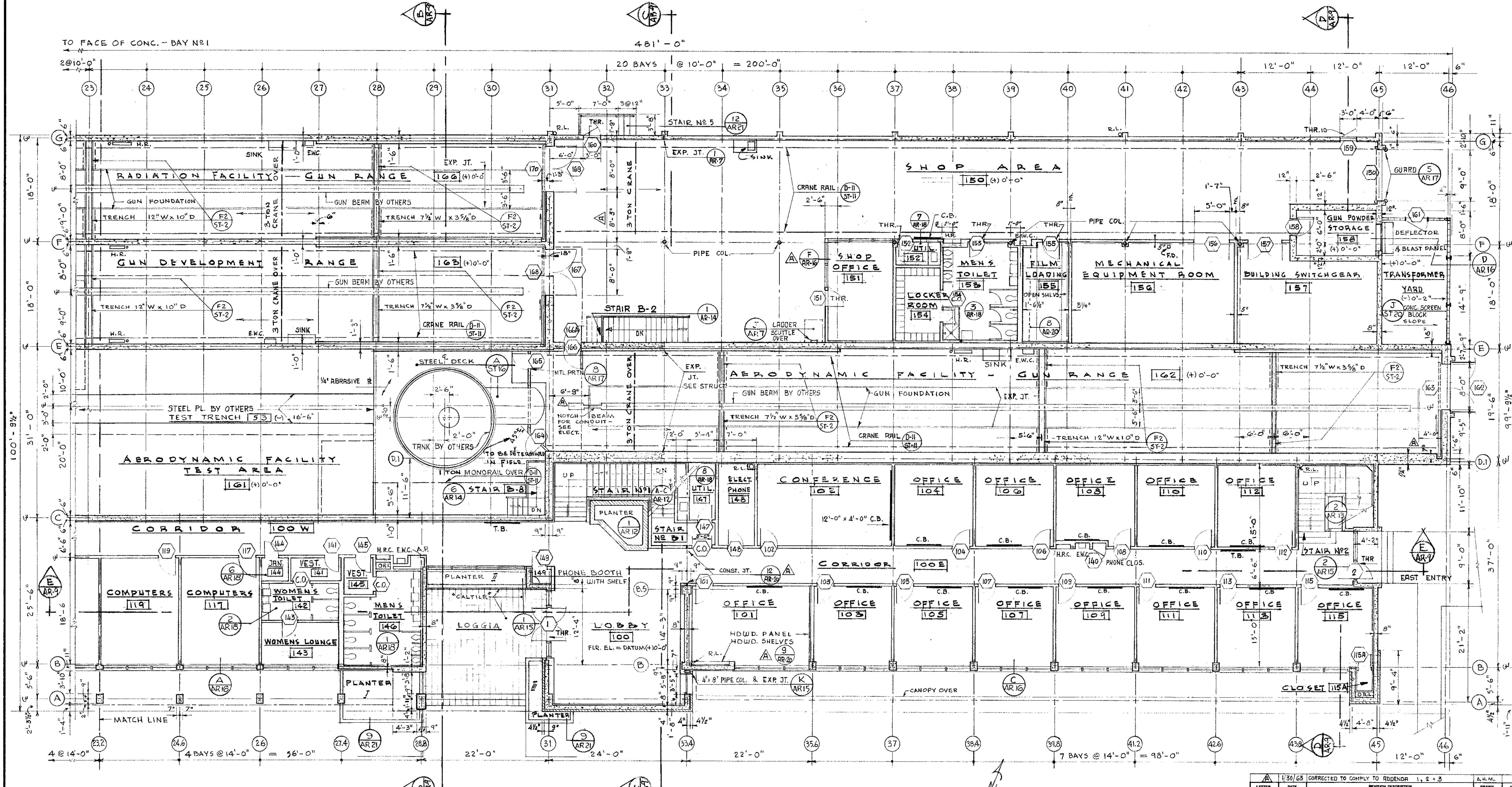
DRAWN: A.H.M. & T.E. — CHECKED — INDEX — MATERIAL
BRANCH: S.S.F.F. — 3 OF 96

A-12082 AR 3 A

237-6204 A-5

H.F.F. BLDG. FIRST FLOOR PLAN WEST

A



PLANTING LEGEND

Planter I : 6 Juniperus Prostrata - 5 Gal.
Planter II : 15 Hahns Ivy - 1 Gal.
Planter III : 12 Japanese Boxwood - 1 Gal.

ABBREVIATIONS

T.B. - TACK BOARD 6'-0" x 3'-6"
R.L. - RAIN LEADER
E.W.C. - ELECTRIC WATER COOLER
H.R.C - HOSE REEL CABINET
THR. - THRESHOLD
EXP. JT. - EXPANSION JOINT
TYP. - TYPICAL
A.P. - ACCESS PANEL ("MILCOR" TYPE K)
C.B. - CHALK BOARD 6'-0" x 3'-6" TYPICAL FOR OFFICES

LEGEND

- CONCRETE
- SPLIT BLOCK VENEER
- METAL STUDS & PLASTER
- DOOR Nº
- DETAIL Nº / SHEET Nº

FIRST FLOOR PLAN - EAST

1/8" = 1'-0"

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.
A	1/30/63	CORRECTED TO COMPLY TO ADDENDA 1, 2 + 3	A.H.M.	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

HYPERVELOCITY FREE FLIGHT FACILITY BUILDING

FIRST FLOOR PLAN — EAST

B. L. NISHKIAN
CONSULTING ENGINEER
812 HOWARD STREET
SAN FRANCISCO 3 CALIFORNIA
2873 12-14-62

DRAWN: A.H.M. & T.E. — CHECKED: [signature] — INDEX: [initials]
DESIGN ENGINEER: [signature] — BRANCH: S.S.F.F.
APPROVED: [signature] — ASSM. DWG. NO.
APPROVED: [signature] — SCALE
MATERIAL — LIMITS UNLESS NOTED: FRAC. DEC. ANG.

4 OF 96

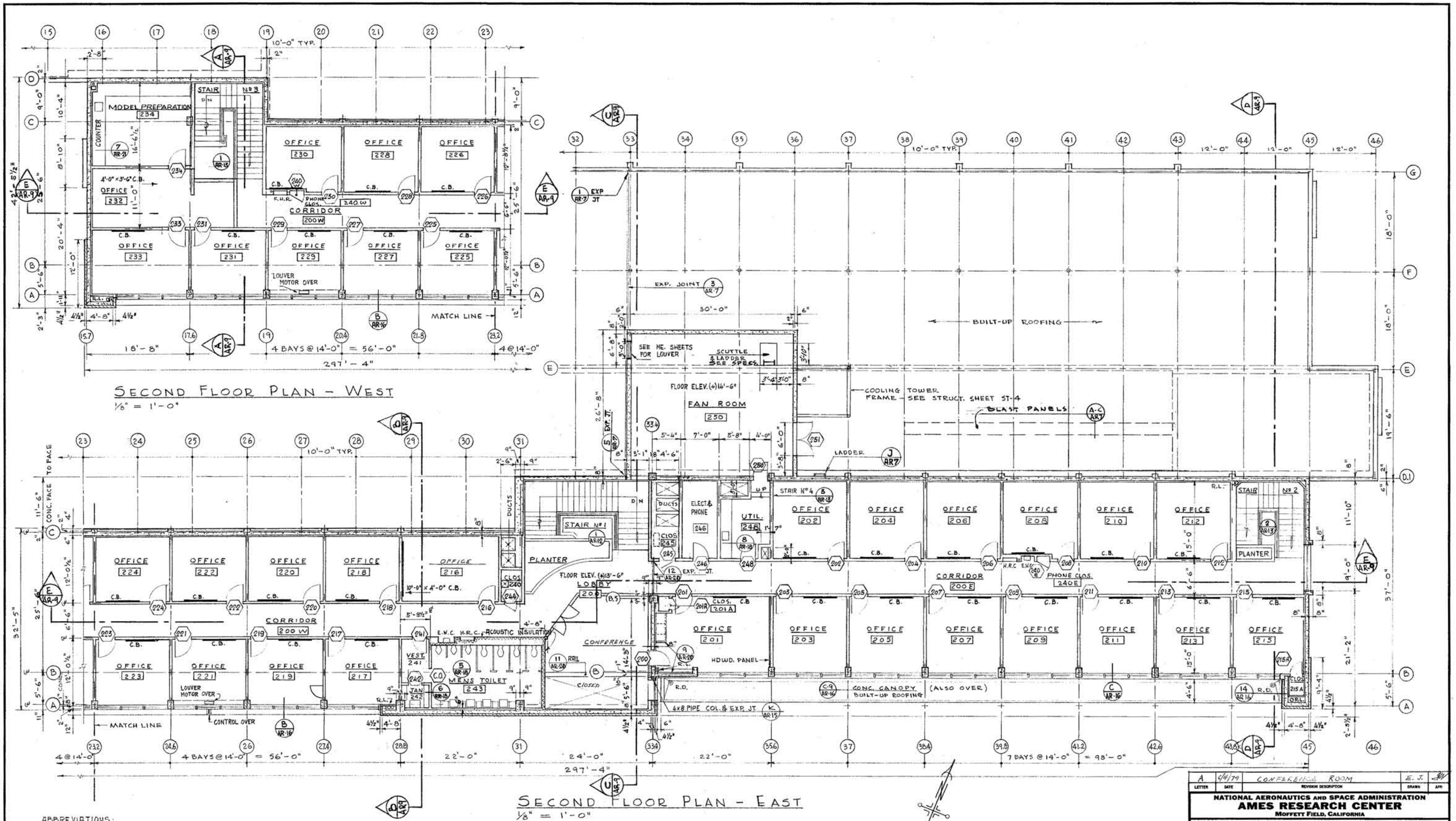
A-12082 AR4 — REV. A

A

237-6204A-6

237-6204 A-6
H.F.F. BLDG. FIRST FLOOR PLAN EAST

PRINTED ON DIETZGEN 197M DURAVEL



ABBREVIATIONS:

R.L. — RAIN LEADER
H.R. — FIRE HOSE REEL
H.R.C. — HOSE REEL CABINET
N.I.C. — NOT IN CONTRACT
EXP. JT. — EXPANSION JOINT
TYP. — TYPICAL
THR. — THRESHOLD
E.W.C. — ELECTRIC WATER COOLER
C.B. — CHALK BOARD 6'-0" x 3'-6" [TYPICAL FOR OFFICES]

LEGEND

- CONCRETE
- SPLIT BLOCK VENEER
- MET. STUD & PLASTER
- DOOR No
- DETAIL No / SHEET No

A	6/4/79	CONFERENCE ROOM	E. J.	
LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

HYPERVELOCITY FREE FLIGHT FACILITY BUILDING

SECOND FLOOR PLAN - EAST & WEST

B. L. NISHKIAN
CONSULTING ENGINEER
812 HOWARD STREET
SAN FRANCISCO 3 CALIFORNIA
2873 12-14-62

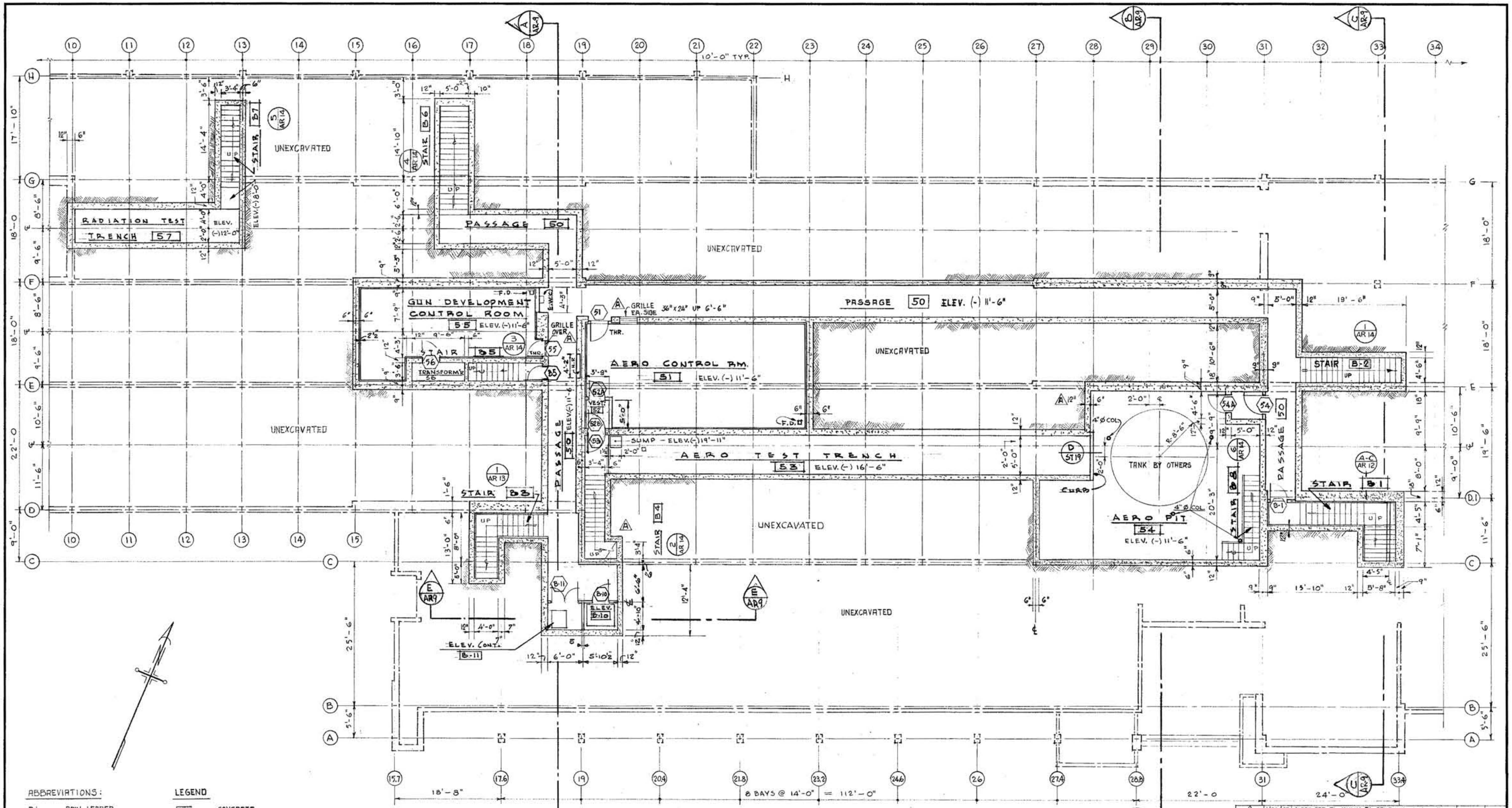
DRAWN: A.H.M. & T.E. — BRANCH: S.S.F.F. — 5 OF 96

A-12082 AR5

A

237-6204 A-7

237-6204 A-7
H.F.F. BLDG. SECOND FLOOR PLAN EAST & WEST



ABBREVIATIONS:

- R.L. — RAIN LEADER
- H.R. — FIRE HOSE REEL
- H.R.C. — HOSE REEL CABINET
- CONST. JT. — CONSTRUCTION JOINT
- EXP. JT. — EXPANSION JOINT
- TYP. — TYPICAL
- THR. — THRESHOLD
- E.W.C. — ELECTRIC WATER COOLER
- N.I.C. — NOT IN CONTRACT

LEGEND

- CONCRETE
- MET. STUD & PLASTER
- EARTH
- DOOR Nº
- DETAIL Nº / SHEET Nº

NOTE:

FOR ALL STAIR DETAILS, SEE SHEETS AR 11, AR 12 & AR 13
FOR DOOR DETAILS, SEE SHEET AR 17

BASEMENT PLAN
1/8" = 1'-0"

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.
A	1/30/63	CORRECTED TO COMPLY TO ADDENDA 1, 2 + 3	A.H.M.	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

HYPERVELOCITY FREE FLIGHT FACILITY BUILDING

BASEMENT PLAN

B. L. NISHKIAN
CONSULTING ENGINEER
812 HOWARD STREET
SAN FRANCISCO 3 CALIFORNIA
2873 12-14-62

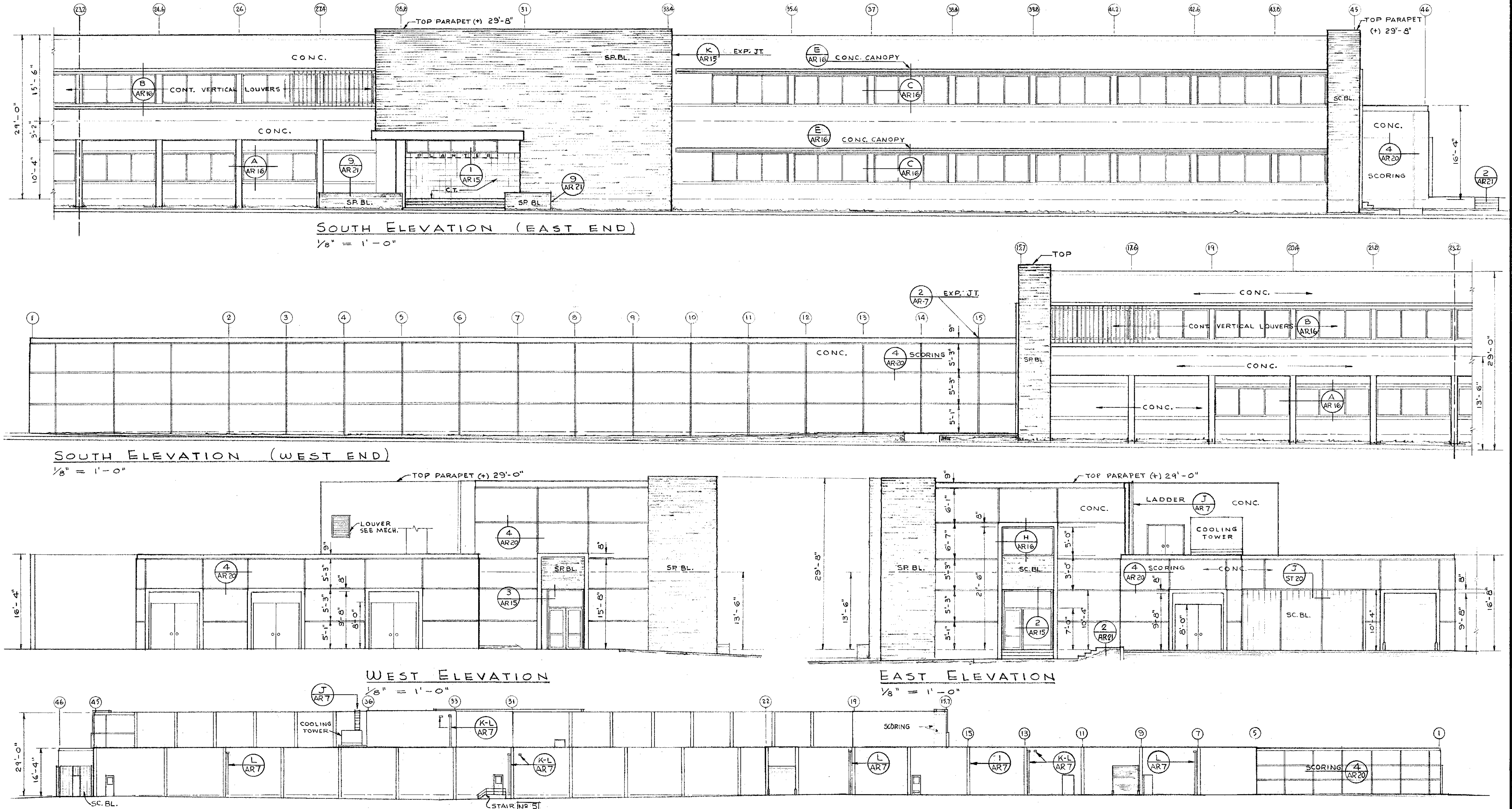
DRAWN: P.T. & T.E. — CHECKED: [illegible] — INDEX: [illegible]
DESIGN ENGINEER: [illegible] — BRANCH: S.S.F.F.
APPROVED: [illegible]
6 OF 96

A-12082 AR6 A

A

237-6204A---8

237-6204 A-8
H.F.F. BLDG. BASMT. PLAN



NORTH ELEVATION
1/16" = 1'-0"

ABREVIATIONS

- SP. BL. — "CALTILE" SPLIT BLOCK VENEER 4"x2¼"x16".
- SC. BL. — SCREEN BLOCK-"EMPRESS" PATTERN 12"x12"x4".
- C. T. — "CALTILE" CONC. TILE 12"x12"x1".
- EXP. JT. — EXPANSION JOINT.

237-6204 A-10
H. F. F. BLDG. ELEVATIONS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

HYPERVELOCITY FREE FLIGHT FACILITY BUILDING

ELEVATIONS

B. L. NISHKIAN
CONSULTING ENGINEER
812 HOWARD STREET
SAN FRANCISCO 3 CALIFORNIA
2873 12-14-62

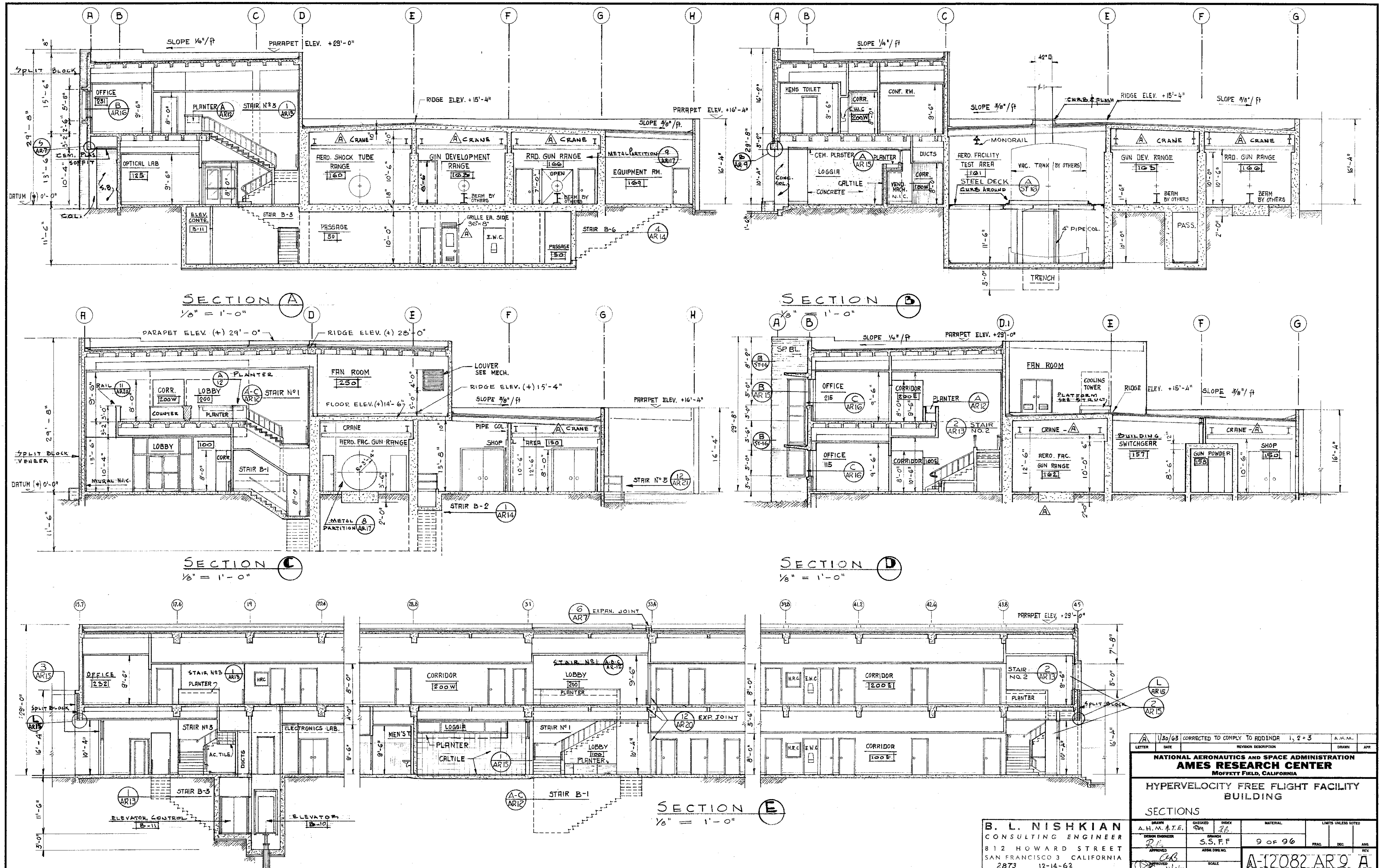
DRAWN	CHECKED	INDEX	MATERIAL
A. H. M.			
DESIGN ENGINEER	BRANCH		
	S.S.F.F.	8 OF 96	

A-12082 AR 8

237-6204 A-10

A

PRINTED ON DIETZGEN 197M DURAVEL



A

237-6204 A-11

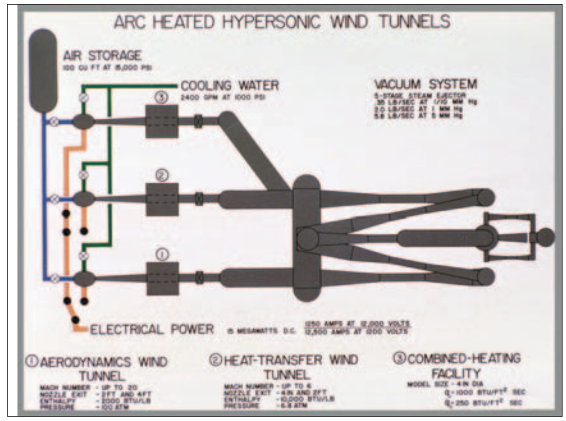
237-6204 A-11
H.F.F. BLDG. SECTIONS

PRINTED ON DIETZGEN 197M DURAVEL

Additional Images:

N-238: Arc Jet Laboratory

N-238, Aerial photograph, 1964
(Source: NASA Ames Research Center, A-33038-22)



N-238, Cutaway Illustration of Arc-Heated Hypersonic Wind Tunnel, 8 June 1964
(Source: NASA Ames Research Center, A-32663-3)

N-238, 60-MGW Interaction Heating Facility, 10 May 1974
(Source: NASA Ames Research Center, AC74-1979)

N-238, Reinforced Carbon-Carbon (RCC) Johnson Space Center model testing in Ames Interaction Heating Facility IHF-127
(Source: NASA Ames Research Center, ACD02-0036-017)

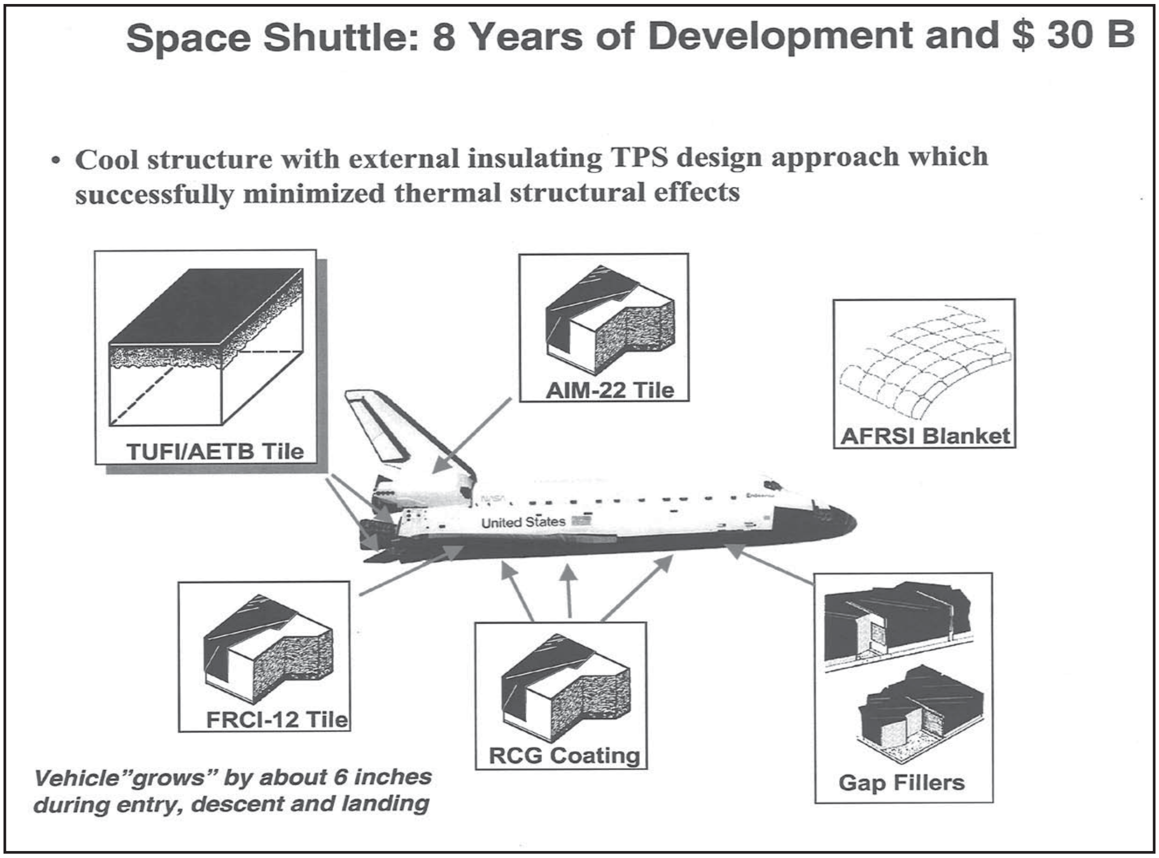
N-238, north facade, main entrance
(Source: Page & Turnbull)

N-238, interior, control room
(Source: Page & Turnbull)

N-238, interior, high-bay and machine shop
(Source: Page & Turnbull)

N-238, 60MGW Interaction Heating Facility
(Source: Page & Turnbull)

N-238, interior, ceiling
(Source: Page & Turnbull)



N-238, Diagram of 3.5-Foot Hypersonic Wind Tunnel
(Source: *NASA Ames Facilities Summary*, 1974)

Architectural Drawings for N-238

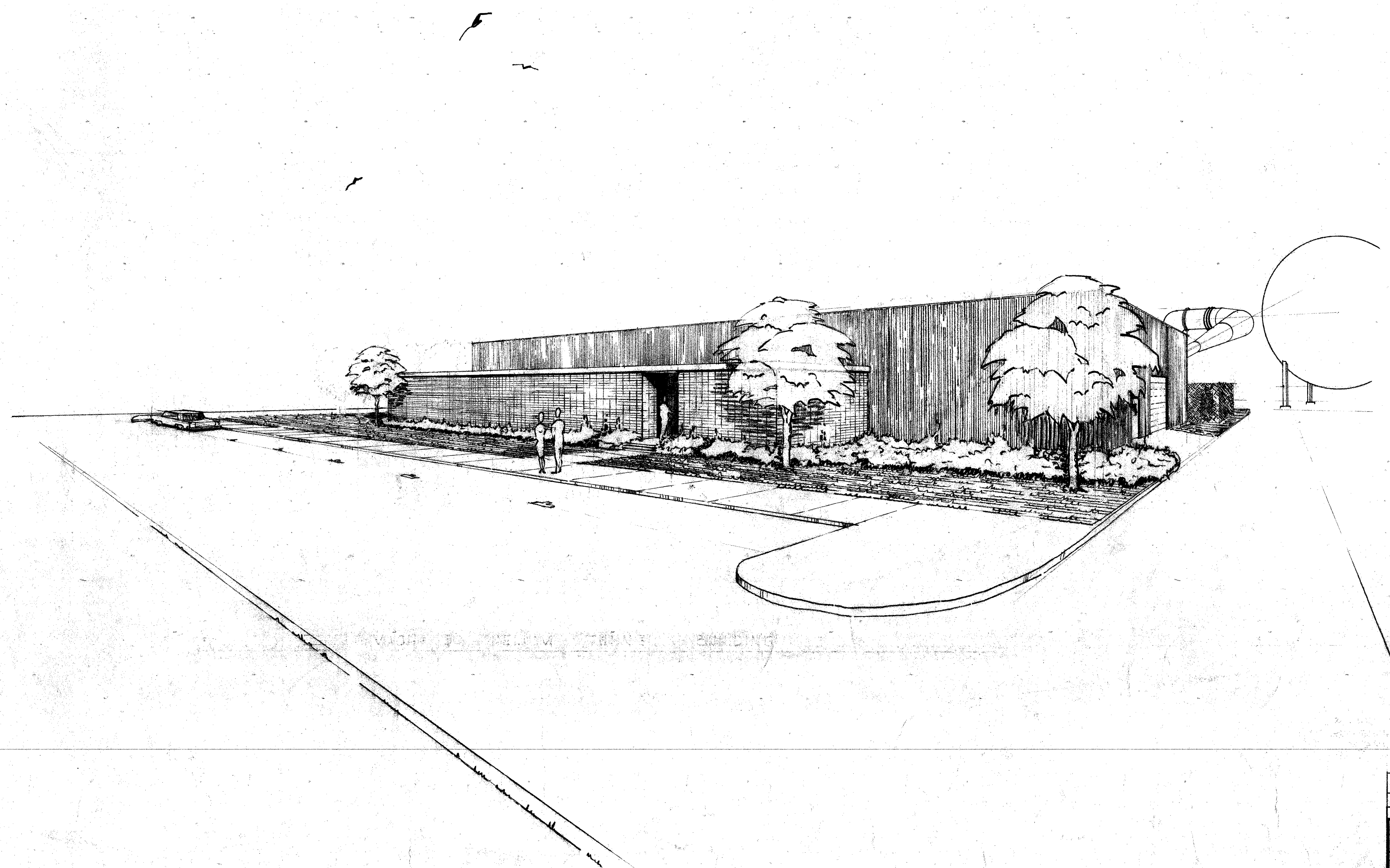
Building N-238 Arc Jet Facility, Architectural Perspectives
Architect: Robert E. Jones, Structural Engineer
Date: 14 January 1963
Sheet: A 238-6200A-1
NASA EDC # 238-6200-A1

Building N-238 Arc Jet Facility, Design Data
Architect: Robert E. Jones, Structural Engineer
Date: 14 January 1963
Sheet: A 238-6200A-3
NASA EDC # 238-6200-A3

Building N-238 Arc Jet Facility, Site Grading, Paving, and Landscaping Plan
Architect: Robert E. Jones, Structural Engineer
Date: 14 January 1963
Sheet: A 238-6200A-4
NASA EDC # 238-6200-A4

Building N-238 Arc Jet Facility, First Floor Plan
Architect: Robert E. Jones, Structural Engineer
Date: 14 January 1963
Sheet: A 238-6200A-5
NASA EDC # 238-6200-A5

Building N-238 Arc Jet Facility, Exterior Elevations
Architect: Robert E. Jones, Structural Engineer
Date: 14 January 1963
Sheet: A 238-6200A-7
NASA EDC # 238-6200-A7



LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.
B	3-83	WAS 238-6201-A---1, IS 238-6200-A---1	JNS	[illegible]
A	4/82	WAS 12092-D1, IS 238-6201-A---1	JCR	[illegible]

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

BUILDING N-238 ARC JET FACILITY

ARCHITECTURAL PERSPECTIVE

ROBERT E. JONES
STRUCTURAL ENGINEER
2180 SCOTT STREET, SAN JOSE, CALIFORNIA

DRAWN	CHECKED	INDEX	MATERIAL	LIMITS UNLESS NOTED		
		3/30/83		FRAC.	DEC.	ANG.
DESIGN ENGINEER	BRANCH		1-14-63			
APPROVED J. BARRIE	ASSM. DWG. NO.					
APPROVED [illegible] 1-21-63	SCALE					

A 238-6200-A--1 REV. B

A

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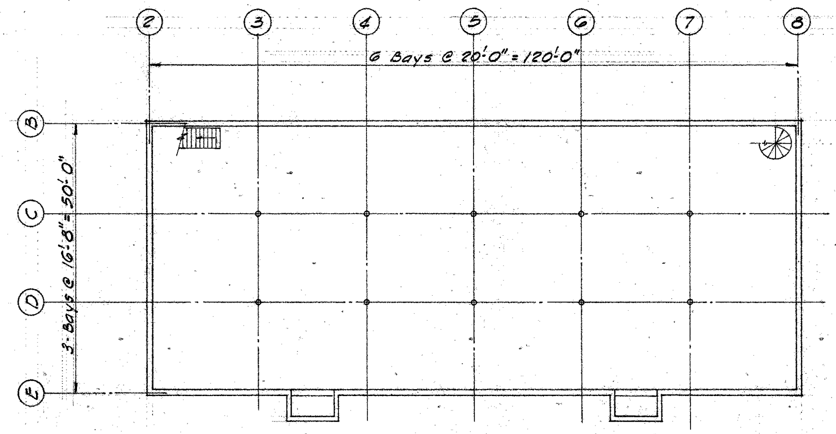
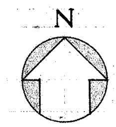
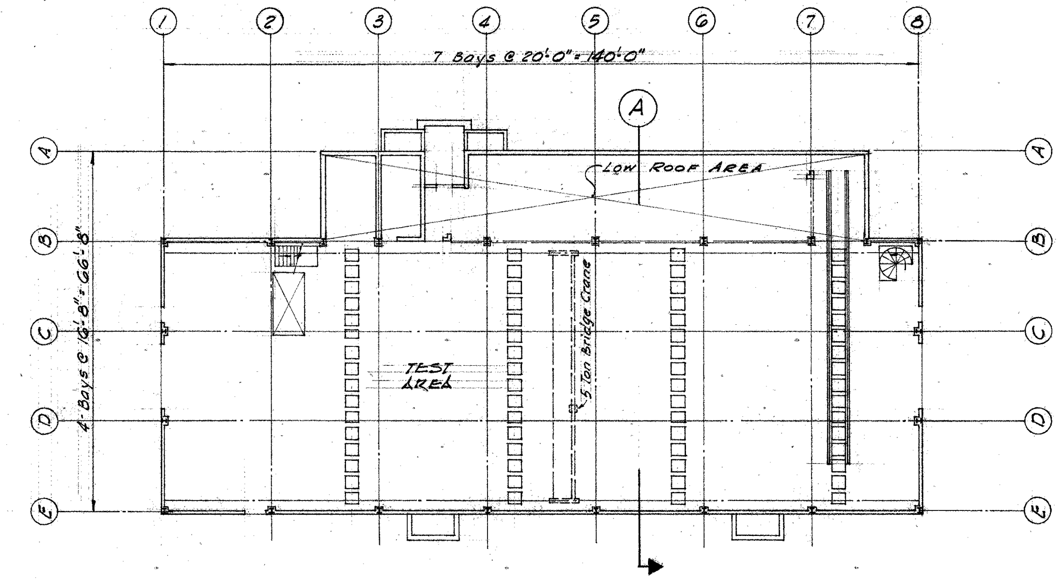
238-6200-A-1
BLDG. N238, ARCH. PERSPECTIVE

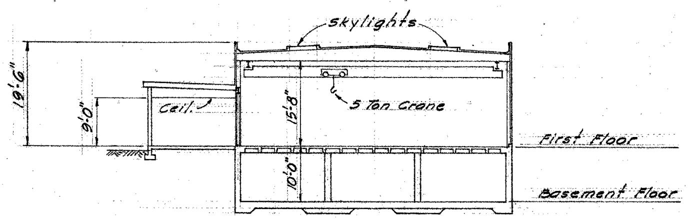


BASEMENT FLOOR PLAN 1/16" = 1'-0"

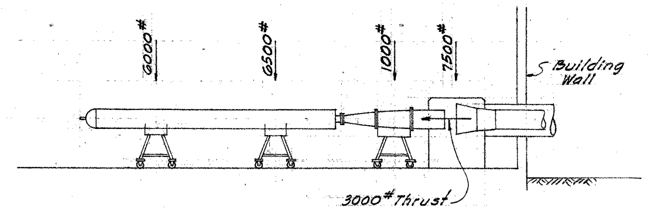




FIRST FLOOR PLAN 1/16" = 1'-0"



CROSS SECTION (A)



LOAD DIAGRAM
CO_2 TUNNEL

GENERAL DESCRIPTION

1. FOUNDATIONS
   a. Reinforced concrete continuous exterior footings and interior spread footings under columns.

2. FLOOR FRAMING
   a. Reinforced concrete slabs on grade.
   b. Reinforced concrete waffle slab (8" + 3") over basement area.
   c. Basement slab 12" thick to allow for concentrated tunnel and other loads.

3. WALL CONSTRUCTION
   a. 12" reinforced concrete basement walls
   b. 8" reinforced concrete blocks around Low Roof Area (Control room, toilets, entrance, etc.)
   c. 18 ga. metal siding around High Roof Area (Test area), steel girts, angles, etc.

4. ROOF FRAMING
   a. Tapered steel beams, steel purlins, WF columns, 20 ga. steel decking.

5. INSULATION
   a. 1¼" rigid roof insulation over steel decking
   b. 1" pre-finished insulation board inside of metal siding.

6. ROOFING
   a. Three ply built up with mineral surface cap sheet.

7. WATERPROOFING
   a. Membrane under slabs on grade.
   b. External waterproofing on basement walls.

8. CEILINGS
   a. Exposed steel decking in Test Area.
   b. Acoustic tile in Control Room.
   c. Gypsum plaster in Toilet Room.
   d. Cement plaster Entry.

9. FLOORING
   a. Concrete in Basement and Test Area.
   b. Vinyl asbestos tile in Control Room, Toilets and Entry.

10. DOORS
   a. Electric operated steel roll-up.
   b. Hollow metal personnel doors.

11. CRANE
   a. 5-ton double girder, low headroom, traveling bridge crane.

12. PAVING
   a. Yard Area: 1½" A.C. over 4" base
   b. Roadways: 3" A.C. over 8" base

DESIGN CRITERIA

1. GENERAL - Uniform Building Code, 1961 Edition.

2. FOUNDATIONS - Dames & Moore Report re/ Addition to Flight Research Hanger.

3. CONCRETE - A.C.I. 318-56

4. STEEL - A.I.S.C. Code

5. CRANE - 15% vertical impact, 20% lateral & 10% longitudinal forces.

STRESSES

1. SOIL BEARING: 1500 psf D.L.
   2000 psf D + LL + Seismic

2. CONCRETE & REINFORCING: $f'_c = 3000$ psi, $f_c = 1350$ psi, $n = 10$
   $f_s = 20000$ psi (A-15 steel)

3. STRUCTURAL STEEL: Per A.I.S.C. for A-7 steel.

4. MASONRY: Mortar and grout $f'_m = 2000$ psi; grade "A" units: $f'_m = 1200$ psi.

DESIGN LOADS

1. CO_2 TUNNEL - See sketch above.
2. ROOF - 20 psf live load
3. FLOORS
   a. Test Area - 125 psf L.L.
   b. Offices - 100 psf L.L.
4. LATERAL
   a. Wind: 30 psf.
   b. Seismic: 20% gravity
5. FLUID PRESSURE - Basement walls
   Saturated earth - 75 psf.

ELECTRICAL DESIGN CRITERIA

1. POWER REQUIREMENTS
   a. "Building Power"
      - 6900 volt 3φ 60 cycle Primary Supply.
      - 480Y/277 volt 3φ 4W Motors, Lighting, Welders
      - 208Y/120 volt 3φ 4W Motors, Lighting, Outlets
   b. "Instrumentation Power"
      - 120/60 volt 1φ 3W Instrumentation Outlets

2. TRANSFORMERS

a.	500 KVA	6900 - 480Y/277 volt	Building Power
b.	45 KVA	480 - 208Y/120 volt	Day Panel B
c.	45 KVA	480 - 208Y/120 volt	Day Panel C
d	30 KVA	480 - 208Y/120 volt	Night Panel N(1)
e.	10 KVA	480 - 120/60 volt	Special Instrumentation

3. DAY PANELS
   a. Upper section of Main Distribution Panel Feeds Welders and other Day Panels
   b. Panel "A" - Feeds 277 volt "Day" Lighting
   c. Panel "B" - Feeds 120 volt "Day" Lighting Receptacles and small Power Outlets
   d. Panel "C" - Same as Panel "B".
   e. Panel "ID" - Feeds Instrumentation Outlets

4. NIGHT PANELS
   a. Lower Section of Main Distribution Panel feeds Night Lighting and Heating & Ventilating equip. on 480/277 volts.
   b. Panel N(1) Feeds Night Lighting, Signal Systems & Small Motors for Heating, Ventilating & Plumbing equip. on 120/208 volts.

5. ILLUMINATION
   a. Control Room, Test Area & Toilet Room lighting to be 277 volt Fluorescent Fixtures.
      Control Room 75 F.C. minimum
      Test Area 50 F.C. minimum
   b. Basement, Street Lighting & Security Lighting to be 120 volt Incandescent Fixtures.

6. COMMUNICATION SYSTEMS
   a. Telephone System outlets & 25 pairs of cable to building.
   b. General Code Call Bells and Relays.
   c. Door Call Button and Bells.
   d. Fire Alarm Auxiliary Station.

7. GROUNDING
   a. Equipment and System Ground Loop.
   b. Instrumentation System Ground Loop.

8. DUCT BANK AND MANHOLES
   a. As required to extend existing underground facilities to new building.

HEATING, VENTILATING AND AIR CONDITIONING

1. Cast iron sectional boiler for hot water service to space heating requirements.
2. Direct expansion, air cooled, roof mounted Air conditioning for cooling Control Room.
3. Hot water horizontal and projection type unit heaters for Test Area & Basement.
4. Roof exhaust fans to provide general ventilation.
5. Temperature control system energized thru time clock.
6. Galv. sheet metal ducts with internal insulation on supply and returns.
7. Air is supplied at approximately 25 air changes per hour to control room.

PLUMBING

1. Toilet facilities for 15 men.
2. Electric water cooler.
3. Roof & area drainage. Lawn sprinkler system.
4. Sump & pump for Basement floor drains. Floor drains in Test area.

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APR
B	3-83	WAS 238-6201 S---8, IS 238-6200-A---3	JNS	ML
A	4/82	WAS 12092-DO IS 238-6201 S---8	JCR	ML

ROBERT E. JONES
STRUCTURAL ENGINEER
2180 SCOTT STREET, SAN JOSE, CALIFORNIA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

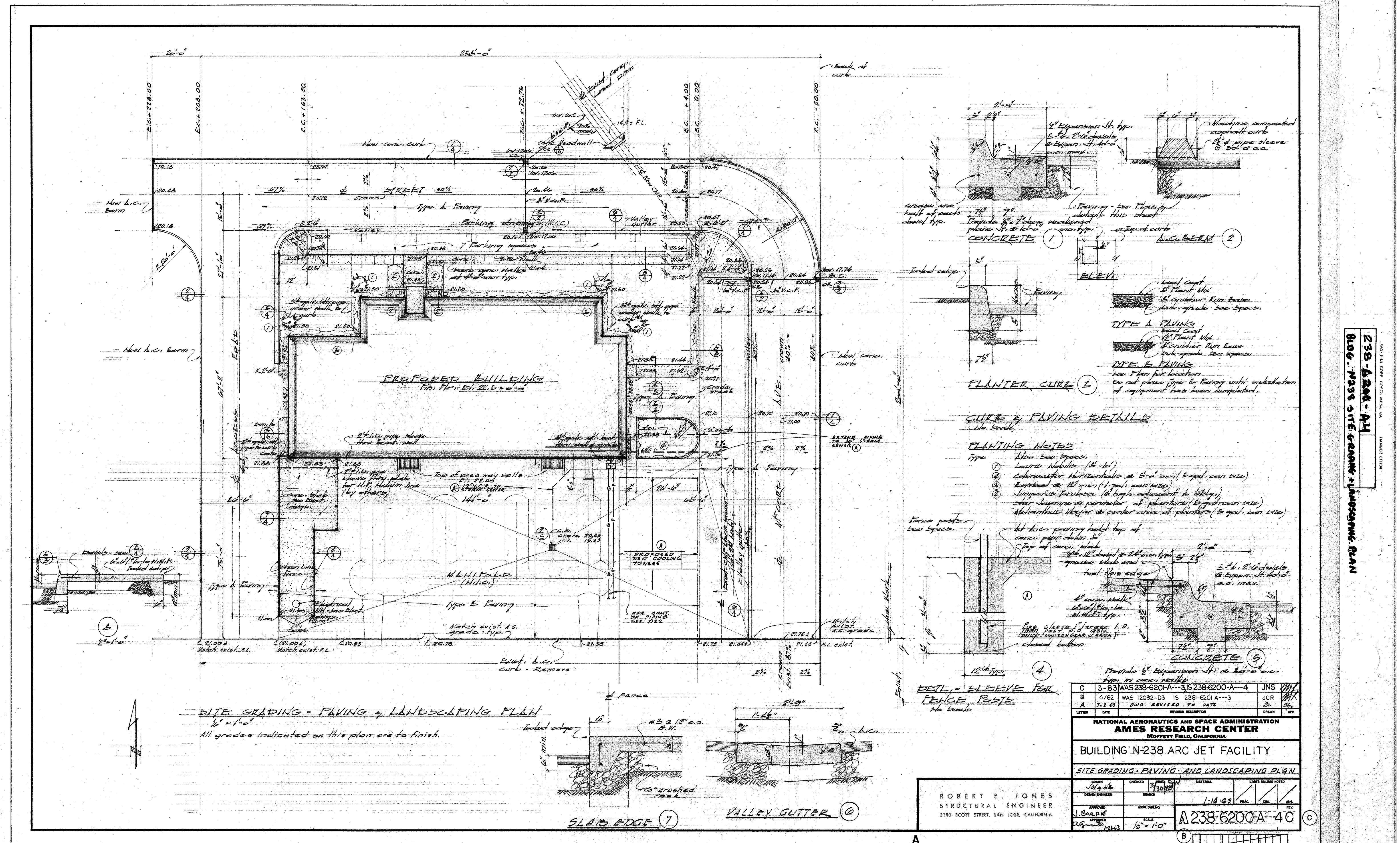
BUILDING N-238 ARC JET FACILITY

DESIGN DATA

DRAWN: HB
CHECKED:
INDEX: 3/13/63
MATERIAL:
DESIGN ENGINEER:
BRANCH:
1-14-63
LIMITS UNLESS NOTED: FRAC. / DEC. / ANG.
APPROVED: J. Barrie 1-22-63
ASSM. DWG. NO.
APPROVED: [signature] 1-21-63
SCALE
REV.

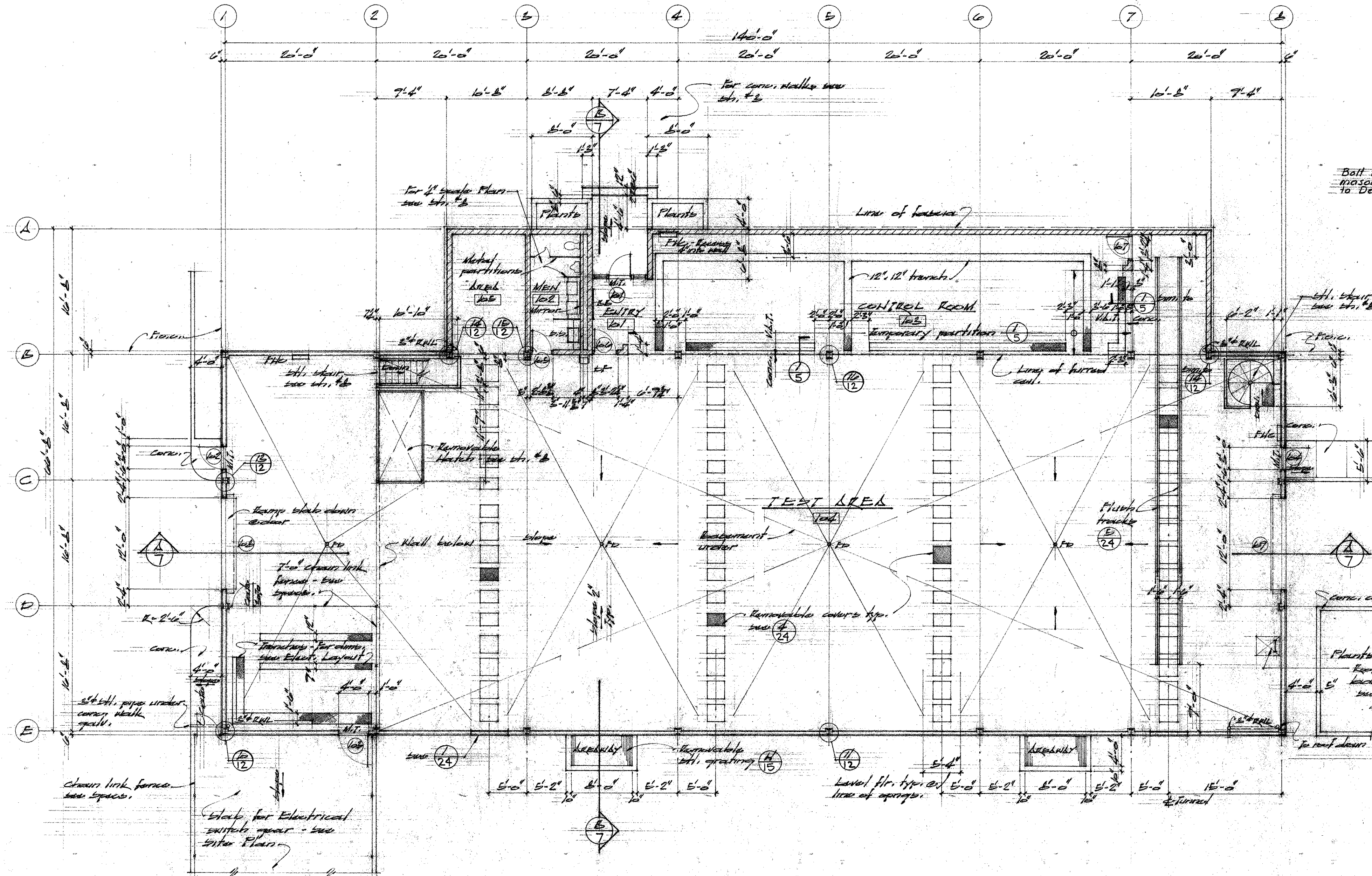
A 238-6200-A-3 B

238-6200-A-3
BLDG. N238 DESIGN DATA



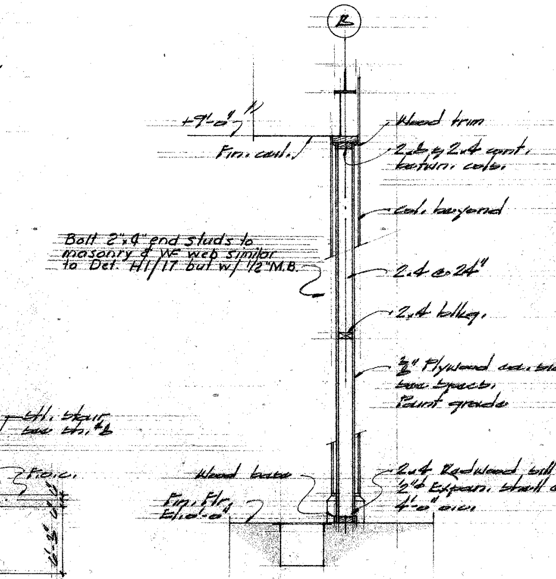
PROPOSED BUILDING
Fin. Flr. El. 22.5=0-0"
STREET
MANIFOLD (N.I.C.)
PROPOSED NEW COOLING TOWERS
CONCRETE 1
A.C. BERM 2
PLANTER CURB 3
CURB & PAVING DETAILS
No Scale
PLANTING NOTES
DETL. - SLEEVE FOR FENCE POSTS
No Scale
CONCRETE 5
SITE GRADING - PAVING & LANDSCAPING PLAN
All grades indicated on this plan are to finish.
SLAB EDGE 7
VALLEY GUTTER 6
Provide ½" Expansion Jt. @ 20'-0" o.c. typ. in conc. walks
C | 3-83 | WAS 238-6201-A---3, IS 238-6200-A---4 | JNS
B | 4/82 | WAS 12092-D3 IS 238-6201 A---3 | JCR
A | 7-2-63 | DWG REVISED TO DATE | B.
LETTER | DATE | REVISION DESCRIPTION | DRAWN | APR.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA
BUILDING N-238 ARC JET FACILITY
SITE GRADING · PAVING · AND LANDSCAPING PLAN
ROBERT E. JONES
STRUCTURAL ENGINEER
2180 SCOTT STREET, SAN JOSE, CALIFORNIA
DRAWN | CHECKED | INDEX | MATERIAL | LIMITS UNLESS NOTED
DESIGN ENGINEER | BRANCH
APPROVED J. BARRIE | ASSM. DWG. NO.
APPROVED 1-21-63 | SCALE 1/16" = 1'-0"
1-14-63
A 238-6200-A--4C
238-6200-A-4
BLDG. N238 SITE GRADING + LANDSCAPING PLAN

A



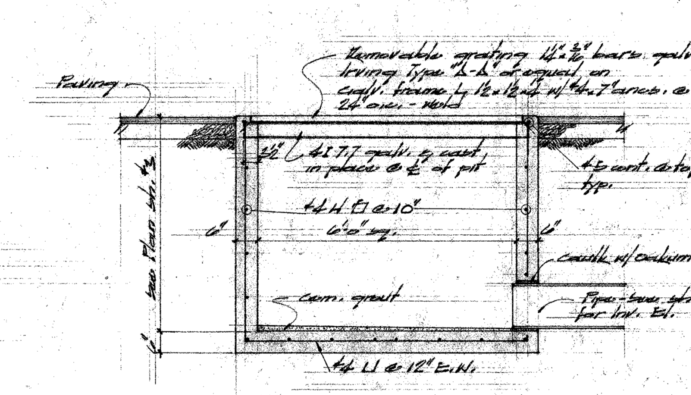
FIRST FLOOR PLAN

1/8" = 1'-0"



TEMPORARY PLYWOOD PARTITION - LINE 6 (1)

LINE 7 SIMILAR



CATCH BASIN DETL. (2)

LEGEND

RWL	Rain Water Leader
MT	Metal Threshold
FOC	Face of Concrete
DF	Drinking Fountain
HB	Hose Bibb
VAT	Vinyl Asbestos Tile
SS	Service Sink
FD	Floor Drain
RD	Roof Drain
FHC	Fire Hose Cabinet
TD	Towel Dispenser
MH	Manhole
BB	Bulletin Board
WWF	Welded Wire Fabric

(X / 1) Detail / Sheet number

Concrete in section

Concrete block in section

Wood continuous

Wood blocking

Footing step

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APR
B	3-83	WAS 238-6201-A--4, IS 238-6200-A---5	JNS	
A	4/82	WAS 12092-D4 IS 238-6201 A---4	JCR	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

BUILDING N-238 ARC JET FACILITY

FIRST FLOOR PLAN

ROBERT E. JONES
STRUCTURAL ENGINEER
2180 SCOTT STREET, SAN JOSE, CALIFORNIA

DRAWN: JM | CHECKED | INDEX: 3/30/63 | MATERIAL | 1-14-63
APPROVED: J. BARRIE | APPROVED: 1-21-63 | SCALE: 1/8" = 1'-0"

A238-6200-A---5 B

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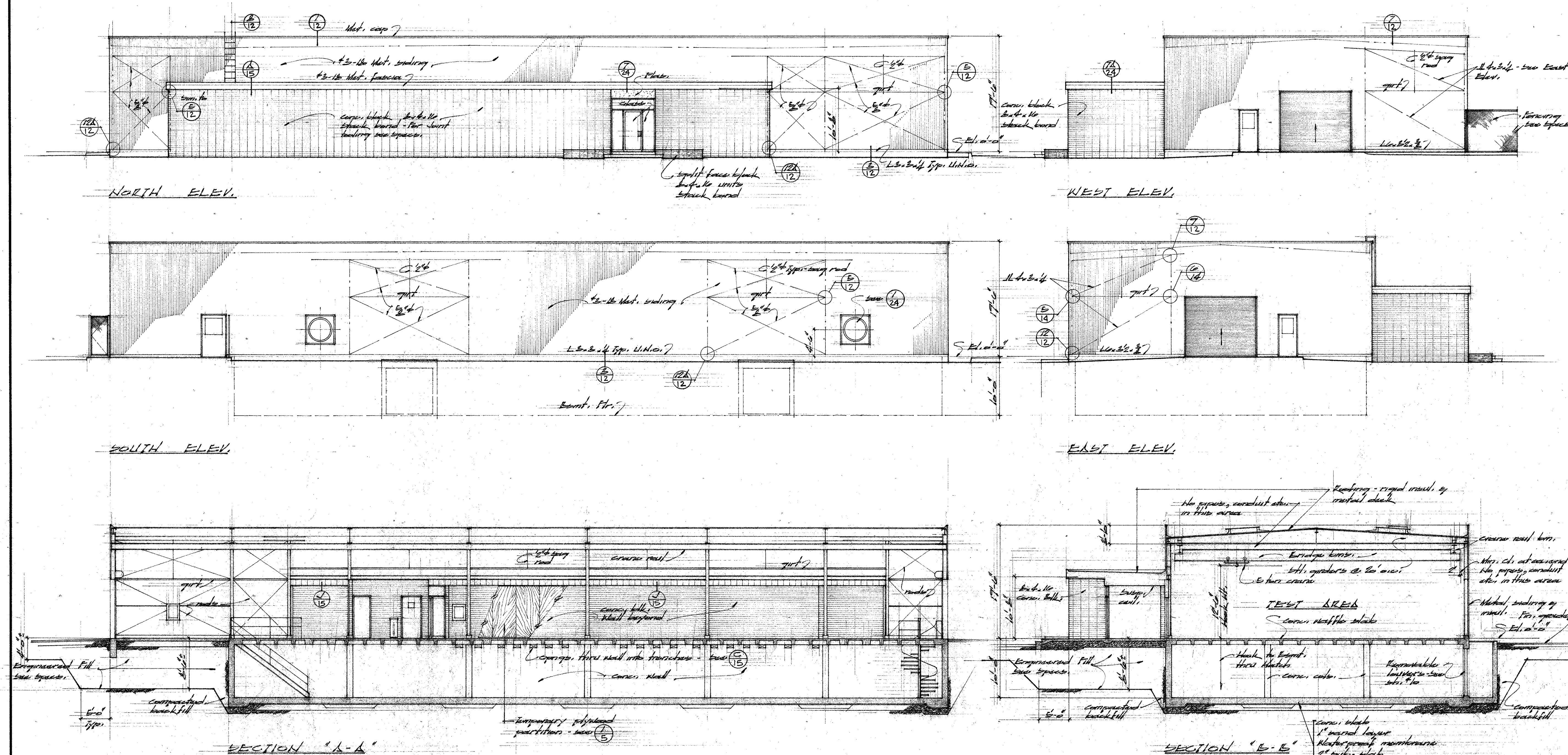
238-6200-A-5 BLDG. N238 FIRST FLOOR PLAN



LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.
B	3-83	WAS 238-6201-A--6, IS 238-6200-A--7	JNS	
A	4/82	WAS 12092.D6 IS 238-6201 A-6	JCR	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

BUILDING N-238 ARC JET FACILITY

EXTERIOR ELEVATIONS

ROBERT E. JONES
STRUCTURAL ENGINEER
2180 SCOTT STREET, SAN JOSE, CALIFORNIA

DRAWN	CHECKED	INDEX	MATERIAL	LIMITS UNLESS NOTED
JM		3/30/83	1-14-63	FRAC. / DEC. / ANG.
DESIGN ENGINEER	BRANCH			
APPROVED: J. BARRIE	ASSM. DWG. NO.			
APPROVED: 1-21-63	SCALE: 1/8" = 1'-0"			

A 238-6200-A--7 B

A

238-6200-A-7 BLDG. N238 EXTERIOR ELEVATIONS

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Additional Images:

N-240: Airborne Missions and Applied Life Sciences Experiments

N-240A: Life Sciences Flight Experiments

N-240 and N-240A, Aerial photograph (Source: NASA Ames Research Center, AC77-0846-51)

N-240, Ground-breaking ceremony for the new Life Sciences building, 13 April 1964 (Source: NASA Ames Research Center, A-32424)

Space Life Sciences Payloads Office (SLSPO) office manual cover, September 1983. (Source: NASA Ames Research Center, AC83-0645.3)

N-240/N-240A, north facade, main entrance
(Source: Page & Turnbull)

N-240/N-240A, west end of south facade
(Source: Page & Turnbull)

N-240/N-240A, south facade, main entrance
(Source: Page & Turnbull)

Architectural Drawings for N-240 and N-240A

Space Environment Research Facility, Site Plan and Details
Architect: Garretson, Elmendorf, Klein, Reiben, Archictects & Engineers
Date: 13 March 1964
Sheet: A 12363-A2
NASA EDC # 240-6301-A2

Space Environment Research Facility, Ground Floor Plan
Architect: Garretson, Elmendorf, Klein, Reiben, Archictects & Engineers
Date: 13 March 1964
Sheet: A 12363-A3
NASA EDC # 240-6301-A3

Space Environment Research Facility, Second Floor Plan
Architect: Garretson, Elmendorf, Klein, Reiben, Archictects & Engineers
Date: 13 March 1964
Sheet: A 12363-A4
NASA EDC # 240-6301-A4

Space Environment Research Facility, Exterior Elevations
Architect: Garretson, Elmendorf, Klein, Reiben, Archictects & Engineers
Date: 13 March 1964
Sheet: A 12363-A6
NASA EDC # 240-6301-A6

Space Environment Research Facility, Exterior Elevations
Architect: Garretson, Elmendorf, Klein, Reiben, Archictects & Engineers
Date: 13 March 1964
Sheet: A 12363-A7
NASA EDC # 240-6301-A7

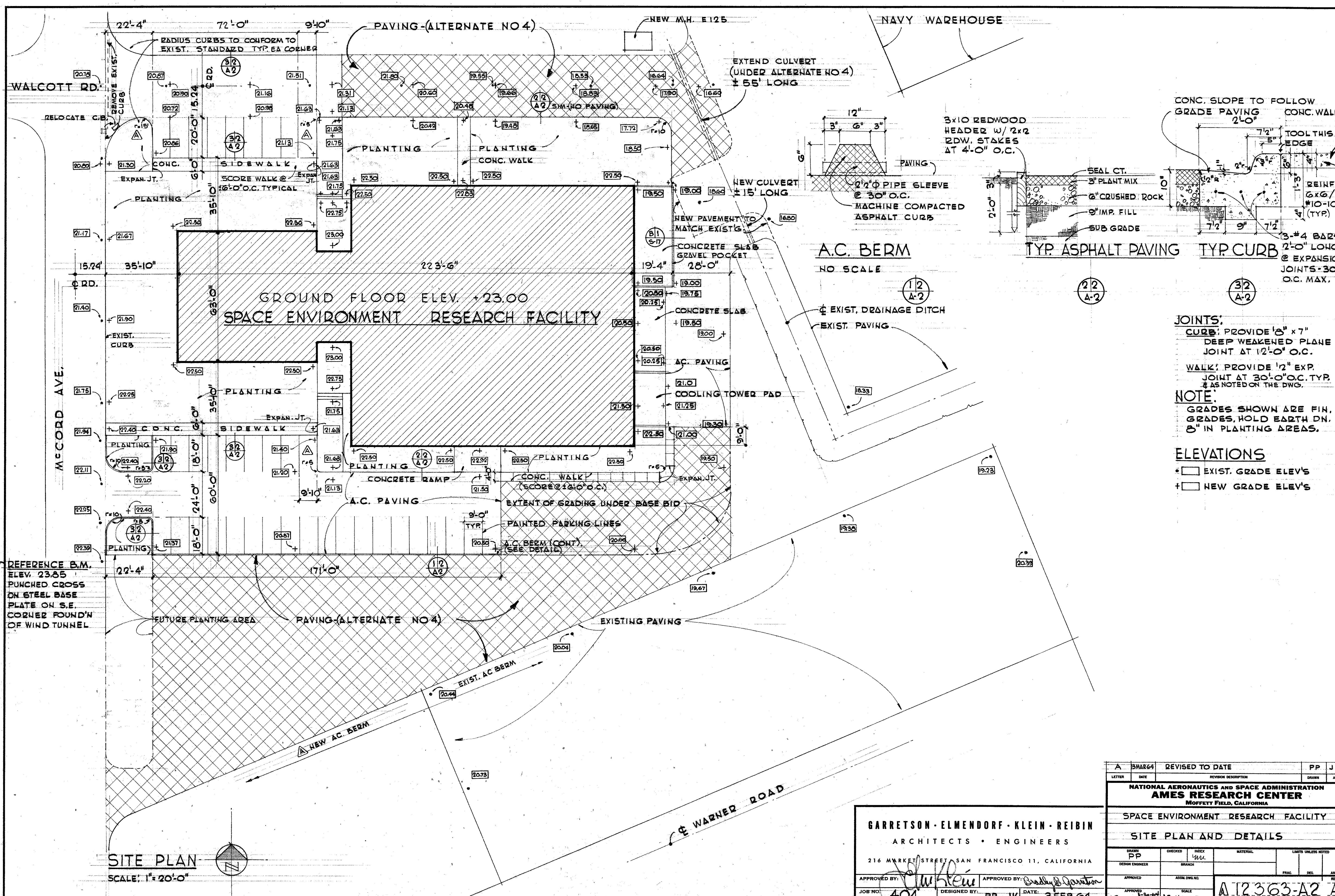
Space Environment Research Facility, Longitudinal Section and High Bay Laboratory Elevations
Architect: Garretson, Elmendorf, Klein, Reiben, Archictects & Engineers
Date: 13 March 1964
Sheet: A 12363-A8
NASA EDC # 240-6301-A8

Life Sciences Flight Experiments Facility (Addition to Building N-240), Site Plan
Architect: Reid & Tarics Associates, Architects & Engineers
Date: 16 July 1980
Sheet: A 240-7903-A2
NASA EDC # 240-7903-A2

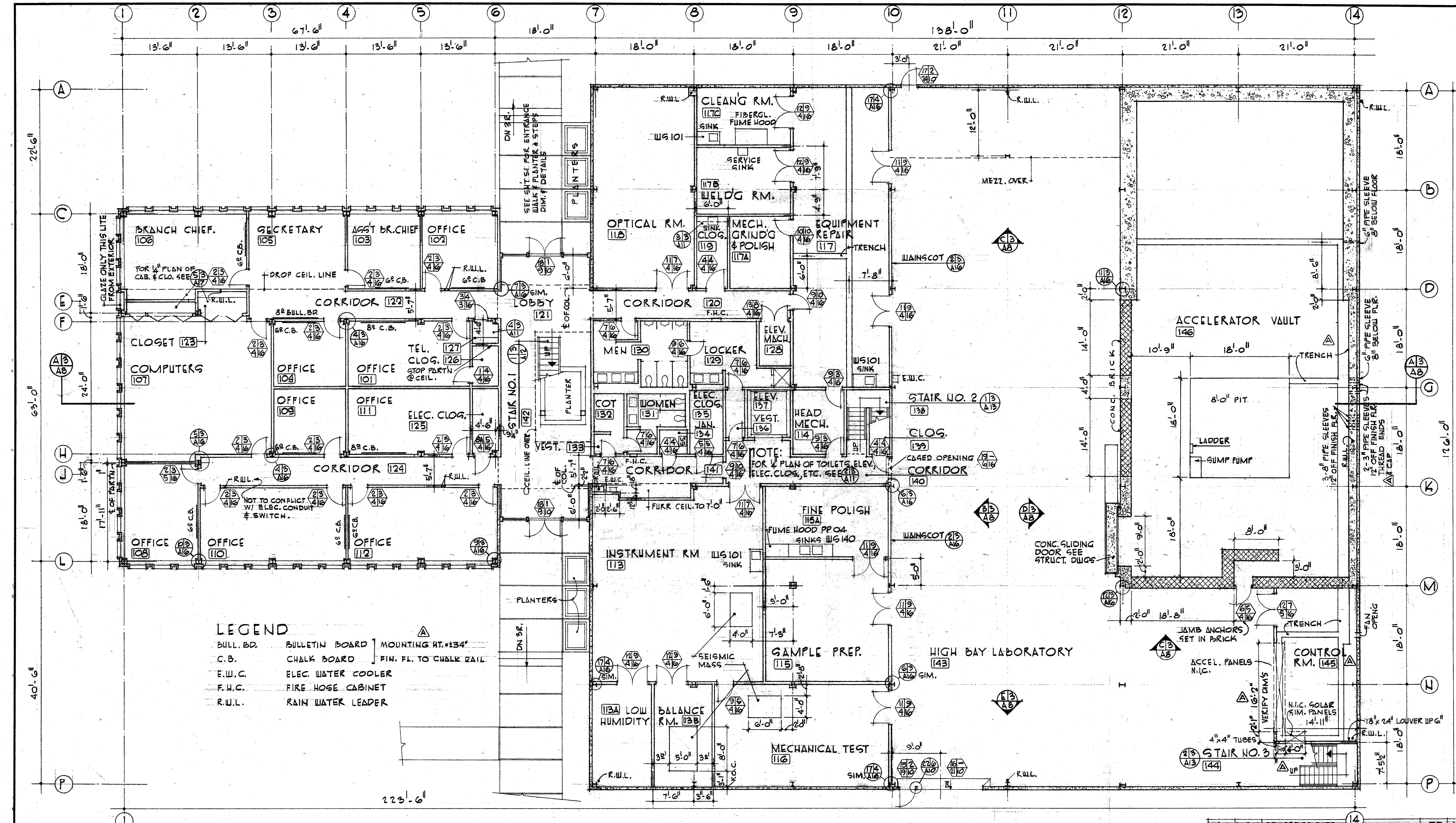
Life Sciences Flight Experiments Facility (Addition to Building N-240), First Floor Plan
Architect: Reid & Tarics Associates, Architects & Engineers
Date: 16 July 1980
Sheet: A 240-7903-A7
NASA EDC # 240-7903-A7

Life Sciences Flight Experiments Facility (Addition to Building N-240), Second Floor Plan
Architect: Reid & Tarics Associates, Architects & Engineers
Date: 16 July 1980
Sheet: A 240-7903-A8
NASA EDC # 240-7903-A8

Life Sciences Flight Experiments Facility (Addition to Building N-240), Exterior Elevations
Architect: Reid & Tarics Associates, Architects & Engineers
Date: 16 July 1980
Sheet: A 240-7903-A9
NASA EDC # 240-7903-A9



SITE PLAN
SCALE: 1" = 20'-0"
GROUND FLOOR ELEV. +23.00
SPACE ENVIRONMENT RESEARCH FACILITY
WALCOTT RD.
McCORD AVE.
℄ RD.
NAVY WAREHOUSE
NEW M.H. E125
PAVING-(ALTERNATE NO 4)
RADIUS CURBS TO CONFORM TO EXIST. STANDARD TYP. EA CORNER
REMOVE EXIST. CURB
RELOCATE C.B.
EXTEND CULVERT (UNDER ALTERNATE NO 4) ±55' LONG
NEW CULVERT ±15' LONG
NEW PAVEMENT TO MATCH EXIST'G
CONCRETE SLAB GRAVEL POCKET
CONCRETE SLAB
A.C. PAVING
COOLING TOWER PAD
PLANTING
CONC. WALK
SIDEWALK
SCORE WALK @ 16'-0" O.C. TYPICAL
EXPAN. JT.
CONCRETE RAMP
CONC. WALK (SCORE @ 16'-0" O.C.)
EXTENT OF GRADING UNDER BASE BID
PAINTED PARKING LINES
A.C. BERM (CONT) (SEE DETAIL)
SIM-(NO PAVING)
℄ EXIST. DRAINAGE DITCH
EXIST. PAVING
EXISTING PAVING
FUTURE PLANTING AREA
EXIST. AC BERM
NEW AC BERM
℄ WARNER ROAD
REFERENCE B.M. ELEV. 23.85 PUNCHED CROSS ON STEEL BASE PLATE ON S.E. CORNER FOUND'N OF WIND TUNNEL
A.C. BERM
NO SCALE
PAVING
2½"⌀ PIPE SLEEVE @ 30" O.C.
MACHINE COMPACTED ASPHALT CURB
3x10 REDWOOD HEADER W/ 2x2 RDW. STAKES AT 4'-0" O.C.
SEAL CT.
3" PLANT MIX
6" CRUSHED ROCK
9" IMP. FILL
SUB GRADE
TYP. ASPHALT PAVING
CONC. SLOPE TO FOLLOW GRADE PAVING
CONC. WALK
TOOL THIS EDGE
REINF: 6x6/ #10-10 (TYP.)
3-#4 BARS x 2'-0" LONG @ EXPANSION JOINTS-30'-0" O.C. MAX.
TYP. CURB
JOINTS:
CURB: PROVIDE 1/8" x 7" DEEP WEAKENED PLANE JOINT AT 12'-0" O.C.
WALK: PROVIDE 1/2" EXP. JOINT AT 30'-0" O.C. TYP. & AS NOTED ON THE DWG.
NOTE:
GRADES SHOWN ARE FIN. GRADES. HOLD EARTH DN. 8" IN PLANTING AREAS.
ELEVATIONS
EXIST. GRADE ELEV'S
NEW GRADE ELEV'S
A 3MAR64 REVISED TO DATE PP JK
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA
SPACE ENVIRONMENT RESEARCH FACILITY
SITE PLAN AND DETAILS
GARRETSON · ELMENDORF · KLEIN · REIBIN
ARCHITECTS · ENGINEERS
216 MARKET STREET SAN FRANCISCO 11, CALIFORNIA
JOB NO: 404
DESIGNED BY: PP-JK
DATE: 3 FEB 64
DRAWN PP
SCALE AS NOTED
A12363-A2 A
240-636/A---2



GROUND FLOOR PLAN

1/8" = 1'-0"

NOTE:
ALL STUDS TERMINATING AT METAL DECK SEE DETAILS 1/A16, 2/A16

A	15 MAR 64	REVISED TO DATE	PP	JK
LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

SPACE ENVIRONMENT RESEARCH FACILITY

GROUND FLOOR PLAN

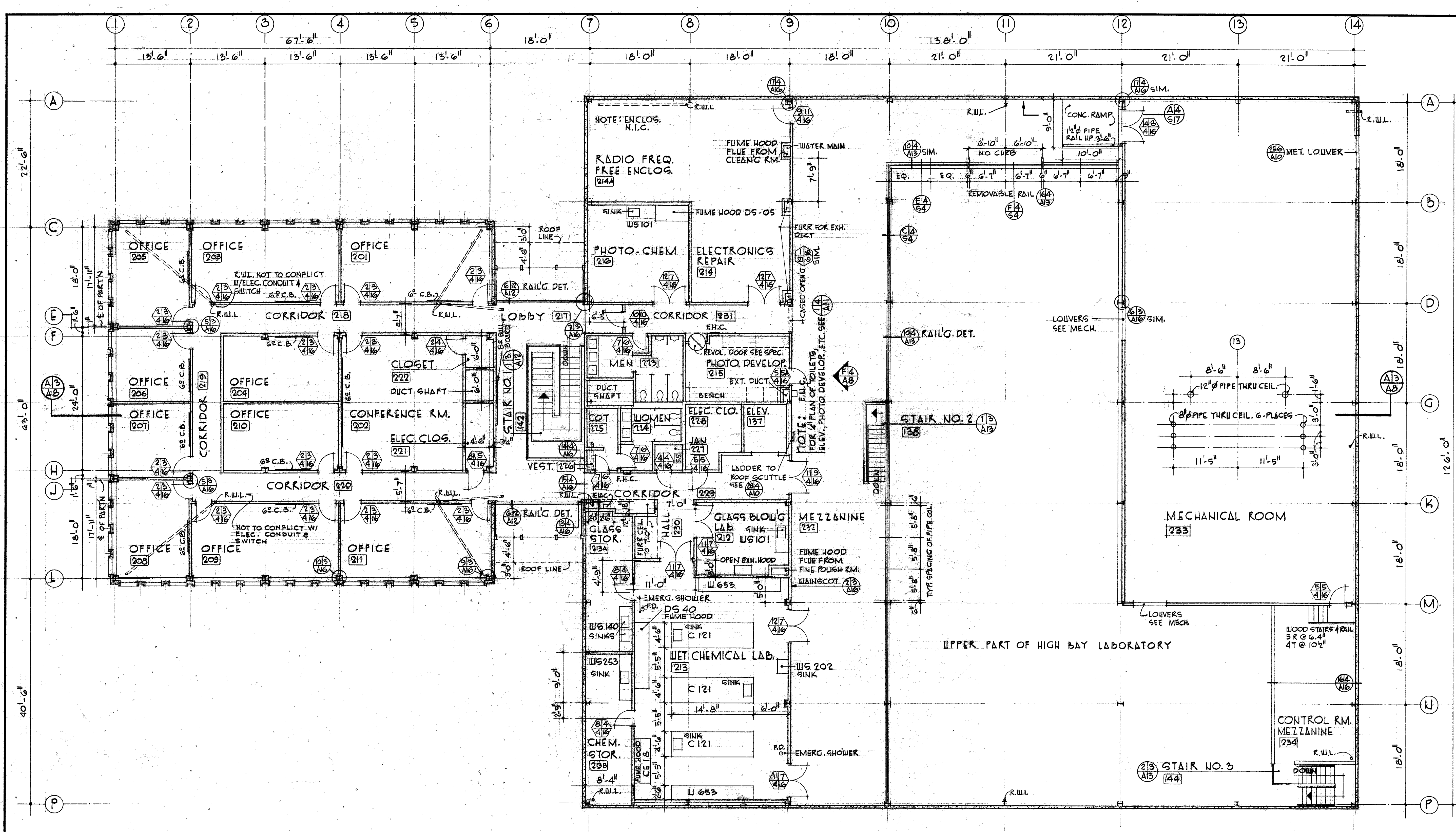
GARRETSON · ELMENDORF · KLEIN · REIBIN
ARCHITECTS · ENGINEERS
216 MARKET STREET, SAN FRANCISCO 11, CALIFORNIA

APPROVED BY: John Klein — APPROVED BY: Bradley B. Gordon
JOB NO. 404 — DESIGNED BY: JK — DATE: 3 FEB 64
DRAWN: CN — APPROVED: J. BARRIE — SCALE: AS NOTED

A12363-A3 A

240 6301 A 3

240-6301 A-3 S.E.R.F. GROUND FLOOR PLAN



SECOND FLOOR PLAN

1/8" = 1'-0"

NORTH

GARRETSON · ELMENDORF · KLEIN · REIBIN
ARCHITECTS · ENGINEERS
216 MARKET STREET, SAN FRANCISCO 11, CALIFORNIA

APPROVED BY: [signature] APPROVED BY: [signature]
JOB NO. 404 DESIGNED BY: JK DATE: 3 FEB 64

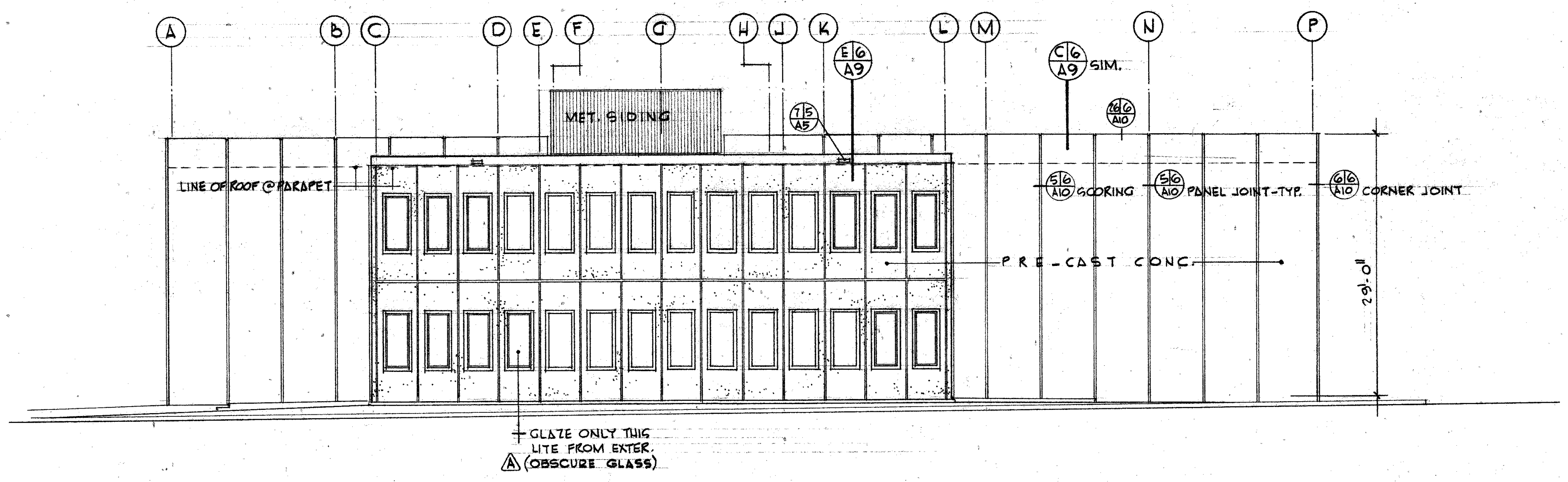
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

SPACE ENVIRONMENT RESEARCH FACILITY
SECOND FLOOR PLAN

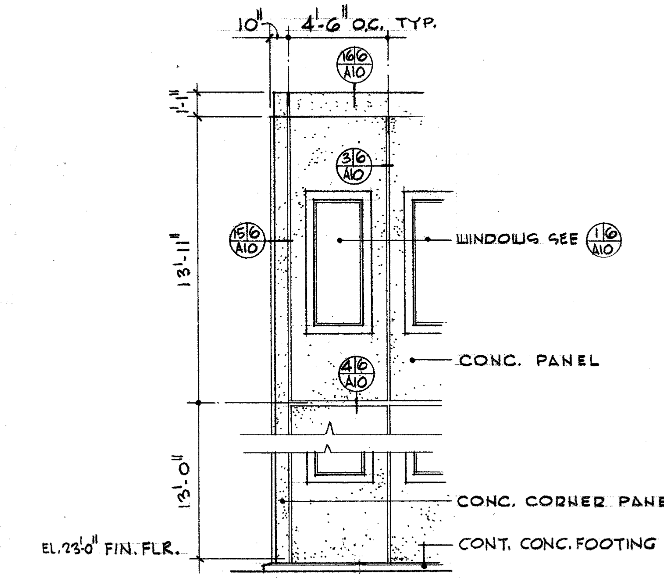
DRAWN: CN
SCALE: AS NOTED

A 12363-A4

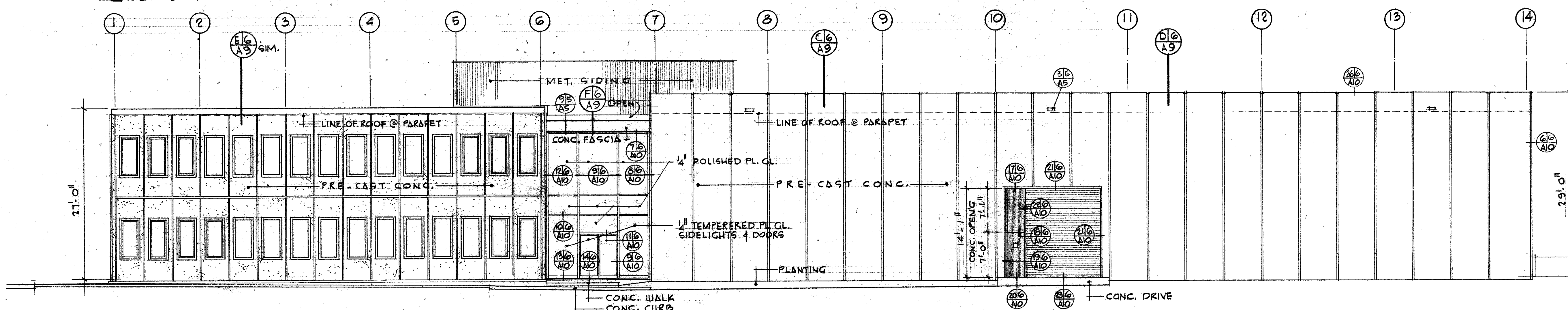
240-630/A---4



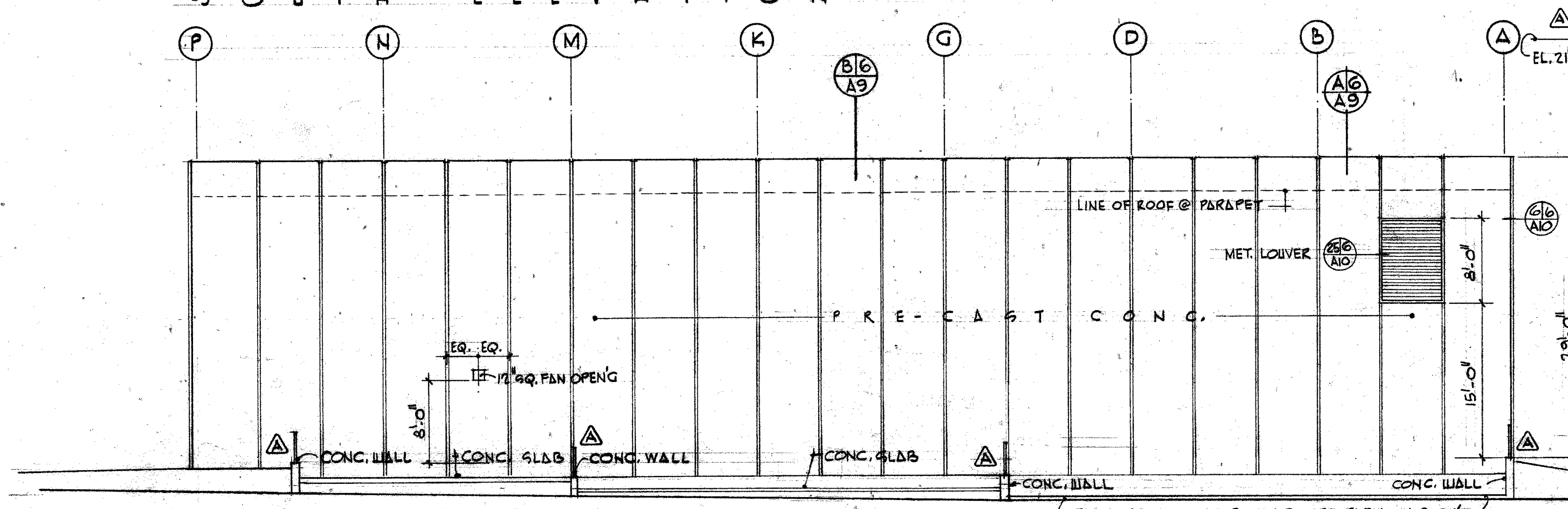
WEST ELEVATION



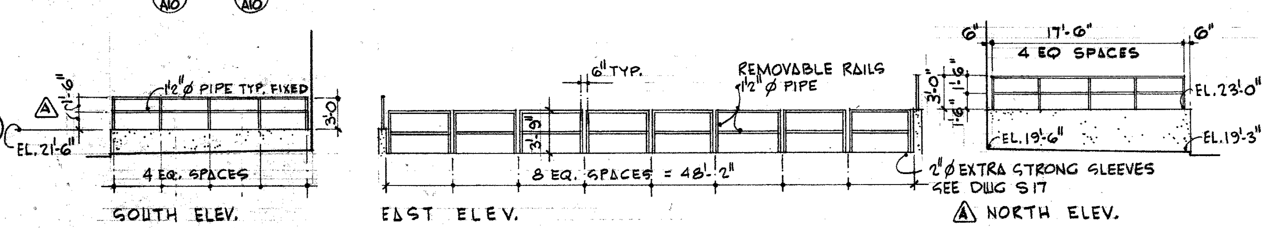
TYPICAL OFFICE PANEL BAY ELEV. 1/4"—1'-0"



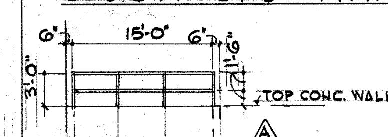
SOUTH ELEVATION



EAST ELEVATION 1/8"—1'-0"



ELECTRICAL TRANSFORMER SLAB ELEV. 1/8"—1'-0"



RAILING-EA. SIDE COOLING TOWER PAD

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.
A	3 MAR 64	REVISED TO DATE	PP	JK

GARRETSON · ELMENDORF · KLEIN · REIBIN
ARCHITECTS · ENGINEERS
216 MARKET STREET, SAN FRANCISCO 11, CALIFORNIA

APPROVED BY: | APPROVED BY:
JOB NO. 404 | DESIGNED BY: JK - PP | DATE: 3-FEB-64

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

SPACE ENVIRONMENT RESEARCH FACILITY

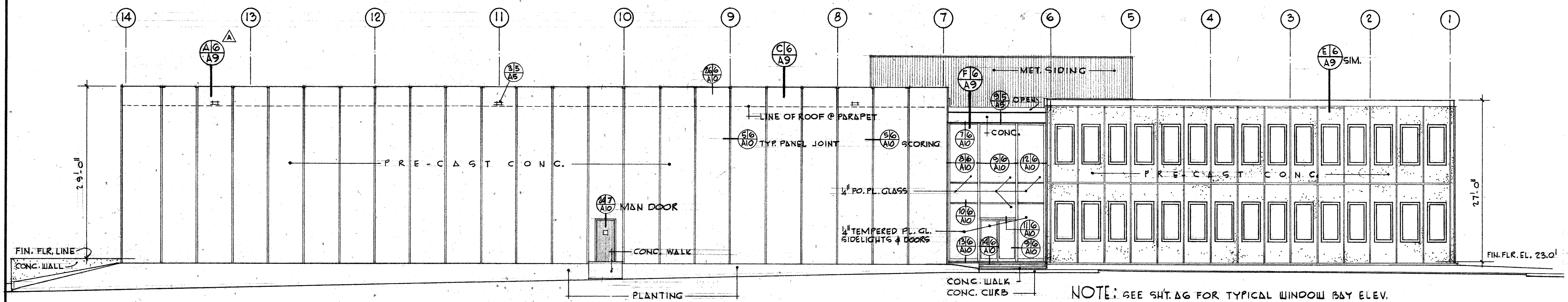
EXTERIOR ELEVATIONS

DRAWN C.N. | SCALE AS NOTED | APPROVED J. BARRIE 1-30-64

A12363-A6 A

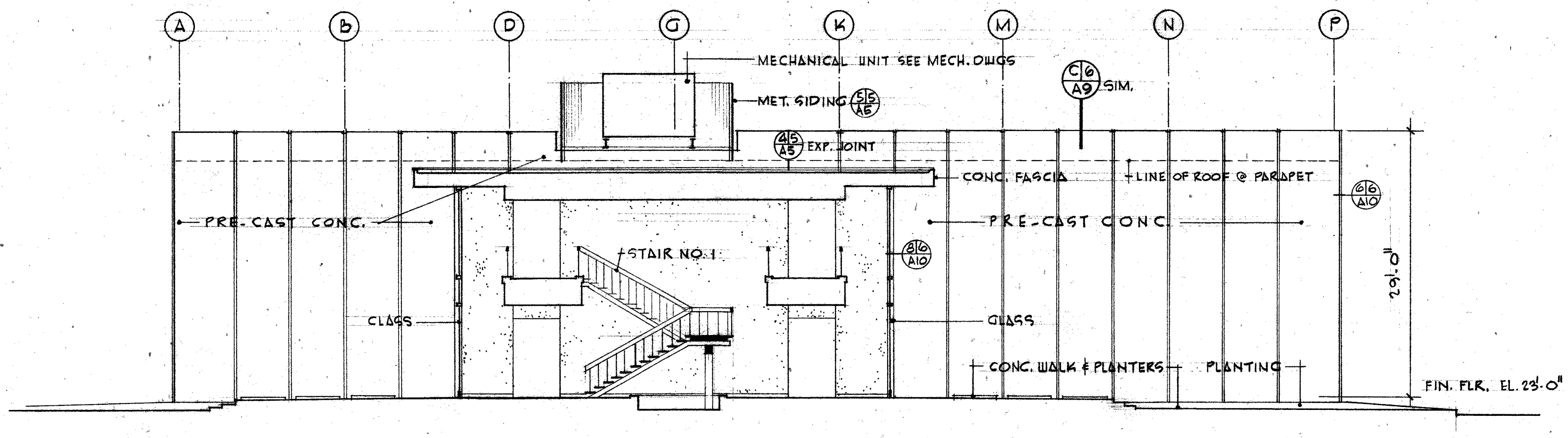
A

240-1630/A-1-1-6

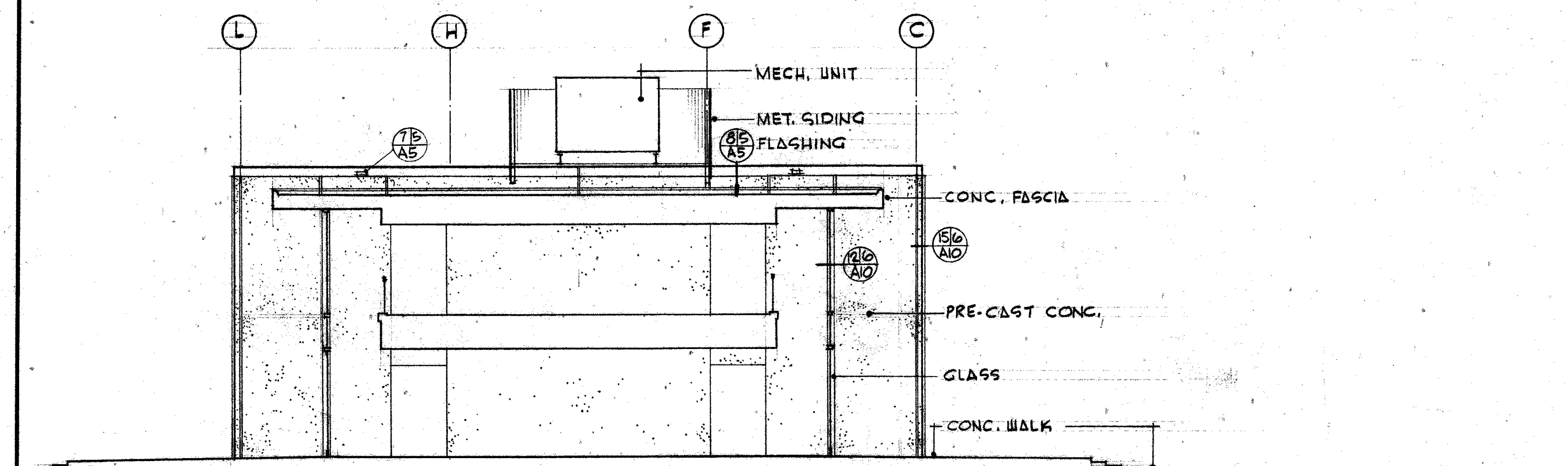


NOTE: SEE SHT. A6 FOR TYPICAL WINDOW BAY ELEV.

NORTH ELEVATION



WEST ELEVATION OF LABORATORY WING



EAST ELEVATION OF OFFICE WING 1/8" = 1'-0"

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP
A	13 MAR 64	REVISED TO DATE	PP	JK

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ARCHITECTS · ENGINEERS
216 MARKET STREET, SAN FRANCISCO 11, CALIFORNIA

APPROVED BY: [signature] APPROVED BY: [signature]
JOB NO. 404 DESIGNED BY: JK - PP DATE: 3-FEB 64

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

SPACE ENVIRONMENT RESEARCH FACILITY

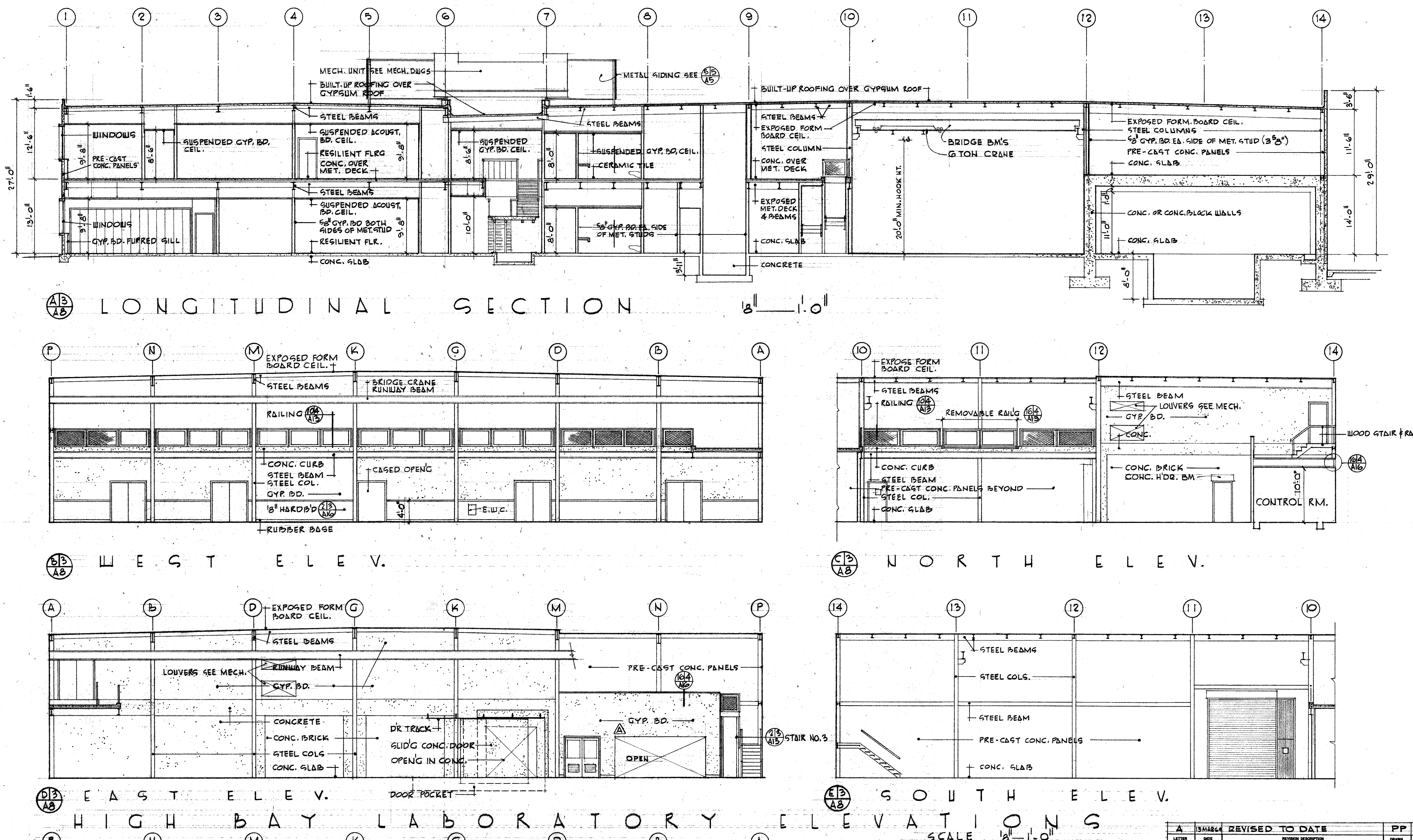
EXTERIOR ELEVATIONS

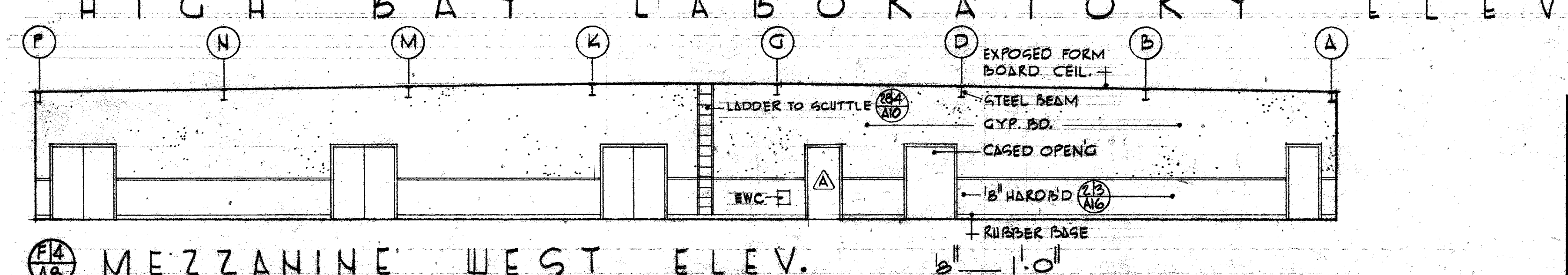
DRAWN: CN
APPROVED: J. Sarafe 1-30-64
SCALE: AS NOTED

A 12363-A7 A

A

240-630 / A-1-7





A	13 MAR 64	REVISED TO DATE	PP	JK
LETTER	DATE	REVISION DESCRIPTION	DRAWN	APR

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

SPACE ENVIRONMENT RESEARCH FACILITY

LONG. SECTION AND HIGH BAY LAB. ELEVATIONS

GARRETSON · ELMENDORF · KLEIN · REIBIN
ARCHITECTS · ENGINEERS
216 MARKET STREET, SAN FRANCISCO 11, CALIFORNIA

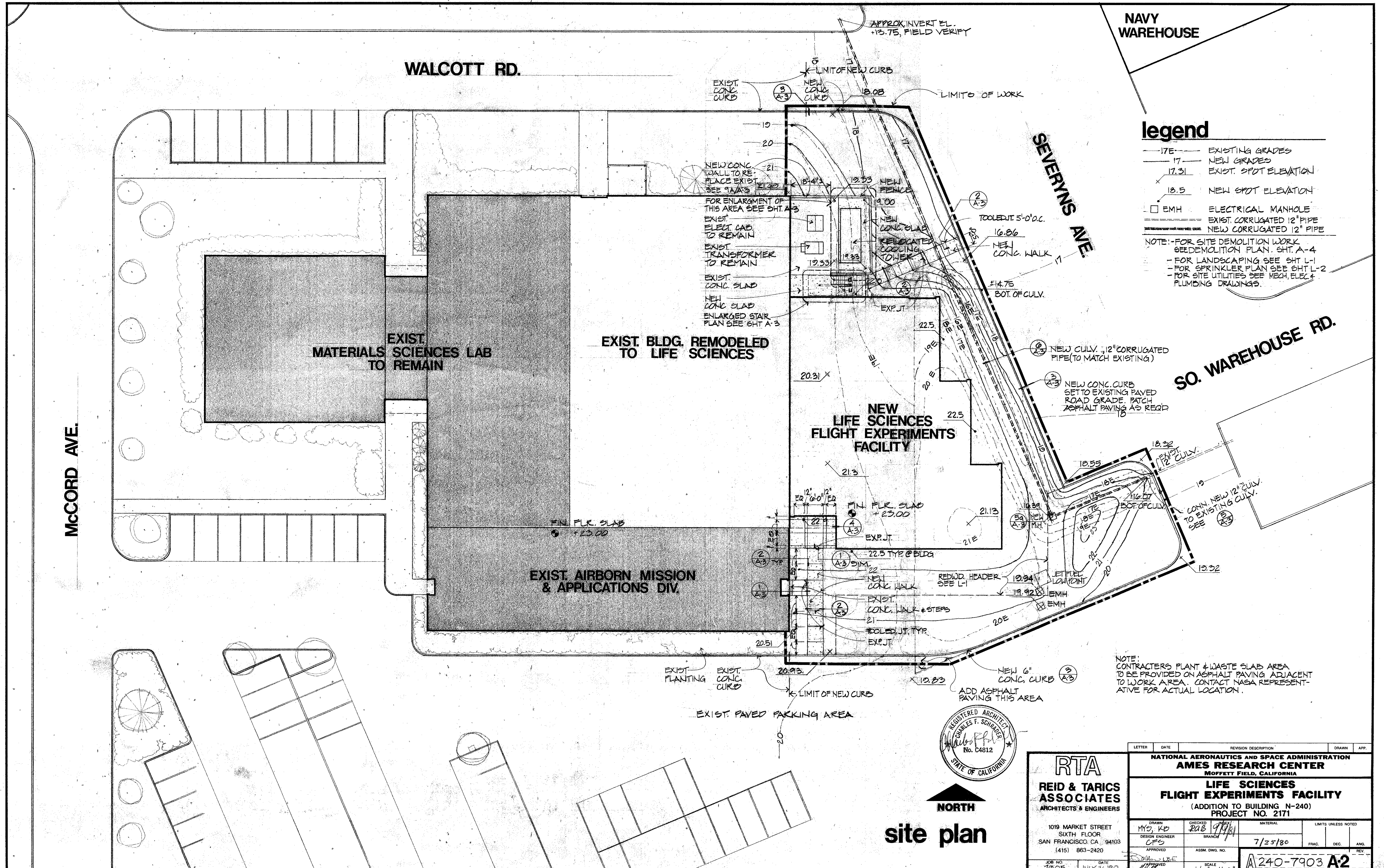
APPROVED BY: [signature] APPROVED BY: [signature]
JOB NO. 404 DESIGNED BY: JK - CN DATE: 3 - FEB - 64

DRAWN: C.N. CHECKED
APPROVED: J.BARRIS 1-30-64 SCALE: AS NOTED

A12363-A8 A

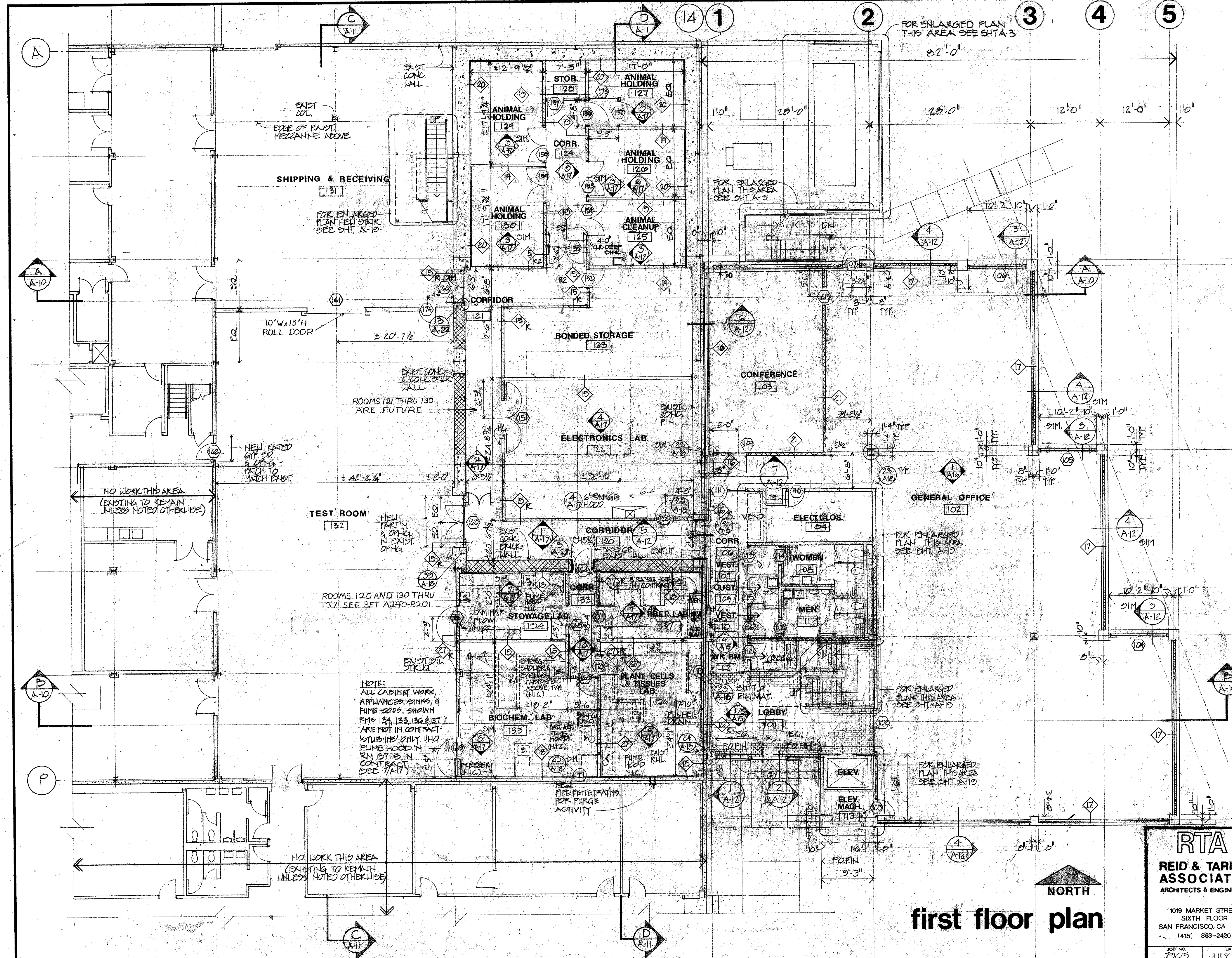
A

2/0-163d/A/-1-8


WALCOTT RD.
McCORD AVE.
SEVERYNS AVE.
SO. WAREHOUSE RD.
NAVY WAREHOUSE
APPROX. INVERT EL. +13.75, FIELD VERIFY
LIMIT OF NEW CURB
EXIST. CONC. CURB
NEW CONC. CURB
LIMITS OF WORK
NEW CONC. WALL TO REPLACE EXIST. SEE 9/A-3
FOR ENLARGMENT OF THIS AREA SEE SHT. A-3
EXIST. ELECT. CAB. TO REMAIN
EXIST. TRANSFORMER TO REMAIN
EXIST. CONC. SLAB
NEW CONC. SLAB
ENLARGED STAIR PLAN SEE SHT A-3
NEW FENCE
NEW CONC. SLAB
RELOCATED COOLING TOWER
TOOLED JT. 5'-0" O.C.
NEW CONC. WALK
BOT. OF CULV.
EXP. JT.
NEW CULV. 12" CORRUGATED PIPE (TO MATCH EXISTING)
NEW CONC. CURB SET TO EXISTING PAVED ROAD GRADE. PATCH ASPHALT PAVING AS REQD
EXIST. MATERIALS SCIENCES LAB TO REMAIN
EXIST. BLDG. REMODELED TO LIFE SCIENCES
NEW LIFE SCIENCES FLIGHT EXPERIMENTS FACILITY
EXIST. AIRBORN MISSION & APPLICATIONS DIV.
FIN. FLR. SLAB +23.00
22.5 TYP @ BLDG
NEW CONC. WALK
EXIST. CONC. WALK & STEPS
TOOLED JT. TYP.
REDWD. HEADER SEE L-1
EMH
EXIST. 12" CULV.
CONN. NEW 12" CULV. TO EXISTING CULV. SEE 5/A-3
BOT. OF CULV.
NEW 6" CONC. CURB 3/A-3
ADD ASPHALT PAVING THIS AREA
EXIST. PLANTING
EXIST. PAVED PARKING AREA
legend
17E EXISTING GRADES
17 NEW GRADES
17.31 EXIST. SPOT ELEVATION
18.5 NEW SPOT ELEVATION
EMH ELECTRICAL MANHOLE
EXIST. CORRUGATED 12" PIPE
NEW CORRUGATED 12" PIPE
NOTE: - FOR SITE DEMOLITION WORK SEE DEMOLITION PLAN. SHT. A-4
- FOR LANDSCAPING SEE SHT L-1
- FOR SPRINKLER PLAN SEE SHT L-2
- FOR SITE UTILITIES SEE MECH, ELEC & PLUMBING DRAWINGS.
NOTE: CONTRACTERS PLANT & WASTE SLAB AREA TO BE PROVIDED ON ASPHALT PAVING ADJACENT TO WORK AREA. CONTACT NASA REPRESENTATIVE FOR ACTUAL LOCATION.
REGISTERED ARCHITECT CHARLES F. SCHRADER No. C4812 STATE OF CALIFORNIA
NORTH
site plan
RTA
REID & TARICS ASSOCIATES
ARCHITECTS & ENGINEERS
1019 MARKET STREET SIXTH FLOOR SAN FRANCISCO, CA. 94103 (415) 863-2420
JOB NO. 7905
DATE JULY 14, 80
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA
LIFE SCIENCES FLIGHT EXPERIMENTS FACILITY
(ADDITION TO BUILDING N-240)
PROJECT NO. 2171
DRAWN MYS, KB
CHECKED BAB
DESIGN ENGINEER CFS
7/25/80
SCALE 1/16" = 1'-0"
A240-7903 A-2

A

2-30178



first floor plan

NOTES

1. ⬡ OPENING NOS.: SEE SHT. A-21 FOR SCHEDULE.
2. ▭ ROOM NOS.: SEE SHT. A-22 FOR FIN. SCHED.
3. INTERIOR ELEV. INDICATOR. FOR MANY INT. ELEV. NOT SO INDICATED SEE BLDG. SECTIONS, SHTS. A-10, A-11.
4. FOR INTERIOR PARTITIONS W/ FINISH TO STRUCTURE ABOVE, SEE REF. CLG. PLAN, SHT. A-13. ALL OTHER INT. PART. FINISH TO MIN 4" ABOVE CLG.
5. DETAIL NUMBER — PARTITION TYPE: SEE DETAIL, SHEET A-18. — NOTE
   - R - RATED PARTN.
   - 1 - CEM. PLAS. @ ANIMAL HOLD. SIDE, GYP. BD. @ BONDED STOR. SIDE. SEE 19/A-18.
   - 2 - RATED GYP. BD. @ CORR. SIDE, CEM. PLAS. @ @ ANIMAL HOLD. SIDE. SEE 19/A-18.

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.
	4/1/82	AS-BUILT	BJT	

REGISTERED ARCHITECT CHARLES F. SCHRADER No. C4812 STATE OF CALIFORNIA

RTA
REID & TARICS ASSOCIATES
ARCHITECTS & ENGINEERS
1019 MARKET STREET
SIXTH FLOOR
SAN FRANCISCO, CA 94103
(415) 863-2420

JOB NO. 7905 — DATE JULY 16, '80

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

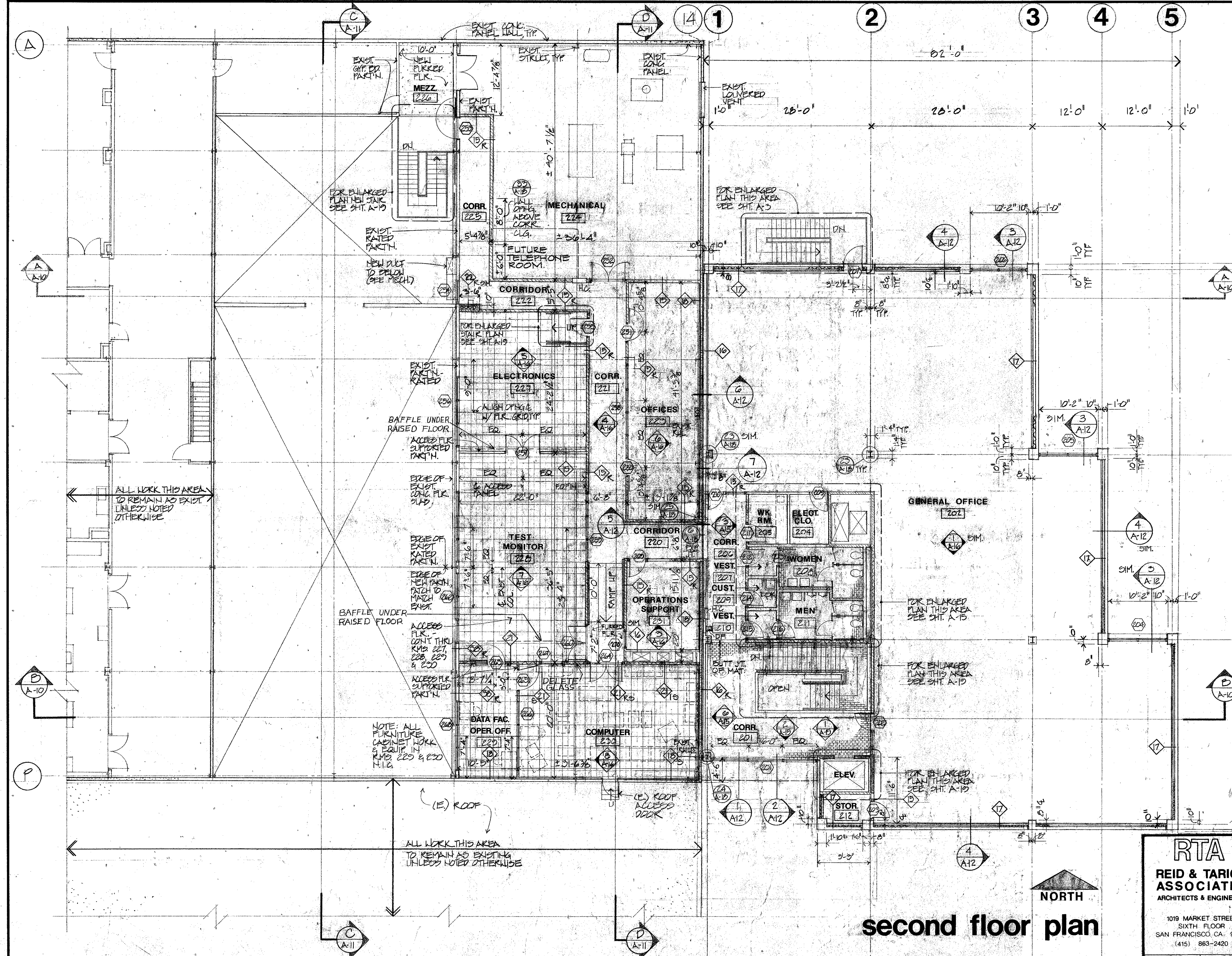
LIFE SCIENCES
FLIGHT EXPERIMENTS FACILITY
(ADDITION TO BUILDING N-240)
PROJECT NO. 2171

DRAWN: MYS CPS — CHECKED: RAB — INDEX: 9/10/81 — MATERIAL
DESIGN ENGINEER: CFS — BRANCH — 7/25/80
APPROVED — ASSM. DWG. NO.
APPROVED — SCALE: 1/8" = 1'-0"
LIMITS UNLESS NOTED: FRAC. DEC. ANG.

A 240-7903 A-7 — REV.

★U.S. GOVERNMENT PRINTING OFFICE: 1979-690-700

2-30178



second floor plan

NOTES

1. ⬡ OPENING NO.: SEE SHT. A21 FOR SCHEDULE.
2. ▭ ROOM NO.: SEE SHT. A22 FOR FIN. SCHEDULE.
3. ◇ INTERIOR ELEVATION INDICATOR. FOR MANY INT. ELEV. NOT SO INDICATED SEE BLDG. SECTIONS, SHTS. A-10 & A-11.
4. FOR INT. PART'N. W/ FINISH TO STRUCTURE ABOVE SEE REFLECTED CLG. PLAN SH. A-14. ALL OTHER INT. PART'N. FIN. MIN. 4" ABOVE CLG.
5. ◇ DETAIL NUMBER / PARTITION TYPE: SEE DETAIL, SHEET A-18. NOTE
   - R - RATED PART'N.
   - 1 - GYP. BD @ ONE SIDE ONLY.
   - S - SOUND ABSORPTION PANELS ON COMPUTER ROOM SIDE. SEE 24/A-23.

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP
	4-1-82	AS BUILT	BJT	

RTA
REID & TARICS ASSOCIATES
ARCHITECTS & ENGINEERS
1019 MARKET STREET
SIXTH FLOOR
SAN FRANCISCO, CA. 94103
(415) 863-2420

JOB NO 7905 — DATE JULY 16, '80

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

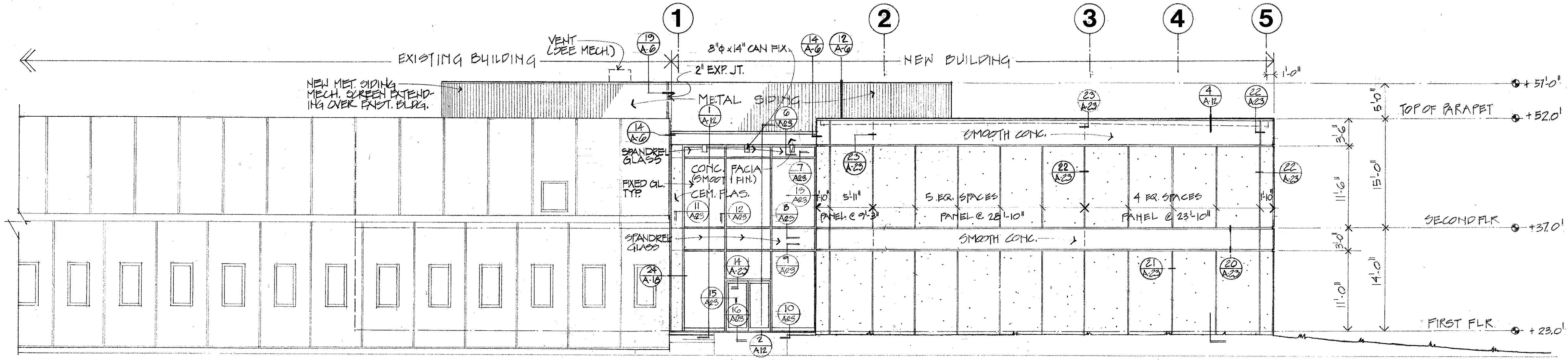
LIFE SCIENCES
FLIGHT EXPERIMENTS FACILITY
(ADDITION TO BUILDING N-240)
PROJECT NO. 2171

DRAWN: CFS, MYS — CHECKED: RAB — DESIGN ENGINEER: CFS — DATE: 7/25/80
SCALE: 1/8" = 1'-0"
A 240-7903 A-8

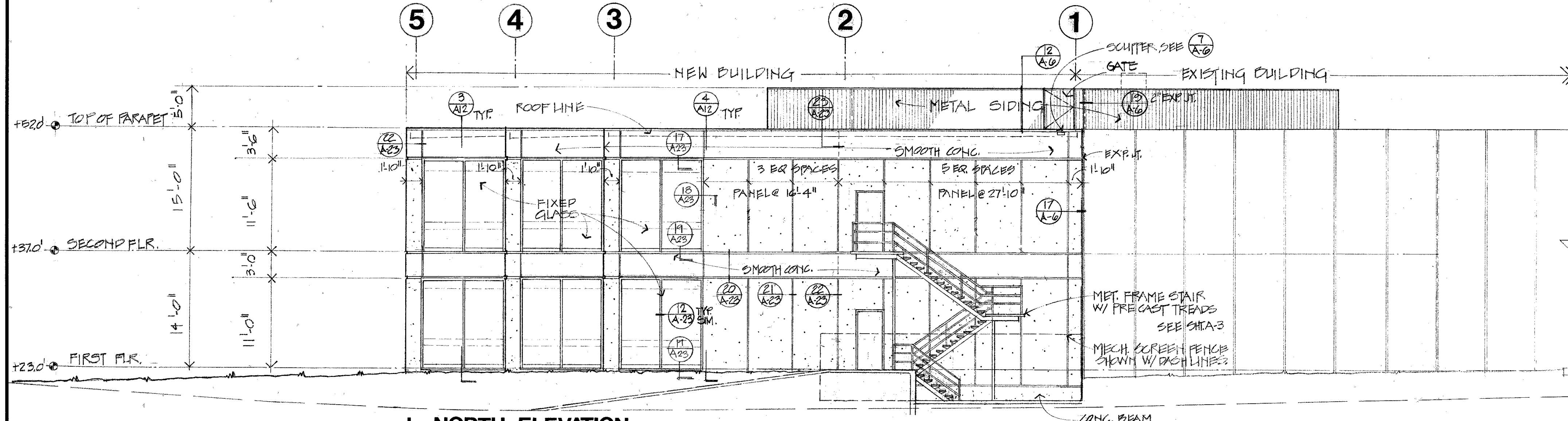
REGISTERED ARCHITECT — CHARLES F. SCHRADER — No. C4812 — STATE OF CALIFORNIA

U.S. GOVERNMENT PRINTING OFFICE: 1979-690-780

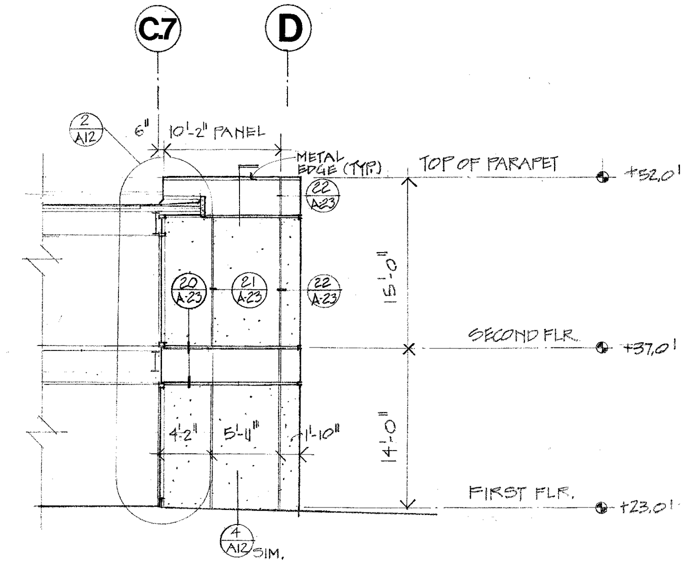
2-30178



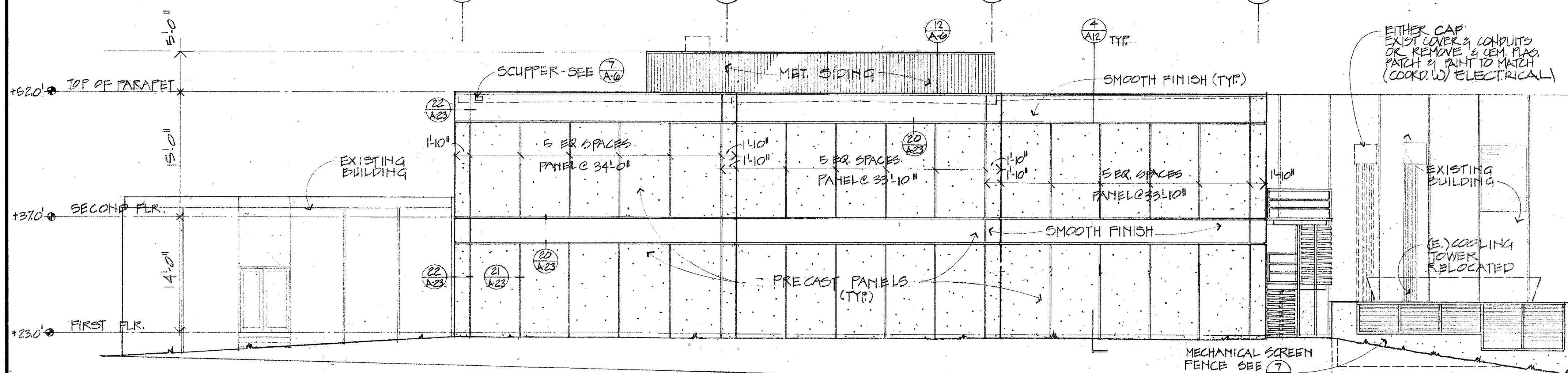
a SOUTH ELEVATION



b NORTH ELEVATION



c WEST ELEVATION (PARTIAL)



d EAST ELEVATION

exterior elevations

REGISTERED ARCHITECT CHARLES F. SCHRADER No. C4812 STATE OF CALIFORNIA

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.
	4/2/82	AS-BUILT	BJT	

RTA
REID & TARICS ASSOCIATES
ARCHITECTS & ENGINEERS
1019 MARKET STREET
SIXTH FLOOR
SAN FRANCISCO, CA 94103
(415) 863-2420

JOB NO. 7505 DATE JULY 6, '80

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

LIFE SCIENCES
FLIGHT EXPERIMENTS FACILITY
(ADDITION TO BUILDING N-240)
PROJECT NO. 2171

DRAWN CFS · CHECKED ROB 9/10/80 · MATERIAL · DESIGN ENGINEER CFS · 7/25/80 · APPROVED · SCALE 1/8" = 1'-0"

A240-7903 A-9

U.S. GOVERNMENT PRINTING OFFICE: 1979-690-700

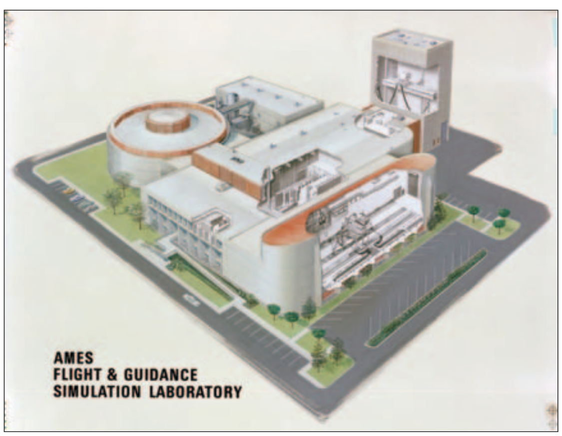
2-30178

Additional Images:

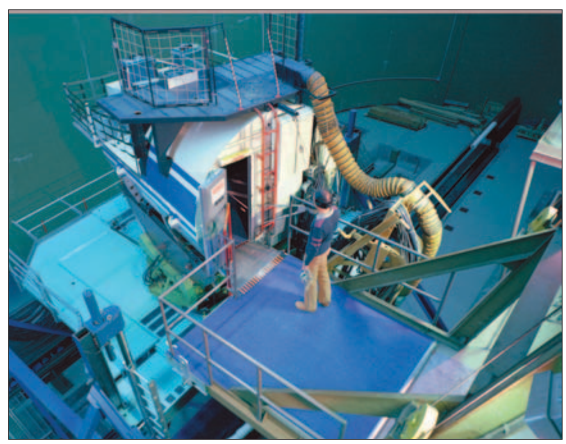
N-243: Flight and Guidance Simulation Laboratory

N-243 under construction, 4 October 1965 (Source: NASA Ames Research Center, A-35531)

N-243, Aerial photograph, 5 July 1977 (Source: NASA Ames Research Center, AC77-0846-40)

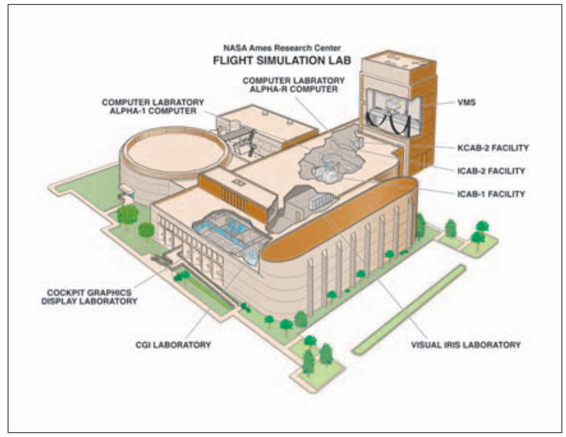


N-243, Diagram of Flight and Guidance Simulation Laboratory, 25 January 1978 (Source: NASA Ames Research Center, AC78-0070)

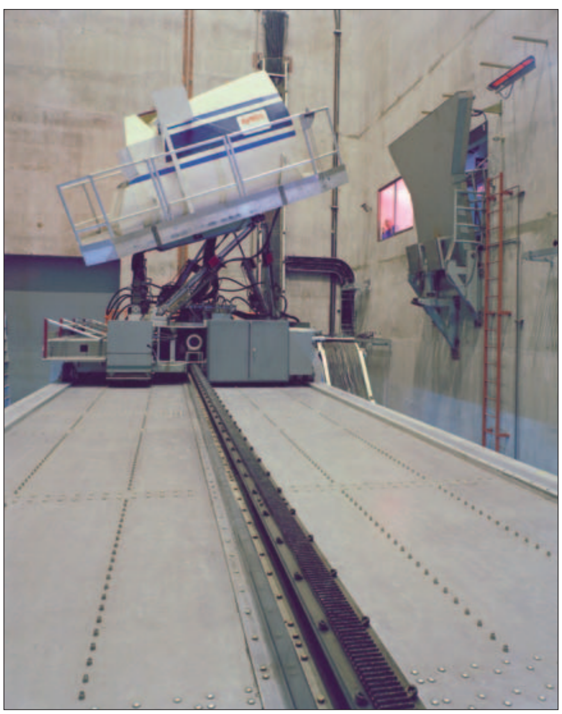


N-243, FSAA Flight Simulator for Advanced Aircraft, 7 March 1989 (Source: NASA Ames Research Center, AC79-0198-11)

N-243, VMS R-Cab: Civil Tiltrotor Simulation Software Screen, 1 December 1994 (Source: NASA Ames Research Center, AC94-0503-7)



N-243, Diagram of Flight and Guidance Simulation Laboratory, July 1998 (Source: NASA Ames Research Center, ACD98-0142)



N-243, Vertical Motion Simulator, 9 February 1979 (Source: NASA Ames Research Center, AC79-0126-3)

N-243, Vertical Motion Simulator cab in motion, 24 October 1997 (Source: NASA Ames Research Center, AC97-0375-1)

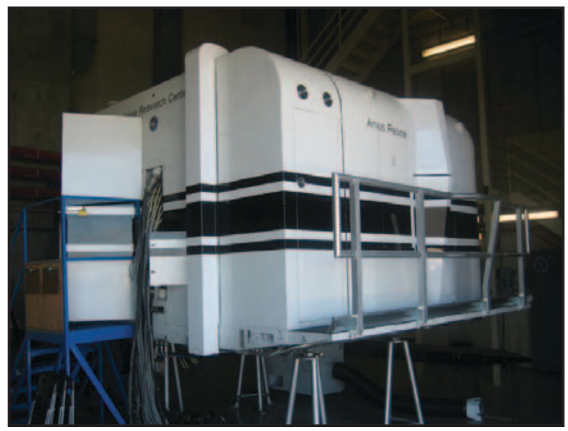
N-243, south facade, east end
(Source: Page & Turnbull)

N-243, north facade, centrifuge
(Source: Page & Turnbull)

N-243, east facade, tower
(Source: Page & Turnbull)

N-243, interior, FSAA high-bay
(Source: Page & Turnbull)

N-243, Vertical Motion Simulator
(Source: Page & Turnbull)



N-243, simulation cab
(Source: Page & Turnbull)

N-243, simulation cab, interior
(Source: Page & Turnbull)

Architectural Drawings for N-243

Space Flight Guidance Research Facility, Flight Simulator for Advanced Aircraft, Basement Flr Plan
Architect: Skidmore, Owings & Merrill
Date: n.d.
Sheet: N/A
NASA EDC # 243-5603-A2

Space Flight Guidance Research Facility, Flight Simulator for Advanced Aircraft, Ground and First Floor Plan
Architect: Skidmore, Owings & Merrill
Date: n.d.
Sheet: N/A
NASA EDC # 243-5603-A3

Space Flight Guidance Research Facility, Flight Simulator for Advanced Aircraft, Second Floor Plan
Architect: Skidmore, Owings & Merrill
Date: n.d.
Sheet: N/A
NASA EDC # 243-5603-A4

Space Flight Guidance Research Facility, Motion Generator, Plot Plan & Drawing Index
Architect: N/A
Date: 19 June 1979
Sheet: A 12370- D1A
NASA EDC # 243-6301-A1

Space Flight Guidance Research Facility, Elevations
Architect: Skidmore, Owings & Merrill
Date: 5 April 1965
Sheet: A 12486-A10
NASA EDC # 243-6401-A10

Space Flight Guidance Research Facility, Elevations
Architect: Skidmore, Owings & Merrill
Date: 5 April 1965
Sheet: A 12486-A10
NASA EDC # 243-6401-A10

Space Flight Guidance Research Facility, Building Sections
Architect: Skidmore, Owings & Merrill
Date: 5 April 1965
Sheet: A 12486-A11
NASA EDC # 243-6401-A11

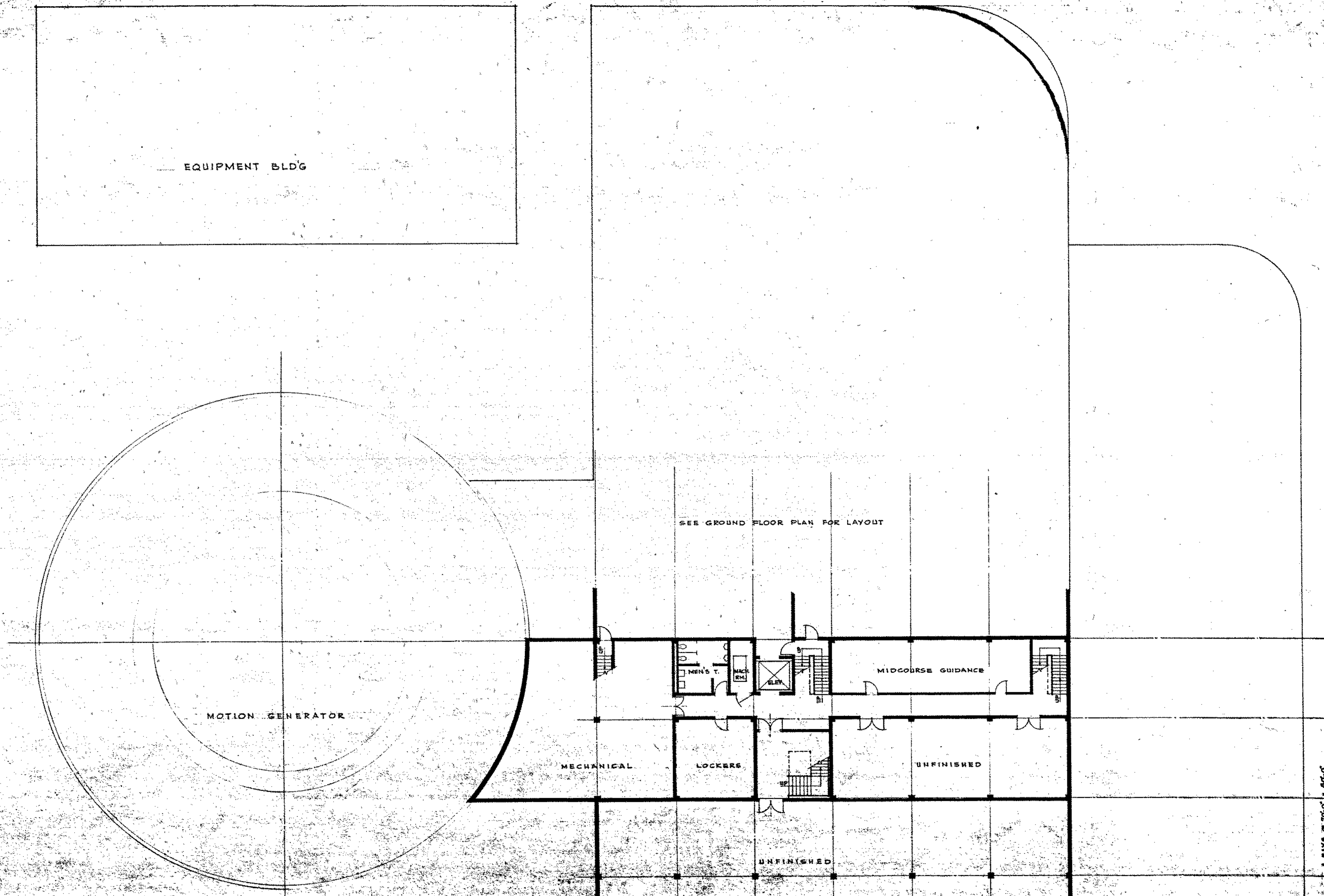
Space Flight Guidance Research Facility, Building Sections
Architect: Skidmore, Owings & Merrill
Date: 5 April 1965
Sheet: A 12486-A12
NASA EDC # 243-6401-A12

Space Flight Guidance Research Facility, Building Sections
Architect: Skidmore, Owings & Merrill
Date: 5 April 1965
Sheet: A 12486-A13
NASA EDC # 243-6401-A13

Addition to Building N-243 Vertical Motion Simulator Building, Exterior Elevations, Details
Architect: Anshen & Allen, Architects/Planners
Date: 28 February 1975
Sheet: A243-02-A5
NASA EDC # 243-7502-A5

Addition to Building N-243 Vertical Motion Simulator Building, Exterior Elevations, Details
Architect: Anshen & Allen, Architects/Planners
Date: 28 February 1975
Sheet: A243-02-A6
NASA EDC # 243-7502-A6

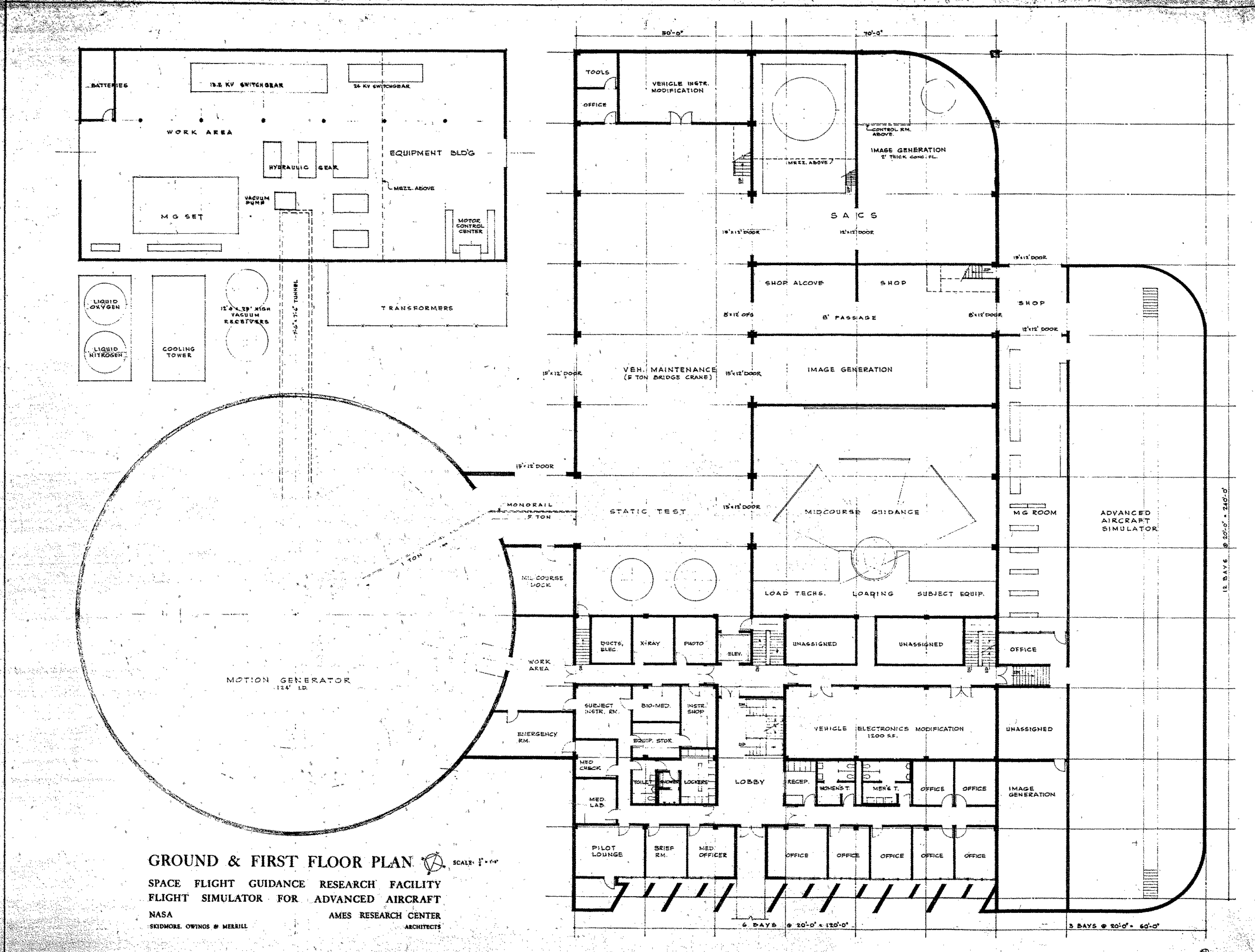
Addition to Building N-243 Vertical Motion Simulator Building, Sections, Seismic Details
Architect: Anshen & Allen, Architects/Planners
Date: 28 February 1975
Sheet: A243-02-A7
NASA EDC # 243-7502-A7



BASEMENT FLOOR PLAN

SPACE FLIGHT GUIDANCE RESEARCH FACILITY
FLIGHT SIMULATOR FOR ADVANCED AIRCRAFT
NASA AMES RESEARCH CENTER
SKIDMORE, OWINGS & MERRILL ARCHITECTS

243-5603-A2
BASEMENT FLOOR PLAN

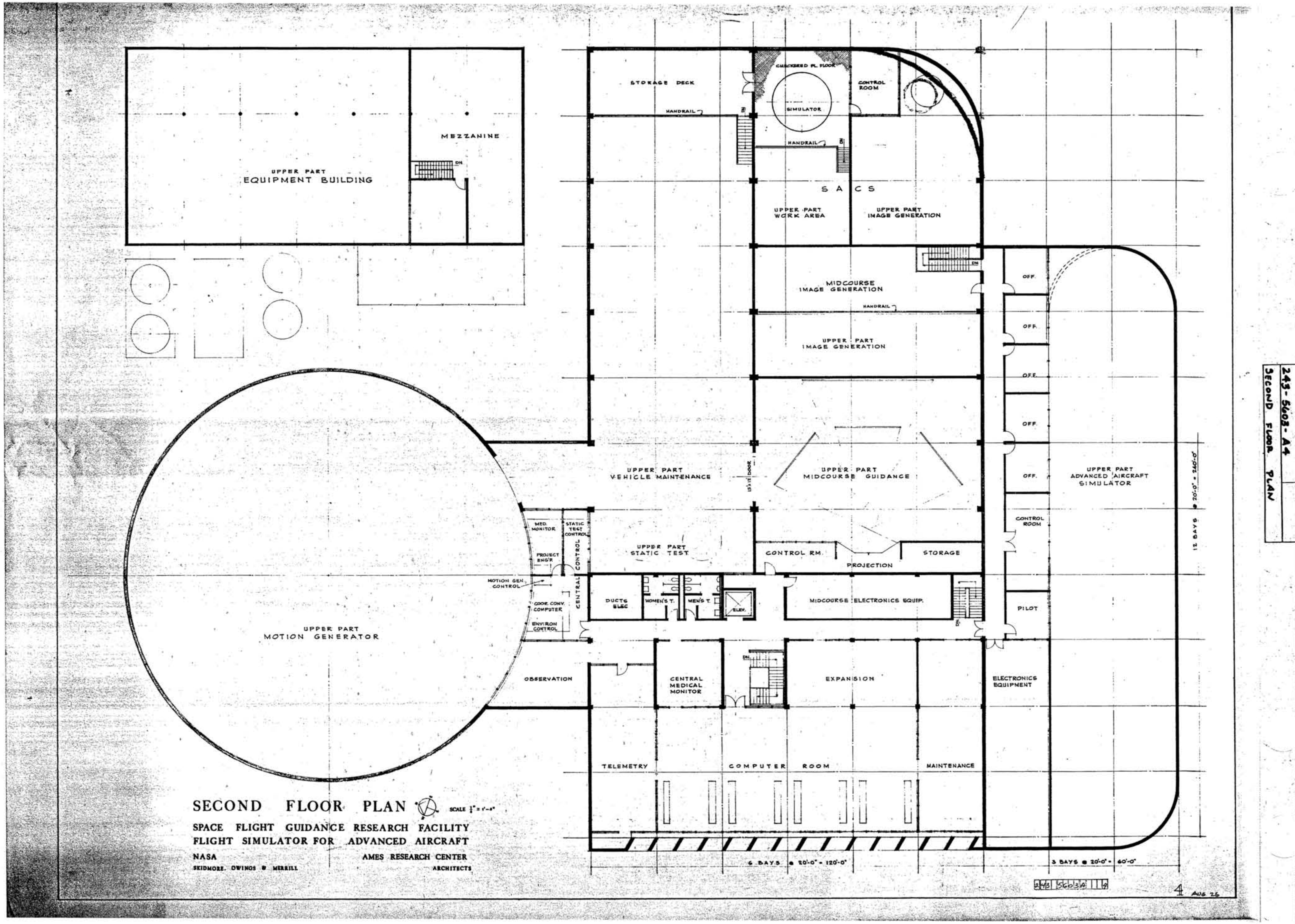


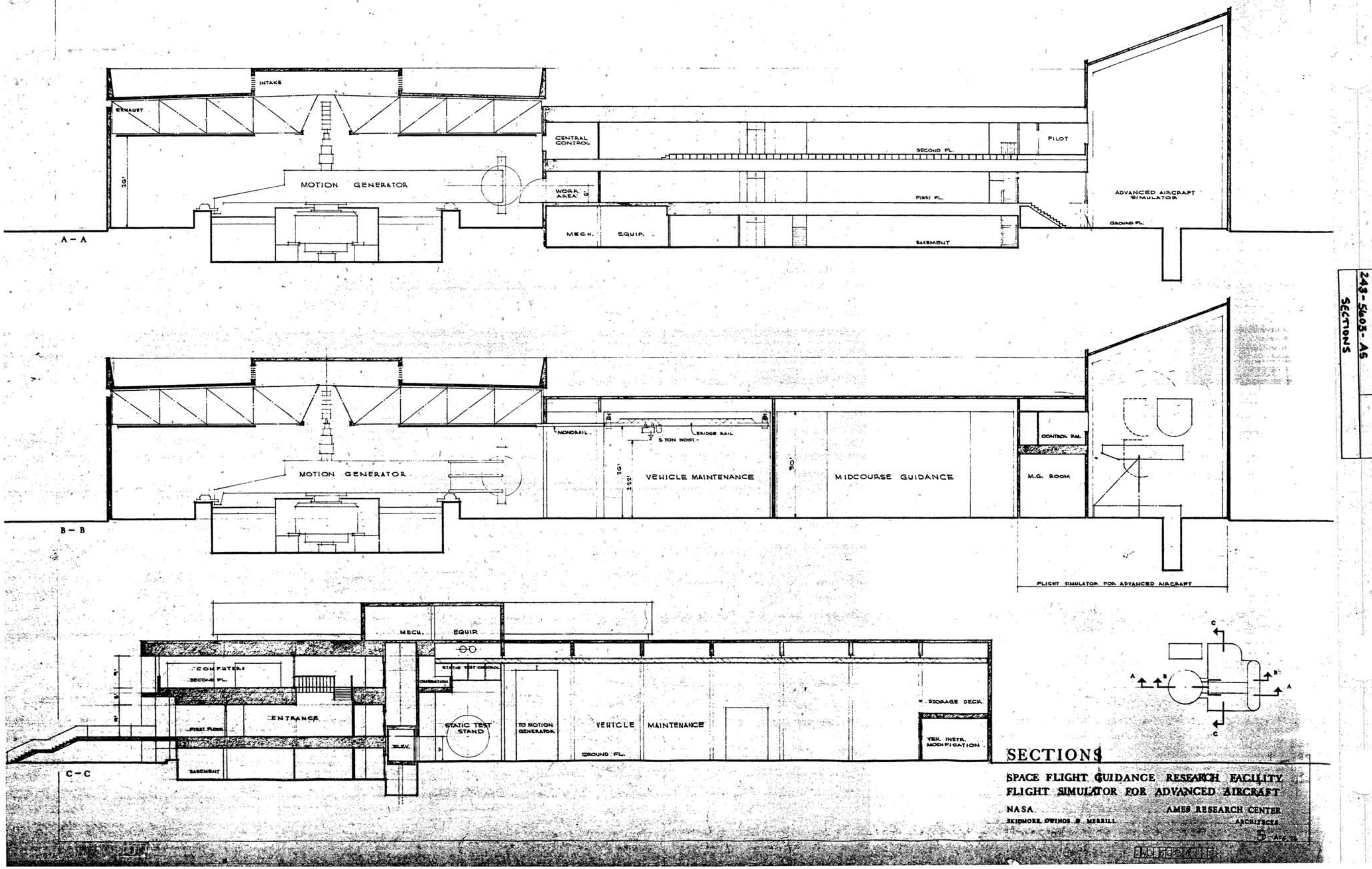
GROUND & FIRST FLOOR PLAN

SPACE FLIGHT GUIDANCE RESEARCH FACILITY
FLIGHT SIMULATOR FOR ADVANCED AIRCRAFT

NASA — AMES RESEARCH CENTER

SKIDMORE, OWINGS & MERRILL — ARCHITECTS


UPPER PART
EQUIPMENT BUILDING
MEZZANINE
STORAGE DECK
HANDRAIL
CHECKERED PL. FLOOR
SIMULATOR
CONTROL ROOM
S A C S
UPPER PART
WORK AREA
UPPER PART
IMAGE GENERATION
MIDCOURSE
IMAGE GENERATION
UPPER PART
IMAGE GENERATION
OFF.
UPPER PART
VEHICLE MAINTENANCE
UPPER PART
MIDCOURSE GUIDANCE
UPPER PART
ADVANCED AIRCRAFT
SIMULATOR
CONTROL ROOM
MED. MONITOR
STATIC TEST CONTROL
PROJECT ENG'R
CENTRAL CONTROL
UPPER PART
STATIC TEST
CONTROL RM.
PROJECTION
STORAGE
MOTION GEN. CONTROL
COOR. CONV. COMPUTER
ENVIRON CONTROL
DUCTS ELEC.
WOMEN'S T.
MEN'S T.
ELEV.
MIDCOURSE ELECTRONICS EQUIP.
PILOT
UPPER PART
MOTION GENERATOR
OBSERVATION
CENTRAL MEDICAL MONITOR
EXPANSION
ELECTRONICS EQUIPMENT
TELEMETRY
COMPUTER ROOM
MAINTENANCE
12 BAYS @ 20'-0" = 240'-0"
6 BAYS @ 20'-0" = 120'-0"
3 BAYS @ 20'-0" = 60'-0"
SECOND FLOOR PLAN
SPACE FLIGHT GUIDANCE RESEARCH FACILITY
FLIGHT SIMULATOR FOR ADVANCED AIRCRAFT
NASA
AMES RESEARCH CENTER
SKIDMORE, OWINGS & MERRILL
ARCHITECTS
243-5603-A4
SECOND FLOOR PLAN



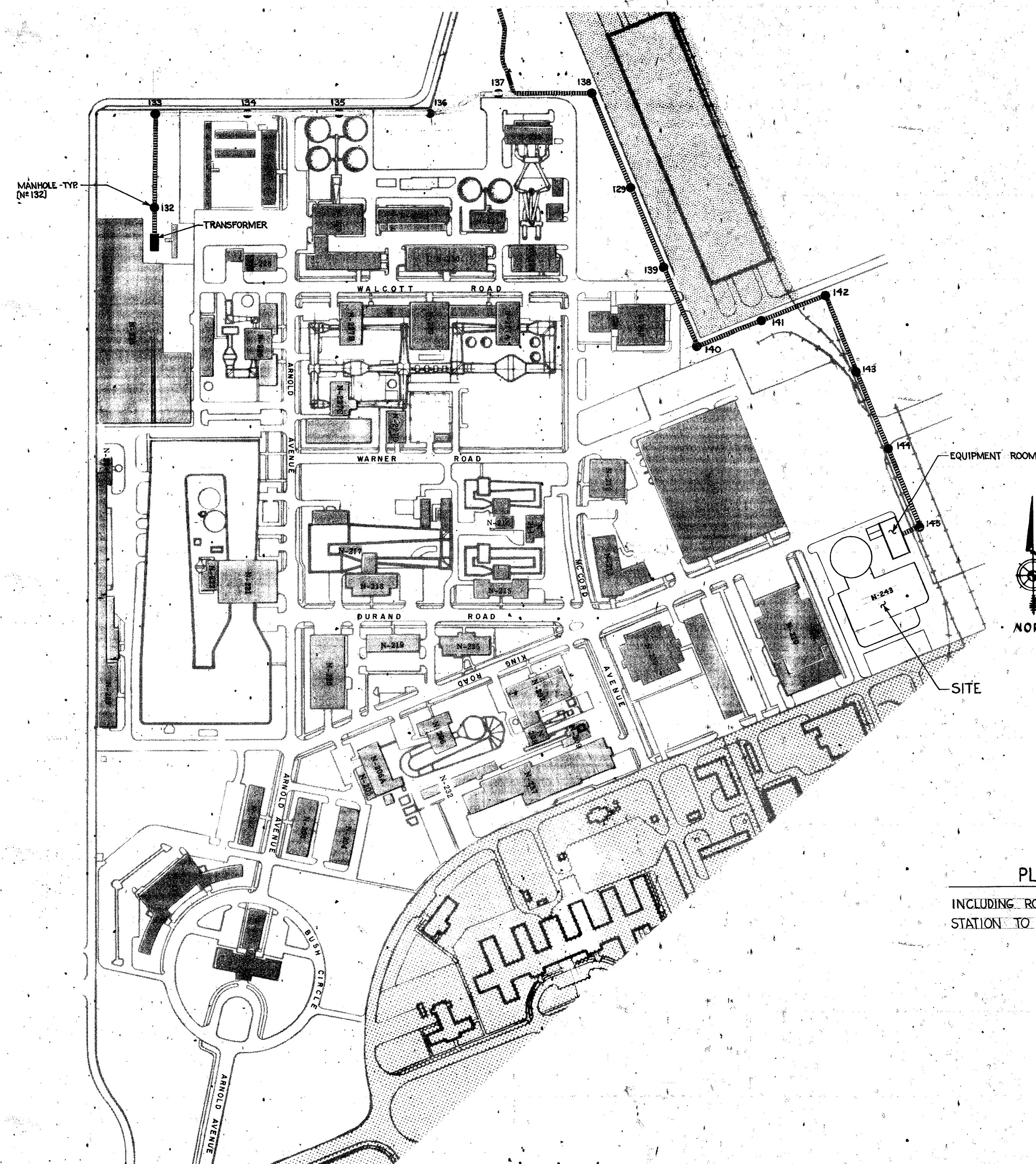
SECTIONS

SPACE FLIGHT GUIDANCE RESEARCH FACILITY
FLIGHT SIMULATOR FOR ADVANCED AIRCRAFT

NASA — AMES RESEARCH CENTER

SKIDMORE, OWINGS & MERRILL — ARCHITECTS

5



· MOTION GENERATOR DRAWING LIST ·

A 12370-D1	PLOT PLAN & DRAWING INDEX
D2	CAPSULE GEOMETRY
D3	VIBRATION ENVELOPE
D4	VELOCITY LIMITING BOUNDARY CONDITIONS
D5	ENVIRONMENTAL SYSTEMS CONTROL & LOCATION
D6	ELECTRICAL ONE-LINE DIAGRAM
D7	110 K.V. SUBSTATION LAYOUT

PLOT PLAN

INCLUDING ROUTE FROM TRANSFORMER STATION TO FACILITY SITE

SCALE: 1" = 200'

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.
A	2-19-65	REDRAWN - RELOCATED DUCT RUNS AND MANHOLES	W.W.	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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MOFFETT FIELD, CALIFORNIA

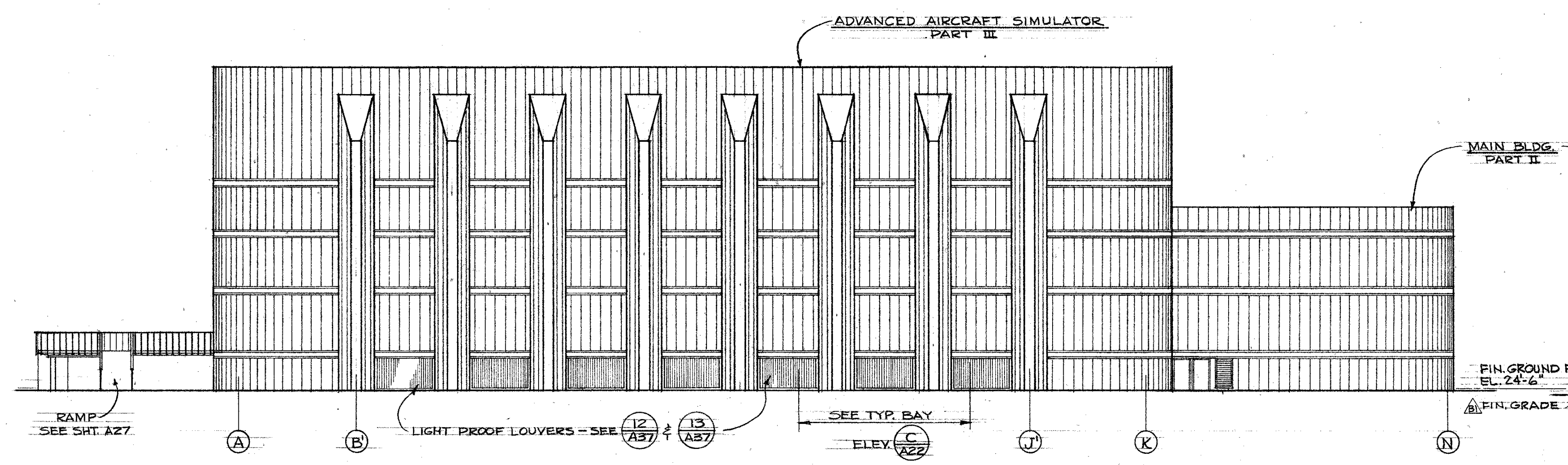
·SPACE · FLIGHT · GUIDANCE · RESEARCH · FACILITY·
· MOTION · GENERATOR ·
· PLOT PLAN & DRAWING INDEX ·

DRAWN: M.B. & W.W.	CHECKED	INDEX: 6/18/79	MATERIAL
DESIGN ENGINEER	BRANCH: RF.EE.		LIMITS UNLESS NOTED: FRAC. / DEC. / ANG.
APPROVED	ASSM. DWG. NO.		A12370-D1
APPROVED	SCALE: NOTED		REV. A

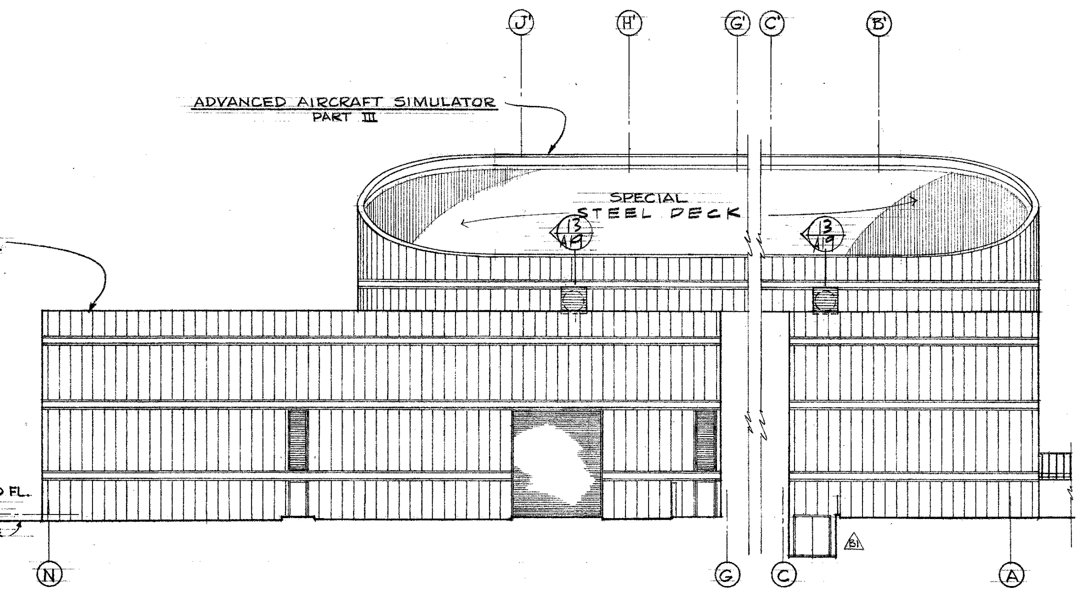
A12370-D1A

243 6301 A

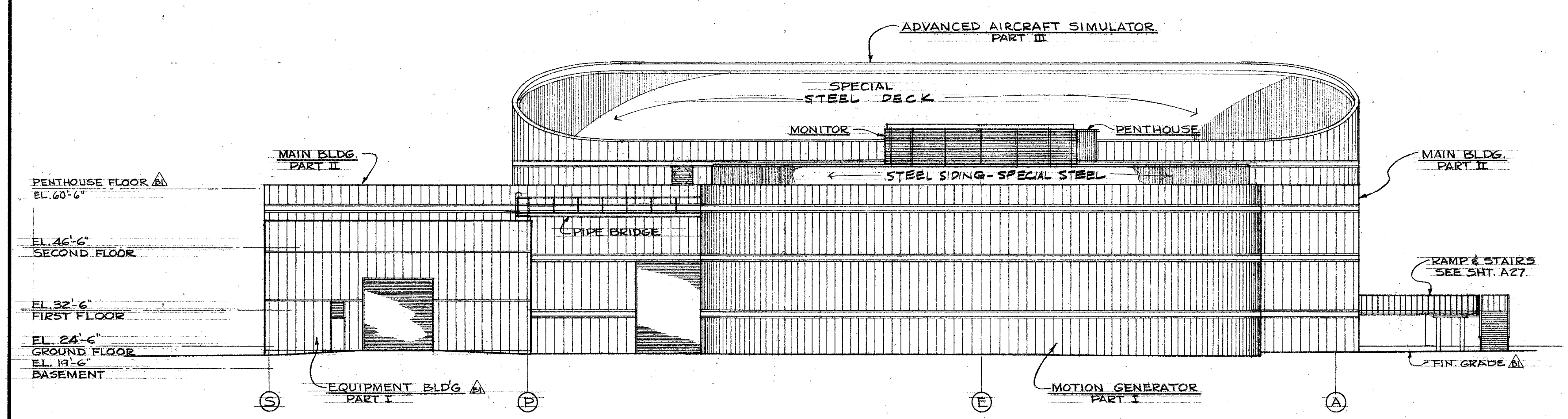
1



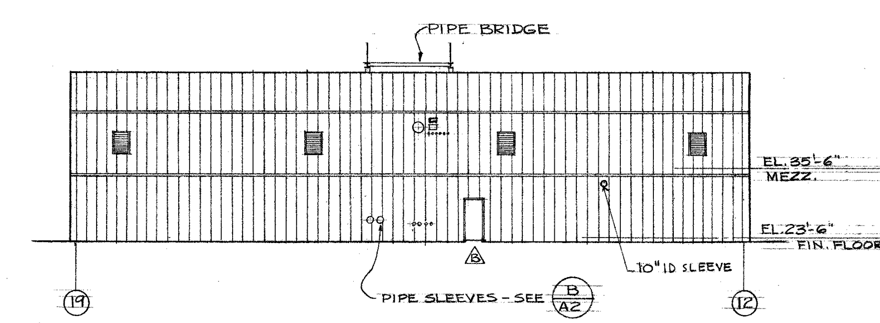
E SOUTH ELEVATION



G NORTH ELEVATION

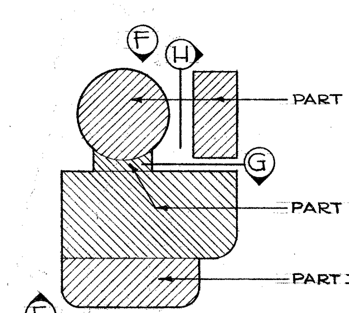


F NORTH ELEVATION



H WEST ELEVATION
EQUIPMENT BLD'G

NOTES–
1. ALL EXTERIOR CONCRETE WALL SURFACES TO HAVE SAND BLASTED FINISH.
2. SEE SHEET A22 FOR TYPICAL EXTERIOR CONCRETE FORMING DETAILS.



KEY PLAN

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.
B1	5-17-65	COORDINATION REVISIONS	CM	
B	5-7-65	REVISIONS PER ADDENDUM	CM	

SKIDMORE, OWINGS & MERRILL
ARCHITECTS
ONE BUSH STREET SAN FRANCISCO, CALIFORNIA
APPROVED FOR THE ARCHITECTS
13470
APR 5 1965

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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MOFFETT FIELD, CALIFORNIA

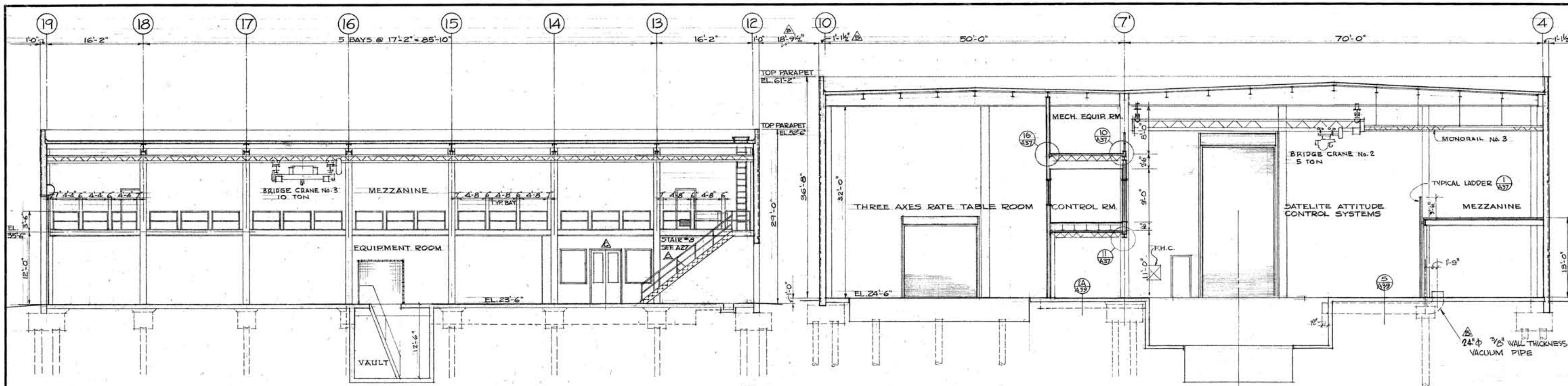
SPACE FLIGHT GUIDANCE RESEARCH FACILITY

ELEVATIONS

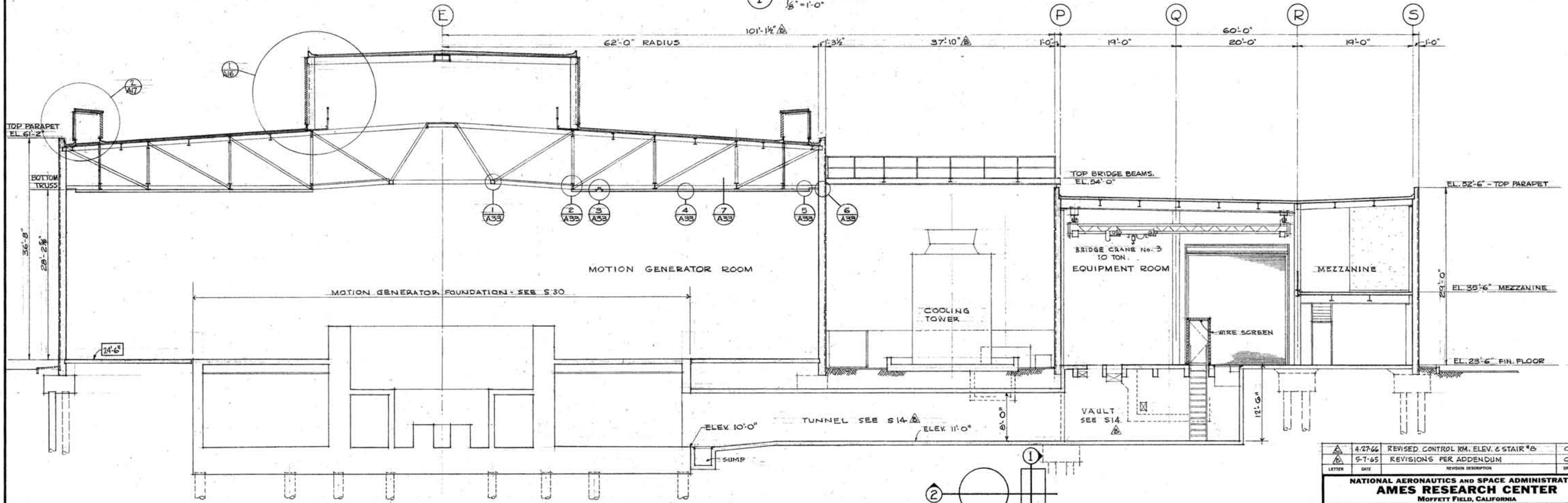
DRAWN: V B — CHECKED: [illegible] — INDEX: [illegible]
DESIGN ENGINEER — BRANCH — MATERIAL — LIMITS UNLESS NOTED: FRAC. DEC. ANG.
APPROVED: [illegible] 4-5-65 — ASSM. DWG. NO. — APPROVED
SCALE: 1/16" = 1'-0"
A 12486 A10 REV. B1

A

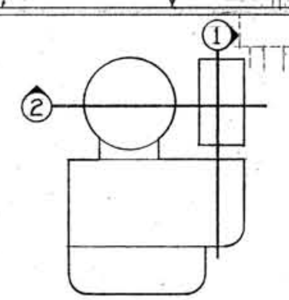
243-640 A-10



1 SECTION
1/8" = 1'-0"



2 SECTION
1/8" = 1'-0"



KEY PLAN

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP
C	4-27-66	REVISED CONTROL RM. ELEV. & STAIR #8	C.M.	
B	5-7-65	REVISIONS PER ADDENDUM	C.M.	

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MOFFETT FIELD, CALIFORNIA

SPACE FLIGHT GUIDANCE RESEARCH FACILITY
BUILDING SECTIONS

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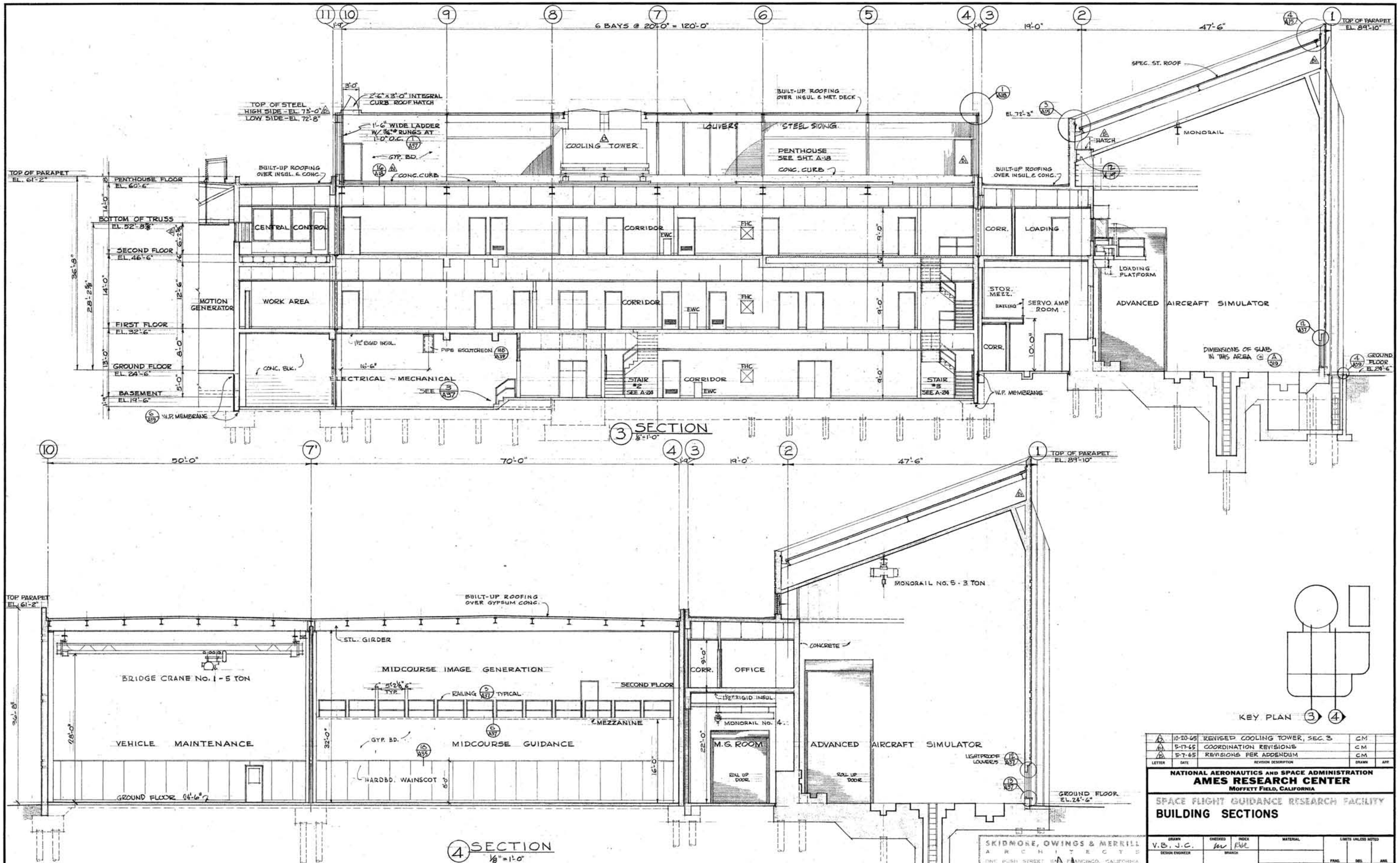
ONE BUSH STREET, SAN FRANCISCO, CALIFORNIA
APPROVED FOR THE ARCHITECTS
JOB NO. 12470 DATE APR 5 1965

DRAWN: V.B., J.C. CHECKED INDEX
DESIGN ENGINEER BRANCH
APPROVED 4-5-65
SCALE 1/8" = 1'-0"
A 12486 A11 REV C

A

243-640/A-11



3	10-20-65	REVISED COOLING TOWER, SEC. 3	CM
2	5-17-65	COORDINATION REVISIONS	CM
1	5-7-65	REVISIONS PER ADDENDUM	CM
LETTER	DATE	REVISION DESCRIPTION	DRAWN

SKIDMORE, OWINGS & MERRILL
ARCHITECTS
ONE BUSH STREET SAN FRANCISCO, CALIFORNIA
APPROVED FOR THE ARCHITECTS
JOB NO. 12470
DATE APR 5 1965

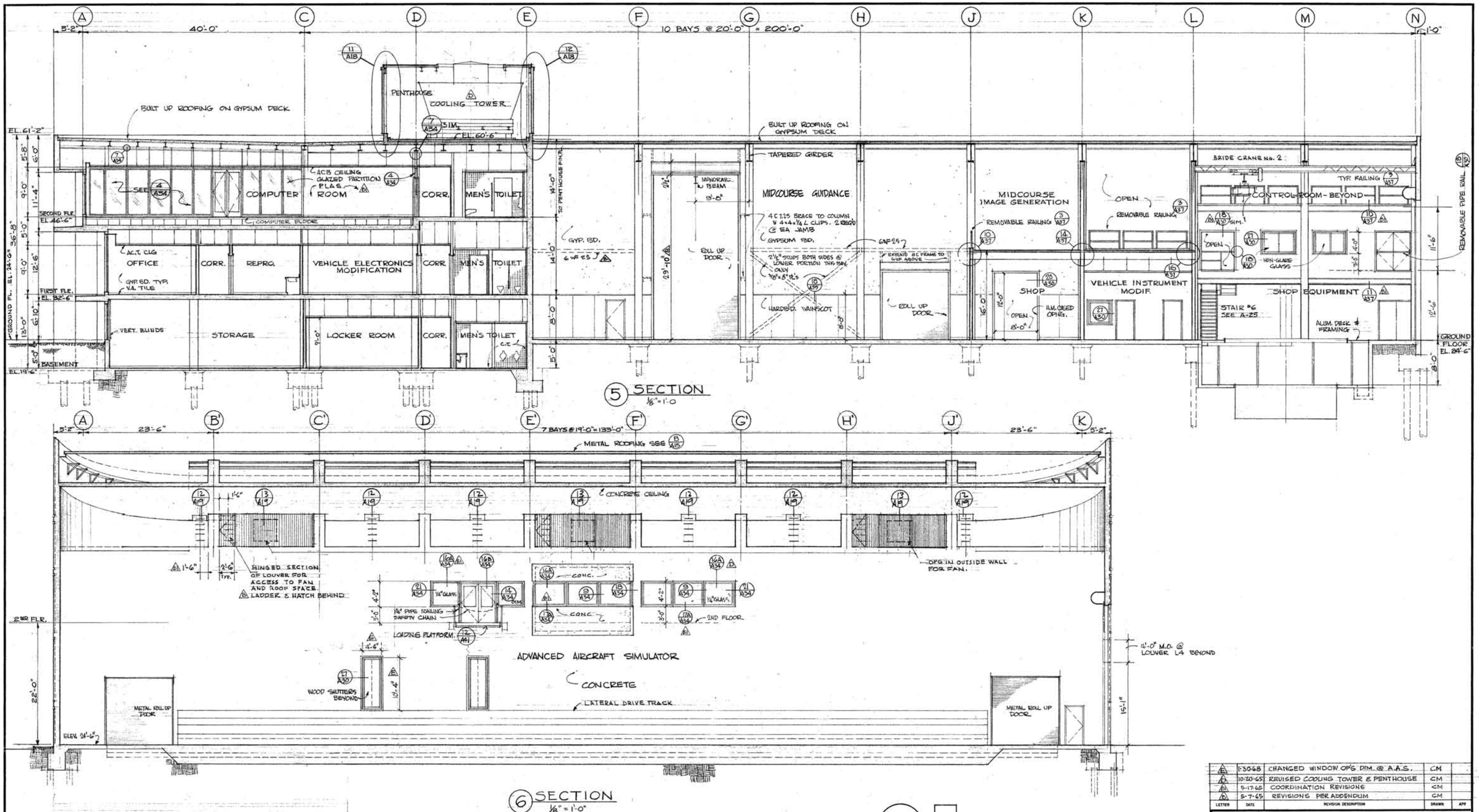
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

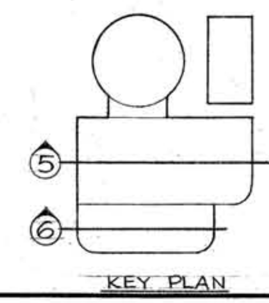
SPACE FLIGHT GUIDANCE RESEARCH FACILITY
BUILDING SECTIONS

DRAWN V.B. J.C. — CHECKED — DESIGN ENGINEER — APPROVED 4-5-65
SCALE 1/8" = 1'-0"
A 12486 A12 D

A

R43-640(A)-12





Letter	Date	Revision Description	Drawn	App
E	1-30-68	CHANGED WINDOW OP'G DIM. @ A.A.S.	CM	
D	10-20-65	REVISED COOLING TOWER & PENTHOUSE	CM	
C	5-17-65	COORDINATION REVISIONS	CM	
B	5-7-65	REVISIONS PER ADDENDUM	CM	

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SPACE FLIGHT GUIDANCE RESEARCH FACILITY

BUILDING SECTIONS

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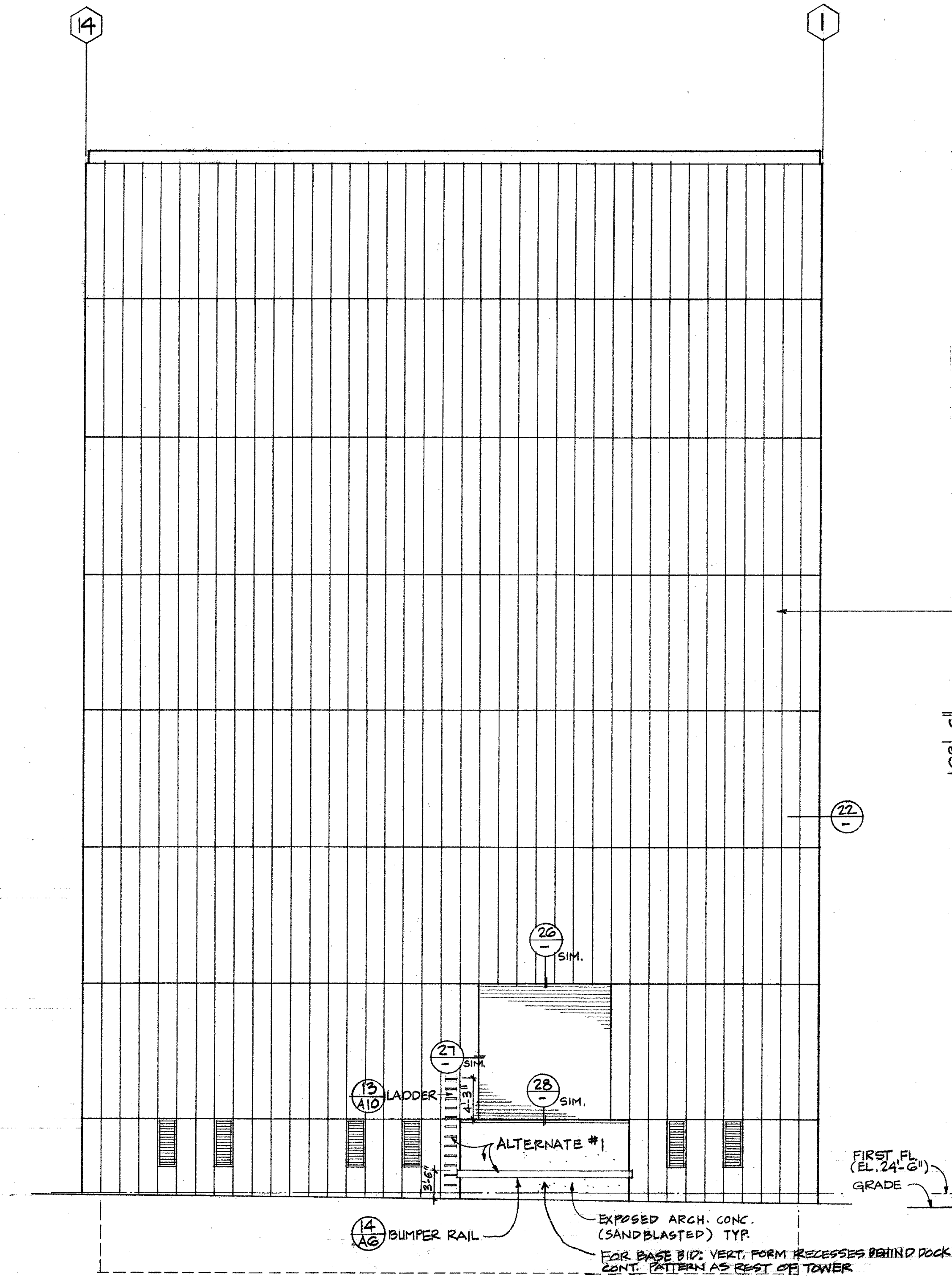
ARCHITECTS
ONE BUSH STREET SAN FRANCISCO CALIFORNIA
APPROVED FOR THE ARCHITECTS
JOB NO. 12470 DATE APR 5 1965

DRAWN V.B. CHECKED INDEX 3342
DESIGN ENGINEER BRANCH
APPROVED
SCALE 1/8" = 1'-0"

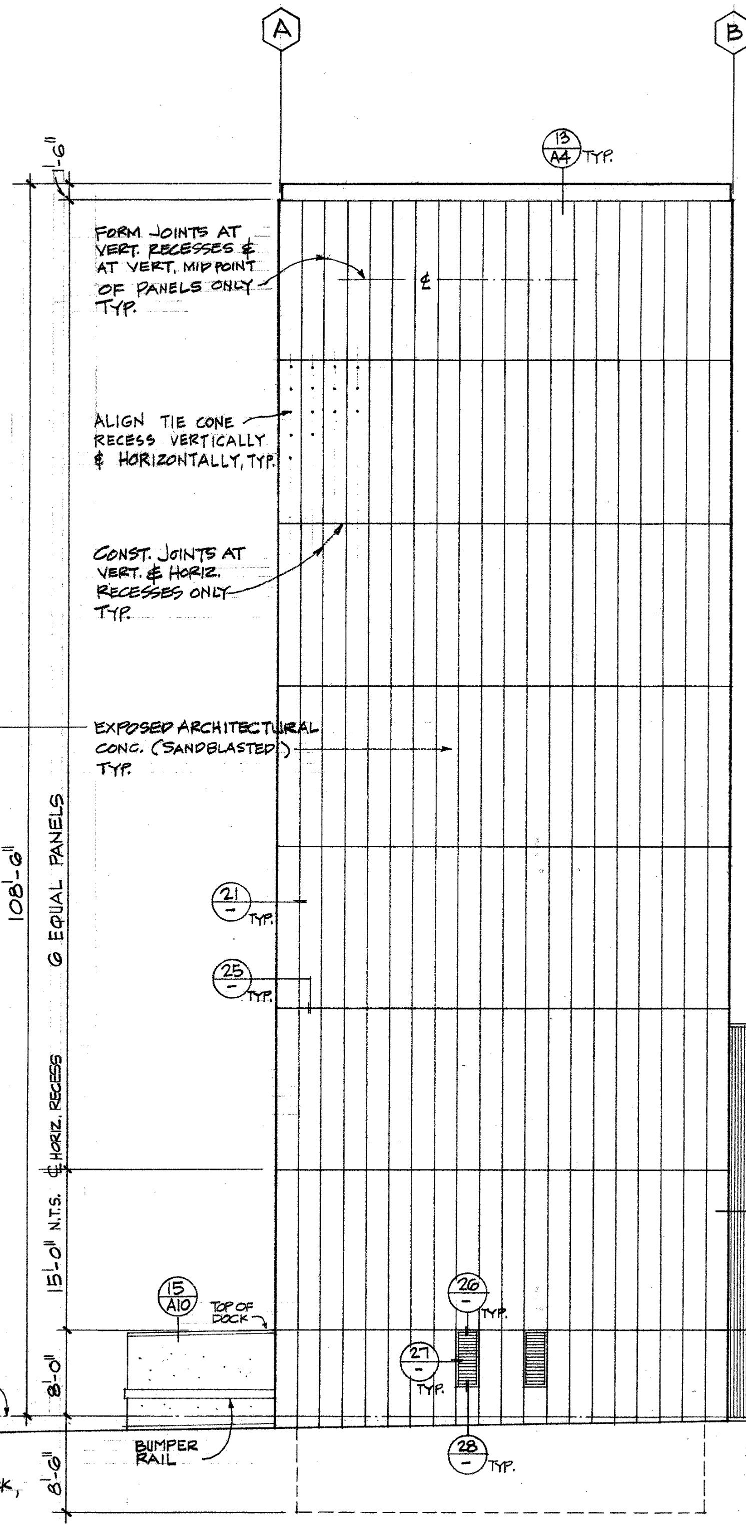
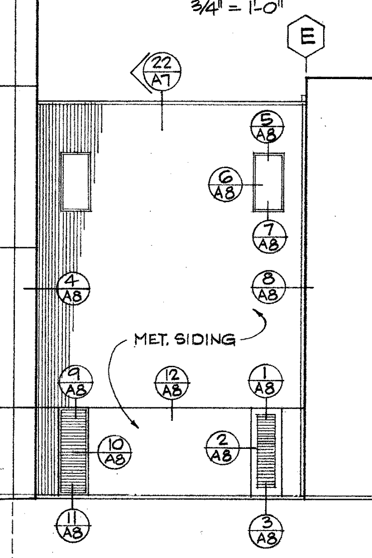
A 12486 A13 E

A

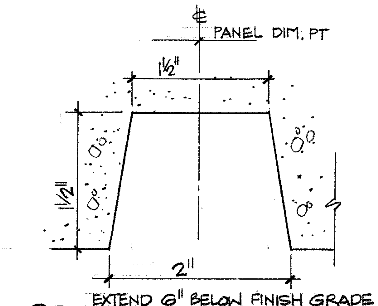
243-6401 A-13



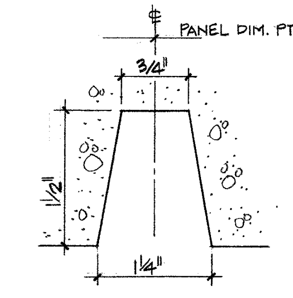
3 EAST ELEVATION
1/8" = 1'-0"

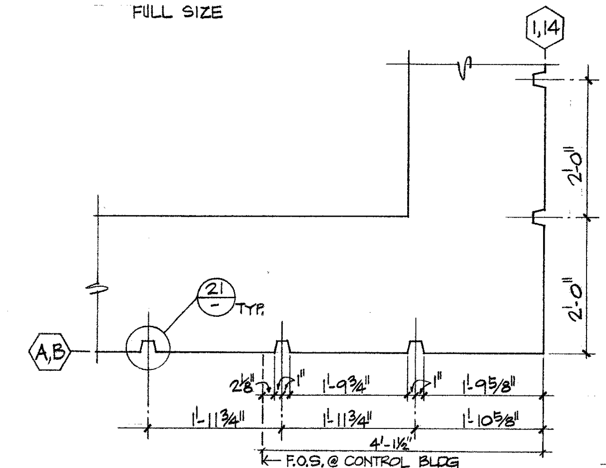
19 NORTH ELEVATION
1/8" = 1'-0"



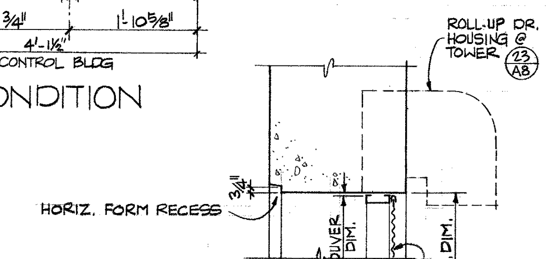
21 TYPICAL VERTICAL FORM RECESS
FULL SIZE



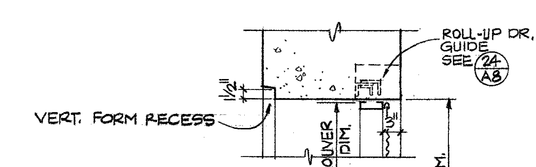
25 TYPICAL HORIZ. FORM RECESS
FULL SIZE



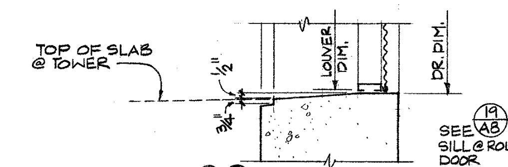
22 TYP. CORNER CONDITION
3/4" = 1'-0"



26 HEAD



27 JAMB



28 SILL
3/4" = 1'-0"

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APR

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ARCHITECTS / PLANNERS
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA 94035

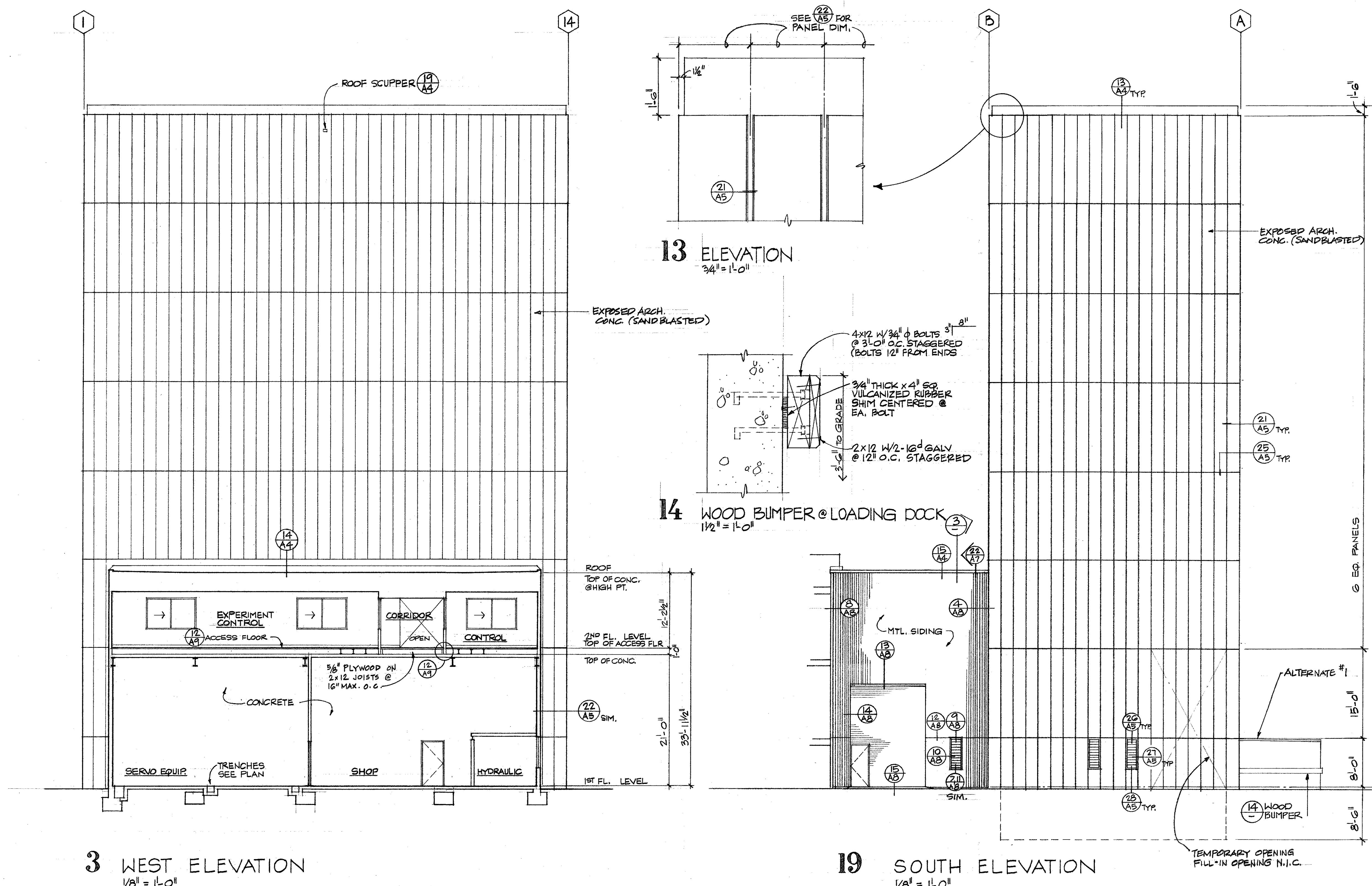
ADDITION TO BUILDING N-243
VERTICAL MOTION SIMULATOR BUILDING
EXTERIOR ELEVATIONS, DETAILS

DRAWN	CHECKED	INDEX	MATERIAL	LIMITS UNLESS NOTED
DESIGN ENGINEER		BRANCH	2-28-75	FRAC. DEC. ANG.
APPROVED RAB		ASSM. DWG. NO.	A 243-02-A5	REV.
APPROVED		SCALE		

GPO 691-008

A

243 75 02 A 5 2-25875



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LETTER	DATE	REVISION DESCRIPTION	DRAWN	APR

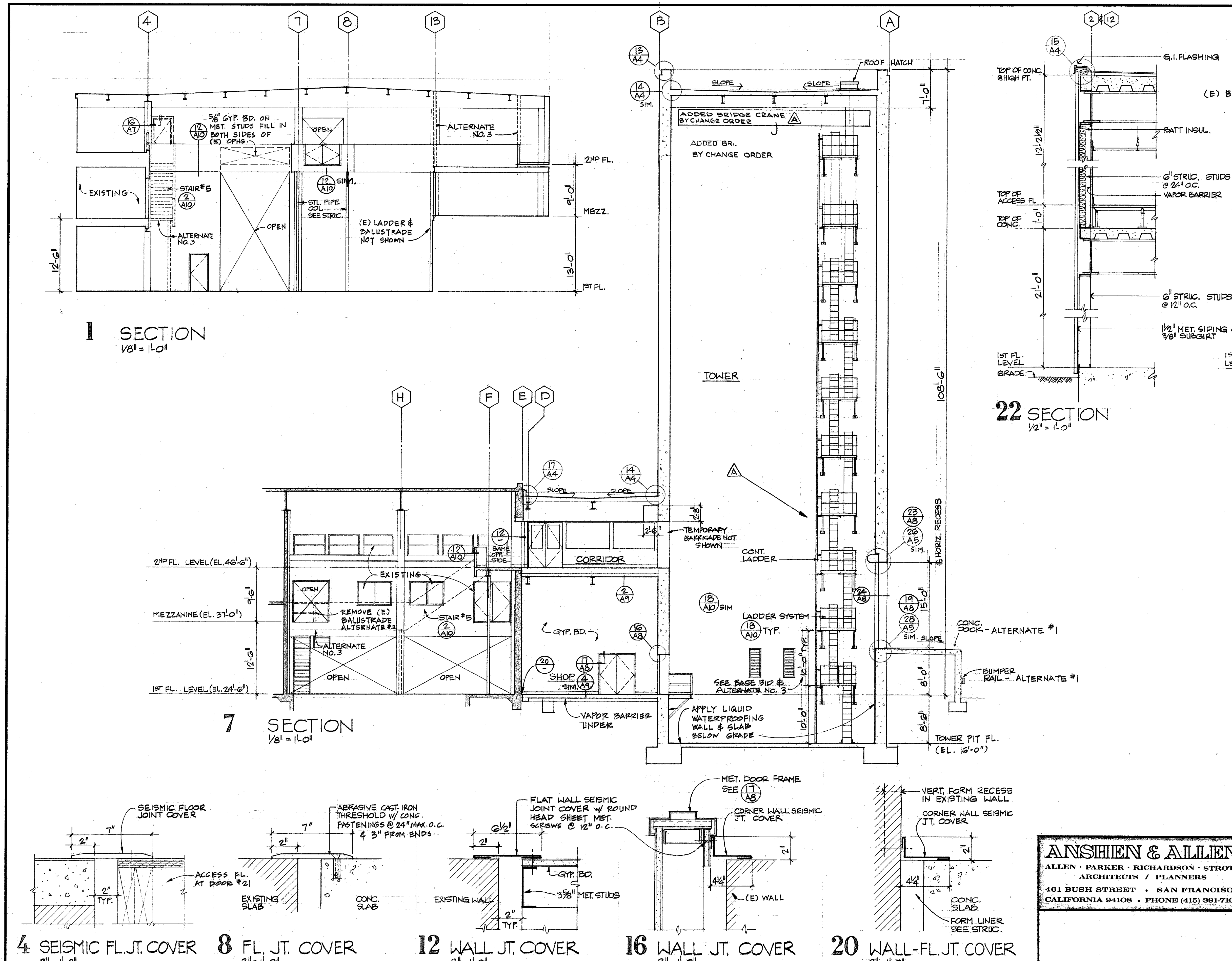
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA 94035

ADDITION TO BUILDING N-243
VERTICAL MOTION SIMULATOR BUILDING
EXTERIOR ELEVATIONS, DETAILS

DRAWN	CHECKED	INDEX	MATERIAL	LIMITS UNLESS NOTED
DESIGN ENGINEER	BRANCH		2-28-75	FRAC. DEC. ANG.
APPROVED RAC	ASSM. DWG. NO.		A 243-02-A6	REV.
APPROVED	SCALE			

A

243 7502A 6 2-25875



LETTER	DATE	REVISION DESCRIPTION	DRAWN	APR
B	6/8/87	REVISED AS PER ECO A20523	D.R.	
A	3-25-76	REVISION AS SHOWN	AZTEC	

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA 94035

ADDITION TO BUILDING N-243
VERTICAL MOTION SIMULATOR BUILDING
SECTIONS, SEISMIC DETAILS

DRAWN | CHECKED | INDEX | MATERIAL | LIMITS UNLESS NOTED
DESIGN ENGINEER | BRANCH | 2-28-75 | FRAC. | DEC. | ANG.
APPROVED RGB | ASSM. DWG. NO. | A 243-02-A7 | REV. B
APPROVED | SCALE

A

243 75 02 A 7 2-25875

ADDITIONAL IMAGES:

N-244: SPACE PROJECTS FACILITY

**N-244, Aerial photograph, 18 May 1989
(Source: NASA Ames Research
Center, AC89-0234-164)**

**N-244, south facade
(Source: Page & Turnbull)**

**N-244, Newly remodeled mezzanine and Space
Station laboratory module mock-up,
15 February 1994
(Source: NASA Ames Research Center,
AC94-0052-1)**

**N-244, main lobby
(Source: Page & Turnbull)**

Architectural Drawings for N-244

Life Sciences Space Flight Facility, Site Plan
Architect: N/A
Date: 30 October 1990
Sheet: A244-8901-XA1
NASA EDC # 244-8901-XA1

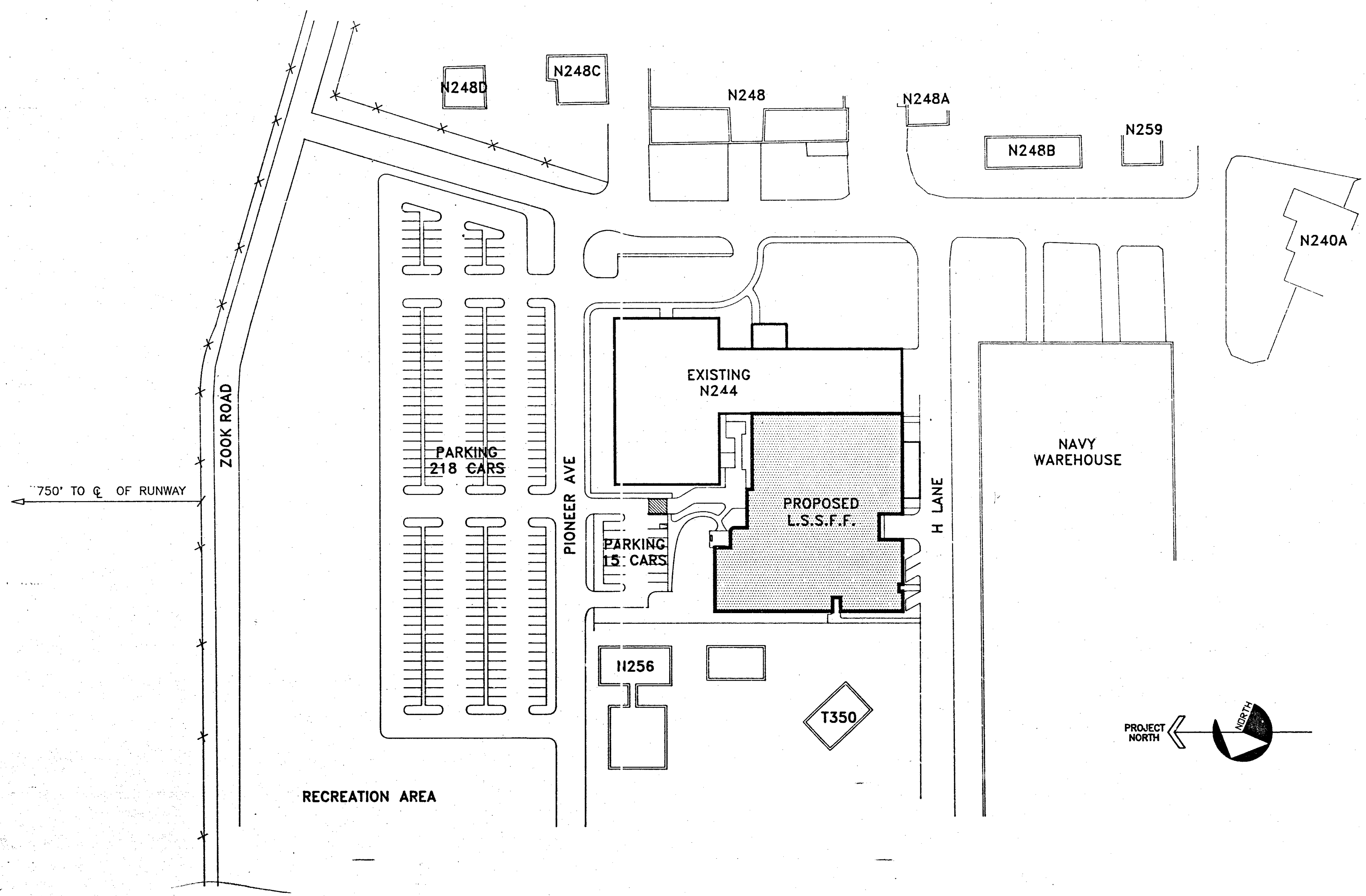
Life Sciences Space Flight Facility, Ground Floor Plan
Architect: N/A
Date: 22 October 1990
Sheet: A244-8901-XA2
NASA EDC # 244-8901-XA2

Life Sciences Space Flight Facility, Second Floor Plan
Architect: N/A
Date: 22 October 1990
Sheet: A244-8901-XA3
NASA EDC # 244-8901-XA3

Life Sciences Space Flight Facility, Third Floor Plan
Architect: N/A
Date: 22 October 1990
Sheet: A244-8901-XA4
NASA EDC # 244-8901-XA4

Life Sciences Space Flight Facility, North and South Elevations
Architect: N/A
Date: 29 October 1990
Sheet: A244-8901-XA6
NASA EDC # 244-8901-XA6

Life Sciences Space Flight Facility, West Elevation and Building Section
Architect: N/A
Date: 22 October 1990
Sheet: A244-8901-XA7
NASA EDC # 244-8901-XA7



PROPOSED L.S.S.F.F. SITE PLAN

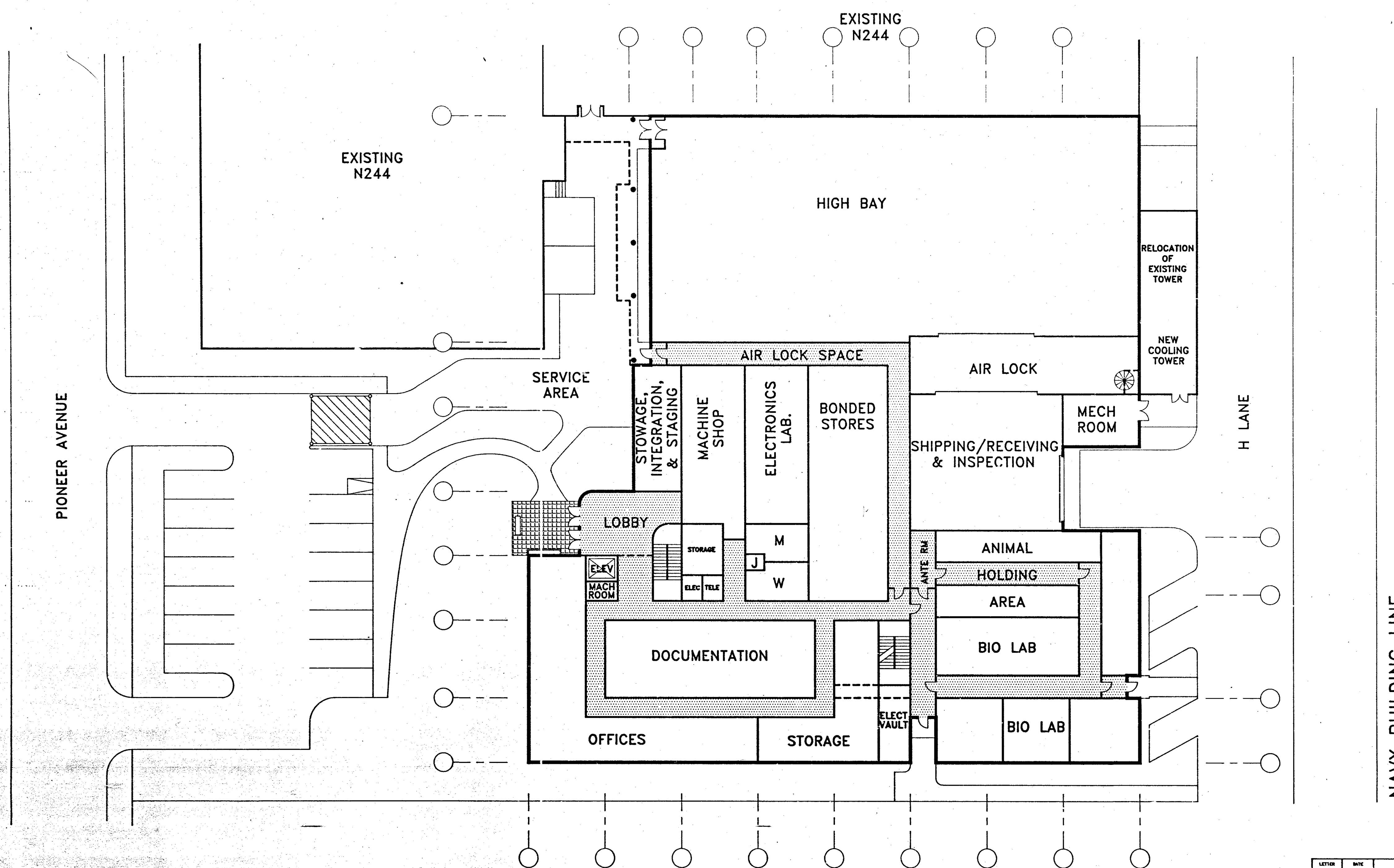
10 60
0 30 120

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

LIFE SCIENCES SPACE FLIGHT FACILITY
SITE PLAN

DRAWN: JME	CHECKED	INDEX	MATERIAL
DESIGN ENGINEER: VS	BRANCH: EEF\BEC	10-30-90	
APPROVED	SCALE: 1" =60'-0"	A 244-8901-XA1	



GROUND FLOOR PLAN

SCALE: 1/16" = 1'-0"

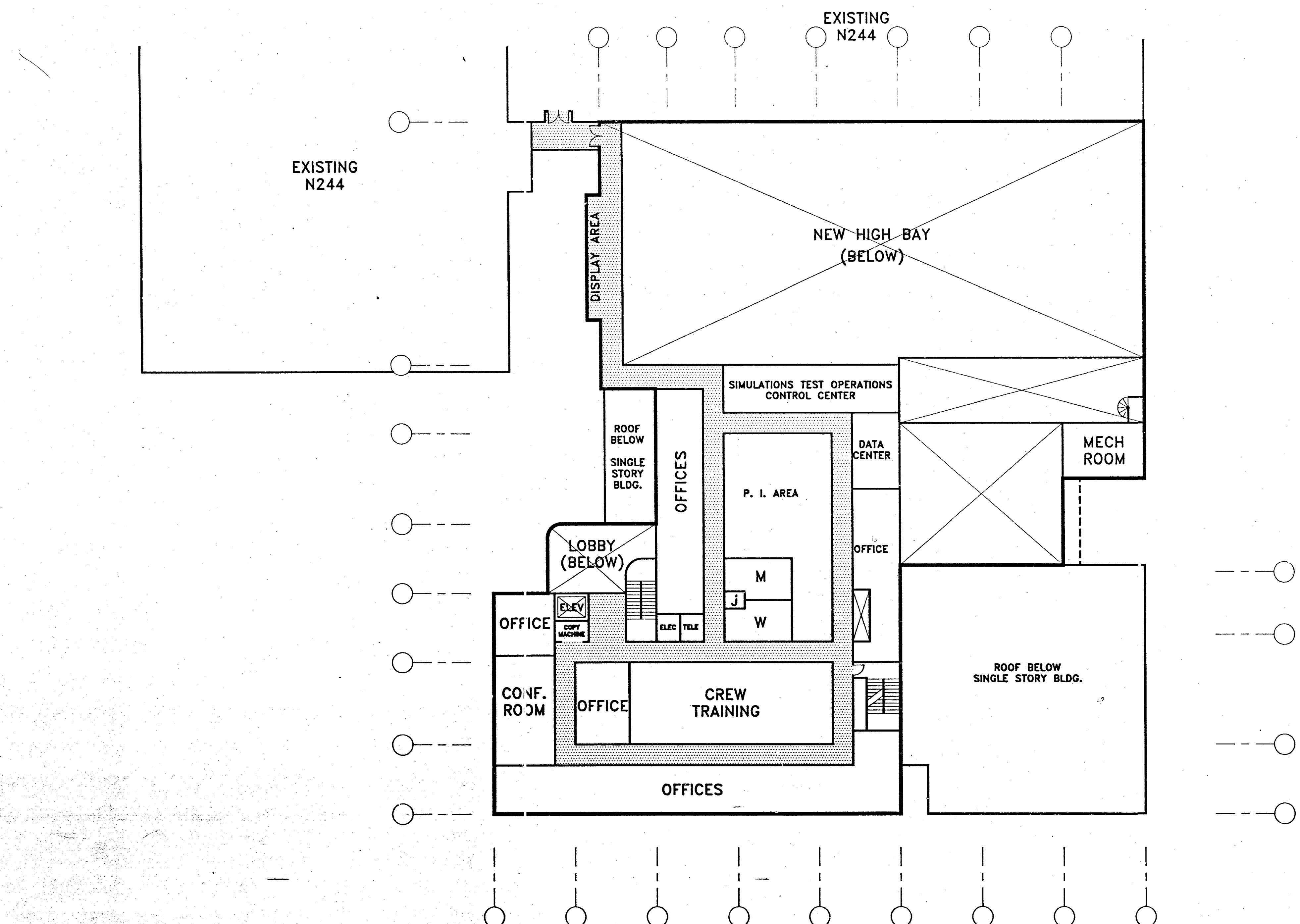
0 4 8 16 32

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

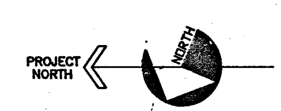
LIFE SCIENCES SPACE FLIGHT FACILITY
GROUND FLOOR PLAN

DRAWN: JME	CHECKED: JPZ	INDEX:	MATERIAL:
DESIGN ENGINEER: VS	BRANCH: EEF/BEC	10-22-90	LIMITS UNLESS NOTED: FRAC. DEC. ANG.
APPROVED: [signature]	ASSN. DWG. NO.	A244-8901-XA2	REV.
APPROVED: [signature] 11/24/90	SCALE: 1/16"=1'-0"		



SECOND FLOOR PLAN

SCALE: 1/16" = 1'-0"



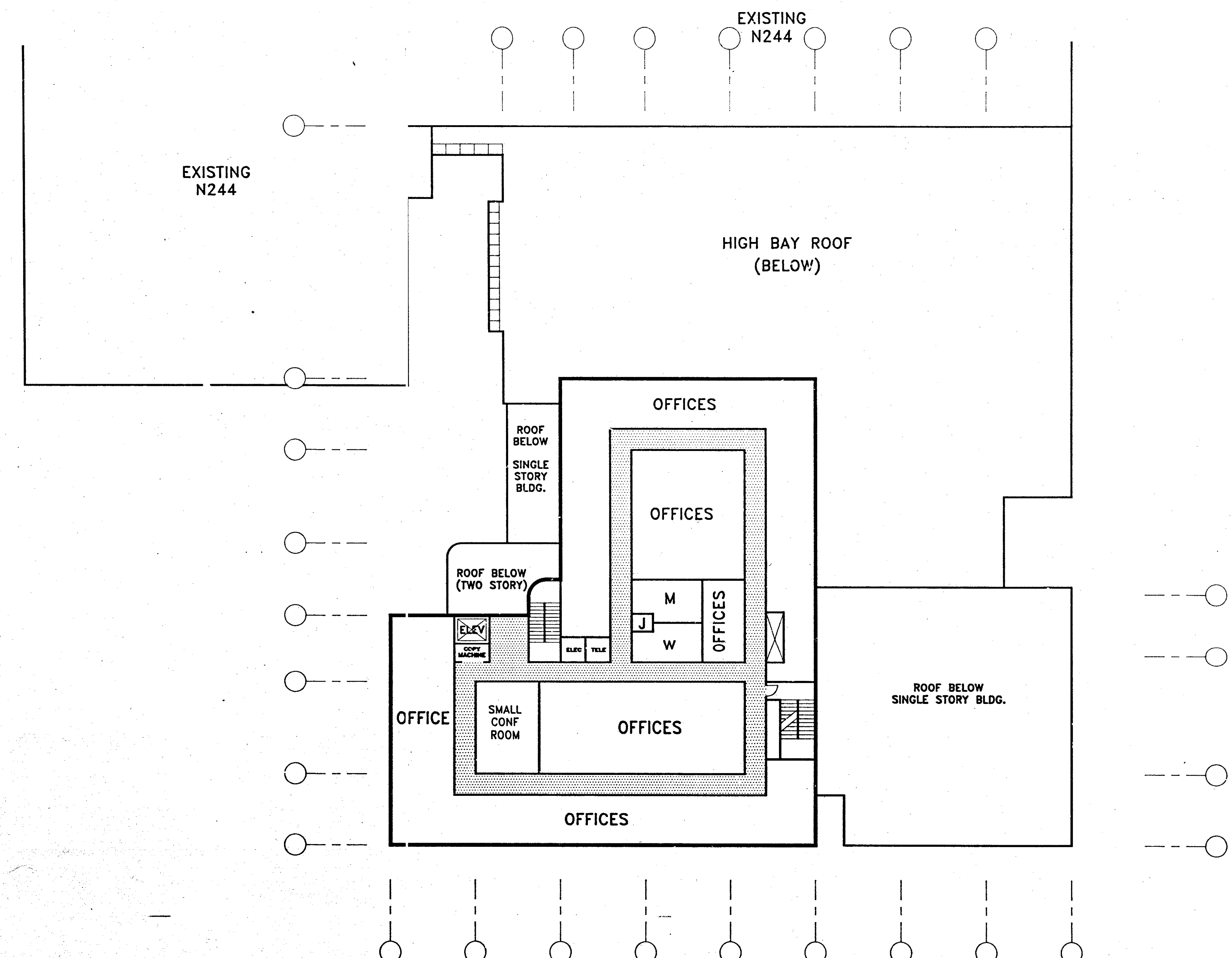
LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

LIFE SCIENCES SPACE FLIGHT FACILITY

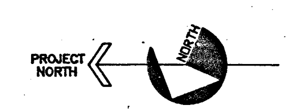
SECOND FLOOR PLAN

DRAWN JME	CHECKED	INDEX	MATERIAL
DESIGN ENGINEER VS	BRANCH EEF/BEC	10-22-90	LIMITS UNLESS NOTED: FRAC. DEC. ANG.
APPROVED	ASSN. DWG. NO.		REV.
APPROVED	SCALE 1/16"=1'-0"	A 244-8901-XA3	



THIRD FLOOR PLAN

SCALE: 1/16" = 1'-0"

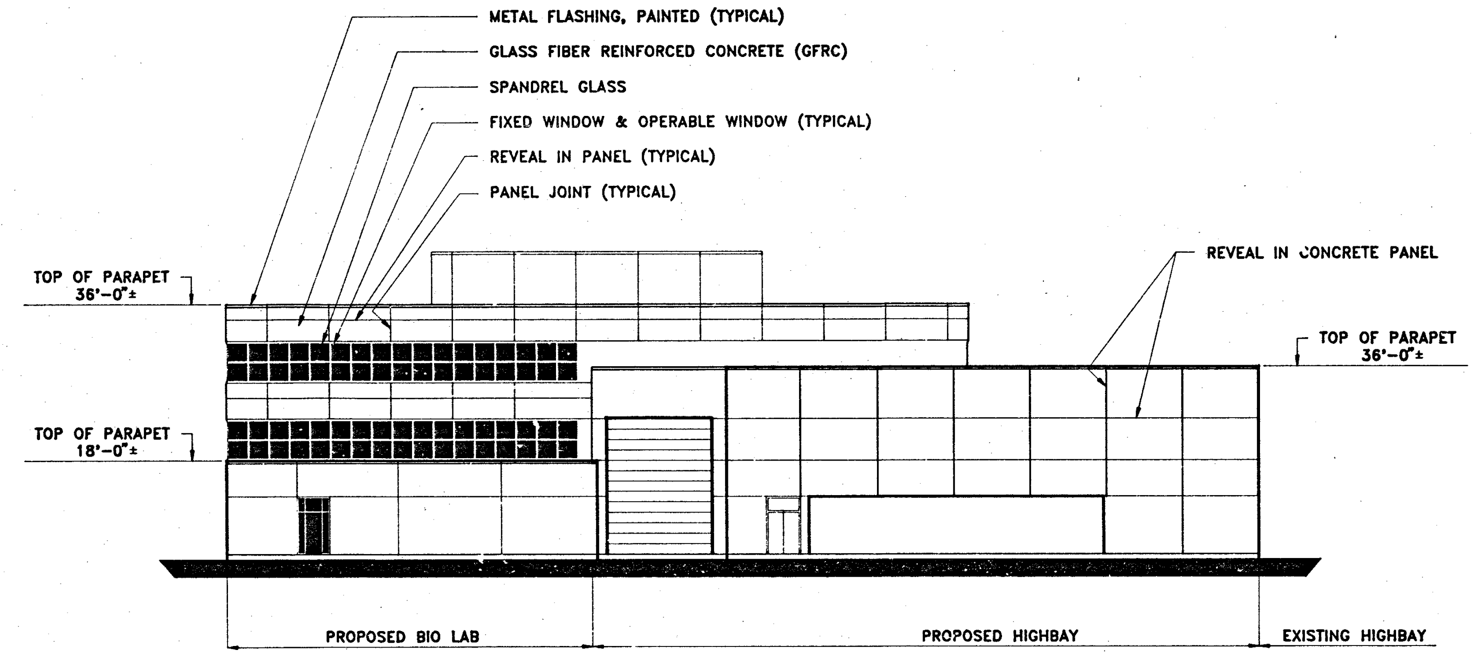


LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.

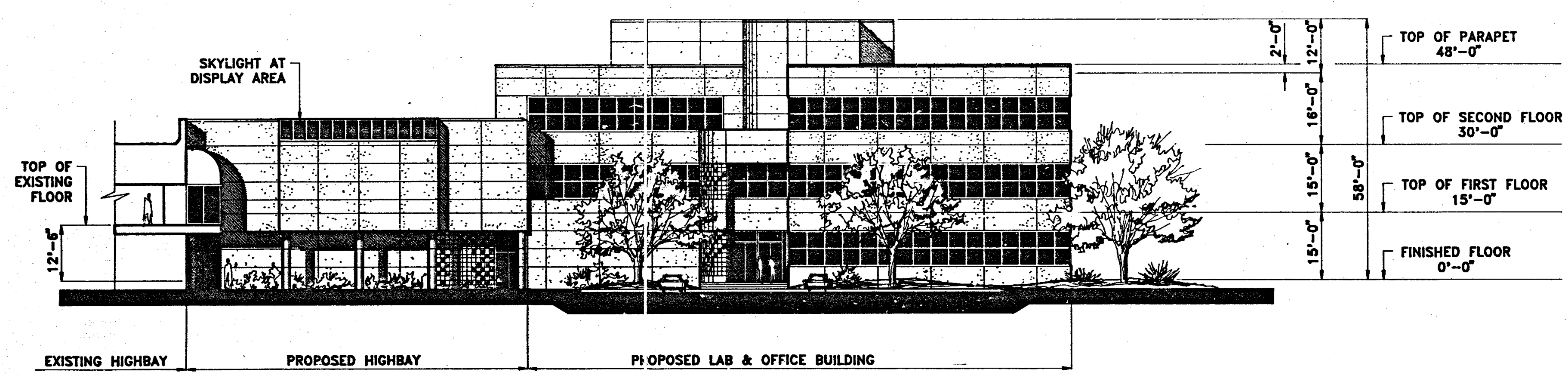
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

LIFE SCIENCES SPACE FLIGHT FACILITY
THIRD FLOOR PLAN

DRAWN: JME	CHECKED: JP2	INDEX	MATERIAL	LIMITS UNLESS NOTED
DESIGN ENGINEER: VS	BRANCH: EEF/BEC		10-22-90	FRAC. / DEC. / ANG.
APPROVED: JW Dyer	ASSM. DWG. NO.			REV.
APPROVED: 12/24	SCALE: 1/16"=1'-0"	A 244-8901-XA4		



SOUTH ELEVATION



NORTH ELEVATION

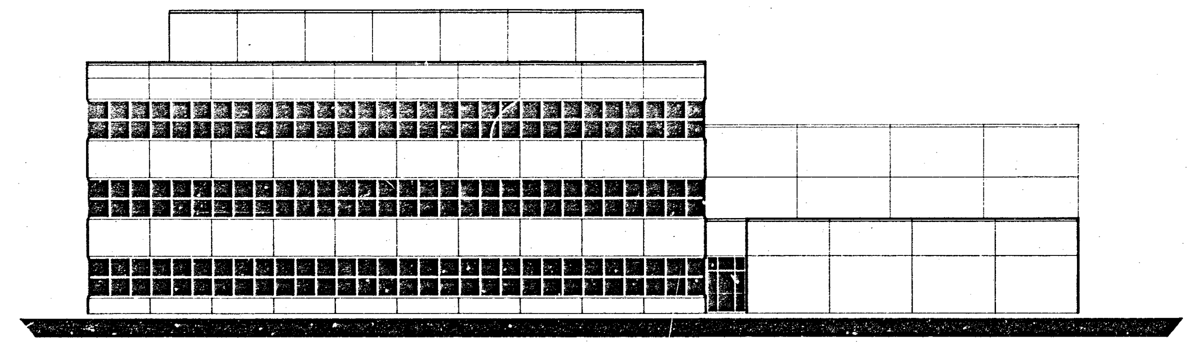
0 8 16 32

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.

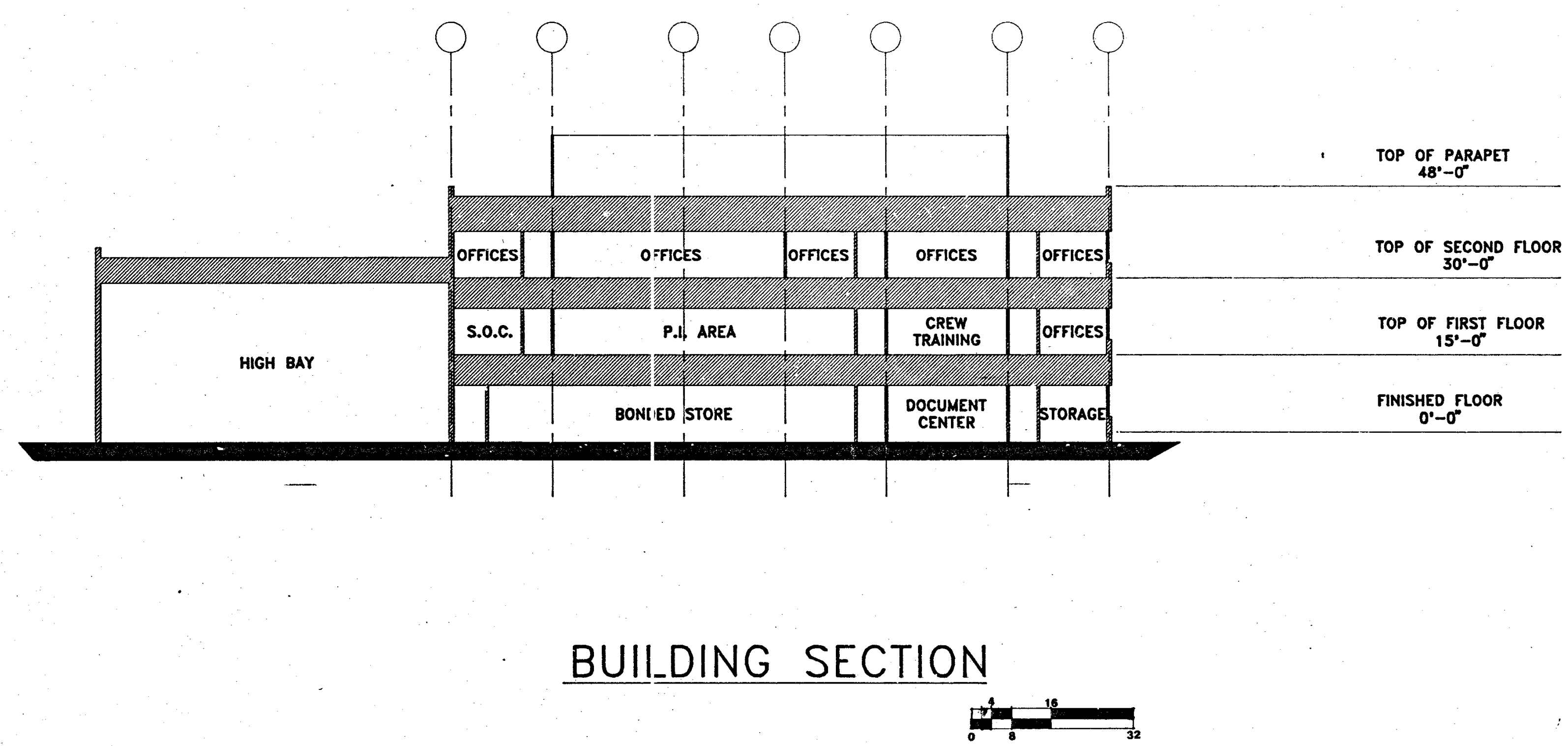
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

LIFE SCIENCES SPACE FLIGHT FACILITY
NORTH AND SOUTH ELEVATIONS

DRAWN	CHECKED	INDEX	MATERIAL	LIMITS UNLESS NOTED
JME	JP2			
DESIGN ENGINEER VS	BRANCH EEF/BEC		10-29-90	FRAC. DEC. ANG.
APPROVED AWDyer	ASSN. DWG. NO.			
APPROVED [signature] 12/24/90	SCALE 1/16"=1'-0"		A 244-8901-XA6	REV.



WEST ELEVATION



BUILDING SECTION

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
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LIFE SCIENCES SPACE FLIGHT FACILITY
WEST ELEVATION AND BUILDING SECTION

DRAWN FMC	CHECKED JPL	INDEX	MATERIAL	LIMITS UNLESS NOTED
DESIGN ENGINEER VS	BRANCH EEF/BEC	10-30-90		FRAC. DEC. ANG.
APPROVED JW Dyer	ASSM. DWG. NO.			
APPROVED W.F.LL 12/24/90.	SCALE 1/16"=1'-0"	A 244-8901-XA7	REV.	

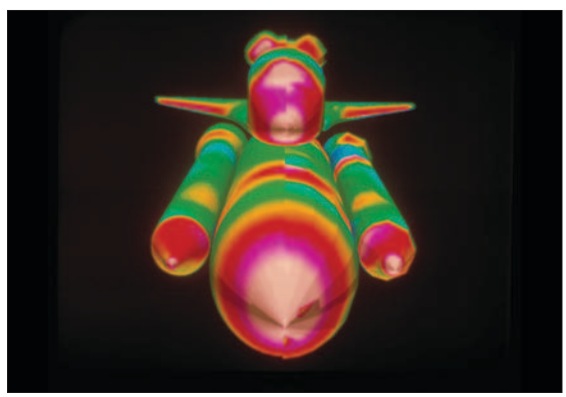
Additional Images:

N-258: NASA Advanced Supercomputing Facility

N-258 under construction, 9 August 1985 (Source: NASA Ames Research Center, A85-5016-1)

N-258, Aerial photograph, 12 June 1986 (Source: NASA Ames Research Center, AC86-5018-19)

N-258, NAS Origin 2000 Computer System - 512 Processor ("LOMAX") station, 30 September 1999 (Source: NASA Ames Research Center, AC99-0195-2)



N-258, NAS CGI Space Shuttle Launch configuration showing surface pressure comparison (Source: NASA Ames Research Center, AC88-0149-2.1)

Architectural Drawings for N-258

Numerical Aerodynamic Simulation Facility, Site Plan
Architect: Hunt & Company, Architects
Date: 24 April 1985
Sheet: A258-8401-A1
NASA EDC # 258-8401-A1

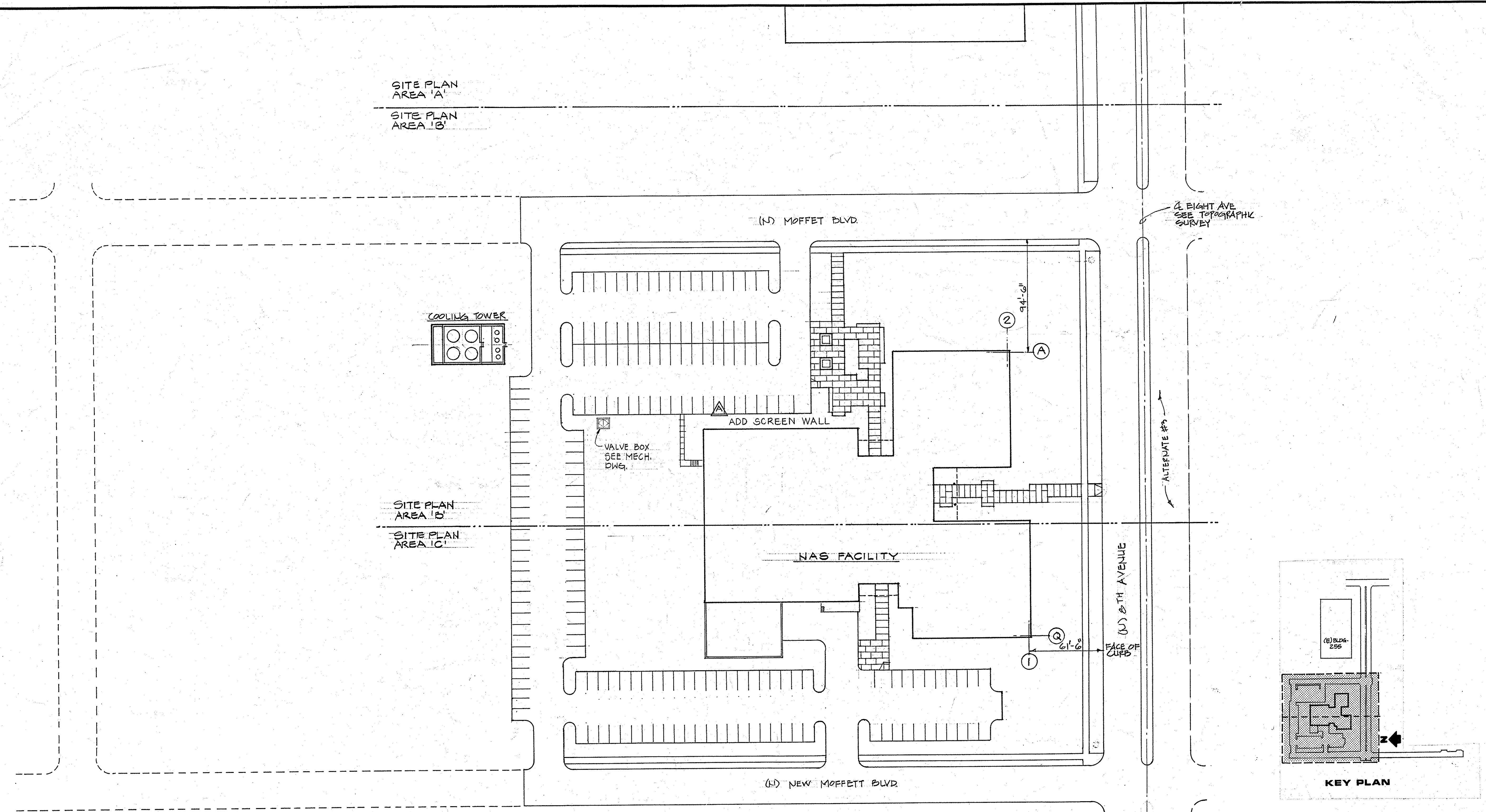
Numerical Aerodynamic Simulation Facility, Plan, Level 1
Architect: Hunt & Company, Architects
Date: 24 April 1985
Sheet: A258-8401-A6
NASA EDC # 258-8401-A6

Numerical Aerodynamic Simulation Facility, Plan, Level 2
Architect: Hunt & Company, Architects
Date: 24 April 1985
Sheet: A258-8401-A7
NASA EDC # 258-8401-A7

Numerical Aerodynamic Simulation Facility, Exterior Elevations
Architect: Hunt & Company, Architects
Date: 24 April 1985
Sheet: A258-8401-A17
NASA EDC # 258-8401-A17

Numerical Aerodynamic Simulation Facility, Building Sections
Architect: Hunt & Company, Architects
Date: 24 April 1985
Sheet: A258-8401-A18
NASA EDC # 258-8401-A18

Numerical Aerodynamic Simulation Facility, Building Sections
Architect: Hunt & Company, Architects
Date: 24 April 1985
Sheet: A258-8401-A19
NASA EDC # 258-8401-A19



ECO NO. A 21517
RECORD DRAWING

To the best of our knowledge, this Drawing has been cross-referenced to appropriate reference documents denoting revisions made during construction.

Mark	PCM	Field Clarification	C drawing
A	93		C65

HCO ARCHITECTS WGR 11/5/87

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MOFFETT FIELD, CALIFORNIA

NUMERICAL AERODYNAMIC SIMULATION FACILITY

SITE PLAN

DRAWN: EJB	CHECKED: EJB	INDEX: 4-24-85	MATERIAL
DESIGN ENGINEER: EJB	BRANCH:		LIMITS UNLESS NOTED: FRAC. DEC. ANG.
APPROVED: F. Kouba	ASSM. DWG. NO.: 11-19-84		
APPROVED:	SCALE: 1" = 40'	A 258-8401- A1	REV.

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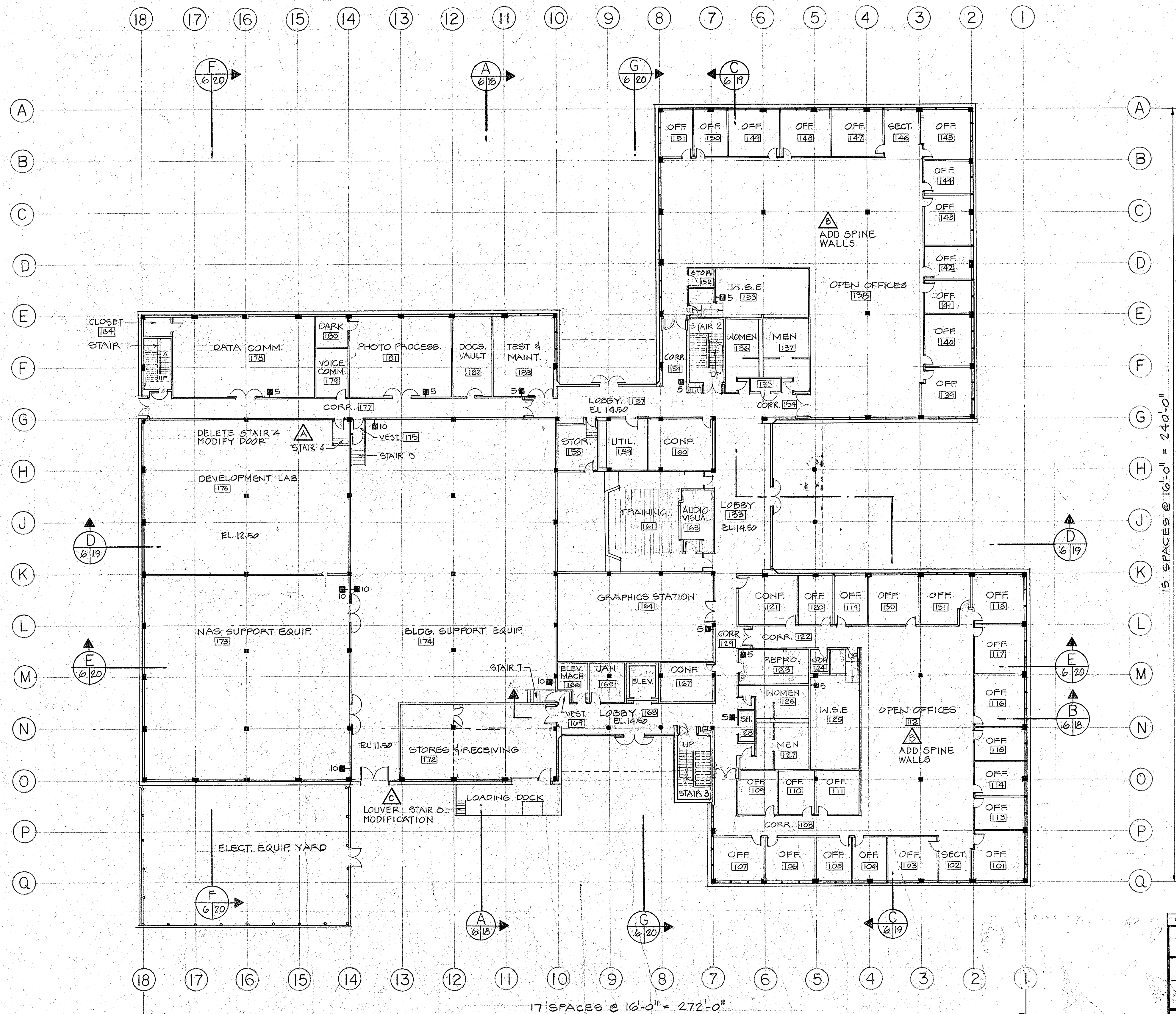
U.S. GOVERNMENT PRINTING OFFICE: 1981-790-093

SITE PLAN



LEGEND:

FIRE EXTINGUISHER CABINETS/BRACKETS

5 SEMI-RECESSED CABINET FOR 5 LB EXTINGUISHER, SEE 11/6/53

10 BRACKET FOR 10-LB EXTINGUISHER

ECO NO. A 21517
RECORD DRAWING

To the best of our knowledge, this Drawing has been cross-referenced to appropriate reference documents denoting revisions made during construction.

Mark	PCM	Field Clarification	C drawing
A	20		C-14,15,16,17
B	76		C-54,55,56
C	94		C-66

HCO ARCHITECTS WGR 11/5/87

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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MOFFETT FIELD, CALIFORNIA

NUMERICAL AERODYNAMIC SIMULATION FACILITY

PLAN, LEVEL 1

DRAWN JJK	CHECKED EJB	INDEX 4-24-85	MATERIAL
DESIGN ENGINEER EJB	BRANCH		LIMITS UNLESS NOTED FRAC. DEC. ANG.
APPROVED F. Kouba	ASSM. DWG. NO. 11-19-84		A 258-8401- A6 REV.
APPROVED B. E. Mobley	SCALE 1/16" = 1'-0"		

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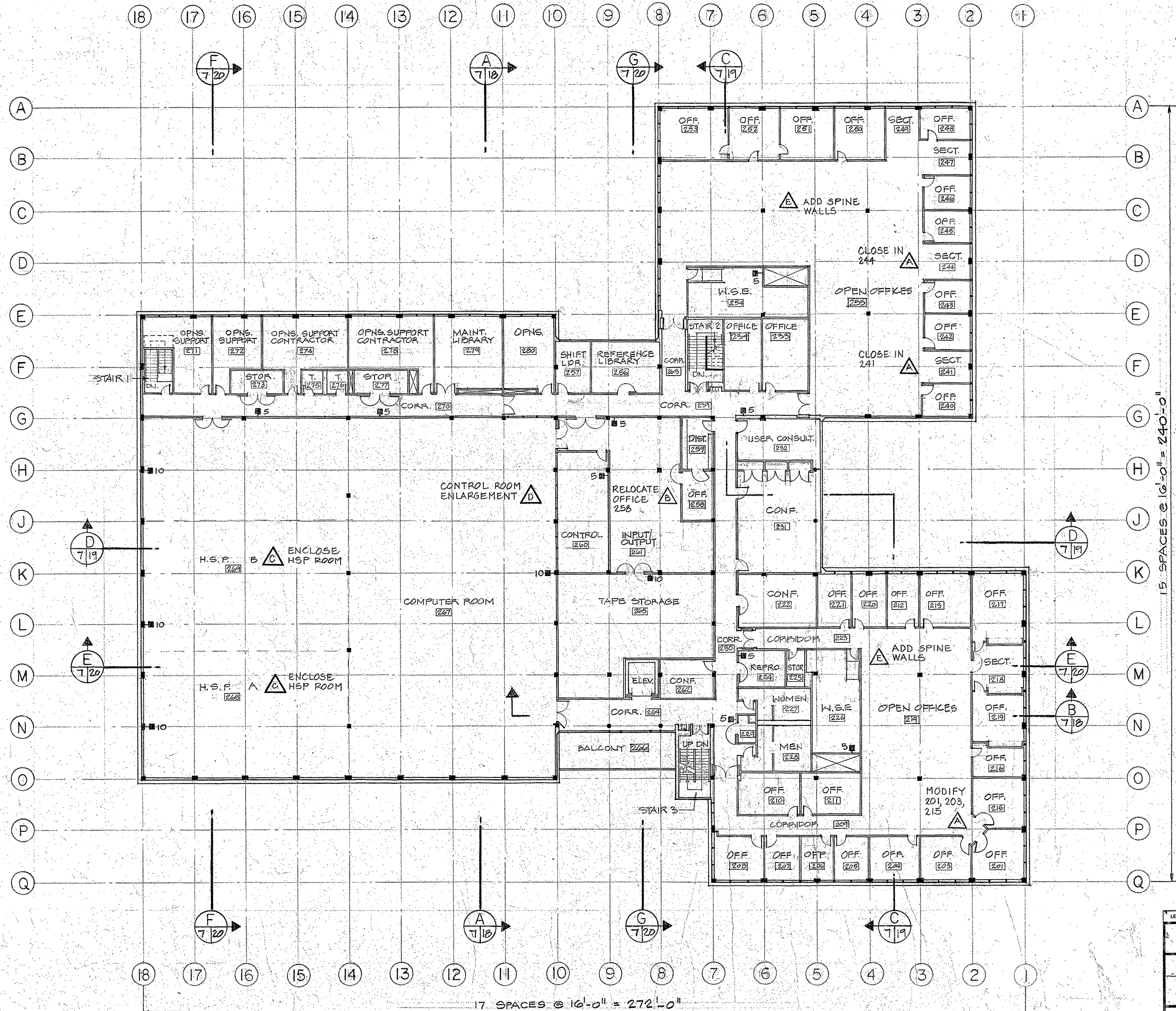
A

PLAN, LEVEL 1



LEGEND:

FIRE EXTINGUISHER CABINETS/BRACKETS

5 SEMI-RECESSED CABINET FOR 5 LB EXTINGUISHER

10 BRACKET FOR 10 LB EXTINGUISHER

ECO NO. A 21517
RECORD DRAWING

To the best of our knowledge, this Drawing has been cross-referenced to appropriate reference documents denoting revisions made during construction.

Mark	PCM	Field Clarification	C drawing
A	22		C-20,21
B	52		C-31,32, 33,34
C	55		C-37,38
D	59A		C-41,42
E	76		C-54,55,56

HCO ARCHITECTS 11/5/87

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INSTRUMENTATION ENGINEER
- KENNEDY /JENKS ENGINEERS

LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.

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AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

NUMERICAL AERODYNAMIC SIMULATION FACILITY

PLAN, LEVEL 2

DRAWN	CHECKED	INDEX	MATERIAL	LIMITS UNLESS NOTED
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DESIGN ENGINEER: EJB	BRANCH			
APPROVED: F. Kouba	ASSM. DWG. NO.: 11-19-84			
APPROVED	SCALE: 1/16" = 1'-0"			

A 258-8401- A7

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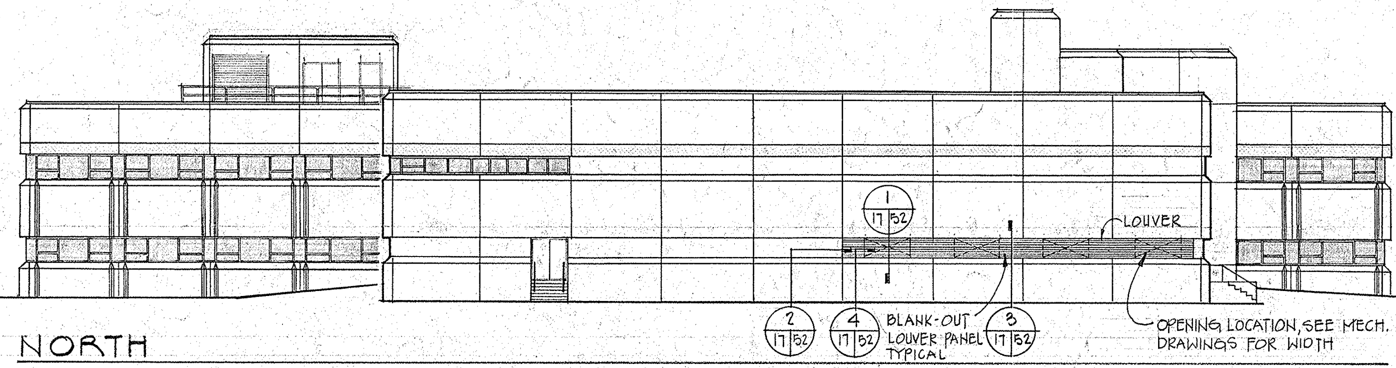
A

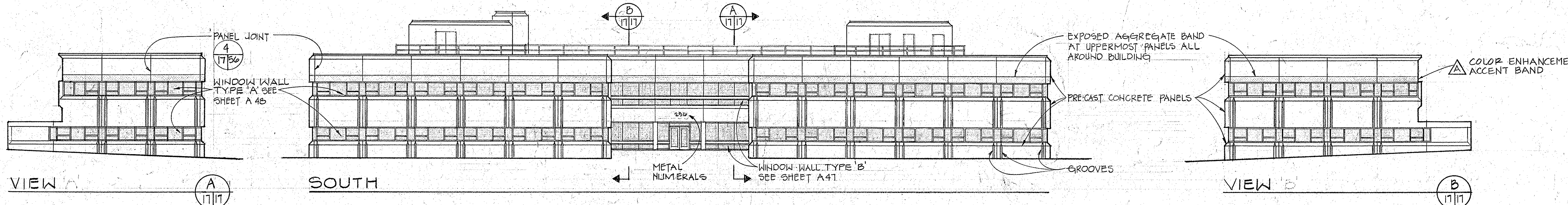
ECO NO. A 21517
RECORD DRAWING

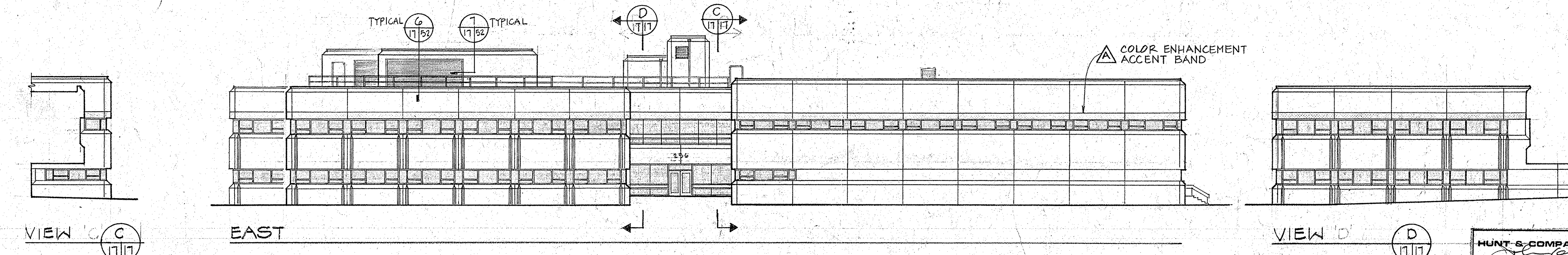
To the best of our knowledge, this Drawing has been cross-referenced to appropriate reference documents denoting revisions made during construction.

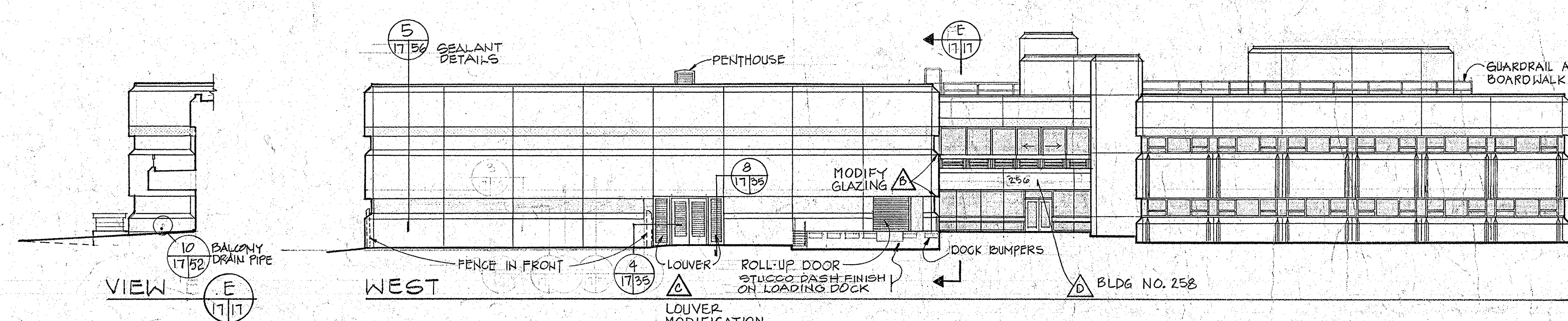
Mark	PCM	Field Clarification	C drawing
A	58		C-40
B	81		C-37
C	94		C-66
D		FC99	

HCO ARCHITECTS WAP 11/5/87









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NUMERICAL AERODYNAMIC SIMULATION FACILITY

EXTERIOR ELEVATIONS

DRAWN	CHECKED	INDEX	MATERIAL	LIMITS UNLESS NOTED
KPF	EJB	4-24-85		
DESIGN ENGINEER: EJB	BRANCH			
APPROVED	ASSM. DWG. NO. 11-19-84			
APPROVED	SCALE 1/16" = 1'-0"			

A 258-8401- A17 D

EXTERIOR ELEVATIONS

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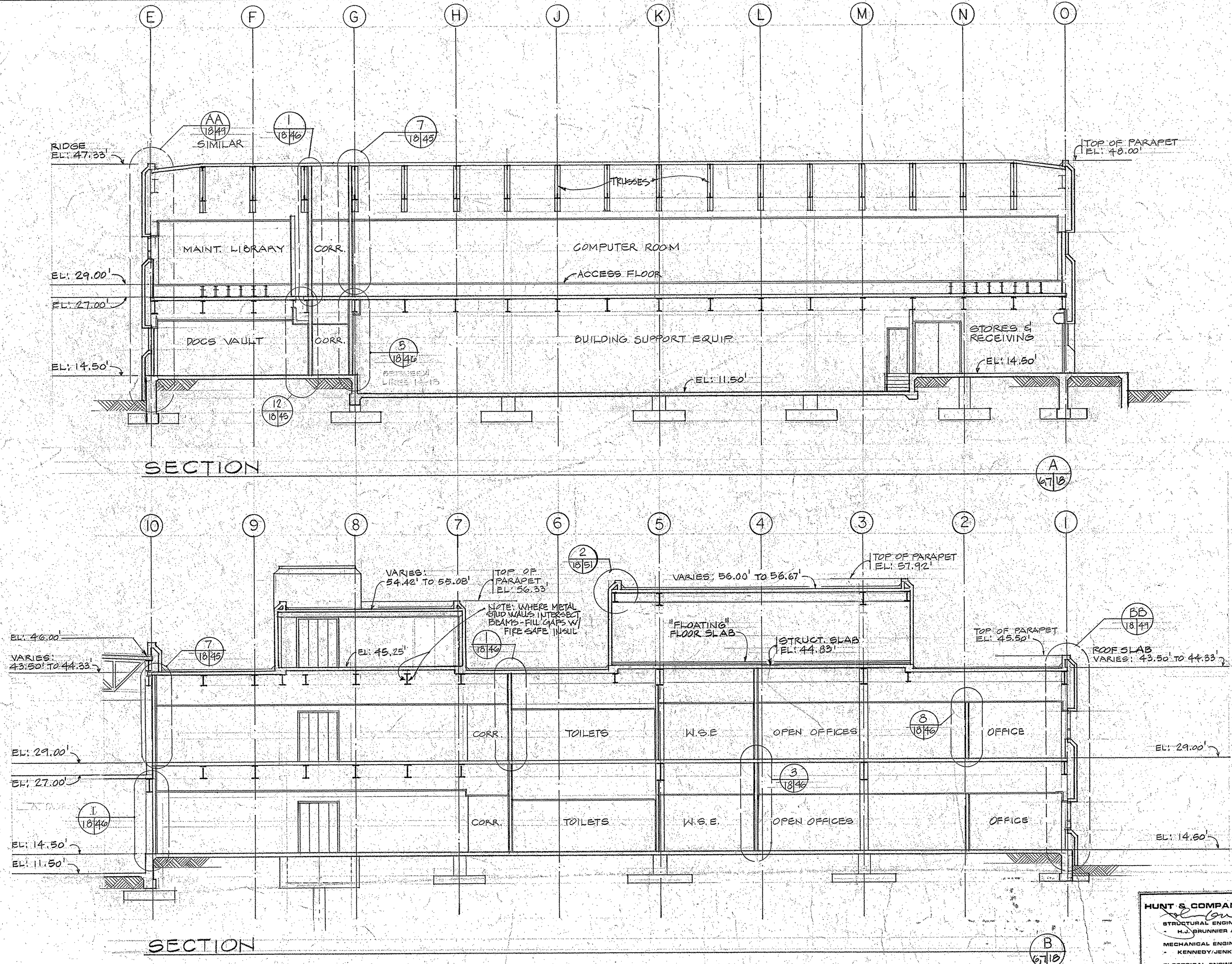

BUILDING SECTIONS

ECO NO. A 21517
RECORD DRAWING

To the best of our knowledge, this Drawing has been cross-referenced to appropriate reference documents denoting revisions made during construction.

Mark	PCM	Field Clarification	C drawing
A	PD		

HCO ARCHITECTS WEP 11/5/87

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LETTER	DATE	REVISION DESCRIPTION	DRAWN	APP.

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MOFFETT FIELD, CALIFORNIA

NUMERICAL AERODYNAMIC SIMULATION FACILITY

BUILDING SECTIONS

DRAWN: EJB	CHECKED: EJB	INDEX: 4-24-85	MATERIAL	LIMITS UNLESS NOTED
DESIGN ENGINEER: EJB	BRANCH			FRAC. / DEC. / ANG.
APPROVED	ASSM. DWG. NO. 11-19-84		A 258-8401-A18	REV.
APPROVED	SCALE 1/8" = 1'-0"			

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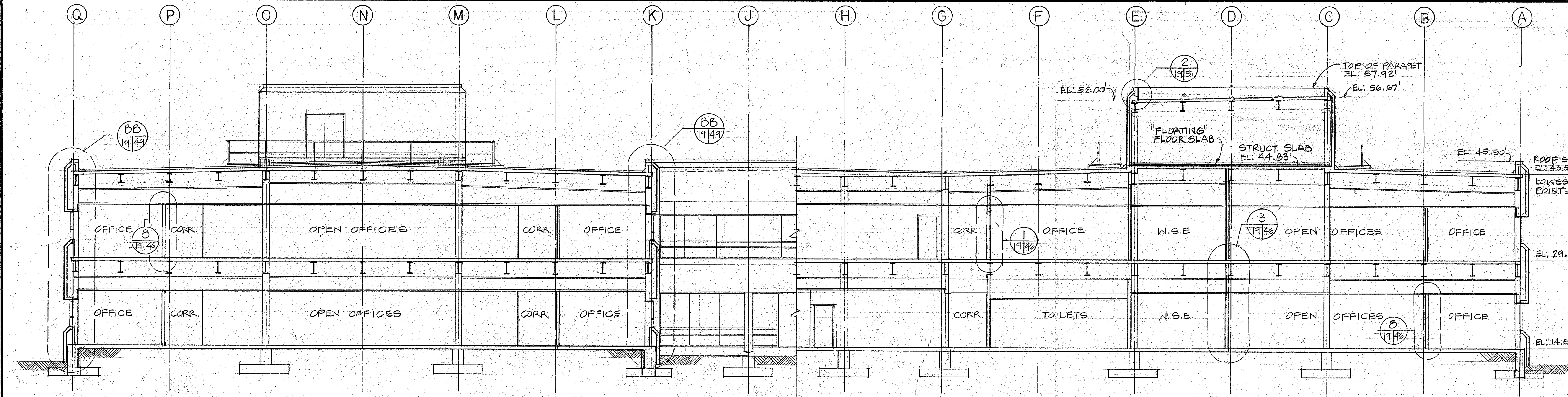
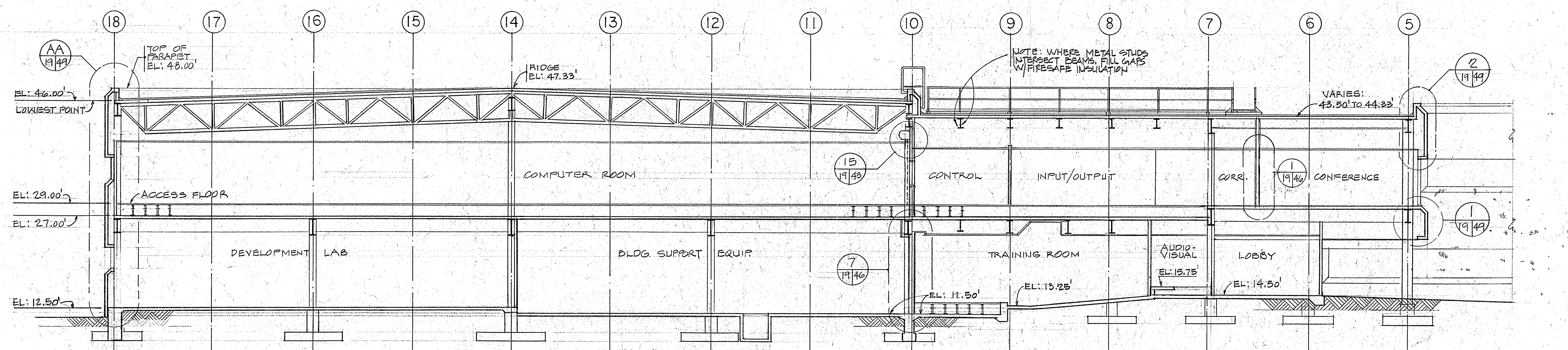


SECTION

C 6,7 19



SECTION

D 6,7 19

ECO NO. A 21517
RECORD DRAWING

To the best of our knowledge, this Drawing has been cross-referenced to appropriate reference documents denoting revisions made during construction.

Mark	PCM	Field Clarification	C drawing
A	PJ		

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NUMERICAL AERODYNAMIC SIMULATION FACILITY

BUILDING SECTIONS

DRAWN: EJB	CHECKED: EJB	INDEX: 4-24-85	MATERIAL	LIMITS UNLESS NOTED: FRAC. DEC. ANG.
DESIGN ENGINEER: EJB	BRANCH:			
APPROVED: F. Kouba	ASSM. DWG. NO.: 11-19-84		A 258-8401- A19	REV.
APPROVED: R. E. Mobley	SCALE: 1/8" = 1'-0"			

A

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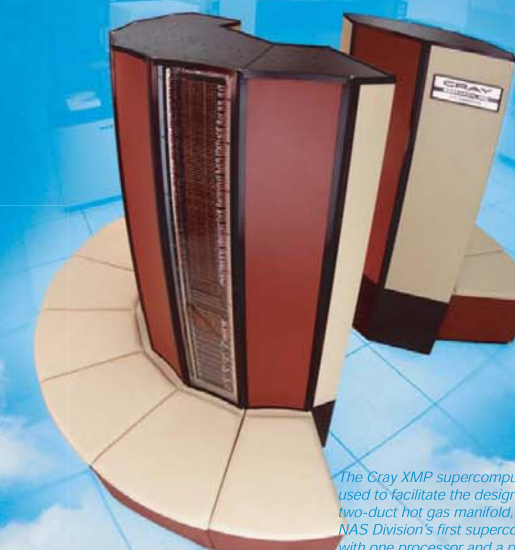
BUILDING SECTIONS

NASA, 25th Shuttle Anniversary,
The Impact of High-End Computing on the Space Shuttle Program

National Aeronautics and Space Administration

The Impact of High-End Computing on the Space Shuttle Prog n

High-end computing and computational fluid dynamics (CFD) have played a key role in improving and enhancing Shuttle performance, reliability, and safety for more than two decades. The NASA Advanced Supercomputing (NAS) Division has been developing CFD-based high-fidelity design and analysis tools, which are being employed to help analyze today's problems, as well as guiding design decisions for future vehicles. The following captures some of the high-level, Shuttle-related events supported by the NAS Division and its supercomputing resources.



The Cray XMP supercomputer, used to facilitate the design of the two-duct hot gas manifold, was the NAS Division's first supercomputer—with one processor and a processing capability of 0.21 Gigaflops or roughly 210 million operations per second. (Photo courtesy of NAS Division)

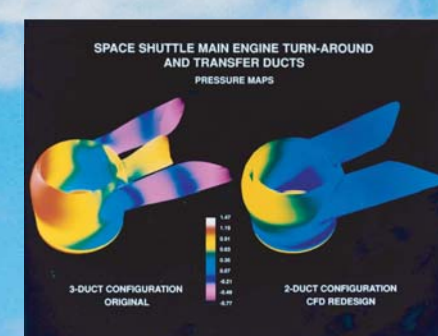
Hot Gas Manifold Redesign

The Space Shuttle Main Engine (SSME), designed in the 1970s, is still the most sophisticated reusable rocket engine in the world today. Since its initial design, NASA has continued to increase reliability and safety of Shuttle flight through a series of enhancements, including major design changes to the hot gas manifold and turbopump.

The original three-duct hot gas manifold in the powerhead, considered the backbone of the SSME, was replaced by two enlarged ducts. The new two-duct design, facilitated with the use of Cray XMP and Cray 1 supercomputers, and CFD techniques developed by NAS researchers, enhanced overall engine performance and reliability. CFD analyses showed that the two-duct design reduced pressure gradients within the system, and lowered temperatures in the engine during operation, which reduces stress on the turbopump and main injector.

After undergoing extensive testing, the newly designed powerhead made its first flight on Discovery's 20th mission (STS-70) in July 1995, and has been used in all subsequent Shuttle missions.

Pictured here is the re-designed two-duct hot gas manifold hardware (new powerhead design), which is considered the backbone of the Shuttle engine, and consists of the main injector and two pre-burners, or small combustion chambers, in addition to various propellant and oxidizer pumps, ducts, and lines. (Photo courtesy of Rocketdyne)



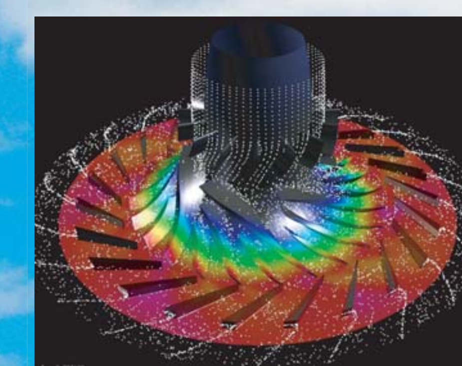
Shown here is a side-by-side comparison of the CFD analyses of the two- and three-duct hot gas manifold designs. White/red represents high pressure, while the blue coloring represents lower pressures. This redesign was the first instance of CFD having an impact in the area of rocket propulsion, and because high-end computing and CFD were so new at the time, code development and analysis were being conducted simultaneously. (Image generated by NASA Ames and Rocketdyne engineers)

Advanced Turbopumps and Flowliners

Since 1985, NASA researchers have been working to provide and enhance a computational framework for design and analysis of the entire fuel supply system of a liquid rocket engine (the Space Shuttle Main Engine's liquid oxygen and liquid hydrogen turbopumps, for example), including high-fidelity unsteady flow analysis.

This effort decreases design costs, improves performance and reliability, and provides developers with information such as transient flow phenomena at startup, impact of non-uniform flows, and impact on the structure. Beginning in 2002, the computational framework was used to investigate the root cause of cracks in the Shuttle engine's fuel-line. In 2004, following the Columbia Shuttle accident, NASA CFD researchers participated in a NASA Engineering and Safety Center-sponsored independent technical assessment investigation of the Shuttle's fuel-line cracks. These results were combined with other analyses and then presented to the Shuttle Program as part of the agency's Return to Flight efforts.

Various computational models have also been developed, and time-accurate computations carried out using this framework to characterize various aspects of the flow field surrounding the flowliner.



A snapshot of particle traces and pressure contours resulting from the flow through the Space Shuttle Main Engine's impeller and diffuser. (Image generated by Tim Sandstrom/David Ellsworth, NASA Ames Research Center)

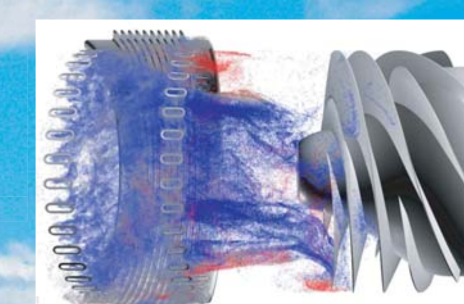


Illustration of unsteady interaction between the backflow and the flow in the bellows cavity—considered one of the major contributors to high-frequency cyclic loading. (Image generated by Tim Sandstrom/David Ellsworth, NASA Ames Research Center)

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The Impact of High-End Computing on the Space Shuttle Program

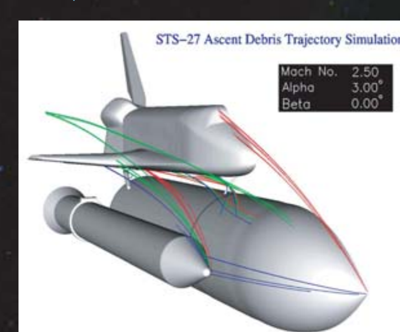
Shuttle Ascent Analysis

OVERFLOW, a computational fluid dynamics program developed in the early 1990s for solving complex flow problems such as designing launch and reentry vehicles, has been applied to a number of Space Shuttle Launch Vehicle and Space Shuttle Orbiter issues over the past two decades. This CFD application has led to an overall better understanding of the aerodynamic loads on the Space Shuttle, and has served as the primary tool for verifying wind tunnel-derived aerodynamic loads during ascent including Orbiter wing, payload bay door, and vertical tail loads.

Following the Shuttle flight STS-27R during which damage was incurred (launched and landed in December 1988), OVERFLOW was used to perform debris analysis. CFD results, which showed that only isolated potential debris sources existed on the vehicle, led to the determination that insulation and ice were the cause of the damage. This analysis has had a huge positive impact on the Space Shuttle Program, leading to increases in safety of flight by minimizing hazardous debris sources; reducing inspection time; minimizing damage on the next flight; and reducing changes to thermal protection system application procedures.

Throughout the 1990s, OVERFLOW was used to support the Shuttle Aerodynamic Loads Verification Program through CFD analysis of the Shuttle Launch Vehicle ascent aerodynamic loads environment. OVERFLOW solutions were used in conjunction with the flight data system, and provided data in areas not covered by flight instruments, yielding a cost savings of approximately $10M.

This image illustrates the OVERFLOW solution of the Space Shuttle Launch Vehicle flowfield at a Mach number of 1.25. The vehicle surface is colored by the pressure coefficient, and the color contours in the flowfield and plumes represent the local Mach number. (Image generated by Reynaldo Gomez, NASA Johnson Space Center)

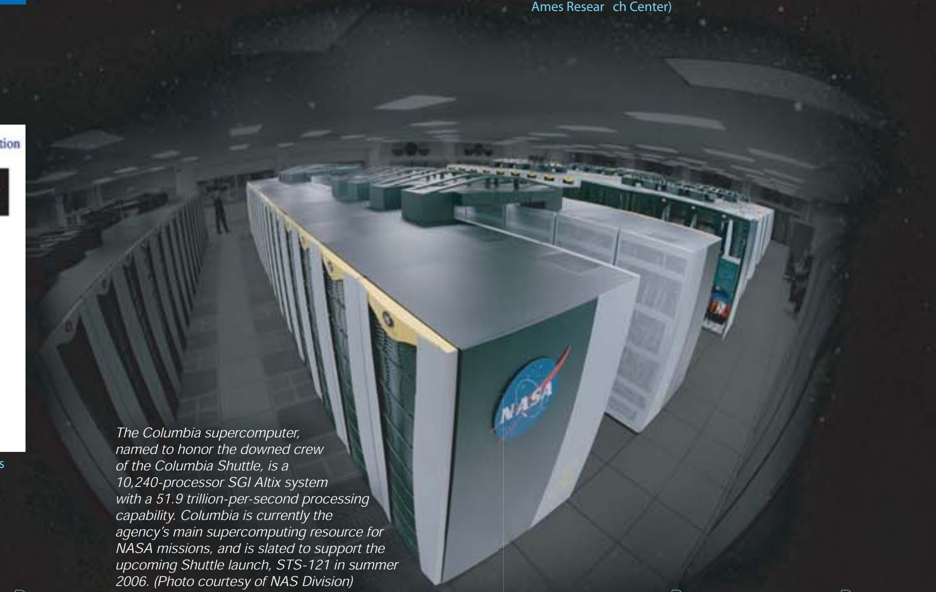


Example of results obtained during analysis of debris trajectories done during flight STS-27R. Here, the flight conditions are at Mach 2.5 and three degrees angle of attack. (Image generated by Reynaldo Gomez, NASA Johnson Space Center)

Shuttle Reentry Analysis

In 1984, NASA Ames CFD researchers obtained the first ever Navier-Stokes solution on an entire reentry vehicle using a Cray XMP supercomputer. Numerical results for turbulent flow around the complete configuration of the Shuttle Orbiter (including canopy, wing, orbital maneuvering system pods, and vertical tail) at a low supersonic free-stream Mach number of 1.4 and a zero degree angle of attack was obtained by segmenting the flow field into four regions. Segmentation was advantageous in that it maximized the number of gridpoints, thus increasing resolution or detail of the numerical model. These numerical results, which showed good agreement with experimental data, paved the way for the more elaborate CFD analyses conducted following the Shuttle Challenger accident in January 1986.

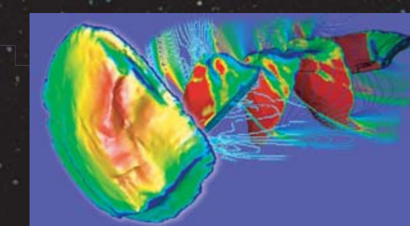
First ever Navier-Stokes solution of the complete configuration of the Shuttle Orbiter. Calculated at Mach 1.4 and zero degrees angle of attack. (Image generated by G. Bancroft and F. Merritt, Applied Computational Fluids Branch, NASA Ames Research Center)



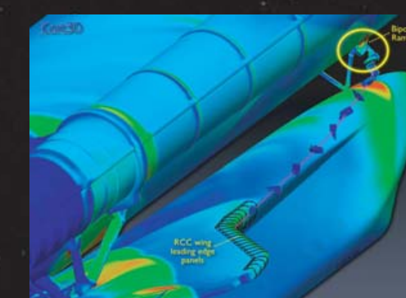
The Columbia supercomputer, named to honor the downed crew of the Columbia Shuttle, is a 10,240-processor SGI Altix system with a 51.9 trillion-per-second processing capability. Columbia is currently the agency's main supercomputing resource for NASA missions, and is slated to support the upcoming Shuttle launch, STS-121 in summer 2006. (Photo courtesy of NAS Division)

Columbia (STS-107) Accident Investigation

In response to the Columbia tragedy of February 1, 2003, the NAS Division employed state-of-the-art CFD codes to simulate steady and unsteady flow fields around Columbia during ascent. Simulation results prompted the use of a higher velocity and kinetic energy in foam impact testing done under the Columbia Accident Investigation Board, which showed massive damage to the Orbiter wing reinforced carbon-carbon panels and damaged T-seals due to foam impact. Simulations also provided insight into the mechanism of debris shedding from the bipod-ramp region. Each moving-body simulation required 1,000-5,000 processor hours running on a 1,024-processor SGI Origin supercomputer. Over a very short time period, more than 450 full simulations were run using about 600,000 processor hours.



This image shows an unsteady Cart3D simulation used to predict the trajectory of a piece of tumbling foam debris released during ascent. The colors represent surface pressure. (Image generated by Scott Murman, NASA Ames Research Center)

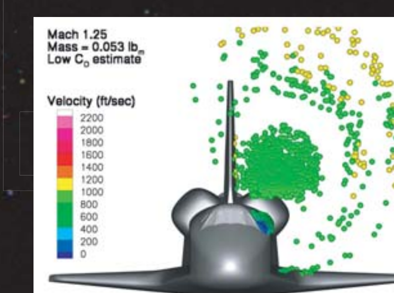


Shown here: foam shedding from the bipod ramp region and its path to impact reinforced carbon-carbon panels on the Orbiter wing. (Image generated by Michael Aftosmis, NASA Ames Research Center)

Discovery (STS-114) Mission Support

During the Discovery mission (summer 2005), NAS Division researchers were on stand-by to provide debris transport analysis support using the NASA Ames-developed debris-transport software running on the 10,240-processor SGI Altix supercomputer, Columbia. Several incidences throughout the mission required NAS resources:

- Evaluation of the potential threat from ice forming on one of the solid rocket boosters/external tank (SRB/ET) aft attach struts on launch day. The ice was a resultant of liquid nitrogen leaking from the ground umbilical connector plate on the ET. Debris simulations were run on Columbia and reported to NASA Johnson within 90 minutes. The threat never materialized, as the final ice inspection from NASA Kennedy reported that no ice was present on this strut.
- Analyses of ice/frost ramp foam debris that were shed 155 seconds into the mission. Within several hours from being tasked by NASA Johnson to analyze the threat of a potential hit on the starboard wing of the Orbiter, NAS researchers delivered an analysis of a complete set of debris simulations indicating that this debris would not cause damage. This conclusion was reinforced by a detailed examination of the on-orbit inspection results, which showed that this debris did not cause any damage to Orbiter tiles or reinforced carbon-carbon panels.
- Analyses of a torn 20 x 3 inch panel of the Advanced Flexible Reusable Surface Insulation blanket located under the commander's window on the Discovery Orbiter using both the debris-transport analysis software and wind tunnel tests. Results indicated that fraying and incremental erosion was the primary failure mode, and large debris fragments were unlikely (which would have resulted in another extravehicular activity).



An example of the CFD-based debris-transport analysis conducted on the torn Advanced Flexible Reusable Surface Insulation blanket, showing probable impact locations for debris of a certain size at a certain flight condition (velocity). Results from CFD analyses were used to establish flow conditions (for example, Mach number and angle-of-attack) for wind tunnel tests conducted to gather more extensive information about the torn blanket. (Image generated by Reynaldo Gomez, NASA Johnson Space Center)

Post-flight photo of the torn 20 x 3 inch panel of the Advanced Flexible Reusable Surface Insulation blanket located under the commander's window on the Discovery Shuttle. (Image courtesy of NASA Orbiter Ops and Project Mgmt Office)

NASA Advanced Supercomputing Facility, Network Roadmap

NETWORK ROADMAP TIMELINE

1984
- First major supercomputer center to adopt TCP/IP across all systems.

1985
- Connected to Ames network via Ethernet, 10 Mb/s. (LAN)
- Created NASA's first TCP/IP WAN (NASnet).
- HyperChannel link installed between workstation and Cray 2. (LAN)

1986
- Long Haul Communications Prototype (LHCP) connects Ames to Langley, Lewis via satellite (224 Kb/s).
- Participated in development of BARRnet.

1988
- T1 link (1.544 Mb/s) installed to Langley.
- NASnet increased to 30 sites with 700 users.

1989
- NASnet circuits transitioned from switched to dedicated 56 Kb/s.

1990
- NAS proves IP routing technology through Research Internet Gateway (RIG) project.

1991
- Installed high speed Ultranet LAN and FDDI ring.
- Transition from NASnet (bridged) to AEROnet (routed network).

1992
- AEROnet 1 becomes operational, providing direct access for NAS remote users, using largest OPSF network.
- Completed first Switched Multimegabit Data Service (SMDS) test demonstrating variable bandwidth.
- Implementation of the router discovery (RFC1256), a software program that allows a host to dynamically choose its next-hop router for default routing, independently of the actual routing protocol used among the routers.

1993
- Distributed computing team established from NAS staff and users. (LAN)
- HIPPI deployed on LAN.
- Frame Relay deployed into AEROnet.
- SMDS employed into AEROnet.
- I of NEWT demonstrates remote access windtunnel concept.
- Supercomputing Conference demonstrated new technologies with the world's highest performance supercomputing network.
- Patent on HNMS – hierarchical network management system, a distributed, scaleable IP network monitor and manager. Used an x-window interface to graphically display and control medium to large-sized IP networks. Based on SNMP.

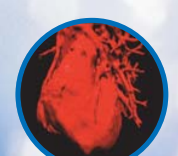
1994
- Upgraded AEROnet backbone to T3.
- First cross country ATM trial conducted over DS-3 circuits.
- Multiple File Transfer Protocol (MFTP) enhanced FTP that opens multiple streams for transferring data, to overcome the bandwidth delay product (1994).
- Demonstrated satellite-based megabit applications using the ACTS satellite and associated ground terminals.

1995
- Deployed first federal native ATM network cross-country over DS-3 (NREN), Phase 1.
- Deployed NREN Phase II Native ATM over OC-3.
- Asynchronous Remote Copy Program (ARCP). A reliable, restartable file transfer mechanism. ARCP guarantees the successful completion of a file transfer.
- Demonstrated 155 Mbps ATM interconnects across NREN.

1996
- WAN consolidation within NASA began and AEROnet transitioned to NISN.
- Demonstrated the interoperability between independently managed NREN networks that are based on ATM technology supplied by multiple vendors.
- NREN joins the federal Next Generation Internet (NGI) initiative.

1997
- Collaborated with Paramount studios to demonstrated the first uncompressed D1 video streaming over WAN (OC12) at Supercomputing Conference.
- Deployed OC-3 155 Mbps network across NREN WAN.
- Established NREN peering at the NGIX-Chicago Exchange point.
- Demonstrated real-time, echocardiography Over a Wide Area Network (WAN).

1998
- Deployed ATM OC-12 (155Mb/s) backbone to DARWINnet.
- Demonstrated real-time high-definition video over an ATM WAN, with remote access to windtunnels at SC98.
- Established the NGIX-West Exchange Point at NASA Ames.
- Transferred ATM-based WAN architecture to NISN.
- Transferred NGIX peering technology to NISN.
- Supported the remote operation of the Nomad Rover between the US and Chile.



1999
- Participated in series of aviation safety projects, RTSS, SMA, AEN, PDARS.
- Deployed native multicast across NREN.
- Deployed OC-12 622 Mbps network across NREN WAN.
- Utilized Uni-Directional Link Routing (UDLR), across satellite links, to support the virtual reality based distributed Virtual Collaborative Clinic application.

2000
- Set up high-speed interconnect (622 Mbps) for DAO between Ames and Goddard, utilizing ATM links and the NREN backbone.
- Began collaboration in the Secure Advanced Federated Environment (SAFE) project.
- Developed PCMon, a passive network monitoring tool.
- Demonstrated High Definition TV streams across NREN and Internet2.
- At the NREN Gigabit Networking workshop, demonstrated the Digital Sky Virtual Observatory.

2001
- Expanded NAS LAN beyond Ames boundaries to Research Park.
- Deployed high-speed Gigabit Ethernet with Jumbo-frames.
- Provided multicast functionality into the NAS LAN.
- Provided dynamic IP address allocation (DHCP) into NAS LAN for visiting scientists.
- The first Multicast Peering point, Multicast was established at Ames.
- Prototype Quality of Service (QoS) mechanisms in a WAN environment between two NREN sites.

2002
- Deployed 802.11b wireless technology into the NAS LAN.
- Co-developed with NAS security a Wireless Firewall Gateway, featured on the cover article of Government Computer News (GCN).
- Completed HiPPI transition to GigE, except CRAY Sv1 (no capability).
- Demonstrated MPEG2 video conferencing between Ames and NASA Headquarters across the NREN WAN.
- Utilized Multi-Path Label Switching (MPLS) to partition NREN WAN in conjunction with the NASA Prototyping Network (NPN).
- Supported remote collaboration among aerospace design teams, utilizing the Virtual Flight Rapid Integrated Test Environment via WAN-based Multicast technologies.

2003
- QoS enables High Definition Television (HDTV) meetings between Ames and JPL.
- NREN partners with Ear se for Aura Spacecraft Che
- Networking and grid tec enable Earth Science ground-truthing experiment.

2004
- Established 1 Gbps link between Ames and Jet Propulsion Laboratory (JPL).
- Established 1 & 10 Gbps networks between the nodes of the Columbia supercomputer.

NASA ADVANCED SUPERCOMPUTING (NAS) FACILITY TIMELINE

www.nasa.gov
www.nas.nasa.gov

1985
Cray X-MP 12 • 1 CPUs
Peak Performance: 0.21 GFLOPS

1985 • *Navier* – 1987 • *Stokes (pictured)*
Cray 2 • 4 CPUs
Peak Performance: 1.95 GFLOPS

1987 • *von Karman*
Convex 3820 • 8 CPUs
Peak Performance: 1.92 GFLOPS

1987 • *Pierre*
Thinking Machines CM-2 • 1,024 CPUs
Peak Performance: 14.34 GFLOPS

1988 • *Reynolds*
Cray Y-MP • 8 CPUs
Peak Performance: 2.54 GFLOPS

1990 • *LaLagrange*
Intel iPSC/860 • 128 CPUs
Peak Performance: 7.68 GFLOPS

1993 • *Boltzmann*
Thinking Machines CM5 • 128 CPUs
Peak Performance: 16.38 GFLOPS

1993 • *Grace*
Intel Paragon • 208 CPUs
Peak Performance: 15.60 GFLOPS

1993 • *von Neumann*
Cray C90 • 16 CPUs
Peak Performance: 15.36 GFLOPS

1993 • *Eagle*
Cray C90 • 8 CPUs
Peak Performance: 7.68 GFLOPS

1994 • *Babbage*
IBM SP-2 • 128 CPUs
Peak Performance: 34.05 GFLOPS

1996 • *Newton*
Cray J90 • 36 CPUs
Peak Performance: 7.20 GFLOPS

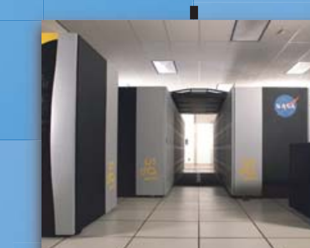
1997 • *Turing*
SGI Origin 2000 • 24 CPUs • 195 MHz
Peak Performance: 9.36 GFLOPS

1998 • *Steger*
SGI Origin 2800 • 256 CPUs • 300 MHz
Peak Performance: 128.00 GFLOPS

1999 • *Lomax*
SGI Origin 2800 • 512 CPUs • 400 MHz
Peak Performance: 409.60 GFLOPS

2001 • *Chapman*
SGI Origin 3800 • 1,024 CPUs • 600 MHz
Peak Performance: 1.23 TFLOPS

2001 • *Bright*
Cray SV1ex • 32 CPUs • 500 MHz
Peak Performance: 64.00 GFLOPS



2003 • *Kalpana*
SGI Altix 3000 • 512 CPUs • 1.3GHz
Peak Performance: 2.66 TFLOPS

2004 • *Columbia*
SGI Altix 3700 • 10,240 CPUs • 1.5 GHz
Peak Performance: 61.44 TFLOPS

2004
Cray X1 • 16 CPUs • 800 MHz
Peak Performance: 51.20 GFLOPS

1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005

Between 1985 and 2004, the NAS Facility increased its peak computing speed by 260,000 times

1 gigaflop = 1 billion floating point operations/second • 1 teraflop = 1 trillion floating point operations/second

Letter from Keith Venter, Facility Historic Preservation Officer, NASA Ames, to Milford Wayne Donaldson, FAIA, State Historic Preservation Officer, 12 July 2006

July 12, 2006

Mr. Milford Wayne Donaldson, FAIA, State Historic Preservation Officer
Office of Historic Preservation
Department of Parks and Recreation
P.O. Box 942896
Sacramento, CA 94296-0001

Re: Historic Resources Associated with the Space Shuttle Program

Dear Mr. Donaldson,

NASA Headquarters, in conjunction with the National Parks service, has begun a review of historic resources that have been associated with the Space Shuttle Program. The objective of this process is to identify resources that may qualify for listing on the National Register of Historic Places as the Space Shuttle program approaches the end of its era. The Space Shuttle program was initiated on January 1972 by President Richard Nixon and ushered in the era of reusable space flight vehicles that were designed to assist in the building of the Space Station. The historic values of this program, like the Apollo-era program, which preceded it, are embodied in the buildings, structures and objects within the NASA centers that contributed to the Space Shuttle program.

Attached you will find a document called Evaluating Historic Resources Associated with the Space Shuttle Program: Criteria of Eligibility for Listing in the National Register of Historic Places. Ames Research Center, as well as other NASA installations, plans on using the criteria contained in this document to screen Space Shuttle era buildings and objects at the Center that may have potential for eligibility to the NRHP.

Ames Research Center plans to have a draft report by early October 2006 for SHPO review. We would greatly appreciate an expedited review of the draft report.

Sincerely,

Keith Venter
Facility Historic Preservation Officer
Ames Research Center

Attachment: *Evaluating Historic Resources Associated with the Space Shuttle Program: Criteria of Eligibility for Listing in the National Register of Historic Places*.

CoF Project Initiation Form –
N234A Steam Vacuum System (SVS) Vacuum Ejector and Boiler Control System

CoF Project Initiation Form

Proposed Project Title: N234A Steam Vacuum System (SVS) Vacuum Ejector and Boiler Control System			
Date: 04/19/05	Proposed FY: 2007	Bldg. No. N234A	Prelim. Cost Estimate: $1.587M
Category: (Choose PD or MS, then indicate Discrete or Minor)	Program Direct:	Discrete:	Minor:
	Mission Support: X	Discrete:	Minor:
Org. Code: TSF M/S: 229-4	Advocate: Joseph Hartman Ext: 4-5269	User: (If not Advocate)	Cost Estimator:

Project Identification

<u>Summary Project Description:</u>
Explain what facility or environmental related work needs to be done at an overview level.

The Steam Vacuum System (SVS) is comprised of a vacuum ejector system and steam-generating boiler. The vacuum ejector system is a large-capacity pumping system driven by five stages of series-connected steam ejectors and is used to create the vacuum conditions required by Arc Jet Complex operations. As the mass flow requirement of the test facility's arc jet increases, the vacuum pressure the SVS maintains must also increase and the stages are ramped back, accordingly, in series. Higher vacuum conditions, at lower flow rates, require more stages to be activated.

The steam flow required for ejector operation is provided by a Babcock and Wilcox M-type express boiler that has been modified to burn natural gas. The boiler is capable of producing 210,000 pounds of saturated steam per hour at a pressure of 425 psig. After leaving the boiler, the steam is passed through a pressure-reducing valve. The output at the downstream side of the valve is superheated steam at 265 psig. The system's pumping capability is obtained by injecting this superheated steam flow through the ejector nozzles into the converging-diverging diffuser of the ejector. The high velocity jets of steam issuing from the nozzles entrain the arc jet gas, and the velocity of the mixture is then converted into pressure in the diffusers.

The current PLC, flowrate/level controllers, and ejector pressure controllers are working on borrowed time. The PLC in use that starts, stops, and controls all active safety mechanisms is nearly 23 years old. The hardware to maintain the system is no longer produced and must be acquired through third party module refurbishers. The laptop interface providing program editing and diagnostics is 15 years old and unreliable. Unfortunately a laptop of this vintage is the only type capable of running the PLC's software, and few reliable laptops of its age exist which can replace it. The flowrate/level controllers maintain fuel, air, and water flowrates to the boiler's burners and steam drum. The current controllers are nearly 10 years old and are no longer supported by the manufacturer. They also require a vintage computer for graphing and reprogramming the control curves. Communications with two of the controllers has become intermittent and it is expected that the remaining controllers will exhibit similar problems. The controllers at the vacuum ejector panel allow operators to modulate the steam pressures to the ejectors for optimum performance. At 26 years of age the controllers cannot be reliably tuned, which leads to wide swings past their set points. Pump down times are increased when these swings cause the uncontrolled dumping of non-motive steam by the ejectors. It takes additional time for the ejector system to pump out and condense this extra steam. This, in turn, delays testing

Justification:
Should include justification for urgency and impact to Center Mission. Give specific reference to enterprises or programs/projects where possible.

The SVS is an integral part of the Arc Jet Complex, which simulates the reentry conditions for thermal protective materials. It provides the necessary vacuum condition to ignite the arc jet and pumping action to maintain test chamber vacuum during arc jet operation. Without its continued operation, the Arc Jet Complex would not be able to operate.

Current mission testing for the Arc Jet Complex includes:

- In-Space Propulsion Program (ISP)
- X-37 prototype reusable launch vehicle program
- Space Shuttle Return to Flight (RTF) Testing
- Space Shuttle External Tank (ET) Program
- Mars Scientific Laboratory (MSL) Program

Without the continued operation of the SVS these programs could not be performed at the Arc Jet Complex.

Project Scope, Elements:
This project will consist of the following elements:

1) Replacement and reprogramming of the PLC rack and modules
2) Replacement and reprogramming of the flowrate/level controllers
3) Replacement of the steam ejector controllers
4) Replacement of the West side blower valve actuator
5) Replacement of boiler and blower indicators
6) Replacement and relocation of current to pressure transducers
7) Shakedown and validation testing of the boiler and ejector control systems.

CoF Project Initiation Form

Cost Estimate Information, Miscellaneous Supporting Materials:
Breakdown should match scope, and elements from above and include an estimate for design.

The cost estimate below is preliminary. An engineering study has yet to be conducted to refine the projected cost and scope details.

PLC Hardware	$0.098M
Flowrate/Level Controllers	$0.042M
Steam Ejector Controllers	$0.046M
Blower Shutter Valve Actuator	$0.017M
Current to Pressure Transducers	$0.028M
Boiler and Blower Indicators	$0.042M
Labor: Design	$0.156M
Installation	$0.460M
IST	$0.387M
Documentation	$0.039M
Construction Management	$0.012M
Contingency	$0.259M
Construction Total	$1.587M

CoF Project Initiation Form

ENVIRONMENTAL CHECKLIST

Part A:	Yes	No	Maybe
1. Will this activity result in changes of potable water use greater that 851,000 gallons/year		X	
2. Will this activity result in a change in employment levels greater than 620 people?		X	
3. Will there be any construction or other activity north of Allen Road (flood plain and wetlands areas)?		X	
4. Will there be any action which could or will affect any threatened or endangered species (north Allen Road)?		X	
5) Will there be any action affecting areas of historical (Moffett Shenandoah Plaza area, Hanger One) or archaeological significance (directly west of the OARF)?		X	

Part B:	Yes	No	Maybe
1) Discharge of any substances into the air, surface or ground water, sanitary sewer, or soils.		X	
2) Removal of vegetation or destruction of wildlife habitat or grading activities.		X	
3) Acquisition, use, generation, storage, or disposal of any toxic or hazardous substances.		X	
4) Generation of hazardous, toxic, or radiological wastes.		X	
5) Generation of ionizing or non-ionizing radiation.		X	
6) Generation of high noise levels (above 80 dBa).		X	
7) Activities resulting in changes of greater than 2,200,000 KWH of electricity, or 3,130,000 CF of natural gas per year for Ames' energy consumption.		X	
8) Use of pesticides, including insecticides, herbicides, fungicides, and rodenticides.		X	
9) Construction or modification of a sewage collection or transmission system.		X	

CoF Project Initiation Form -
Arc Jet Complex Data Acquisition Systems Upgrade

CoF Project Initiation Form

<table>
<tr><td colspan="4">Proposed Project Title:
Arc Jet Complex Data Acquisition Systems Upgrade</td></tr>
<tr><td>Date:
04/20/05</td><td>Proposed FY: 09</td><td>Bldg. No.
N234 & N238</td><td>Prelim. Cost Estimate
$1.25M</td></tr>
<tr><td rowspan="2">Category:
(Choose PD or MS, then indicate Discrete or Minor)</td><td>Program Direct:</td><td>Discrete:</td><td>Minor:</td></tr>
<tr><td>Mission Support:
X</td><td>Discrete:</td><td>Minor:</td></tr>
<tr><td>Org. Code:
TSF

M/S: 229-4</td><td>Advocate:
Joseph Hartman

Ext: 4-5269</td><td>User: (If not Advocate)</td><td>Cost Estimator:</td></tr>
</table>

Project Identification

Summary Project Description:
Explain what facility or environmental related work needs to be done at an overview level.

An upgrade to the Data Acquisition Systems of the Ames Arc Jet Complex is desired to better protect the data systems from the harsh arc jet test environment, improve data quality and measurement accuracy, and increase the efficiency of the technician staff that supports arc jet testing. The data systems need improved protection from the high levels of electromagnetic interference and potential arc strikes onto models and instrumentation, which is created by the partially ionized flow and arc heater power supplies. The upgrade would procure high-precision isolation amplifiers, which can make accurate measurements in such adverse conditions, and integrate them into the data system front-end. The project would also include automated calibration hardware and programming, such that the amplifiers could be maintained at a high accuracy with minimal technician effort.

Justification:
Should include justification for urgency and impact to Center Mission. Give specific reference to enterprises or programs/projects where possible.

During the recent review of NASA's core competencies, Ames Research Center was sited as a key center for Entry, Descent, and Landing Systems, specifically for its expertise in Thermal Protection Systems (TPS) and Technologies. One critical element of this expertise is the Arc Jet Complex whose facilities have provided materials and systems testing for nearly every NASA spacecraft that has entered an atmosphere, be it that of Earth, Mars, Jupiter, or even Saturn's moon, Titan.

In order to perform hypersonic and TPS testing in the Arc Jet Complex, an arc jet facility uses a stable, high-power, electric arc to heat the gas stream to such extreme temperatures (more than 10,000 °F) that it is partially converted into ionized plasma. Both the electrically conductive plasma and the electromagnetic interference, introduced by the power supplies, one of which is designed to exceed 75 Megawatts of continuous, direct current power, present a significant hazard to the sensitive electronic instruments that are used to make measurements of the materials and models. In the most powerful facility in the complex, the Interaction Heating Facility (IHF), electromagnetic fields on the order of hundreds of volts can be detected when the arc initially strikes. These pulses can be picked up on thermocouples, which provide signals that are only millivolts in strength. Because the arc jet stream has been partially ionized, it is significantly more electrically conductive and can charge a test model to high electric potentials. Component failures were common and could result in repair costs exceeding $10,000 per month before industrial-quality signal isolators were implemented at the IHF to protect the data system from these high voltages. While it is rare, arc jet facilities can experience an arc strike outside of the heater and even onto the test model. With a power supply operating at several thousand volts, such a strike could result in the destruction of hundreds of thousands of dollars of test equipment and significant delays to TPS testing on the critical-path to a spacecraft launch.

The industrial-quality isolators currently in use in the Arc Jet Complex facilities are merely adequate to provide immediate protection of the data acquisition system, but they limit the ultimate accuracy of the data system and require continual evaluation and adjustment to keep the system sufficiently accurate (0.1% or better). With precision isolation amplifiers, this concern is eliminated with components that typically perform to 0.02% accuracy, far closer to that of the analog-to-digital converters in use. In addition, modern, computer-controlled components allow automated calibration to quickly and easily confirm or improve accuracy. This improved accuracy is required to improve the fidelity of the arc jet simulation and provide increased data quality to critical reentry systems development projects.

Current mission testing that would benefit from the proposed upgrade include:

- In-Space Propulsion (ISP) Program – Aerocapture TPS design and sensors
- X-37 prototype reusable entry vehicle program
- Space Shuttle Return to Flight (RTF) – Repair materials and methods
- Space Shuttle External Tank (ET) Program – Improved insulation foam
- Mars Scientific Laboratory (MSL) Program – Probe entry shell TPS

The proposed facility enhancement will allow the facility to meet the stringent requirements imposed by these and future programs, ensuring continued, high-quality materials testing capability.

Project Scope, Elements:
This project will consist of the following elements:

1) Specify and procure precision isolation amplifiers and the auxiliary components (chassis, data acquisition boards, etc.) required to support them.
2) Develop software to implement automated calibration of the amplifiers.
3) Re-program the data acquisition system software to integrate amplifier calibration, configuration, and use.

The following items will have to be conducted around scheduled arc jet testing and planned to result in the minimal practical downtime:

4) Install or modify data acquisition system enclosures to house the new amplifier components.
5) Incorporate amplifiers into the data system infrastructure of the Arc Jet Data Acquisition Systems.
6) Install components to provide automated calibration of the amplifier units.

Cost Estimate Information, Miscellaneous Supporting Materials:
Breakdown should match scope, and elements from above and include an estimate for design.

The cost estimate below is preliminary. An engineering study has yet to be conducted to refine the projected cost and scope details.

Isolation Amplifiers for IHF, AHF, PTF, and DAF (approx. 50 channels per facility + chassis)	$750k
Enclosure Components	$30k
Equipment Installation (Labor)	$240k
Programming Support (Labor)	$70k
Management, Overhead, and Contingency	$160k
Construction Total	$1,250k

ENVIRONMENTAL CHECKLIST

Part A:	Yes	No	Maybe
1. Will this activity result in changes of potable water use greater that 851,000 gallons/year		X	
2. Will this activity result in a change in employment levels greater than 620 people?		X	
3. Will there be any construction or other activity north of Allen Road (flood plain and wetlands areas)?		X	
4. Will there be any action which could or will affect any threatened or endangered species (north Allen Road)?		X	
5) Will there be any action affecting areas of historical (Moffett Shenandoah Plaza area, Hanger One) or archaeological significance (directly west of the OARF)?		X	

Part B:	Yes	No	Maybe
1) Discharge of any substances into the air, surface or ground water, sanitary sewer, or soils.		X	
2) Removal of vegetation or destruction of wildlife habitat or grading activities.		X	
3) Acquisition, use, generation, storage, or disposal of any toxic or hazardous substances.		X	
4) Generation of hazardous, toxic, or radiological wastes.		X	
5) Generation of ionizing or non-ionizing radiation.		X	
6) Generation of high noise levels (above 80 dBa).		X	
7) Activities resulting in changes of greater than 2,200,000 KWH of electricity, or 3,130,000 CF of natural gas per year for Ames' energy consumption.		X	
8) Use of pesticides, including insecticides, herbicides, fungicides, and rodenticides.		X	
9) Construction or modification of a sewage collection or transmission system.		X	

CoF Project Initiation Form -
Steam Vacuum System NOx Emission Reduction System [N238A]

CoF Project Initiation Form

Proposed Project Title: Steam Vacuum System NO_x Emission Reduction System			
Date: 20 Apr 2005	Proposed FY: 09	Bldg. No. N238A	Prelim. Cost Estimate $2.40M
Category: (Choose PD or MS, then indicate Discrete or Minor)	Program Direct:	Discrete:	Minor:
	Mission Support: X	Discrete:	Minor:
Org. Code: TSF M/S: 229-4	Advocate: Joseph Hartman Ext: 4-5269	User: (If not Advocate)	Cost Estimator:

Project Identification

<u>Summary Project Description:</u>
Explain what facility or environmental related work needs to be done at an overview level.

The Ames Arc Jet Complex is the largest arc jet facility of its type in the United States. The complex is composed of a number of individual test legs including the Interaction Heating Facility (IHF), the Aerodynamic Heating Facility (AHF), and the Panel Test Facility (PTF). The Ames arc jets provide super-heated air at hypersonic speeds to simulate the high-temperature flows experienced by spacecraft reentering planetary atmospheres. As consequence of heating air at temperatures up to 10,000 K, a significant amount of pollutants in the form of nitrogen oxides (NO_x) are also produced. Left untreated, these NO_x emissions would need to be vented directly to the atmosphere in direct conflict with local, state, and federal air emission regulations. The arc jet facility currently provides a NO_x scrubber system designed to remove these pollutants to levels that meet all required air emission regulations. However, the current system is over 30 years old and nearing the end of its useful life. To ensure interrupted facility operation, a replacement of this system is required within the next few years to ensure that emissions from the facility continue to meet air regulations. This project will design, fabricate, and install a new NO_x emission reduction system to replace the existing aging and deteriorating scrubber system with newer and more maintainable system.

Justification:

Should include justification for urgency and impact to Center Mission. Give specific reference to enterprises or programs/projects where possible.

The Ames Arc Jet Complex was designed and constructed in the late 1960's and early 1970's to validate the thermal performance of reentry thermal protection systems (TPS). It has been used to test the design of virtually every TPS employed on NASA missions for the last thirty years. The Arc Jet Complex continues to be a key facility for the development of current and future spacecraft and supports NASA's key mission goals of planetary and near earth orbit exploration for both manned and unmanned vehicles. Since its initial construction, NASA missions have continued use of the arc jets, which, with the use of the air emission reduction system, allow the facility to meet all required air emission standards. It is anticipated that within the next several years the facility may no longer be able to meet key current and future air emission requirements with the current infrastructure. To ensure continued compliance with local, state, and federal laws, a replacement air emission reduction system described here will be needed.

Current mission testing requirements that require the proposed upgrade include:

- In-Space Propulsion Program (ISP)
- X-37 prototype reusable launch vehicle program
- Space Shuttle Return to Flight (RTF) Testing
- Space Shuttle External Tank (ET) Program
- Mars Scientific Laboratory (MSL) Program

The proposed facility enhancement will allow the facility to continue to meet the requirements imposed by these and future program ensuring NASA's continued materials testing capability.

Project Scope, Elements:

This project will consist of the following elements:

1) Development of the necessary emission levels requirements to meet or exceed current and anticipated future legal requirements.
2) Identification and conceptual design of possible emission reduction system configuration meeting the requirements in item 1 above.
3) Detailed design of the specific emission reduction device including chemical, structural, and mechanical phases in sufficient detail to provide for fabrication of the device.
4) Fabrication of the actual emission reduction device.
5) Identification and design development of facility modifications required to install, operate, and maintain the emission reduction device. This includes structural, cooling water, electrical, and control modifications.
6) Construction modifications of the existing facility in order to accept the new emission reduction device.
7) Installation and integration of the emission reduction device into the IHF facility.

8) Facility shakedown and validation testing of the new emission reduction device.

Cost Estimate Information, Miscellaneous Supporting Materials:
Breakdown should match scope, and elements from above and include an estimate for design.

	Hours	Amount
Design		
Chemical Design	550	$79,200
Structural Design	400	$57,600
Mechanical Design	600	$86,400
Management	155	$22,320
	Sub Total	$245,520
Fabrication		$1,350,000
Construction		
Permitting, Environmental		$85,000
Site Preparation		$280,000
Installation		$410,000
Management		$69,000
	Sub Total	$759,000
Validation		
Engineering	200	$28,800
Mechanical Modification	100	$14,400
Management	30	$4,320
	Sub Total	$47,520
	Total	**$2,402,040**

ENVIRONMENTAL CHECKLIST

Part A:	Yes	No	Maybe
1. Will this activity result in changes of potable water use greater that 851,000 gallons/year		X	
2. Will this activity result in a change in employment levels greater than 620 people?		X	
3. Will there be any construction or other activity north of Allen Road (flood plain and wetlands areas)?		X	
4. Will there be any action which could or will affect any threatened or endangered species (north Allen Road)?		X	
5) Will there be any action affecting areas of historical (Moffett Shenandoah Plaza area, Hanger One) or archaeological significance (directly west of the OARF)?		X	

Part B:	Yes	No	Maybe
1) Discharge of any substances into the air, surface or ground water, sanitary sewer, or soils.		X	
2) Removal of vegetation or destruction of wildlife habitat or grading activities.		X	
3) Acquisition, use, generation, storage, or disposal of any toxic or hazardous substances.			X
4) Generation of hazardous, toxic, or radiological wastes.		X	
5) Generation of ionizing or non-ionizing radiation.		X	
6) Generation of high noise levels (above 80 dBa).		X	
7) Activities resulting in changes of greater than 2,200,000 KWH of electricity, or 3,130,000 CF of natural gas per year for Ames' energy consumption.		X	
8) Use of pesticides, including insecticides, herbicides, fungicides, and rodenticides.		X	
9) Construction or modification of a sewage collection or transmission system.		X	

CoF Project Initiation Form -
Semi-Elliptical Nozzle for Interaction Heating Facility [N-238]

CoF Project Initiation Form

Proposed Project Title: Semi-Elliptical Nozzle for Interaction Heating Facility			
Date: 04/18/2005	Proposed FY: 09	Bldg. No. N238	Prelim. Cost Estimate $3.64 M
Category: (Choose PD or MS, then indicate Discrete or Minor)	Program Direct:	Discrete:	Minor:
	Mission Support: X	Discrete:	Minor:
Org. Code: TSF M/S: 229-4	Advocate: Joseph Hartman Ext: 4-5269	User: (If not Advocate)	Cost Estimator:

Project Identification

<u>Summary Project Description:</u>
Explain what facility or environmental related work needs to be done at an overview level.

The Interaction Heating Facility (IHF) is NASA's largest constricted arc jet facility. The IHF provides super-heated gas at hypersonic speeds to simulate the high-temperature flows experienced by spacecraft entering planetary atmospheres. Candidate thermal protection materials, TPS, in single sample or in assemblies, are tested under simulated heating conditions of hypersonic entry into Earth, Mars, or other planet's atmospheres. Experiments in IHF provide data that is critical to the design and success of human spaceflight programs and to scientific planetary spacecraft missions.

One of the critical elements of the IHF, the semi-elliptical nozzle, provides unique boundary-layer flows over large, 80cm x 80 cm test panels, simulating a portion of TPS acreage on a spacecraft. The nozzle is a highly water-cooled copper assembly that must absorb the high heat fluxes generated by the intensely hot internal gas flows. The thermal design requirements are similar to that of a rocket nozzle, though it is operated in a ground facility in the N238 laboratory. The present nozzle, after about 3 years of service, is showing severe degradation in its shape and strength of materials caused by lack of adequate water cooling. A previous nozzle of exactly similar design also degraded in the same fashion. Fabricating more nozzles using the same design would be futile in that there would be no improvement in safety, reliability, or performance. A new nozzle design is therefore required with an improved water-cooling scheme. The scope of this project is to complete the design and fabrication of a new semi-elliptical nozzle that will safely operate over a period of 20 years without degrading or warping.

Justification:
Should include justification for urgency and impact to Center Mission. Give specific reference to enterprises or programs/projects where possible.

The IHF arc jet facility was designed and constructed in the early 1970's to validate the thermal performance of reentry thermal protection systems (TPS). It has been used to test and validate the design of virtually every TPS employed on NASA missions for the last thirty years. The IHF facility continues to be a critical facility for the development of current and future spacecraft and supports NASA's key mission goals of planetary and near-earth orbit exploration for both human and robotic space vehicles. Failure of the semi-elliptical nozzle, a key component of the facility, would result in significant down time and delay of acquiring critical test data. The time to build a replacement is approximately 8 to 12 months. A spare nozzle exists now and yet it has demonstrated the same operational problems. Fabricating more spares is not cost efficient and therefore not recommended as a solution.

Since the initial construction of the IHF, NASA mission requirements have expanded to include longer duration tests and higher power levels. Current semi-elliptical nozzle hardware has experienced significant degrading manifested as warping and materials overheating. These have lead to altering the shape of the nozzle through which the test gas flows, and to leaks of high pressure cooling water. The warping is due to excess thermal stress because of inadequate water cooling. Warping degrades the flow quality and has lead to weeping water leaks. The quality and safety of operations are being compromised by these problems. The faulty design of the water cooling passages has been identified as the direct cause of these issues with existing hardware. Designing a new semi-elliptical nozzle using new, copper electroforming technology that will incorporate improved water cooling passages can avoid these issues. This forming technology has already been demonstrated in other NASA ground test facility nozzles. It must be recognized that the design of this type of hardware borders on the limits of convection-cooling techniques close to material limits of temperature and pressure because of the severe high heating loads that the nozzle experiences in normal operation.

The goal is to successfully design and operate the nozzle which can absorb a heat flux of over 6000 W/sq.cm. continuously for hours, survive multiple exposures per day, and have a life expectancy of twenty years. The internal flow contours for the super-heated test gas will not be significantly altered from the present design. The proposed new semi-elliptical nozzle will allow NASA to meet the more stringent testing requirements imposed by present and future programs and to ensure NASA's continued arc-jet testing capability. It will improve operations by eliminating the present high pressure leaks and nozzle warping which compromise the integrity and quality of arc jet testing.

Current mission testing requirements that require the proposed upgrade include:

- In-Space Propulsion Program (ISP)
- X-37 prototype reusable launch vehicle program
- Space Shuttle Return to Flight (RTF) Testing
- Space Shuttle External Tank (ET) Program
- Mars Scientific Laboratory (MSL) Program

Project Scope, Elements:
This project will consist of the following elements:

1) Development of the maximum heat flux to be absorbed, and the distribution of heating. This will provide the requirements to adequately cool the nozzle using high pressure cooling water (flow and pressure requirements). Advanced computational tools and engineering correlations will be used to complete this task element.
2) Identify and produce conceptual design(s) of cooling passages that meet thermal and structural loads.
3) Detailed design of the semi-elliptical nozzle throat including thermal, structural, and mechanical phases in sufficient detail to provide for fabrication of the assembly. Detailed three-dimensional solid models will be generated and analyzed to complete this element.
4) Fabrication of the hardware.
5) Identification and design development of facility modifications (if any) that are required to install, operate, and maintain the new nozzle. This includes structural, cooling water, electrical, and control modifications.
6) Inspection, assembly, test, and final acceptance of the new semi-elliptical nozzle hardware.
7) Installation and integration of the nozzle into the IHF arc jet.
8) Facility shakedown and validation testing of the new nozzle.

CoF Project Initiation Form

Cost Estimate Information, Miscellaneous Supporting Materials:
Breakdown should match scope, and elements from above and include an estimate for design.

The cost estimate below is a preliminary. An engineering study has yet to be conducted to refine the projected cost and scope details.

Preliminary requirements study	$0.55 M
Detailed design and shop-ready drawings	$0.50 M
Manufacturing the nozzle	$1.75 M
Inspection, Test, and Assembly	$0.23 M
Construction Management, Contingency	$0.61 M
Construction Total	$3.64 M

CoF Project Initiation Form

ENVIRONMENTAL CHECKLIST

Part A:	Yes	No	Maybe
1. Will this activity result in changes of potable water use greater that 851,000 gallons/year		X	
2. Will this activity result in a change in employment levels greater than 620 people?		X	
3. Will there be any construction or other activity north of Allen Road (flood plain and wetlands areas)?		X	
4. Will there be any action which could or will affect any threatened or endangered species (north Allen Road)?		X	
5) Will there be any action affecting areas of historical (Moffett Shenandoah Plaza area, Hanger One) or archaeological significance (directly west of the OARF)?		X	

Part B:	Yes	No	Maybe
1) Discharge of any substances into the air, surface or ground water, sanitary sewer, or soils.		X	
2) Removal of vegetation or destruction of wildlife habitat or grading activities.		X	
3) Acquisition, use, generation, storage, or disposal of any toxic or hazardous substances.			X
4) Generation of hazardous, toxic, or radiological wastes.		X	
5) Generation of ionizing or non-ionizing radiation.		X	
6) Generation of high noise levels (above 80 dBa).		X	
7) Activities resulting in changes of greater than 2,200,000 KWH of electricity, or 3,130,000 CF of natural gas per year for Ames' energy consumption.		X	
8) Use of pesticides, including insecticides, herbicides, fungicides, and rodenticides.		X	
9) Construction or modification of a sewage collection or transmission system.		X	

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