MSFC RPO-PN-Dec 74, V.2

APRIL 1974

cy 1

PROPERTY OF
MARSHALL LIBRARY
A&TS-MS-IL

RECEIVED
NASA STI FACILITY
ACCESS DEPT.

GEORGE C. MARSHALL SPACE FLIGHT CENTER

MILESTONE AND FINANCIAL CHARTS TO ACCOMPANY RESEARCH AND TECHNOLOGY PROGRESS REPORTS

(NASA-TM-81083) MILESTONE AND FINANCIAL CHARTS TO ACCOMPANY RESEARCH AND TECHNOLOGY PROGRESS REPORTS, 1 OCTOBER 1973 - 31 MARCH 1974 (NASA) 329 p

N80-74906

Unclas
00/85 17295

FOR THE PERIOD OCTOBER 1, 1973 THROUGH MARCH 31, 1974

COMPILED AND EDITED BY:
RESEARCH PLANNING OFFICE
SCIENCE AND ENGINEERING DIRECTORATE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NOTICE: THIS DOCUMENT MAY BE EXEMPT FROM PUBLIC DISCLOSURE UNDER THE FREEDOM OF INFORMATION ACT 5 U.S.C. 552). REQUESTS FOR ITS RELEASE TO PERSONS OUTSIDE THE U.S. GOVERNMENT SHOULD BE HANDLED UNDER THE PROVISIONS OF NASA POLICY DIRECTIVE 1382.2

MSFC - Form 454-1 (Rev October 1967)

17295

329 p

PREFACE

This issue of MSFC's Research and Technology Progress Reports has been prepared in accordance with instructions for reporting Research and Technology from the Office of Aeronautics and Space Technology. A format is used, which provides only a narrative summary report at the RTOP level. Milestone Schedule Charts and Financial Status Charts are no longer required as elements of each progress report. However, as both charts provide useful information to individuals and groups within NASA having a program management function, they are available separately, in a supplementary volume, to those having a special need for them.

Issues of these reports are published twice a year, with reporting dates conforming to the OAST requirements of April 1 and October 1.

NOTES

The Milestone Charts in this volume are in NASA Program-Office categories as in the Report- Texts Volume. The Financial Charts are not categorized by Program-Office, but are simply in numerical sequence by RTOP Codes.

In a few cases, Milestone Charts and Financial Charts corresponding to Report-Texts were unavailable at time of publication; thus, absence of a chart does not indicate lack of a plan-schedule nor a lack of funding.

TABLE OF CONTENTS
OAST

RTOP Code No.	Title	Page
113-31-12	Main Propulsion for Space Shuttle Vehicle	1
113-31-14	Shuttle Main Propulsion Technology	2
114-03-33	Structural Composite Materials for Space Shuttle	5
114-08-04	Space Shuttle Composites for Primary Structures	7
115-17-04	Shuttle Guidance	9
124-07-06	Aerothermodynamics	10
124-08-37	Space Shuttle Advanced Composites for Primary Structures	11
501-08-10	Atmospheric Parameters	12
501-38-13	Hazard Avoidance and Elimination	20
502-01-03	Properties of Materials for Electronic Applications	28
502-21-27	Space Vehicle Thermal Control	29
502-21-28	Optical Contamination	30
502-21-30	Environmental Design Criteria	31

TABLE OF CONTENTS
OAST

RTOP Code No.	Title	Page
502-22-11	Space Vehicle Dynamics	33
502-23-21	Large Telescope Technology	34
502-23-31	Optical Mass Memory	35
502-23-42	Inertial components	37
502-23-51	Design, Processing and Testing of LSI Arrays	38
502-23-52	Screening and Reliability Testing of Microcircuits and Electronic Devices	42
502-24-17	Feasibility Study of a Solar Electric Propulsion System "SEPS" for Geosynchronous Missions	43
502-24-21	Launch Vehicle Propulsion Technology	44
502-25-73	Multi-KW DC Distribution System	48
502-33-53	Space Shuttle Sensors and Instrumentation	49
503-24-06	Reusable Nuclear Stage Technology	54

TABLE OF CONTENTS
OMSF

RTOP Code No.	Title	Page
908-51-05	Electrical Power	57
908-51-08	Stabilization and Control	58
908-51-21	Manufacturing and Inspection	61
908-52-08	Stabilization and Control	62
908-52-10	Guidance and Navigation	65
908-52-37	Cryogenics	66
908-52-39	Aerothermodynamics	71
908-54-05	Electrical Power	73
908-54-08	Stabilization and Control	74
909-51-02	Thermal Control	76
909-51-05	Electrical Power	80
909-51-07	Communications	82
909-52-39	Aerothermodynamics	83

TABLE OF CONTENTS
OMSF

RTOP Code No.	Title	Page
909-52-46	Physical Standards	88
909-52-47	Environmental Quality	90
909-54-05	Electrical Power	93
909-54-07	Communications	97
909-54-21	Manufacturing and Inspection	98
909-54-22	Transportation	104
909-54-33	Information Management System	106
909-55-01	Structural	108
909-55-02	Thermal Control	110
909-55-03	Propulsion	111
909-55-05	Electrical Power	113
909-55-10	Guidance and Navigation	118
909-55-37	Cryogenics	120
909-55-40	Aeroelasticity	122

TABLE OF CONTENTS
OMSF

RTOP Code No.	Title	Page
909-55-47	Environmental Quality	126
970-62-20	Food, Atmosphere, Water and Waste Management	128
970-62-23	Water and Waste Management	129
970-62-40	CVT EC/LSS Support Program	130
970-63-10	Requirements for Work Performance Design	137
970-63-20	Teleoperator Manipulation and Control	140
972-30-00	Aeroelasticity	146
972-50-00	Aeroelasticity	147
975-61-05	Zero-G Atmospheric Cloud Physics Program	148
975-72-01	Spacecraft Surfaces	149
975-72-39	Optical Contamination	150
976-30-02	Thermal Control	151
976-30-04	Space Shuttle Auxiliary Propulsion System (APS)	152

TABLE OF CONTENTS
OMSF

RTOP Code No.	Title	Page
976-30-38	Materials	153
976-30-40	Aeroelasticity	154
976-30-45	Aeroelasticity	156
976-30-50	Eastern Test Range Statistics for Space Shuttle Booster Design and Recovery Operations	159
976-30-61	Structures	160
976-30-84	Shuttle Development	163
976-30-93	Structural	166
982-52-03	Shuttle Main Propulsion Technology	167
982-52-61	Space Shuttle Engine and Vehicle TPS Review	168
983-15-21	Instrumentation for Space Shuttle	169

TABLE OF CONTENTS
OA

RTOP Code No.	Title	Page
161-80-01	Space Station Thermal Control	171
175-21-71	Worldwide Cloud Cover Model	172
175-61-71	Interrelationships Between Atmospheric Motions of Different Scales	173
175-61-73	Zero-G Atmospheric Cloud Physics Program	175
179-10	Materials and Process R & D	176
179-11-10	Study of Liquid-Solid Transition for Materials Processing in Space	190
179-11-11	Single Crystals of Metal Solid Solutions	191
179-11-12	Segregation Effects During Solidification in Weightless Melts	192
179-11-14-02	Immiscible Materials - Ground Based Studies	193

TABLE OF CONTENTS
OA

RTOP Code No.	Title	Page
179-11-21-00	Zone Refining in a Zero Gravity Environment	194
179-12-13	Growth of Single Crystal Ribbon in Space	195
179-12-13-06	Analytics of Crystal Growth	196
179-12-15-01	Space Processing Research on Crystal Growth	197
179-12-15-02	Crystal Growth and Characterization	198
179-12-16	Gravitational Effects on Process-Induced Dislocation in Silicon	199
179-12-23	Crystal Growth in Fused Solvent Systems	200
179-12-23-02	Solution Crystal Growth	201
179-15-11-02	Convection Analysis	202
179-15-12-01	Soret Separation in Zero Gravity	203
179-15-12-02	Diffusion Analysis in Low Gravity	204

TABLE OF CONTENTS
OA

RTOP Code No.	Title	Page
179-20	Space Processing Equipment Technology	205
179-21-20	Solar Energy Concentrator System for Crystal Growth and Zone Refining in Space	211
179-24-30-01	Crystal Growth Techniques in Zero Gravity	212
179-26-11-01	Acoustic Mixing for Space Processed Materials	213
179-30	Ground Based Space Processing Tests	214
179-40	Space Processing Flight Systems	215
645-10-01	Zero-G Cloud Physics Experiments	216
684-30-90	Terminal Guidance and Navigation for Comet and Asteroid Rendezvous	217

TABLE OF CONTENTS
OSS

RTOP Code No.	Title	Page
180-17-50	System Performance and Technology Assessment for Unmanned Missions	219
180-17-52	System and Trajectory Analysis	220
180-17-53	Dynamic Test of Inertial Sensors	222
180-17-54	Guidance Computer Technology	225
180-17-55	Contamination Control in Microelectronic Modules	226
180-17-56	Low Cost Computer for SEPS	227
180-17-57	Solar Array Technology for Solar Electric Propulsion Stage	232
188-36-56	Magnetospheric-Physics-Particle and Particle/Photon Interactions	238
188-38-52	Real Time Solar Magnetograph (RTSM)	239
188-41-51	Ultraviolet and Optical Astronomy	240
188-45-52	Meteor Astronomy	241
188-46-64	Cosmic-Ray and Gamma-Ray Astronomy Investigations	242
188-78-57	Large Space Telescope	243

TABLE OF CORRESPONDING CODES
IN-HOUSE TO AGENCY

MSFC Code	Title	Headquarters Assigned Code
976-30-45*	AEROELASTICITY	976-30-40
976-30-84*	SHUTTLE DEVELOPMENT	976-30-50
976-30-93*	STRUCTURAL	976-30-61

* Listed By This Code In Text-Volume.

CROSS-REFERENCE TABLE
OAST

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
113-31-12	1	1, 2
113-31-14	2	3, 4
	3	5
	4	6, 7
114-03-33	5	8, 9
	6	10, 11
114-08-04	7	12, 13
	8	14, 15
115-17-04	9	16, 17
124-07-06	10	18, 19
124-08-37	11	20, 21
501-08-10	12	22
	13	23, 24
	14	25, 26
	15	27, 28
	16	29, 30
	17	31, 32
	18	33, 34
	19	35, 36
501-38-13	20	37, 38
	21	39, 40
	22	41, 42
	23	43, 44

CROSS-REFERENCE TABLE (Continued)
OAST

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
501-38-13 (Cont'd)	24	45, 46
	25	47, 48
	26	49
	27	50, 51
502-01-03	28	52, 53, 54, 55
502-21-27	29	56, 57, 58
502-21-28	30	59, 60
502-21-30	31	61, 62
	32	63, 64, 65
502-22-11	33	66, 67, 68, 69
502-23-21	34	70, 71, 72
502-23-31	35, 36	73, 74, 75
502-23-42	37	76, 77, 78
502-23-51	38-41	79, 80, 81, 82, 83
502-23-52	42	84, 85, 86
502-24-17	43	87, 88
502-24-21	44	89, 90
	45	91, 92
	46	93, 94

CROSS-REFERENCE TABLE (Cont'd)
OAST

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
502-24-21	47	95, 96
502-25-73	48	97, 98
502-33-53	49	99
	50	100
	51, 52	101, 102, 103
	53	104
503-24-06	54	105
	55	106, 107

CROSS REFERENCE TABLE
OMSF

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
908-51-05	57	109, 110
908-51-08	58	111
	59	112, 113
	60	114, 115
908-51-21	61	116, 117
908-52-08	62	118, 119, 120
	63	121
	64	122, 123, 124, 125
908-52-10	65	126, 127
908-52-37	66	128, 129
	67	130
	68	131, 132
	69	133
	70	134
908-52-39	71	135, 136
	72	137, 138
908-54-05	73	139, 140
908-54-08	74	141, 142
	75	143, 144
909-51-02	76	145, 146
	77	147, 148
	78	149, 150
	79	151, 152

CROSS-REFERENCE TABLE (Cont'd)
OMSF

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
909-51-05	80	153, 154
	81	155, 156
909-51-07	82	157, 158
909-52-39	83	159, 160
	84, 85, 86	161, 162
	87	163, 164
909-52-46	88	165, 166
	89	167, 168
909-52-47	90	169, 170
	91	171, 172
	92	173, 174
909-54-05	93	175, 176
	94	177, 178
	95	179, 180
	96	181, 182
909-54-07	97	183, 184
909-54-21	98	185, 186
	99	187
	100	188, 189
	101	190, 191
	102	192
	103	193, 194
909-54-22	104	195, 196, 197
	105	198, 199

CROSS-REFERENCE TABLE (Cont'd)
OMSF

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
909-54-33	106	200
	107	201, 202
909-55-01	108	203, 204, 205, 206, 207, 208, 209
	109	210, 211
909-55-02	No chart	212, 213
	110	214, 215, 216
909-55-03	111	217, 218
	112	219, 220
909-55-05	113	221, 222, 223, 224, 225
	114	226, 227, 228, 229
	115, 116	230, 231, 232, 233
	117	234, 235
909-55-10	118	236, 237
	119	238, 239
909-55-37	120	240, 241
	121	242, 243, 244
909-55-40	122	245
	123	246, 247
	124	248, 249
	125	250
909-55-47	126	251
	127	252, 253
970-62-20	128	254, 255
970-62-23	129	256, 257

CROSS-REFERENCE TABLE (Cont'd)
OMSF

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
970-62-40	130	258, 259
	131	260
	132	261, 262
	133	263, 264
	134	265
	135	266
	136	267, 268
970-63-10	137	269, 270
	138	271
	139	272, 273
970-63-20	No Chart	274
	140, 141	275, 276, 277, 278, 279
	142	280, 281, 282
	143	283, 284
	144	285, 286, 287, 288 289
	145	290, 291
972-30-00	146	292, 293
972-50-00	147	294, 295
975-61-05	148	296
975-72-01	149	297, 298
975-72-39	150	299, 300
976-30-02	151	301
976-30-04	152	302, 303

CROSS REFERENCE TABLE (Cont'd)
OMSF

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
976-30-38	153	304, 305, 306
976-30-40	154	307
	155	308, 309
976-30-45	156	310, 311
	157	312, 313, 314
	158	315, 316
976-30-50	159	317, 318
	160	325, 326
	161	327, 328
	162	329, 330
976-30-61	163	319, 320
	164	321, 322
	165	323, 324
	166	331
982-52-03	167	332, 333
982-52-61	168	334, 335, 336
983-15-21	169	337, 338
	170	339, 340

CROSS-REFERENCE TABLE
OA

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
161-80-01	171	341, 342
175-21-71	172	343, 344
175-61-71	173 174	345, 346 347, 348
175-61-73	175	349
177-53-71	No Chart	350, 351
179-10	176 177 178 179 180 181 182 183 184 185 186 187 188 189	352, 353 354, 355 356 357, 358 359, 360 361 362, 363 364, 365 366, 367 368, 369 370, 371 372 373 374
179-11-10	190	375, 376, 377
179-11-11	191	378, 379
179-11-12	192	380, 381
179-11-14-02	193	382, 383
179-11-21-00	194	384

CROSS-REFERENCE TABLE (Cont'd)
OA

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
179-12-13	195	385, 386
179-12-13-06	196	387
179-12-15-01	197	388
179-12-15-02	198	389
179-12-16	199	390, 391
179-12-23	200	392, 393, 394
179-12-23-02	201	395
179-15-11-02	202	396, 397, 398
179-15-12-01	203	399, 400
179-15-12-02	204	401, 402
179-20	205 206 207 208 209 210	403 404, 405 406, 407 408, 409 410 411
179-21-20	211	412, 413
179-24-30-01	212	414
179-26-11-01	213	415
179-30	214	416, 417

CROSS-REFERENCE TABLE (Cont'd)
OA

RTOP CODE. NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
179-40	215	418
645-10-01	216	419, 420
684-30-90	217	421, 422

CROSS-REFERENCE TABLE
OSS

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
180-17-50	219	423, 424
180-17-52	220	425, 426
	221	427, 428
180-17-53	222	429, 430
	223	431, 433
	224	433
180-17-54	225	434, 435, 436
180-17-55	226	437, 438
180-17-56	227	439
	228	440
	229	441, 442
	230	443, 444
	231	445, 446
180-17-57	232	447, 448, 449, 450
	233	451
	234	452
	235	453, 454
	236	455
	237	456, 457
186-68-64	No Chart	458
188-36-56	238	459, 460
188-38-52	239	461, 462, 463, 464
188-41-51	240	465, 466, 467
188-41-54	No Chart	468, 469

CROSS-REFERENCE TABLE (Cont'd)
OSS

RTOP CODE NO.	CHARTS VOLUME PAGE NO.	TEXT VOLUME PAGE NO.
188-45-52	241	470, 471
188-46-64	242	472, 473, 474, 475
188-48-51	No Chart	476, 477
188-78=57	243 244 245 246	478 479 480 481, 482

MILESTONE SCHEDULE CHARTS

OFFICE OF AERONAUTICS
AND
SPACE TECHNOLOGY

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PF
APPROVAL A. L. Worlund
ACCOMPLISHMENT T. W. Winstead

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE MAIN PROPULSION FOR SPACE SHUTTLE VEHICLE
113-31-12
RTOP NO. 128-31-63 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES	CY 1970	CY 1971	CY 1972	CY 1973	CY 1974
1	RAPID START OF LH_2 TURBOPUMPS					
2	SUBTASK					
3	I. Analytical Studies					
4	II. Lab Sample Tests					
5	III. Feed System Tests					
6	IV. Coated System Tests					
7	FINAL REPORT					
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-I
APPROVAL W. O. FROST
ACCOMPLISHMENT H. S. Harman

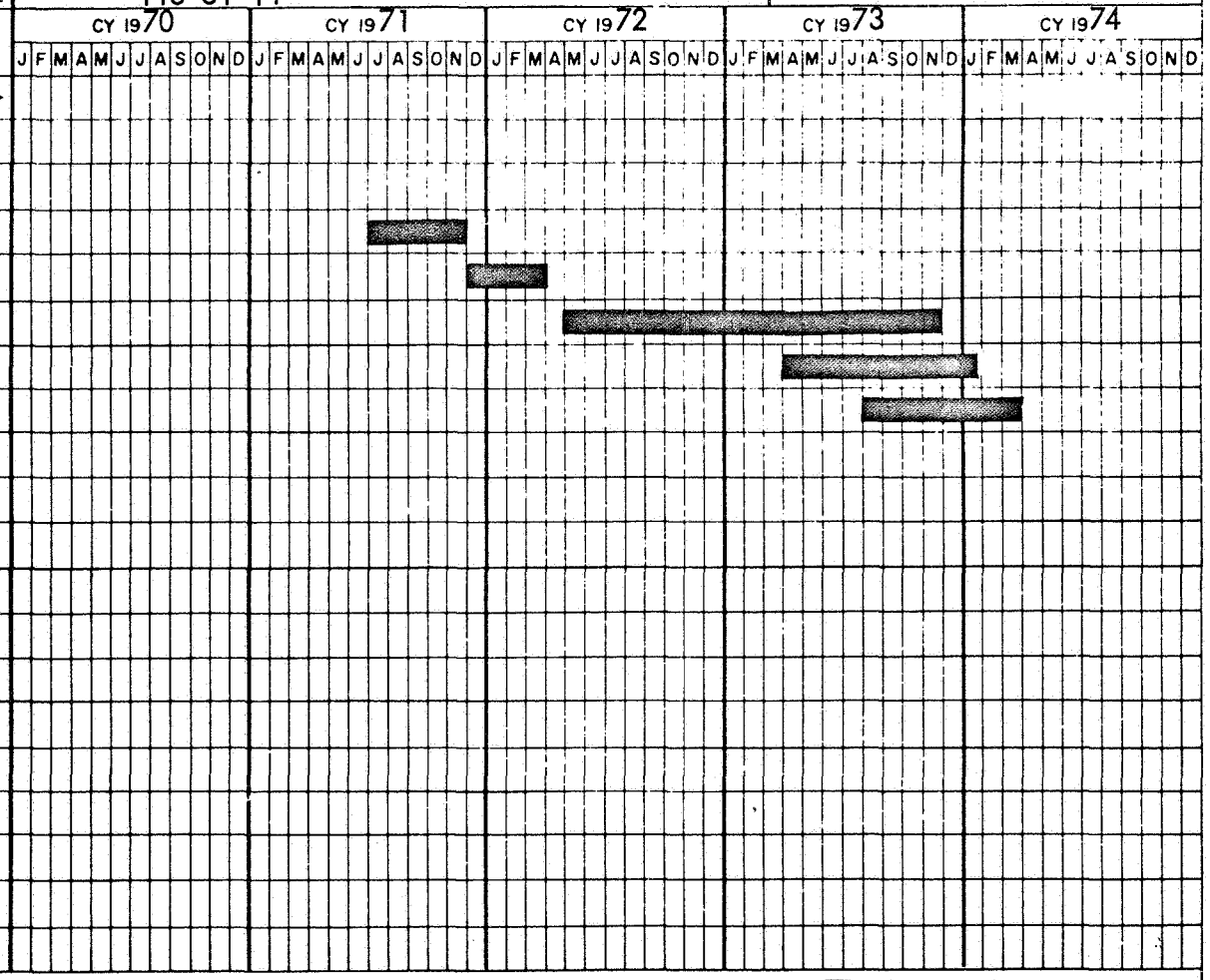
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Shuttle Main Propulsion Technology
RTOP NO. 113-31-14 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Pressure Transducer for →
2	Active Pogo Control
3	
4	Define Requirements
5	Development Contract
6	Prototype Development
7	Prototype Testing
8	Final Recommendations
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-I
APPROVAL O. T. Duggan
ACCOMPLISHMENT J. H. Goldstein

MILESTONE SCHEDULE

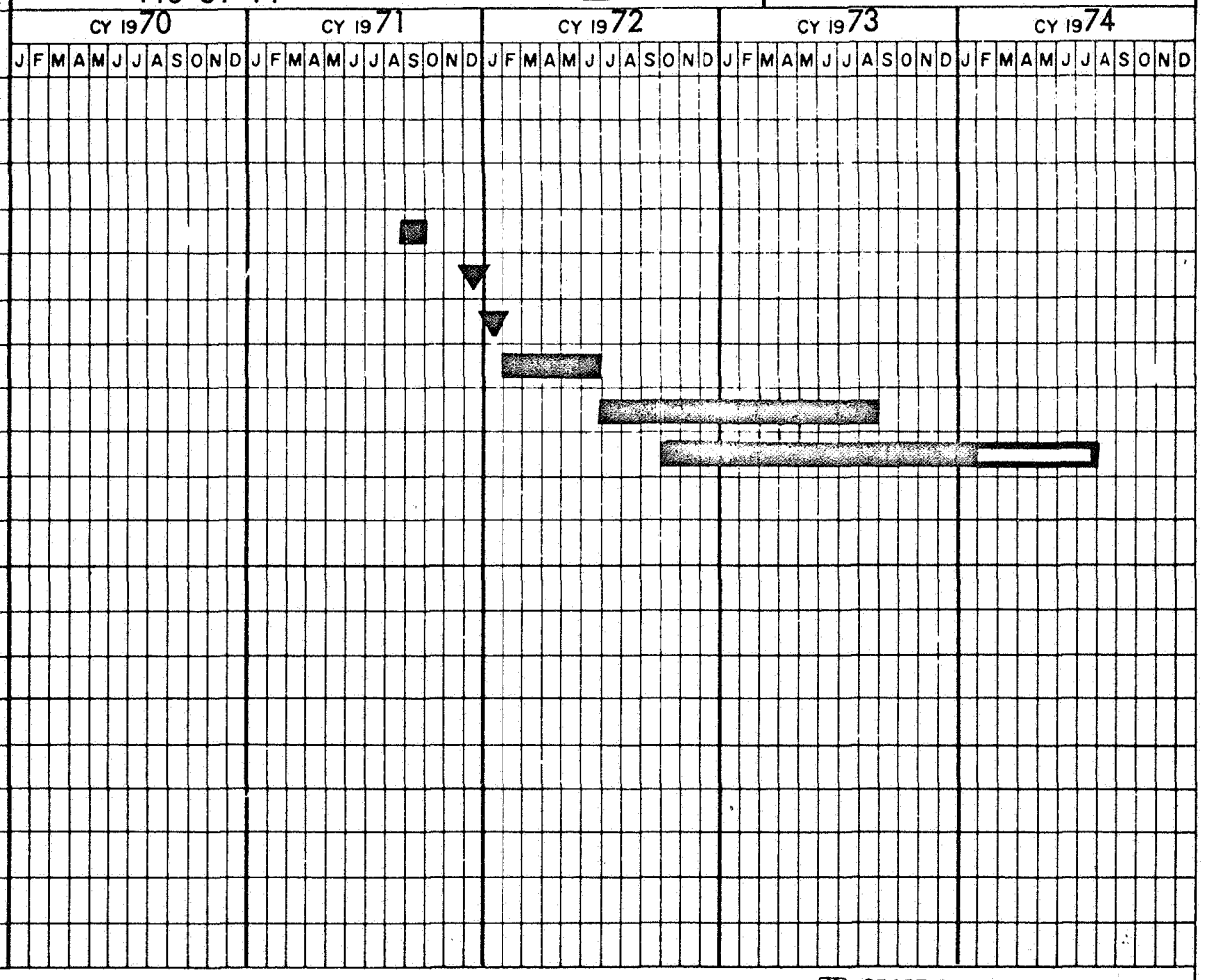
4 LEVEL

RTOP TITLE Shuttle Main Propulsion Technology

RTOP NO. 113-31-14 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date)

	ACTIVITIES
1	Cryogenic Facility Mass
2	Flowmeter
3	
4	Preparation of RFQ
5	Contract Award
6	Facility Change Criteria
7	Facility Design
8	Facility Modification
9	Flowmeter Evaluation
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-1
APPROVAL O.T. Duggan
ACCOMPLISHMENT W. B. White

MILESTONE SCHEDULE

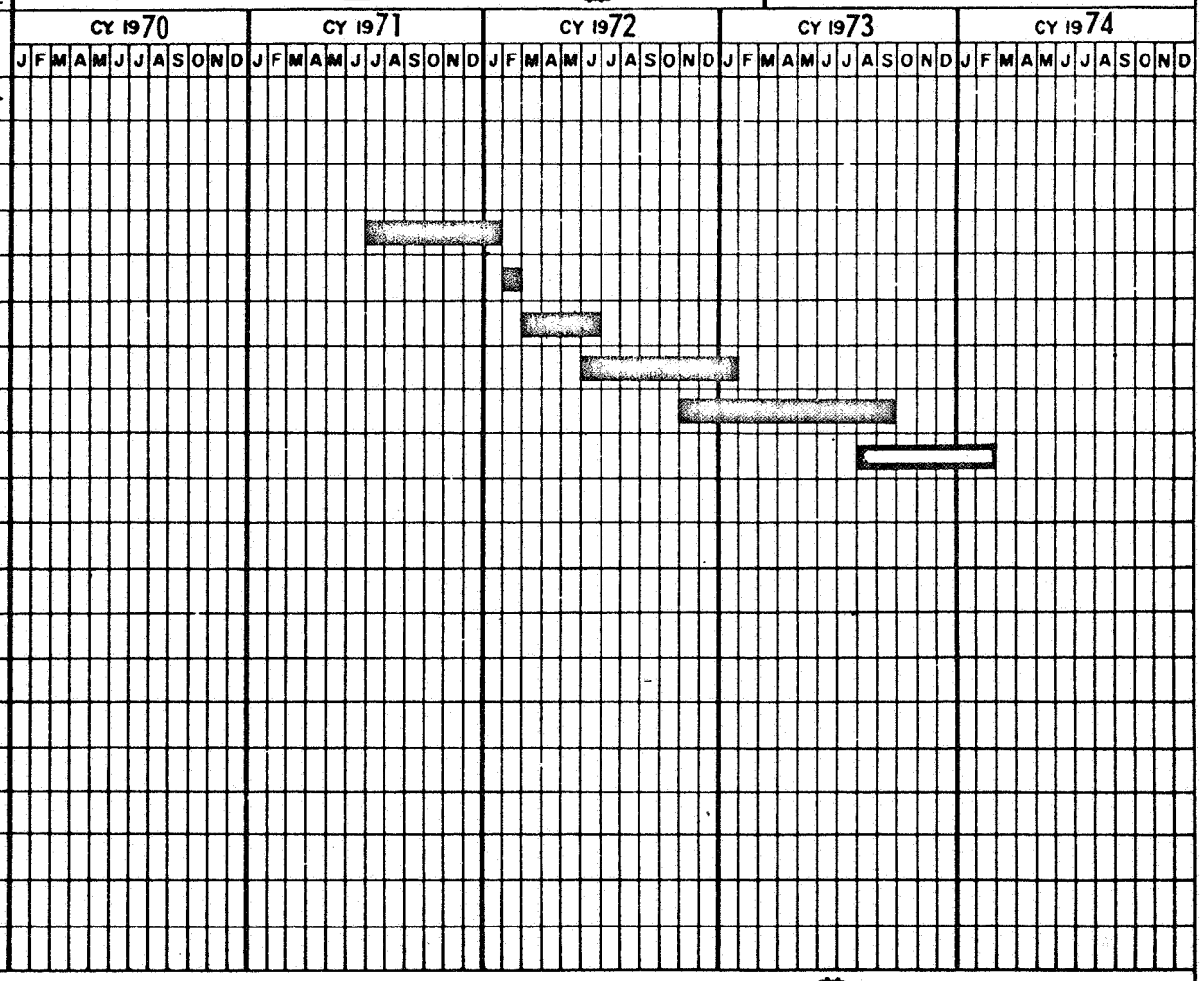
RTOP TITLE Shuttle Main Propulsion Technology

5 LEVEL

RTOP NO. 113-31-14 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Fast Response High
2	Temperature Sensor
3	
4	Define Requirements
5	Write RFQ
6	Contract Award
7	Develop Technique
8	Prototype
9	Testing
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTN-M
APPROVAL R. J. Schwinghamer
ACCOMPLISHMENT F. P. LaIacona

MILESTONE SCHEDULE

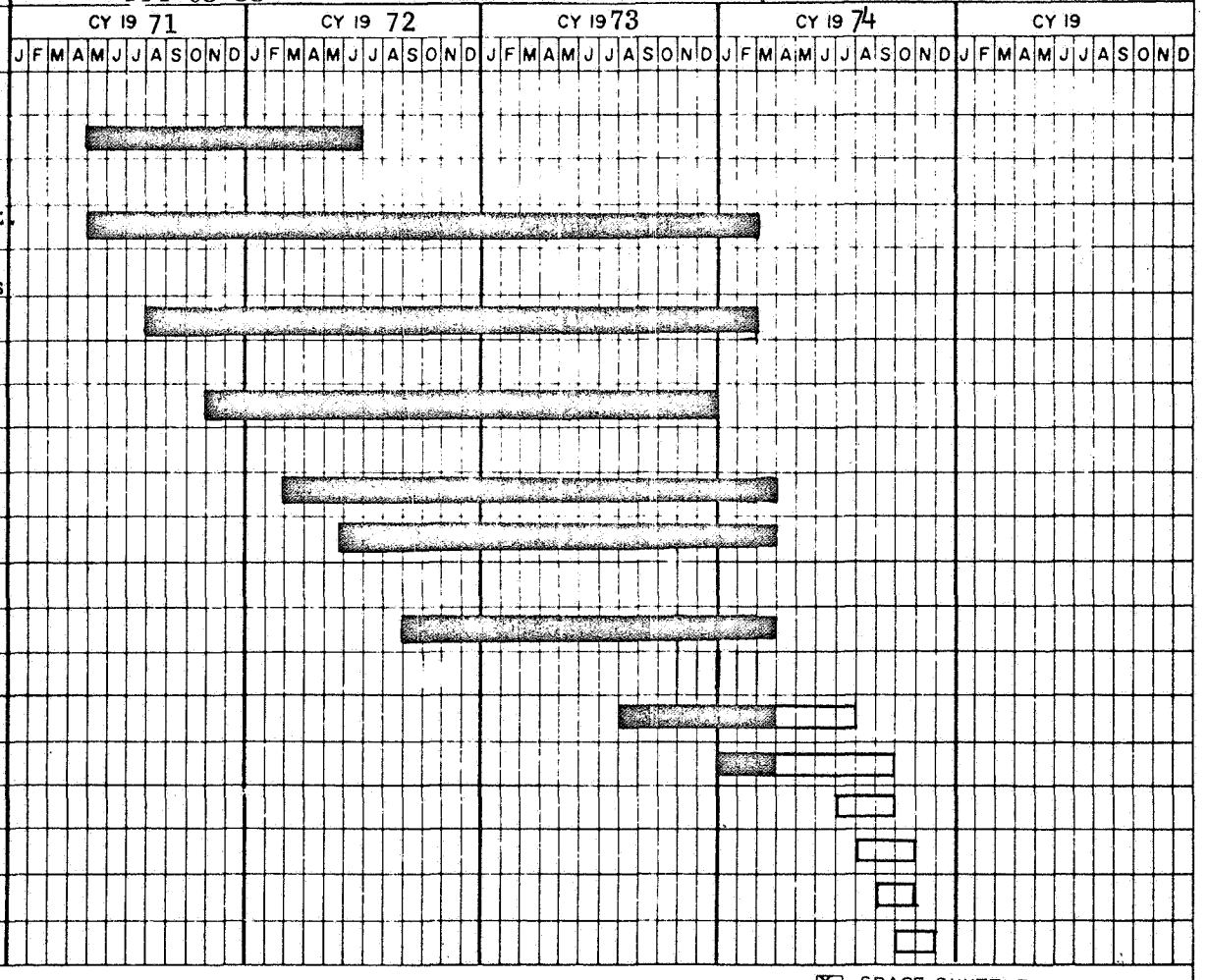
5 LEVEL

RTOP TITLE Structural Composite Materials For Space Shuttle

RTOP NO. 114-03-33 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	Dev. of Method for Fab. Composites
2	Estab. Winding Parameters
3	Establish Matrix and
4	Reinforcement Mat'ls Reqmt.
5	Establish Temp. + Pressures
6	for Consolidation
7	Design Continuous Process
8	System
9	Produce First Continuous
10	Composites
11	Produce Final Composites
12	Specimen Test - Extruded
13	Lengths
14	Graphite/Aluminum
15	Det. Consolidation Cond.
16	Estab. Cont. Process
17	Produce Cont. Composite
18	Produce Final Composite
19	Test Component
20	Final Report



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Completed Work
Planned Work
Probable Work

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-M
APPROVAL R. J. Schwinghamer
ACCOMPLISHMENT F. P. LaIacona

MILESTONE SCHEDULE

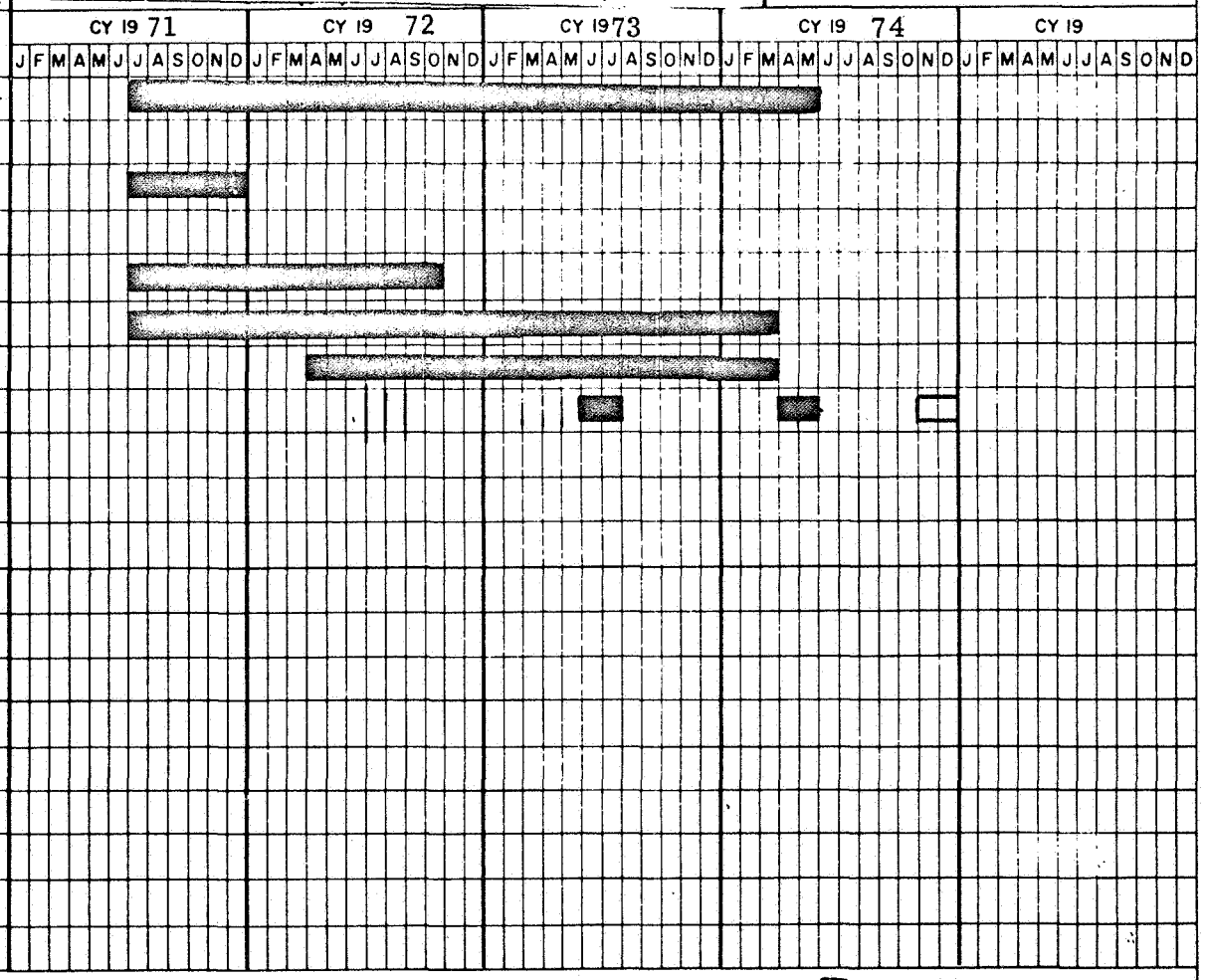
RTOP TITLE STRUCTURAL COMPOSITE MATERIALS FOR SPACE SHUTTLE

5 LEVEL

RTOP NO. 114-03-33 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Eval. of B/Al for Space Shuttle
2	Phase I: Materials
3	Evaluation
4	Phase II: Design and
5	Analysis
6	Process Technology
7	Test and Evaluation
8	Final Report
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Completed Work
Planned Work
Probable Work

CENTER MSFC
RESPONSIBILITY S&E-ASTN-ES
APPROVAL G. A. Kroll
ACCOMPLISHMENT E. E. Engler

MILESTONE SCHEDULE

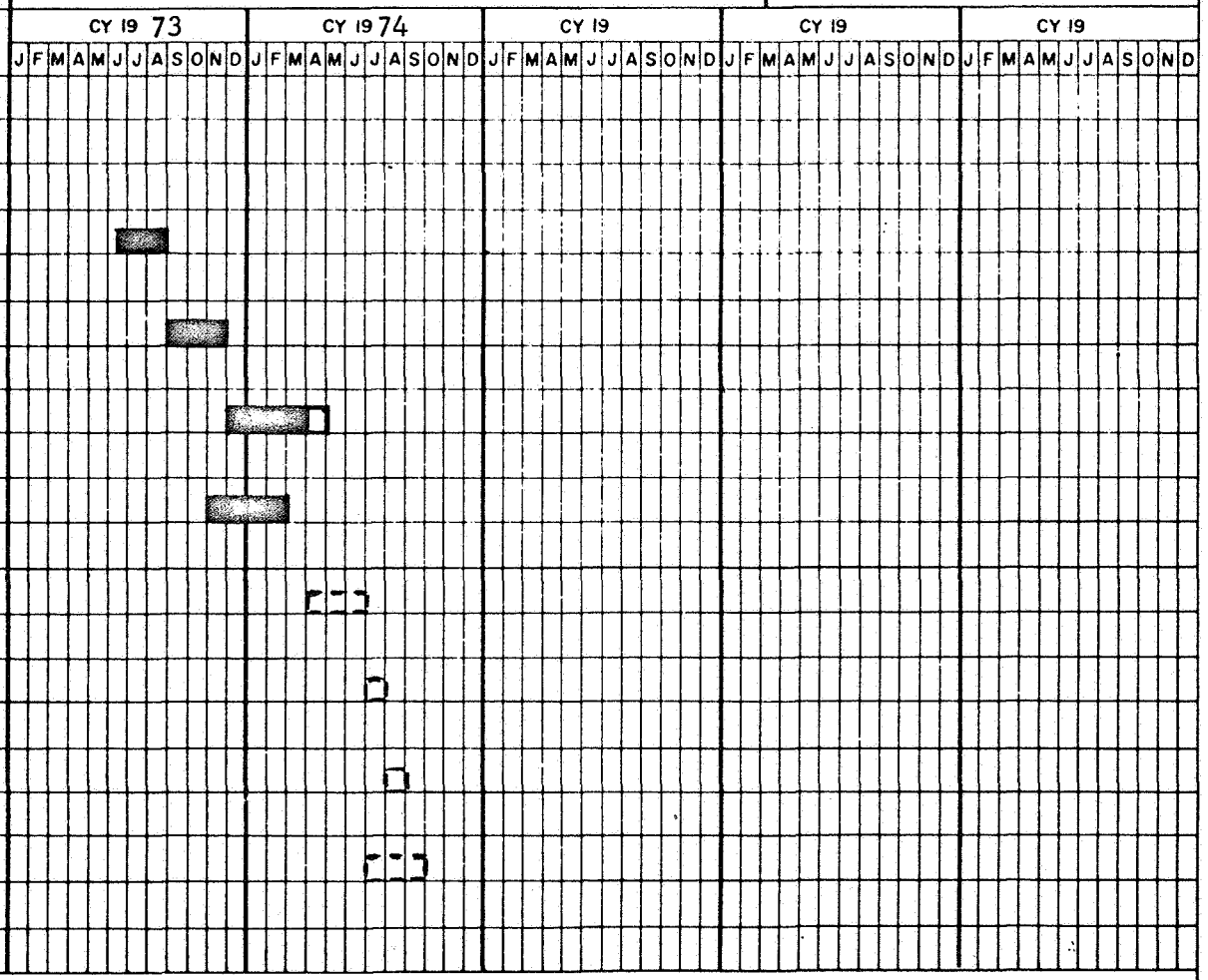
5 LEVEL

RTOP TITLE Space Shuttle Composites for Primary Structures

RTOP NO. 114-08-04 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	GRAPHITE/EPOXY
2	METERING SHELL
3	
4	PRELIMINARY DESIGN
5	
6	DETAIL DESIGN
7	
8	COMPONENT TESTING
9	
10	TOOLING
11	
12	COMPONENT FAB. & ASSY
13	
14	STATIC & DYNAMIC TESTS
15	
16	THERMAL VACUUM TEST
17	
18	FINAL REPORT
19	
20	



NOTES
COMPLETED
PLANNED
PROBABLE

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ LST PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-ES
APPROVAL G. A. Kroll
ACCOMPLISHMENT E. E. Engler

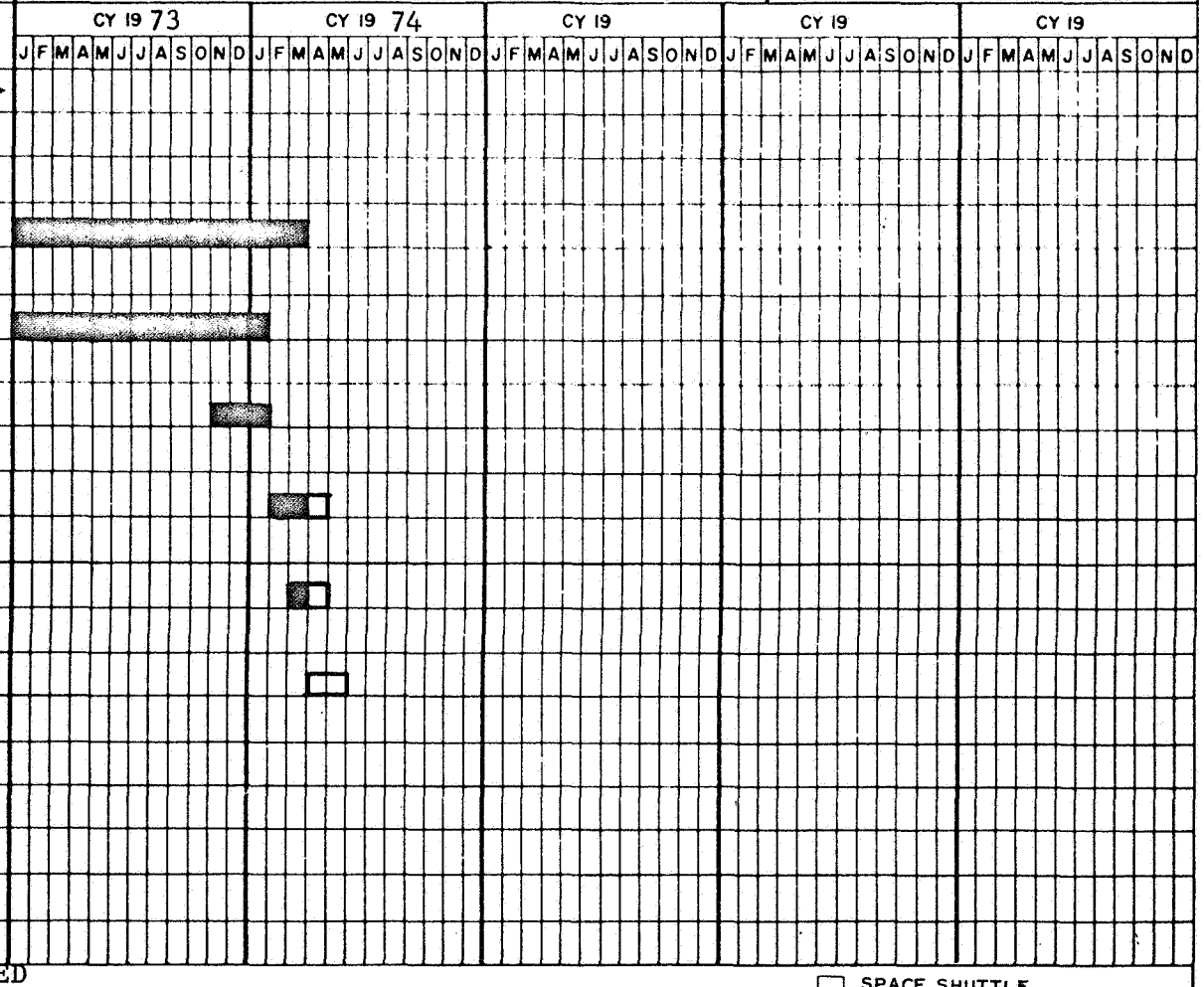
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Space Shuttle Composites for Primary Structure
RTOP NO. 114-08-04 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	GRAPHITE/EPOXY METERING ➔
2	TRUSS STRUCTURE COMPONENTS
3	
4	MATERIAL CHARACTERIZATION
5	
6	DESIGN STUDIES
7	
8	COMPONENT DETAIL DESIGN
9	
10	COMPONENT FABRICATION
11	
12	COMPONENT TEST
13	
14	FINAL REPORT
15	
16	
17	
18	
19	
20	



NOTES
COMPLETED
PLANNED
PROBABLE

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ LST PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-G
APPROVAL James C. Blair
ACCOMPLISHMENT R. R. Burrows

MILESTONE SCHEDULE

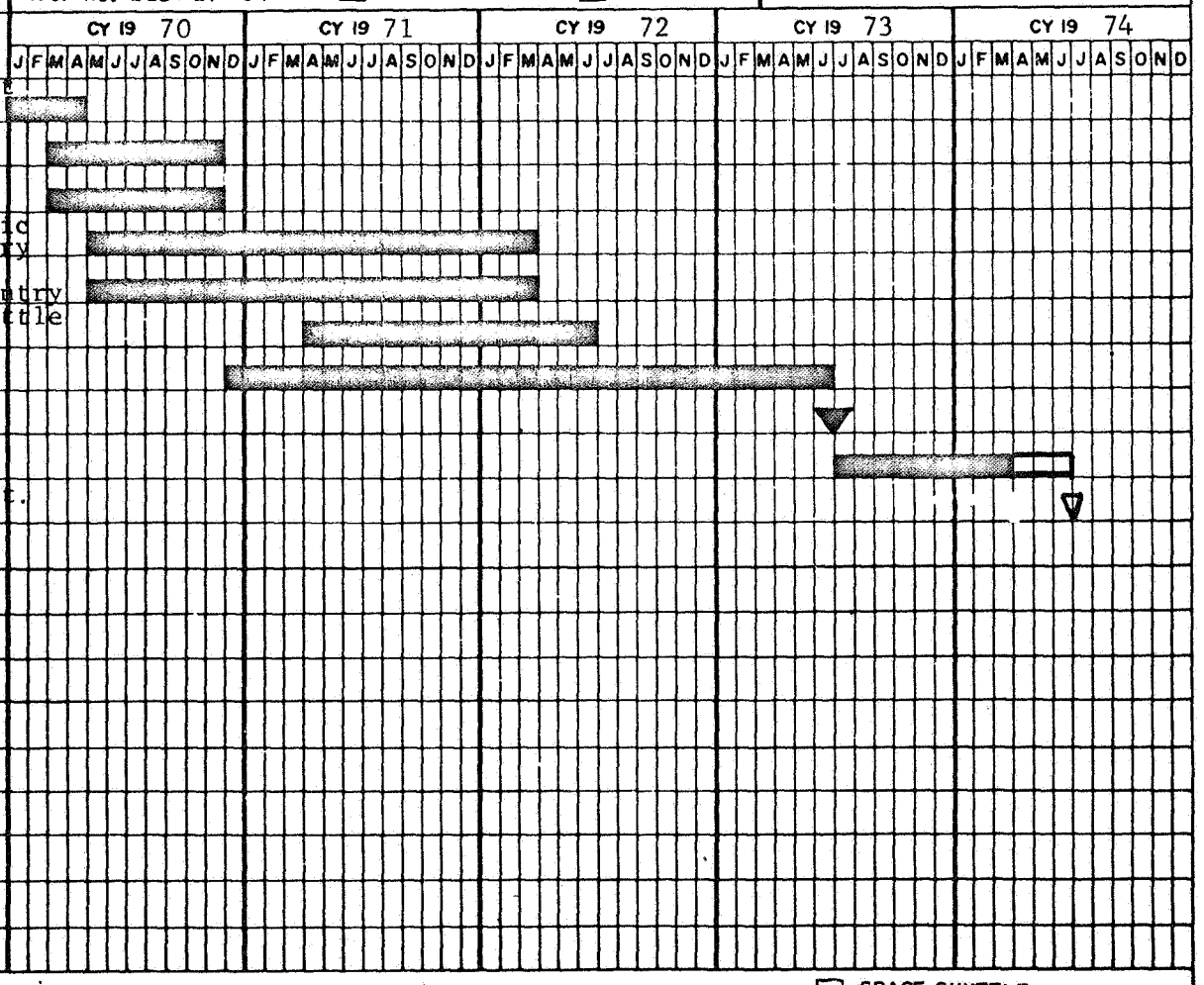
4 LEVEL

RTOP TITLE Shuttle Guidance

RTOP NO. 115-17-04 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Guidance Concept Development for Vacuum Flight
2	Guidance Scheme Development for Vacuum Flight
3	Problem Formulation Studies for Optimal Reentry
4	Translational & Thermodynamic Model Development for Reentry
5	Trajectory Optimization Program Development for Reentry
6	Program Development for Shuttle Ascent and Reentry Motion
7	Guidance Scheme Development for Reentry
8	Reentry Guidance Scheme Documentation
9	Powered Flight Algorithm Mod. and update
10	Documentation of powered Flt. Algorithm for Tug
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Tug PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-AT
APPROVAL W. K. Dahm
ACCOMPLISHMENT H. B. Wilson

MILESTONE SCHEDULE

RTOP TITLE Aerothermodynamics

5 LEVEL

RTOP NO. 124-07-06 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1971	CY 1972	CY 1973	CY 1974	CY 1975
1	High Altitude Plume Expansions					
2						
3	High Pressure H_2/O_2 Short Duration					
4	Technique Development					
5						
6	Obtain Model Data					
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

J F M A M J J A S O N D

NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-M
APPROVAL R. J. Schwinghamer
ACCOMPLISHMENT J. Stuckey

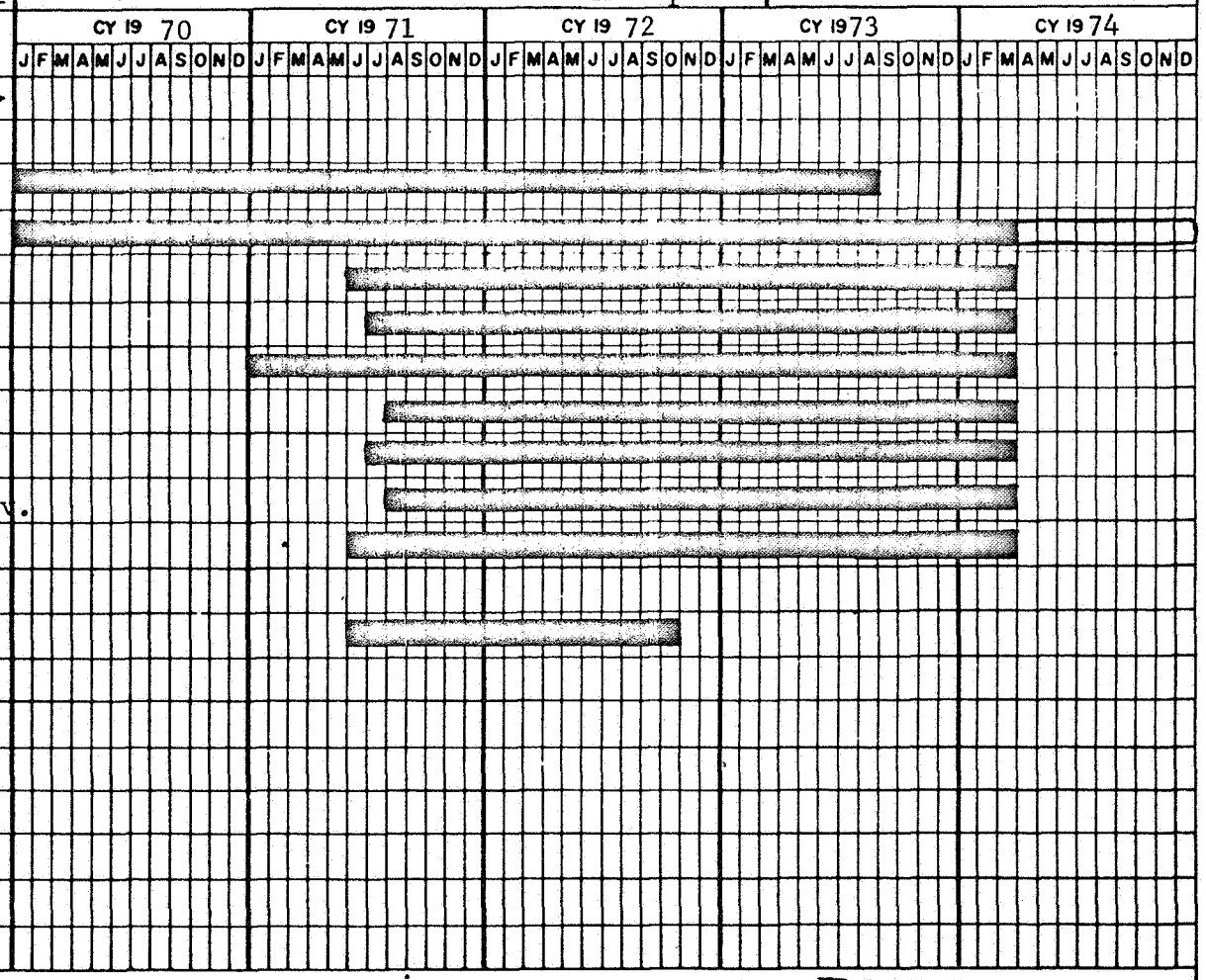
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Space Shuttle Advanced Composites for Primary Structures
RTOP NO. 124-08-37 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	In House Effort on Eval.
2	of Graphite Composites
3	New equipment procurement
4	Graphite/epoxy dev.
5	Graphite/polyimide dev.
6	Cure studies
7	Boron/epoxy dev.
8	Boron/polyimide dev.
9	Graphite/pyrone testing
10	Graphite/polyquinoxaline Dev.
11	Graphite/polyphenylquinoxa-
12	line dev.
13	Graphite/epoxy-phenolic
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC

RESPONSIBILITY S&E-AERO-YA

APPROVAL William W. Vaughan

ACCOMPLISHMENT George Fichtl

MILESTONE SCHEDULE

RTOP TITLE Atmospheric Parameters

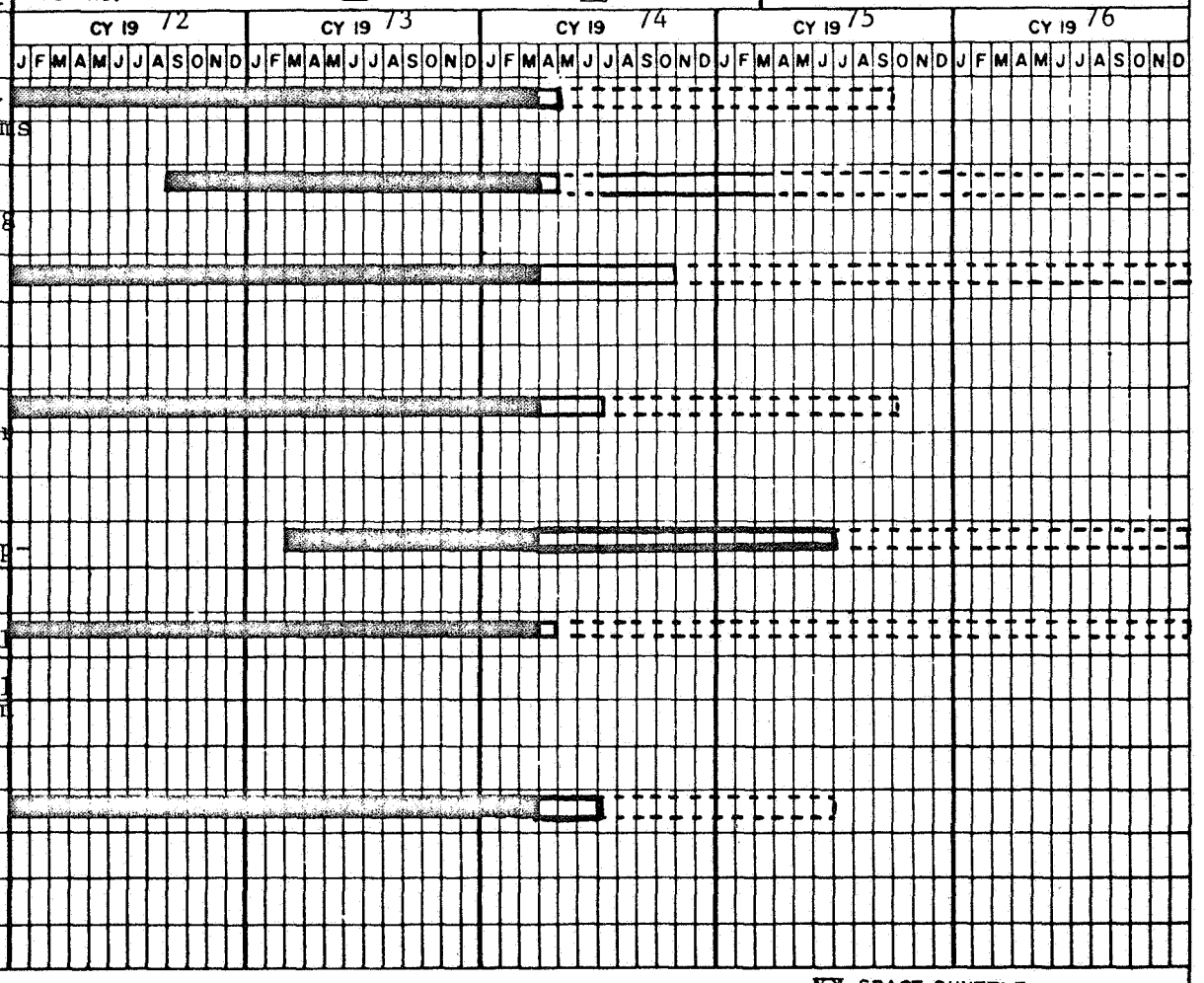
4 LEVEL

RTOP NO. 501-08-10 [X] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)



	ACTIVITIES
1	Definition of & Effect of Wind Shear on the Operation of Aeronautical Systems
2	Fog Microphysical Research & Numerical Modeling of Fog
3	Wind Profiles Over Non-Uniform Surfaces Relative to Design of Aircraft & Space Vehicles
4	Atmospheric Parameters for the Definition of Clear Air Turbulence Statistics
5	Wake Structure Model Development for Aeronautics
6	Definition of the Horizontal & Vertical Structure of Turbulence for Aeronautical System Design and Operation
7	Structure of Turbulence in Severe Atmospheric Conditions

NOTES
- Completed Work
- Planned Committed, Not Complete
- Planned, Not Committed

[X] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[X] Aeronautical PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC

RESPONSIBILITY

APPROVAL William W. Vaughan

ACCOMPLISHMENT George Fichtl

MILESTONE SCHEDULE

4 LEVEL

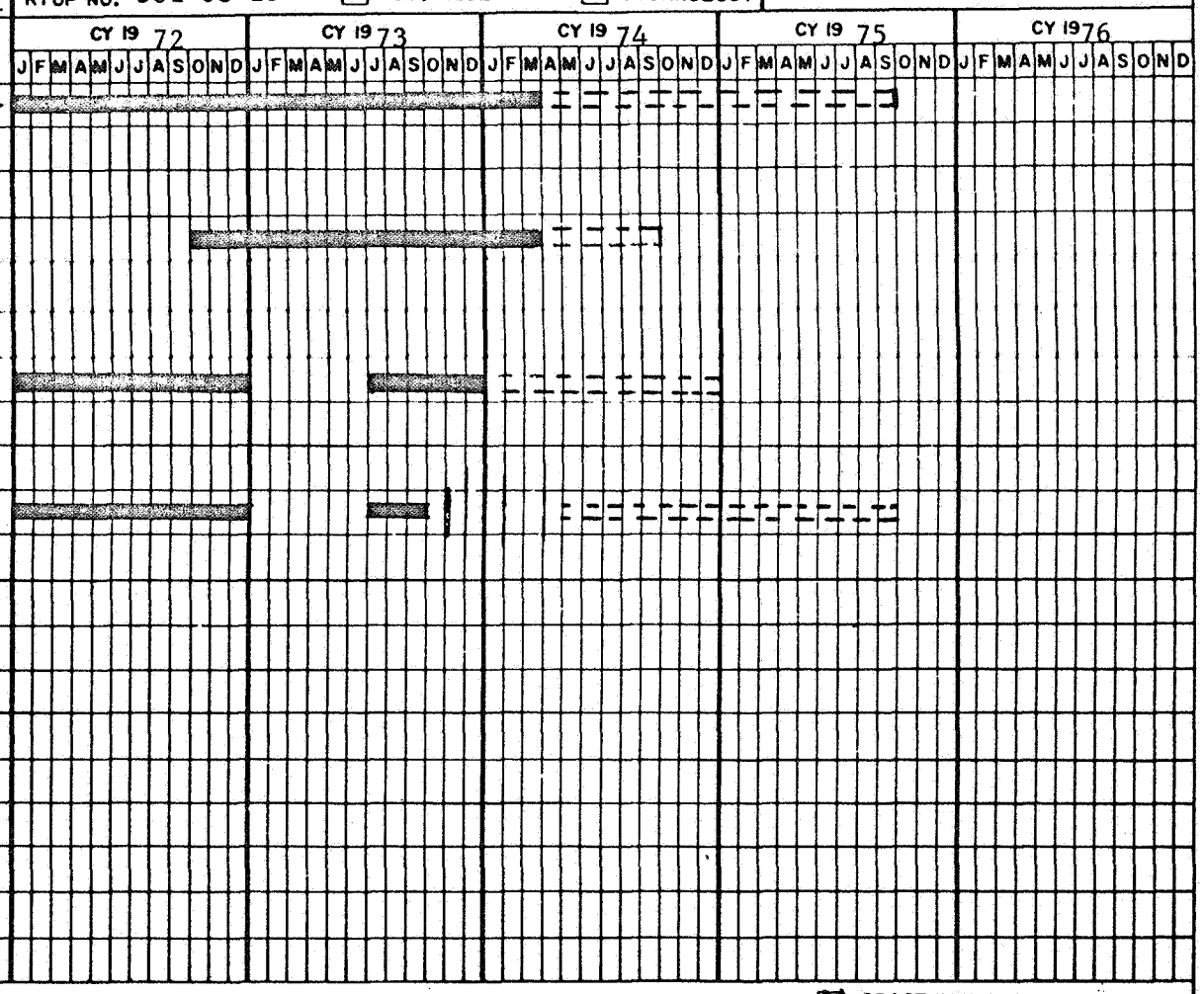
RTOP TITLE Atmospheric Parameters

RTOP NO. 501-08-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)



NOTES

Completed Work

Planned Committed, Not Complete

Planned, Not Committed

☒ SPACE SHUTTLE

☐ SPACE STATION/BASE

☐ _____ PROJECT

☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-Y
APPROVAL William W. Vaughan
ACCOMPLISHMENT Otha H. Vaughan

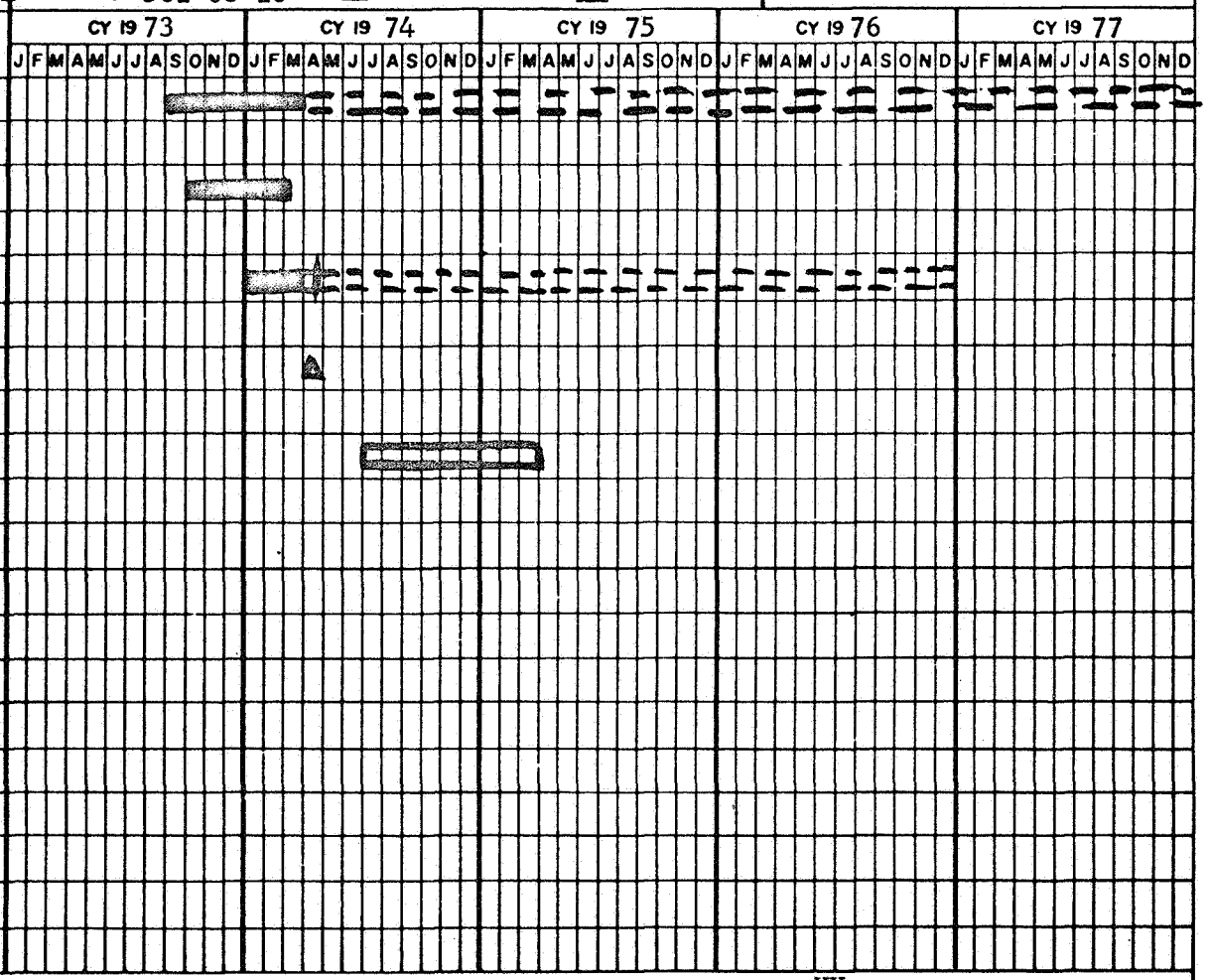
MILESTONE SCHEDULE

RTOP TITLE ATMOSPHERIC PARAMETERS (4 LEVEL)

RTOP NO. 501-08-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Fog Microphysical Research
2	Research Survey
3	Nuclei & Pollutants
4	~~Report~~
5	Computer Modeling Study



NOTES
Completed Work
Planned Committed, Not Complete
Planned, Not Committed

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC

RESPONSIBILITY S&E-AERO-YA

APPROVAL William W. Vaughan

ACCOMPLISHMENT George Fichtl

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Atmospheric Parameters

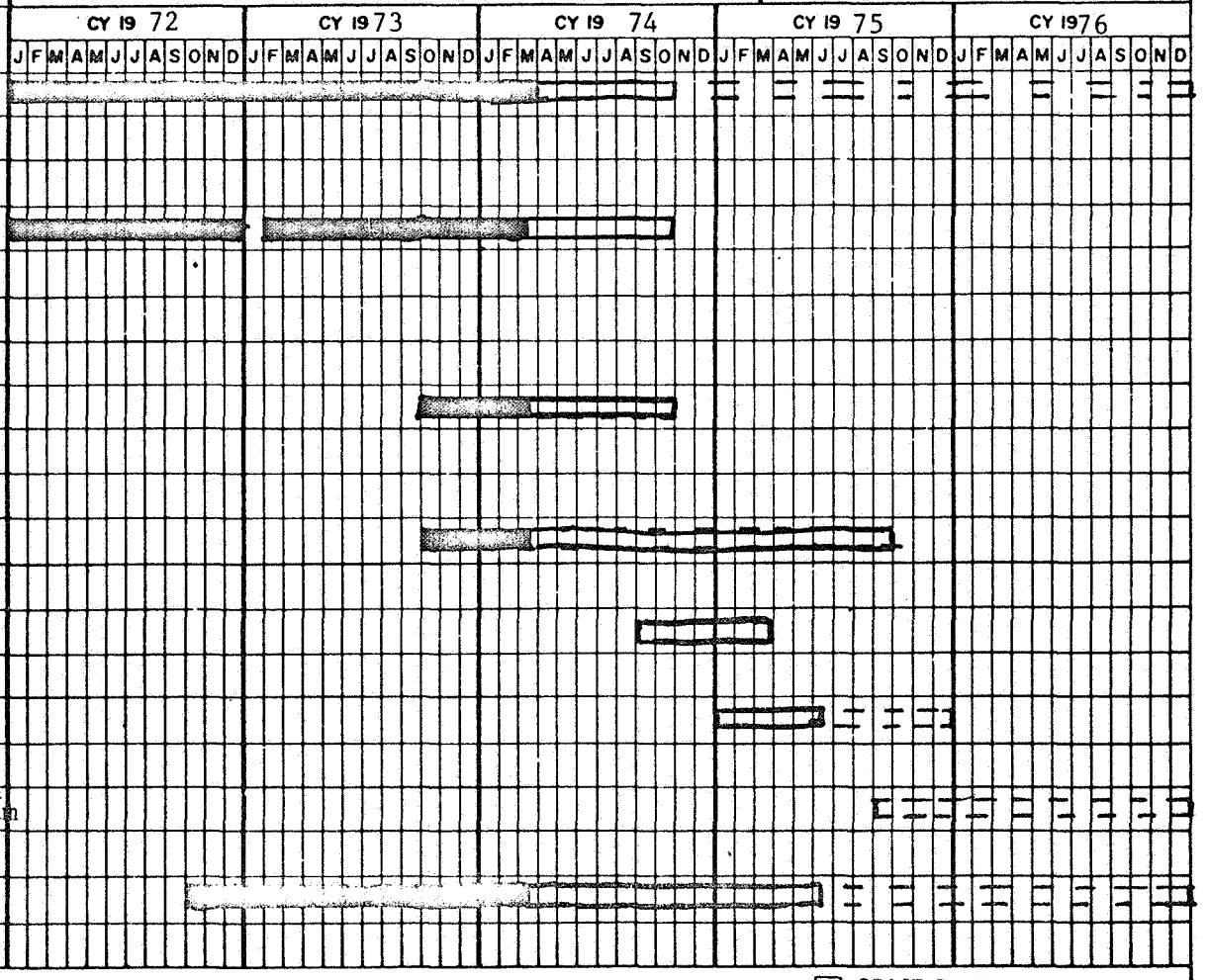
RTOP NO. 501-08-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 3 1 0 3 7 4 (Date) (Initials)

	ACTIVITIES
1	Wind Profiles Over Non-Uniform Surfaces Relative to Design of Aircraft and Space Vehicles
2	
3	
4	2-D Flow Model Valid up
5	to Separation Point
6	
7	2-D Flow Model Past
8	Separation Point with
9	Separation Bubble
10	
11	3-D Flow Model up to and Past Separation Point
12	
13	Field Program to Test Models
14	
15	Analysis of Data from Field Program
16	
17	Update of Models Based on Results of Field Program
18	
19	Interpretation of Results
20	Relative to Aeronautics



NOTES
- Completed Work
- Planned Committed, Not Complete
- Planned, Not Committed

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Aeronautical PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY
APPROVAL William W. Vaughan
ACCOMPLISHMENT George Fichtl

MILESTONE SCHEDULE

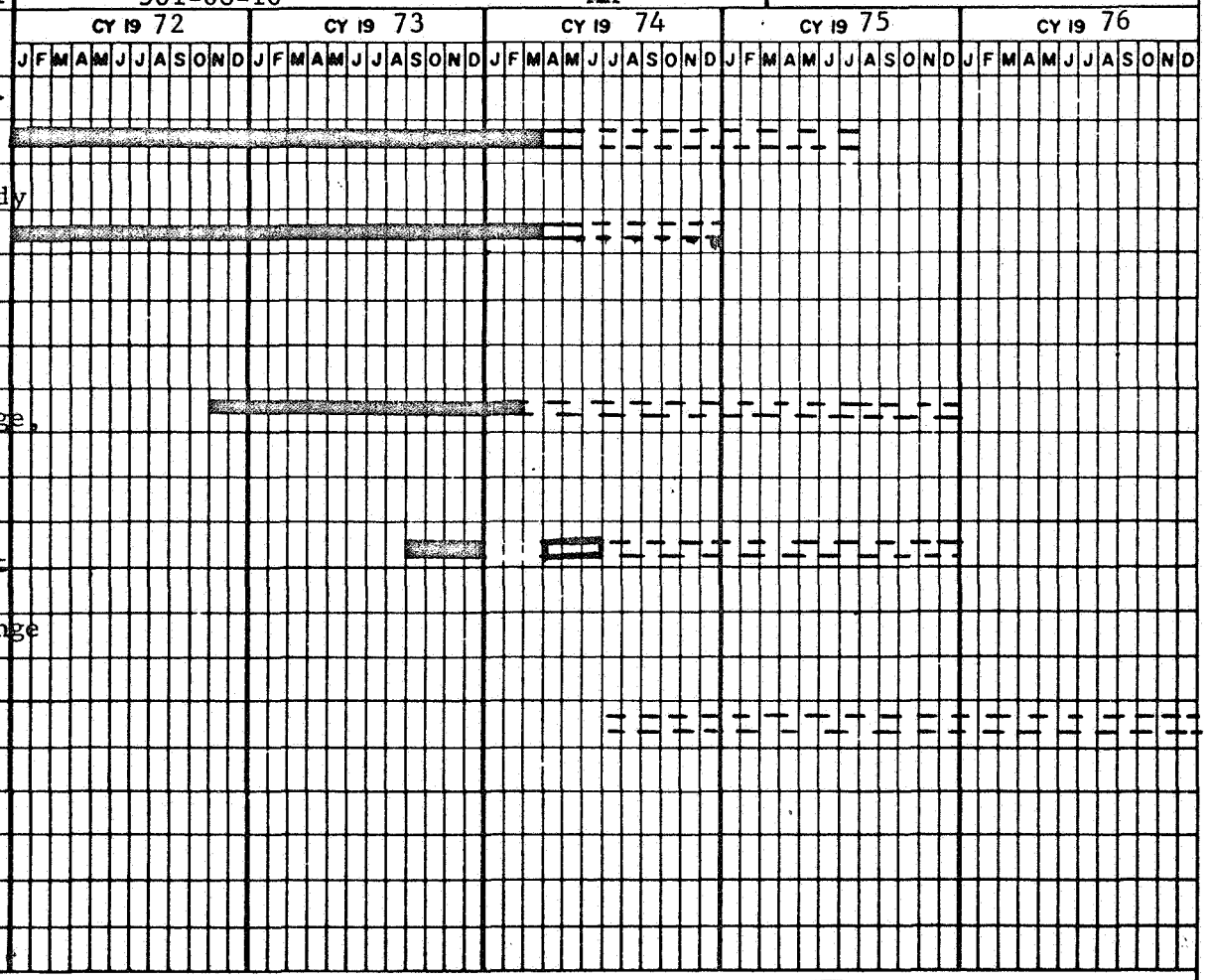
RTOP TITLE Atmospheric Parameters

4 LEVEL

RTOP NO. 501-08-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	Clear Air Turbulence
2	Studies
3	Collect Data from Kennedy
4	Space Center, White
5	Sands Missile Range, Pt. Mugu, California
6	
7	Data Analysis
8	~~Kennedy Space Center~~ White Sands Missile Range,
9	Pt. Mugu, California
10	
11	Statistical Richardson ~~Number Model Development~~
12	Kennedy Space Center
13	White Sands Missile Range
14	Pt. Mugu, California
15	Model Integration
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Aeronautical PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC

RESPONSIBILITY

APPROVAL William W. Vaughan

ACCOMPLISHMENT George H. Ficht

MILESTONE SCHEDULE

RTOP TITLE Atmospheric Parameters

4 LEVEL

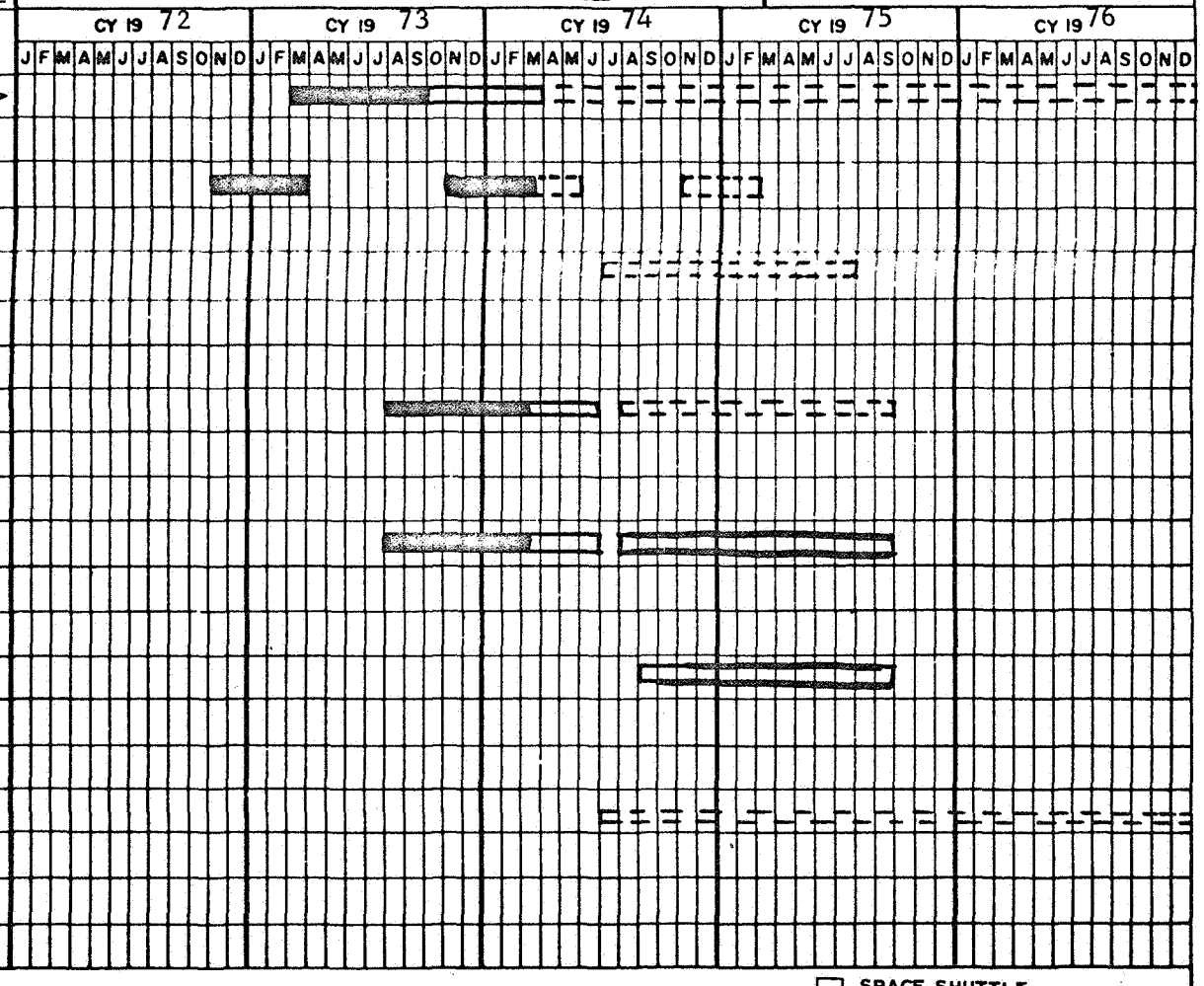
RTOP NO. 501-08-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Building Wakes
2	
3	Data Acquisition from 8-Tower Array
4	
5	Data Analysis to Model Building Wakes with
6	8-Tower Data
7	
8	Feasibility Study of Probing Building Wakes
9	with Aircraft
10	
11	Feasibility Study of Probing Building Wakes
12	with Wind Tunnels
13	
14	Compare Results to Determine Optimum Approach
15	of Studying Building
16	Wakes
17	Development of Building
18	Wake Models for Aeronautical Applications
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Aeronautical PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY
APPROVAL William W. Vaughan
ACCOMPLISHMENT George H. Ficht

MILESTONE SCHEDULE

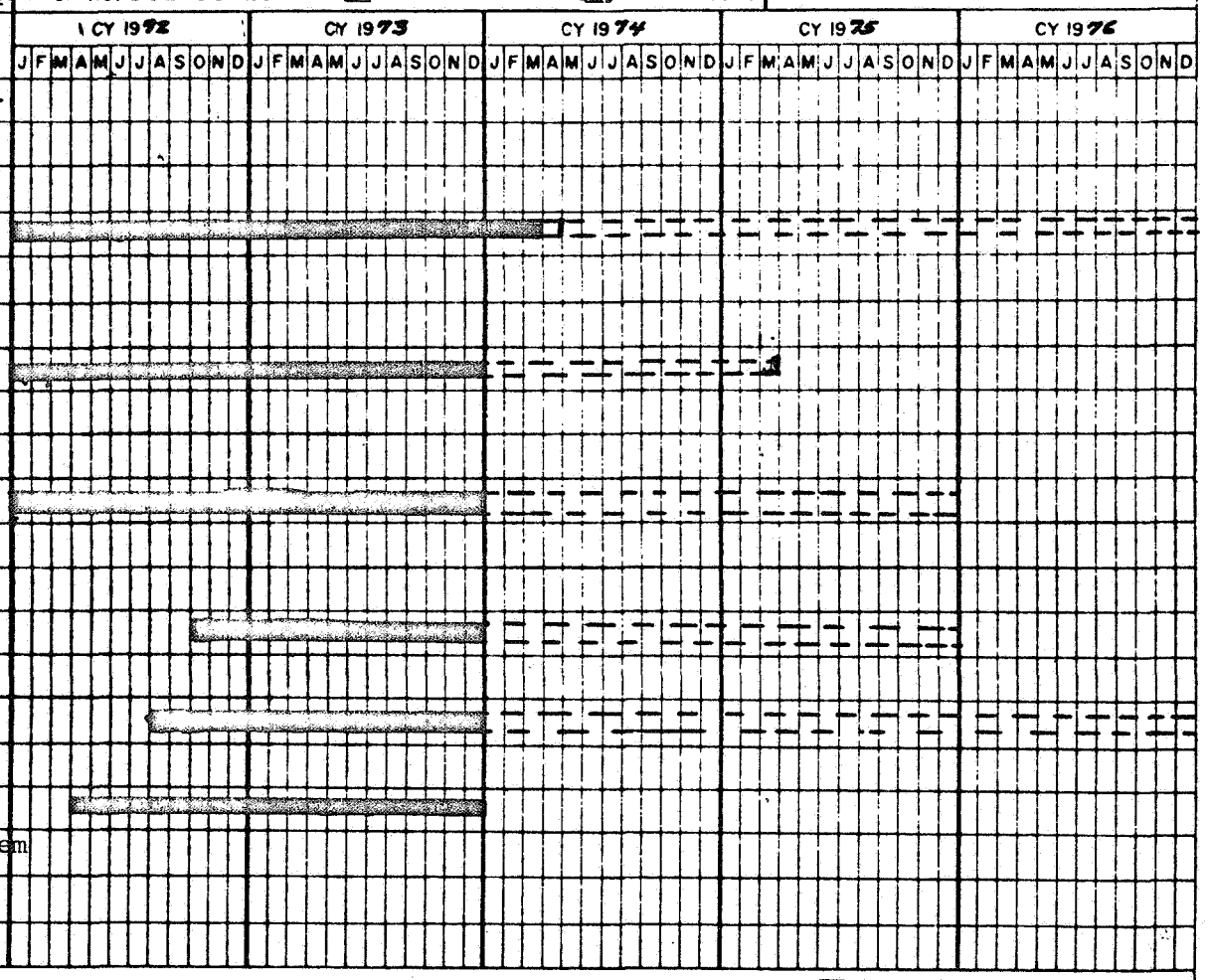
RTOP TITLE Atmospheric Parameters

4 LEVEL

RTOP NO. 501-08-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) _____ (No.) _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	Definition of the
2	Horizontal and Vertical
3	Structure of Turbulence for
4	Aeronautical System Design and Operation
5	
6	Data Acquisition from
7	MSFC 8-Tower Array
8	KSC 150-Meter Tower
9	Vertical Structure of
10	Turbulence Models
11	
12	Horizontal Structure of
13	Turbulence Models
14	Turbulence Simulation
15	Model Dev.
16	
17	Study and Development of
18	an Acoustical Radar System
19	
20	



NOTES
Completed Work
Planned Comitted, Not Complete
Planned, Not Committed

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ Aeronautical PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC

RESPONSIBILITY S&E-AERO-YA

APPROVAL William W. Vaughan

ACCOMPLISHMENT G. H. Fichtl

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Atmospheric Parameters

RTOP NO. 501-08-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

ACTIVITIES	CY 1972	CY 1973	CY 1974	CY 1975	CY 1976
1 Structure of Turbulence					
2 in Severe Atmospheric					
3 Conditions					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

NOTES

Completed work

Planned Committed, Not complete

Planned, Not Committed

☐ SPACE SHUTTLE

☐ SPACE STATION/BASE

☐ _____ PROJECT

☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-AF
APPROVAL W. K. Dahm
ACCOMPLISHMENT J. A. Dunkin

MILESTONE SCHEDULE

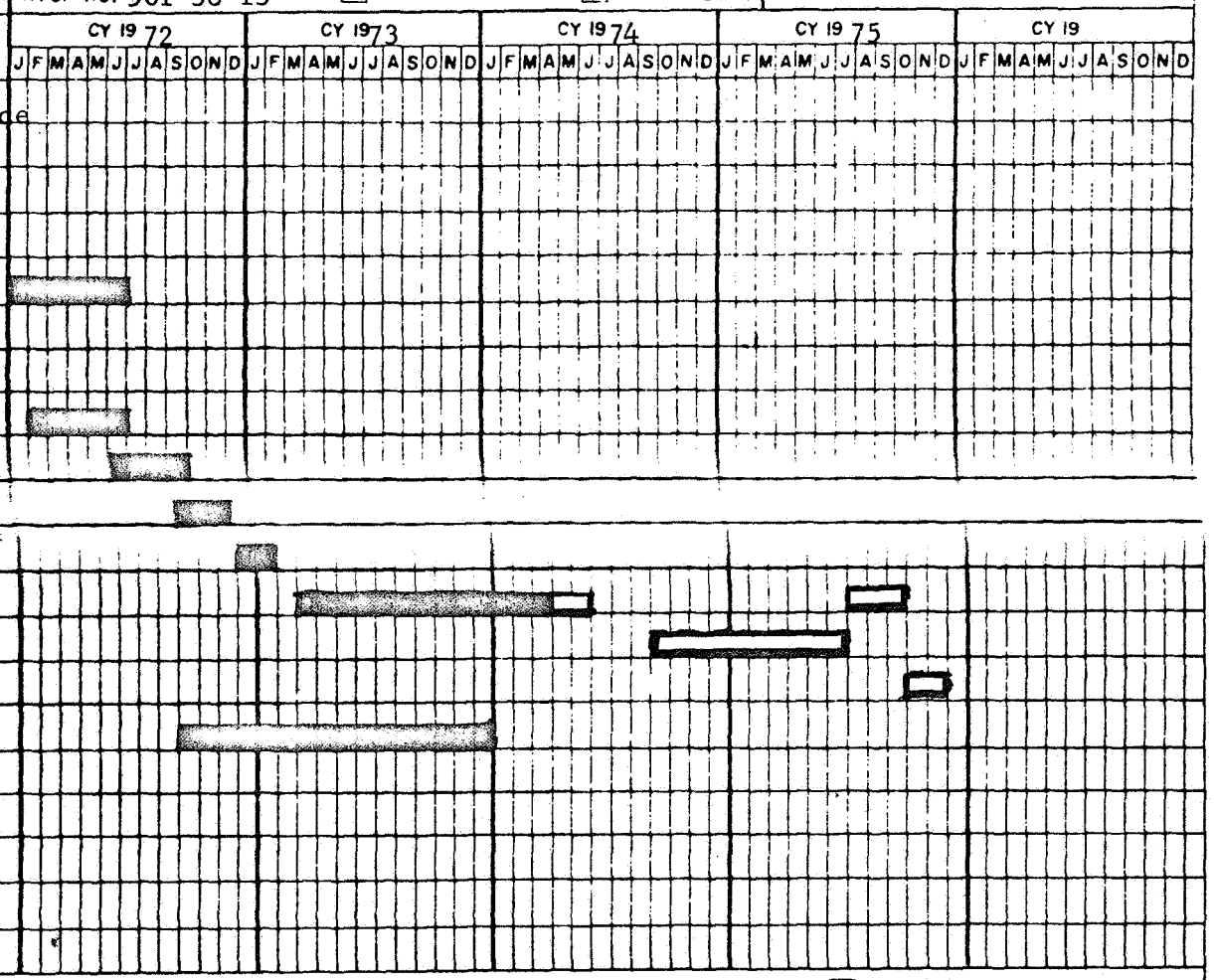
4 LEVEL

RTOP TITLE Hazard Avoidance and Elimination

RTOP NO. 501-38-13 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	Development of a Laser Doppler Clear Air Turbulence
2	Detection System
3	*CAT Research System
4	System Design & Mfg.
5	System Integration
6	
7	**CAT Research System
8	System Ground Test
9	Environmental Shakedown Flight Test
10	[illegible]
11	Evaluation & Coordinate Detection Flight Test
12	Component Evaluation & System Ground Test
13	System Modifications
14	CAT Detection and Measuring Flight Test
15	Data Evaluation
16	
17	
18	
19	
20	



NOTES
*NAS8-24742 - Raytheon Company
**NAS8-28424 - Raytheon Company

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E–ASTR–IR
APPROVAL Werner K. Dahm
ACCOMPLISHMENT Ed Gleason

MILESTONE SCHEDULE

RTOP TITLE Hazard Avoidance and Elimination

4 LEVEL

RTOP NO. 501-38-13 ☐ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED APPROVAL (Date)
LAST SCHED. CHANGE (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1973	CY 1974	CY 1975	CY 1976	CY 1977
1	Design, Fabrication and Development of Signal Processing Units for Use with Atmospheric Laser Doppler Systems					
2						
3						
4	Design Optimization					
5	Circuit Design					
6	Design Approval					
7	First Model Checkout, Fabrication & Test					
8						
9	Assemble					
10	Test					
11	Delivery to MSFC					
12	Second & Third Models Checkout, Fabrication & Test					
13	Assemble					
14	Test					
15	Delivery to MSFC					
16	Final Report					
17	Field Modification Design Fabrication & Test					
18	Delivery					
19						
20						

J F M A M J J A S O N D

NOTES 21

▽ Scheduled Milestone

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-AF
APPROVAL W. K. Dahm
ACCOMPLISHMENT J. W. Bilbro

MILESTONE SCHEDULE

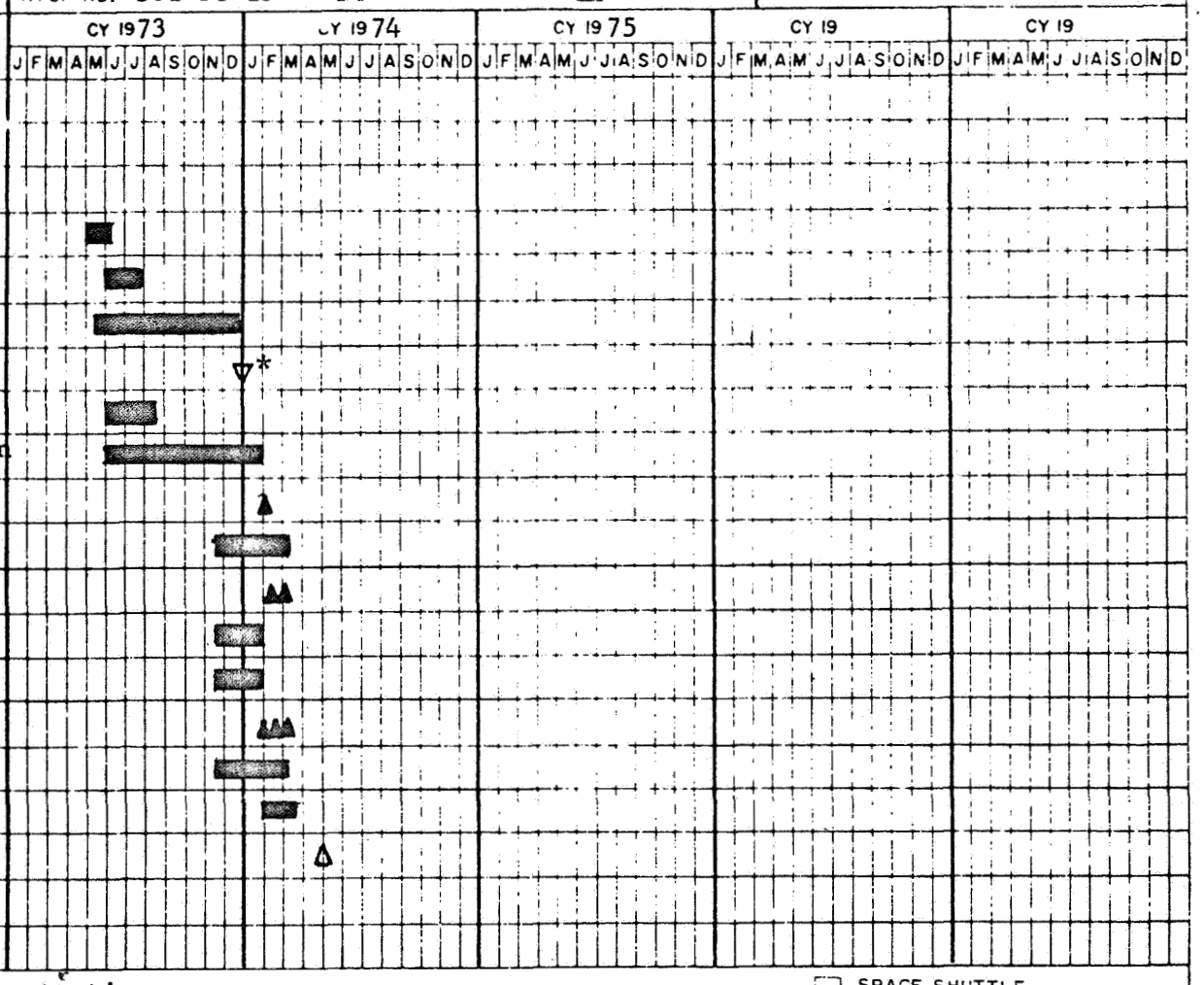
4 LEVEL

RTOP TITLE Hazard Avoidance and Elimination

RTOP NO. 501-38-13 ☐ ADV RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Development of a Frequency Translator for use with
2	Atmospheric Laser Doppler System
3	
4	Bragg Cell Study
5	Translator Design
6	Translator Fabrication
7	Translator Delivery
8	Optics Package Design
9	Optics Package Fabrication and Assembly (1) Unit
10	Delivery (1) Unit
11	Assemble (2) Units
12	Delivery (2) Units
13	Detector Evaluation
14	Bias Network Design & Fabrication
15	Delivery Bias Networks
16	Optics Ray Trace
17	System Checkout MSFC
18	Final Report
19	
20	



NOTES *Delivery subject to further testing.

Scheduled Milestone

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-AF

APPROVAL W. K. Dahm

ACCOMPLISHMENT R.M. Huffaker

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Hazard Avoidance and Elimination

RTOP NO. 501-38-13 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1972	CY 1973	CY 1974	CY 1975	CY 19
1	Test Planning and Modeling of Laser Doppler Systems		▼			
2						
3	Determine Constraints of Measuring Transverse & Radial Velocity					
4						
5	Determine Feasibility					
6	Determine Optimum Performance Parameters for FAA System					
7						
8	Analyze Factors which Degrade Operation					
9	Test Planning					
10	Ground Based CAT					
11	Measurement Feasibility					
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

▼ Completed Milestone

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-AF
APPROVAL W. K. Dahm
ACCOMPLISHMENT J. W. Bilbro

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Hazard Avoidance and Elimination

RTOP NO. 501-38-13 ☐ ADV RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1973	CY 1974	CY 1975	CY 19	CY 19
1	Development, Testing, Fabrication					
2	~~and Delivery of Various~~					
3	Components of a Laser Doppler System					
4	Scanner Design					
5	Fabrication & Assembly					
6	Delivery one Unit					
7	Delivery 2nd & 3rd Units					
8	Scanner Checkout					
9	System Upgrade					
10	System Engineering/					
11	Simulation Checkout					
12	Data Reduction					
13	Field Testing					
14	Final Report					
15						
16						
17						
18						
19						
20						

NOTES

Scheduled Milestone

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-AF

APPROVAL W. K. Dahm

ACCOMPLISHMENT W. C. Cliff

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Hazard Avoidance and Elimination

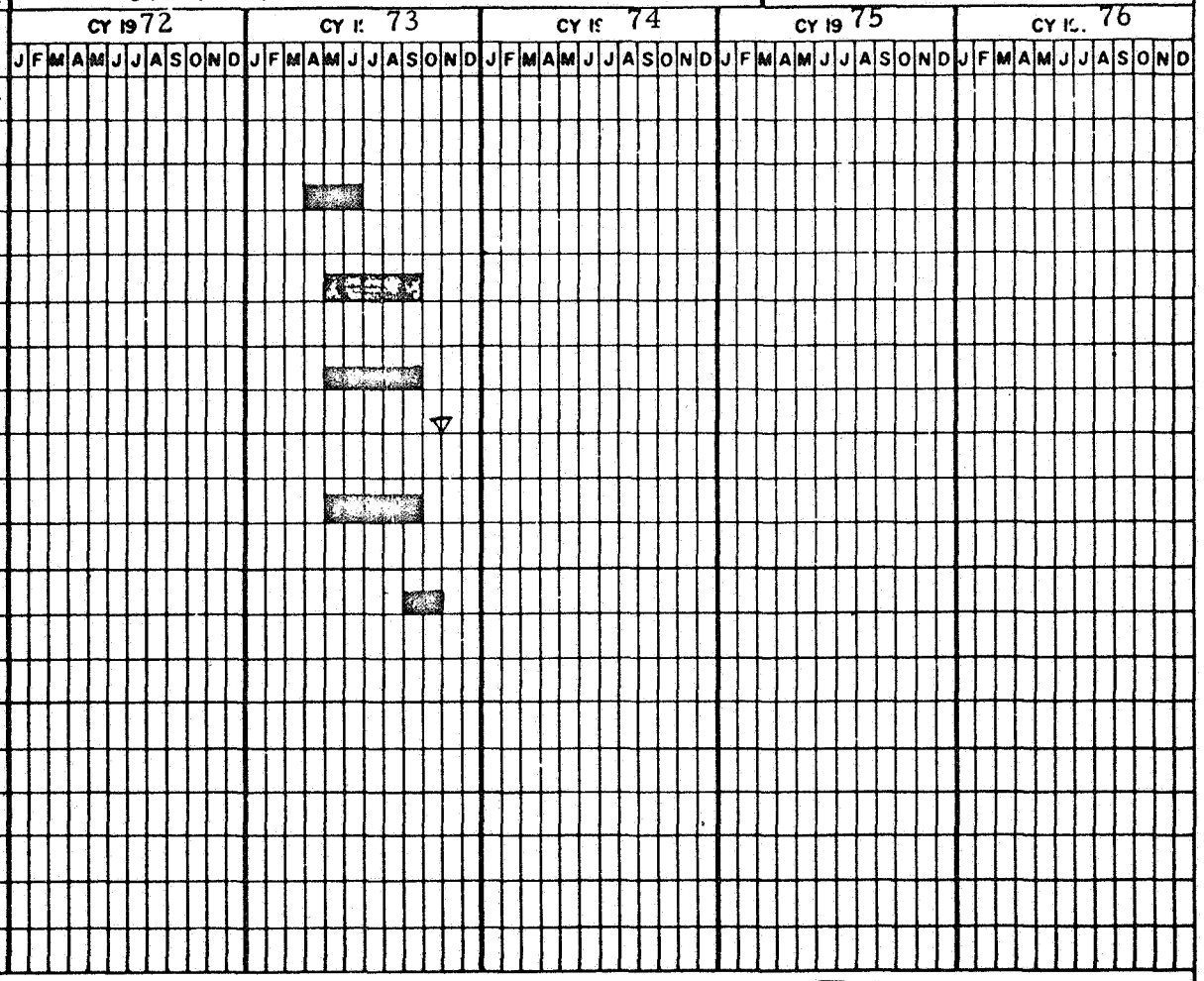
RTOP NO. 501-38-13 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Study on LDV Atmospheric Interrogation System
2	
3	Evaluate Existing Performance Data
4	
5	Test Conical Scan
6	
7	Evaluate System Under Variable Atmospheric Conditions
8	
9	
10	Develop Software
11	
12	Final Report
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

▽ Scheduled Milestone

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-AF
APPROVAL W. K. Dahm
ACCOMPLISHMENT W. C. Cliff

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Hazard Avoidance and Elimination

RTOP NO. 501-38-13 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Purchase of Equipment For Laser Doppler System →
2	
3	CO_2 Laser Purchased
4	
5	5/4 Waveplate Purchased
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

CY 19 72 | CY 1973 | CY 1974 | CY 19 | CY 19
J F M A M J J A S O N D

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3480 (April 1970)

Page 2 of 2

TASK: NASA Support to FAA on Aircraft Wake Turbulence Problems

2 YEAR

MSFC/S&E-AERO-AF

SCHEDULE RESPONSIBILITY W. K. Dahm

STATUS RESPONSIBILITY E. A. Weaver

HAZARD AVOIDANCE & ELIMINATION
(LASER DOPPLER WAKE VORTEX SYSTEM)

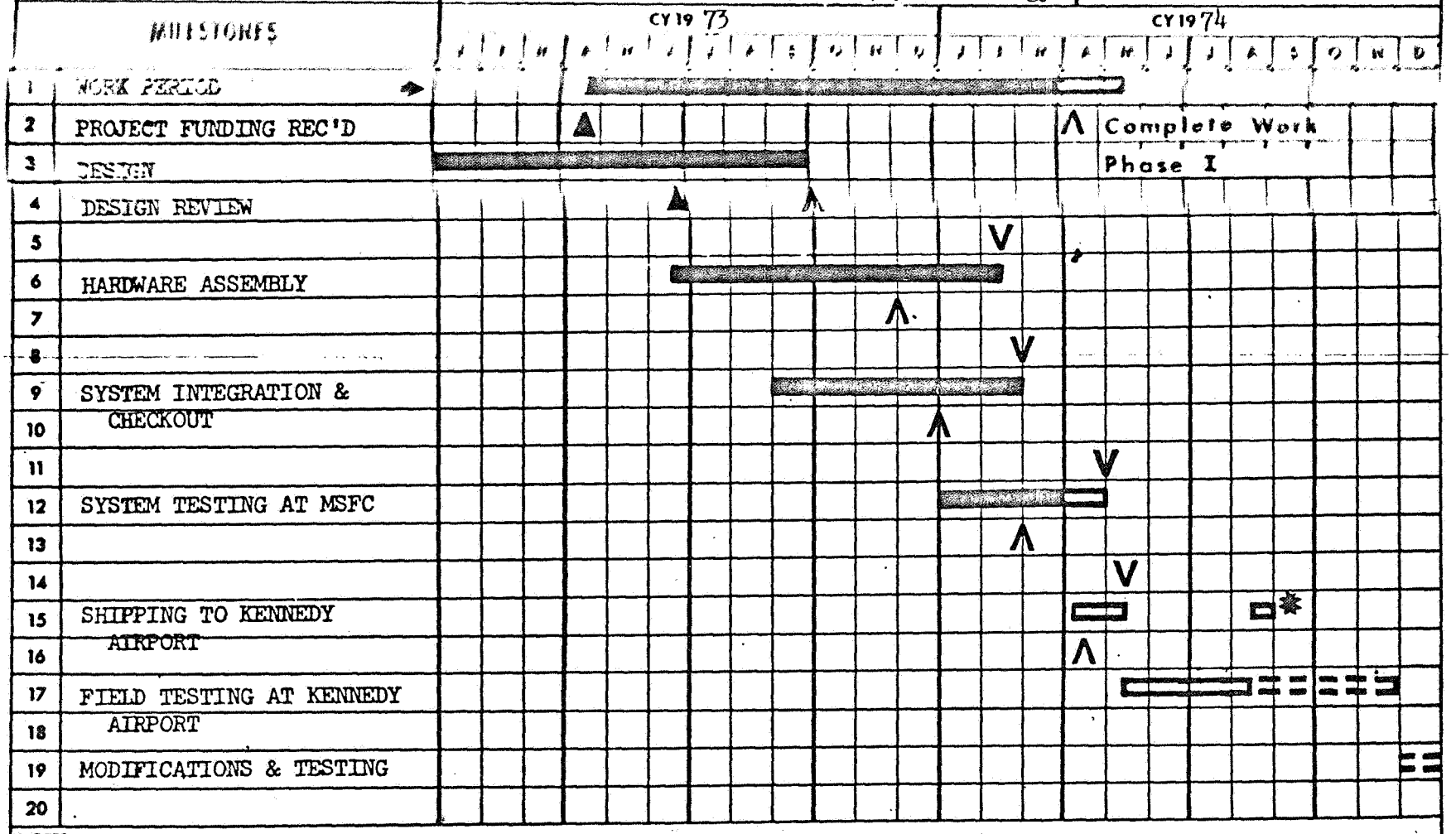
4 LEVEL

RTOP NO. 501-38-13 (X) Technology

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE 7/23/73 (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)



NOTES

Λ ORIGINAL PLAN

V SCHEDULE DELAY

= = = = FUTURE REQUIREMENTS

✱ RETURN SHIPMENT TO MSFC

MSFC - Form 1975-3 (October 1963)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL R. Decher

ACCOMPLISHMENT Urban/Dalins

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Properties of Materials for Electronic Applications

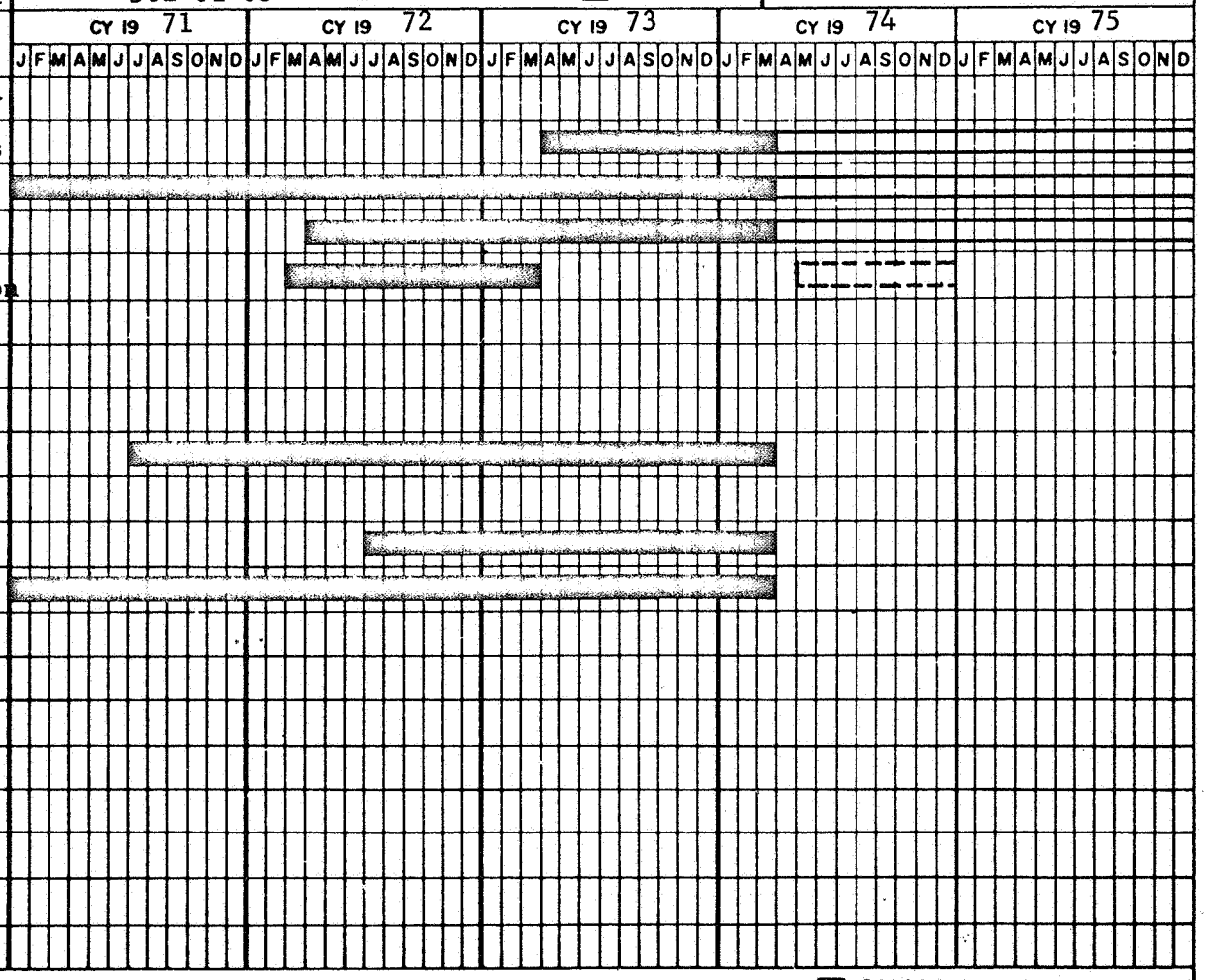
RTOP NO. 502-01-03 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (Reason)

STATUS AS OF 31 03 74 (Date) (Date)

	ACTIVITIES
1	Superconductivity Research
2	Thin Film Superconductors
3	Sup. Material Studies
4	Sup. Instruments
5	Magnetic Flux Annihilation
6	
7	Surface Science
8	Gallium Arsenide
9	Theoretical
10	Epitaxial Studies
11	(Experimental)
12	MIT Grant
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[X] Solar Cell PROJECT
[X] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY W. C. Snoddy

APPROVAL W. C. Snoddy

ACCOMPLISHMENT D. Gates

MILESTONE SCHEDULE

RTOP TITLE SPACE VEHICLE THERMAL CONTROL

5 LEVEL

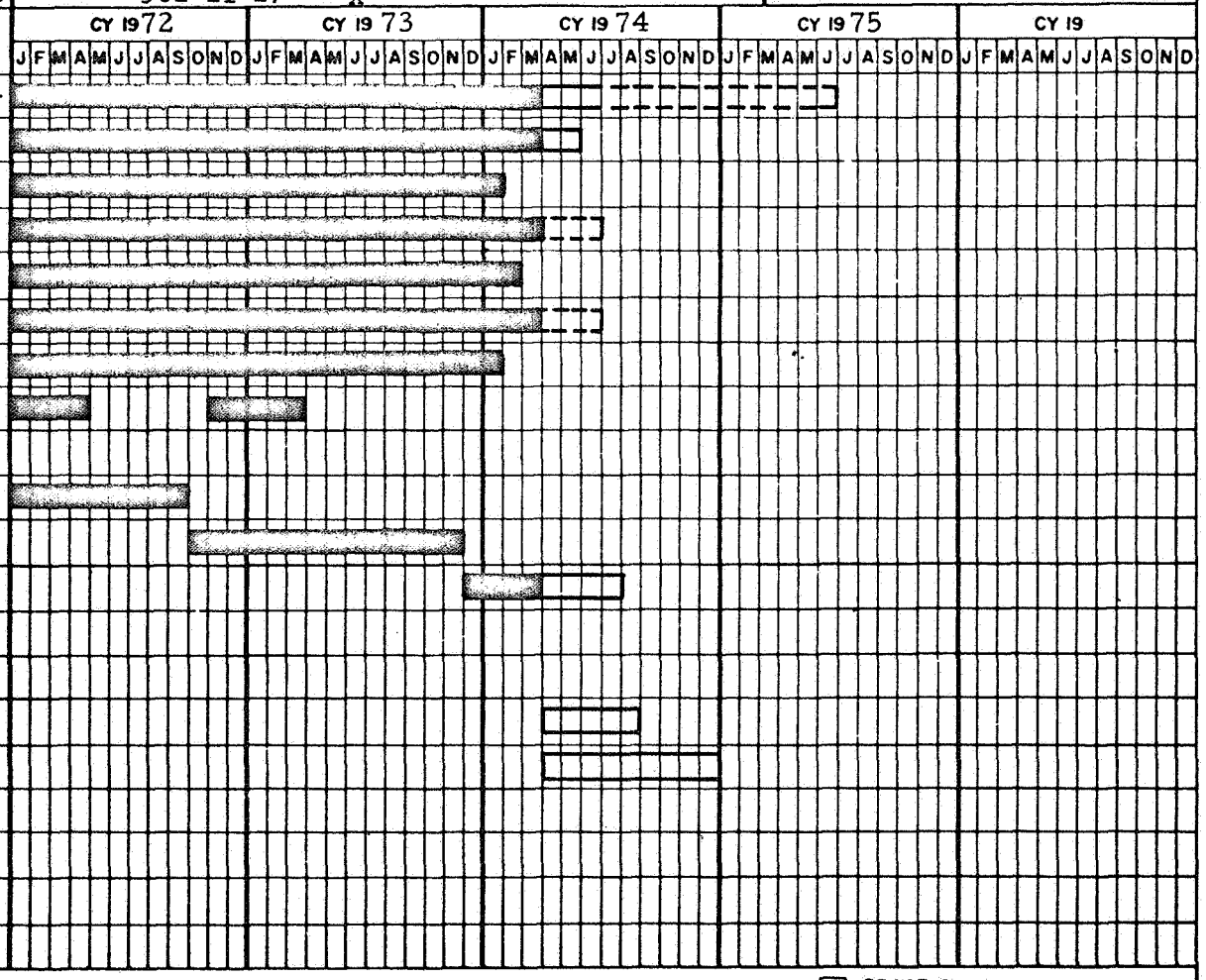
RTOP NO. 502-21-27 [x] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Initials)

STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	Thermal Control Coatings
2	Zn_2TiO_4 Paint Formulation
3	Pigment Pilot Plant
4	Reactive Encapsulation
5	Doping of Pigment
6	OI-650 Binder Studies
7	Alternate Binders
8	Strippable Coatings
9	ISSIS
10	Assemble
11	Calibrate
12	Testing
13	
14	Preparation NASA Spec.
15	For Paint
16	Multiyear Tests in CREF
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY
APPROVAL Hoyt M. Weathers
S&E-SSL-X
ACCOMPLISHMENT Hoyt M. Weathers

MILESTONE SCHEDULE

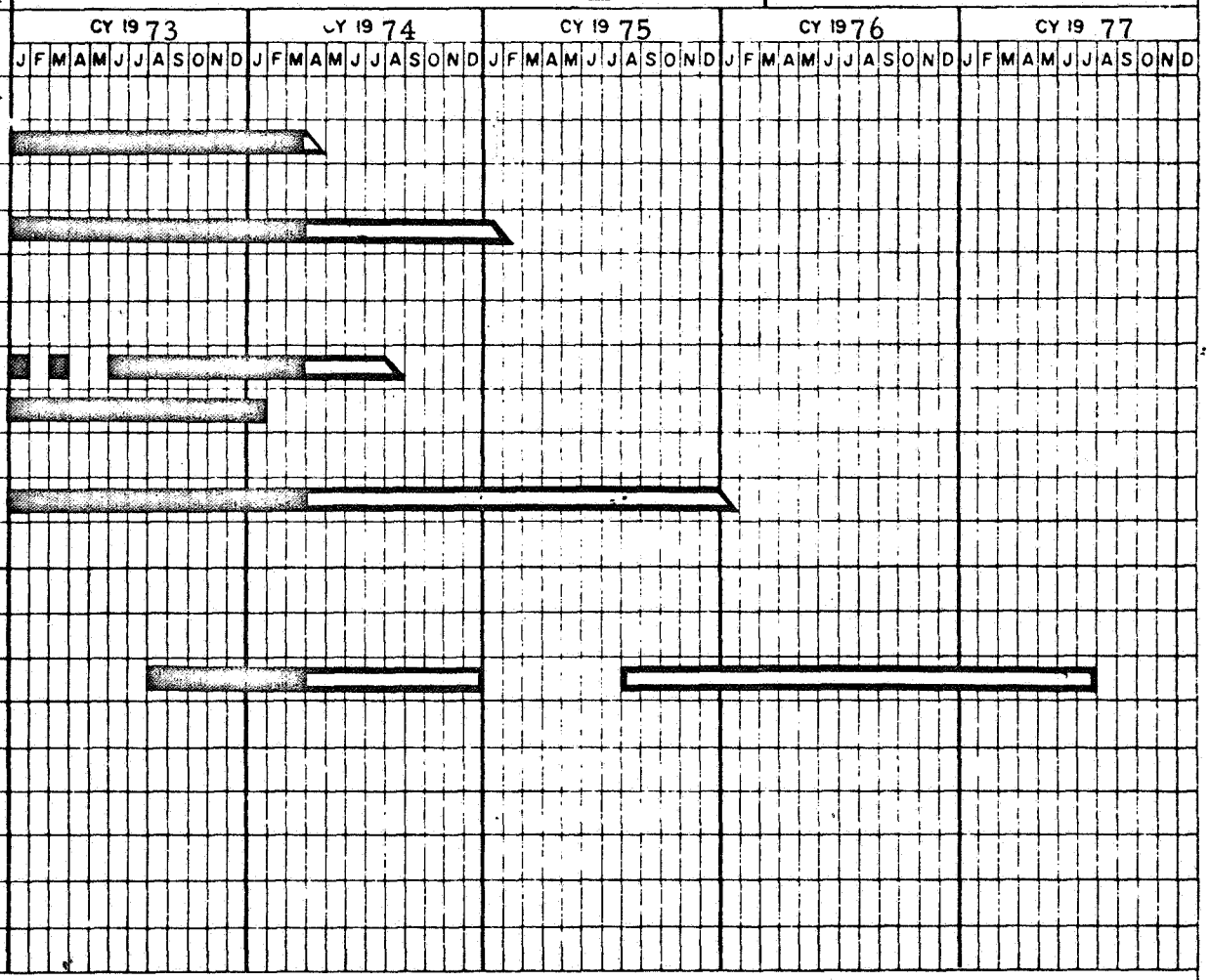
5 LEVEL

RTOP TITLE Optical Contamination

RTOP NO. 502-21-28 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____
LAST SCHED. CHANGE 9-30-73 (Date)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Optical Contamination
2	Optical Scattering Tests
3	Controlled Deposition &
4	Optical Effects Exp.
5	Contam. Transport Anal.
6	
7	Analysis of QCM Data
8	Skylab Mission Support
9	
10	Contam. Effects on X-ray
11	Optics
12	
13	Special Shuttle Plume &
14	Particulate Studies
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION BASE
☒ Spacelab PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-YS
APPROVAL William W. Vaughan
ACCOMPLISHMENT Robert E. Smith

MILESTONE SCHEDULE

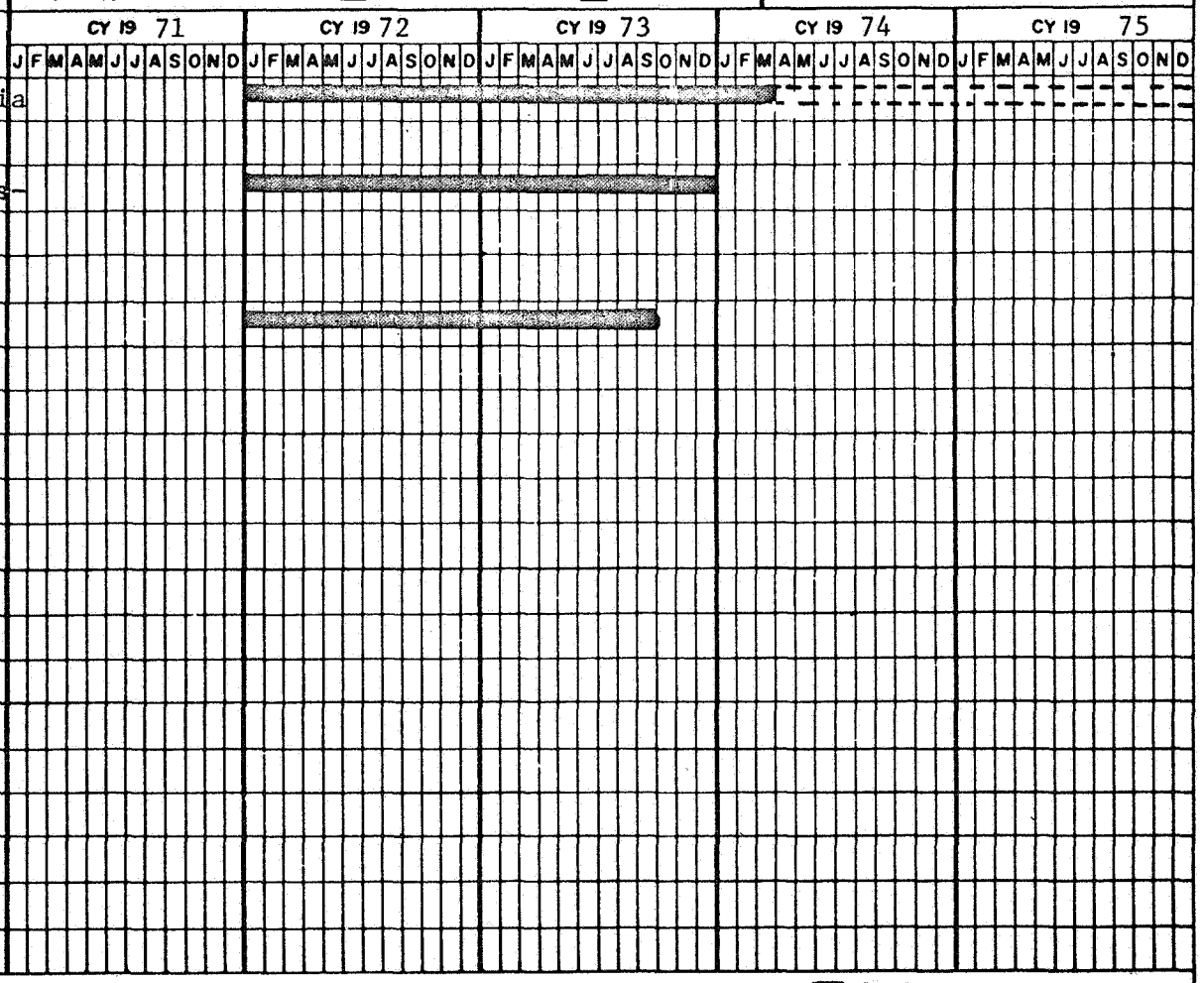
4 LEVEL

RTOP TITLE Environmental Design Criteria

RTOP NO. 502-21-30 [X] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Environmental Design Criteria
2	
3	Theoretical Model of Thermos-
4	pheric Heating
5	
6	Traveling Ionospheric Dis-
7	turbances
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

RTOP 502-21-30 was formerly coded 114-03-55

[XX] SPACE SHUTTLE
[XX] SPACE STATION/BASE
[XX] All vehicles PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-YT
APPROVAL William W. Vaughan
ACCOMPLISHMENT L. W. Falls

MILESTONE SCHEDULE

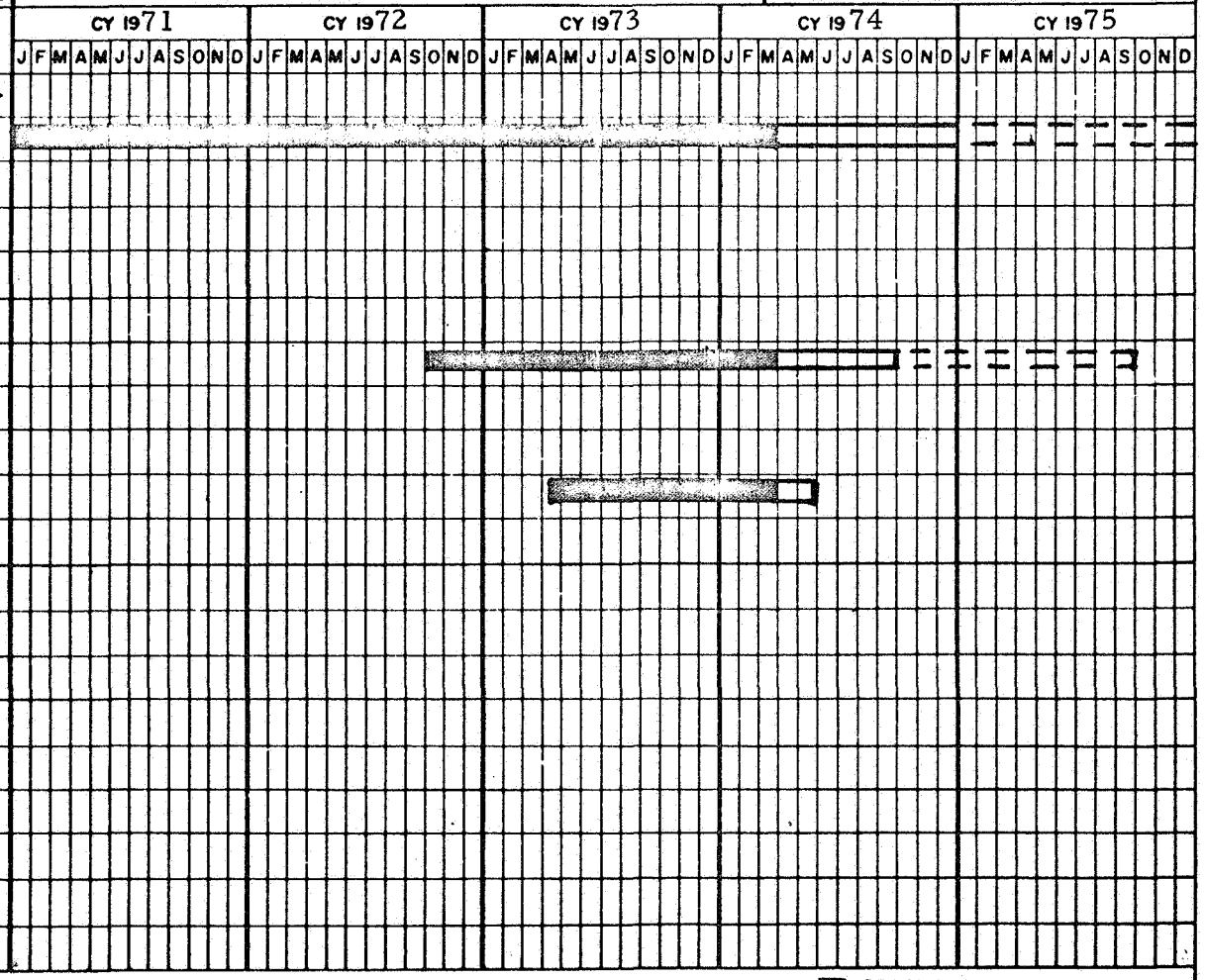
RTOP TITLE Environmental Design Criteria

4 LEVEL

RTOP NO. 502-21-30 [x] ADV. RESEARCH [x] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Environmental Design
2	Criteria
3	
4	Statistical Studies of
5	Atmospheric Variables
6	Related to Space Shuttle
7	Program
8	
9	Martian Surface Models
10	Monograph
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[x] SPACE SHUTTLE
[x] SPACE STATION/BASE
[x] All Vehicles PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-AA
APPROVAL H. R. Coldwater
ACCOMPLISHMENT J. R. Admire

MILESTONE SCHEDULE

RTOP TITLE Space Vehicle Dynamics

4 LEVEL

RTOP NO. 502-22-11 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 74	CY 19 75	CY 19 76	CY 1977	CY 19 78
1	Development of Vibration Test Criteria for Qualifying Space Vehicle Components					
2	Response Prediction for Preliminary Design					
3	Utilization Survey of Prototype Structural Test Article					

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY
APPROVAL J. C. Taylor
ACCOMPLISHMENT J. L. Randall

MILESTONE SCHEDULE

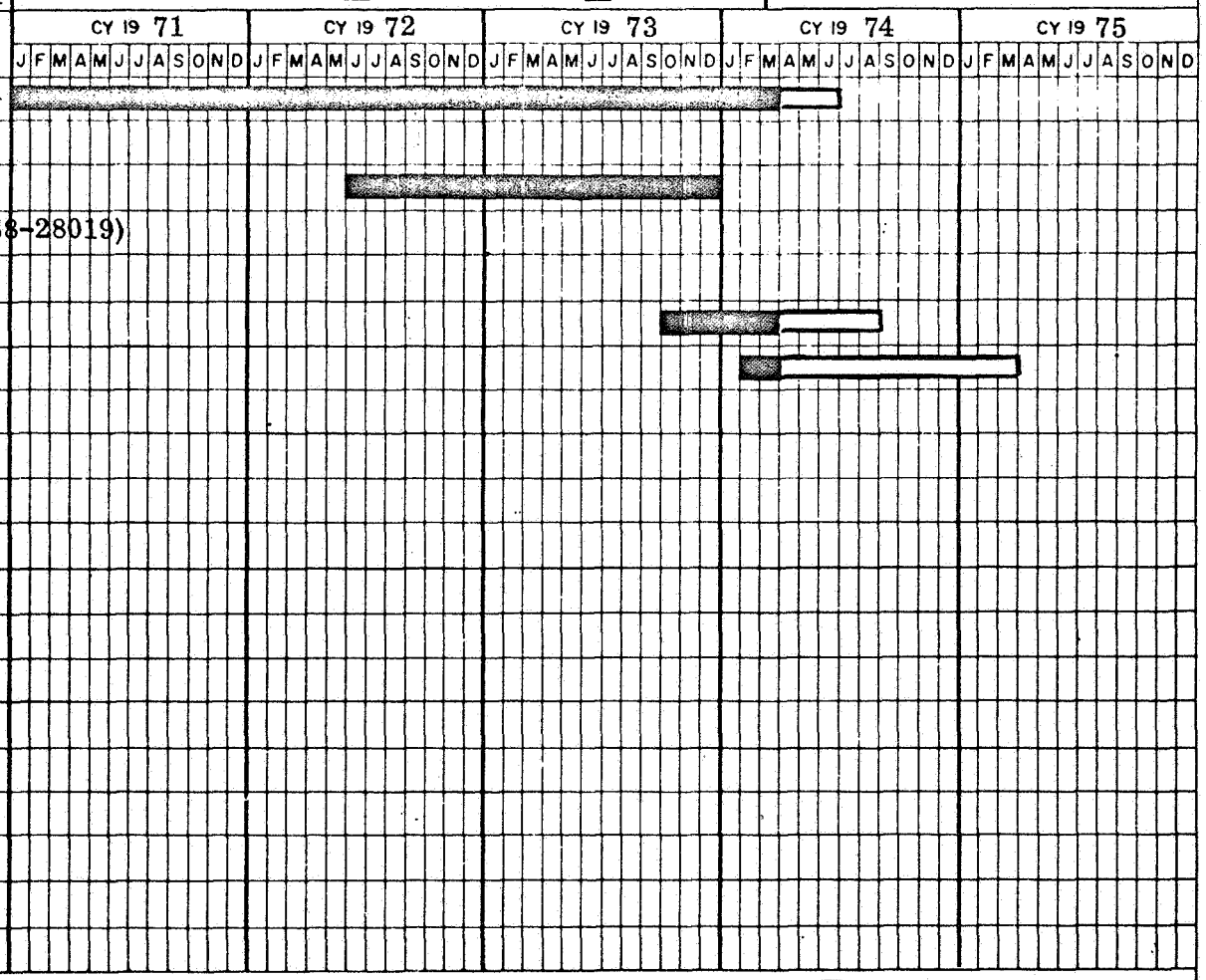
RTOP TITLE Large Telescope Technology

4 LEVEL

RTOP NO. 502-23-21 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Active Mirror Program
2	Thin-Mirror System
3	Test & Development
4	Univ. of Ala. Contract (NAS8-28019)
5	Augmented Thick Mirror
6	Design & Development
7	Testing
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[X] LST PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-R
APPROVAL J. C. Taylor
ACCOMPLISHMENT E. J. Reinbolt

MILESTONE SCHEDULE

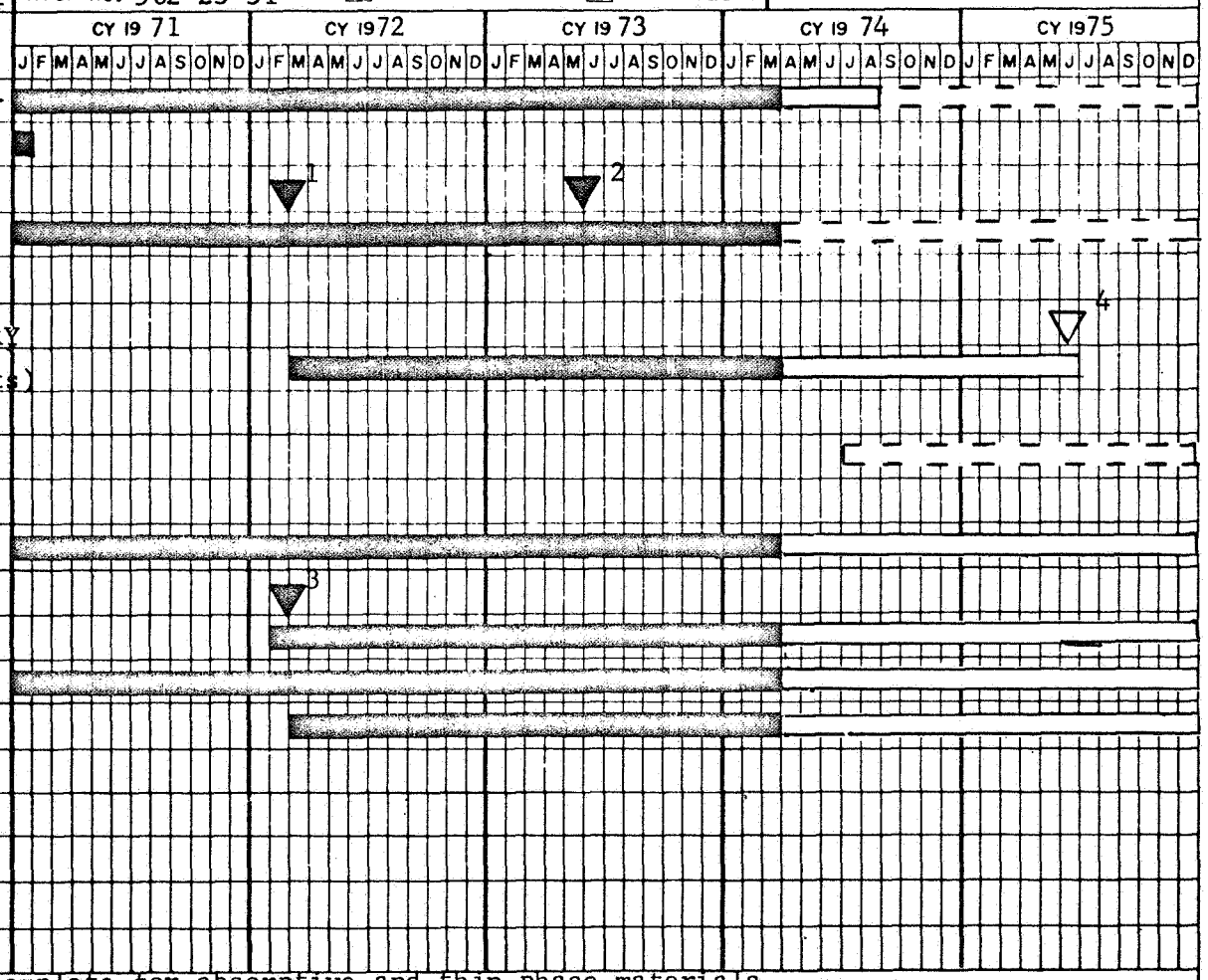
4 LEVEL

RTOP TITLE OPTICAL MASS MEMORY

RTOP NO. 502-23-31 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No) (Initials)
STATUS AS O. 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	OPTICAL MEMORY SYSTEM
2	MEMORY SYSTEM DESIGN
3	
4	COMP SIM PROGRAM
5	PREL DES ANALYSIS & FAB-
6	RICATION OF 10^9 BIT MEMORY
7	(Possibly primary elements)
8	
9	DEVELOP 10^{12} BIT MEMORY
10	
11	OPTICAL MEMORY BREADBOARD
12	
13	OPERATION OF BREADBOARD
14	SYSTEM OPTIMIZATION
15	COMPUTER INTERFACE
16	
17	
18	
19	
20	



NOTES
1. First computer model complete for absorptive and thin phase materials.
2. First computer model complete for thick phase materials.
3. Breadboard operational at MSFC.
4. 10^9 bit memory developed.

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-R
APPROVAL J. C. Taylor
ACCOMPLISHMENT E. J. Reinbolt

MILESTONE SCHEDULE

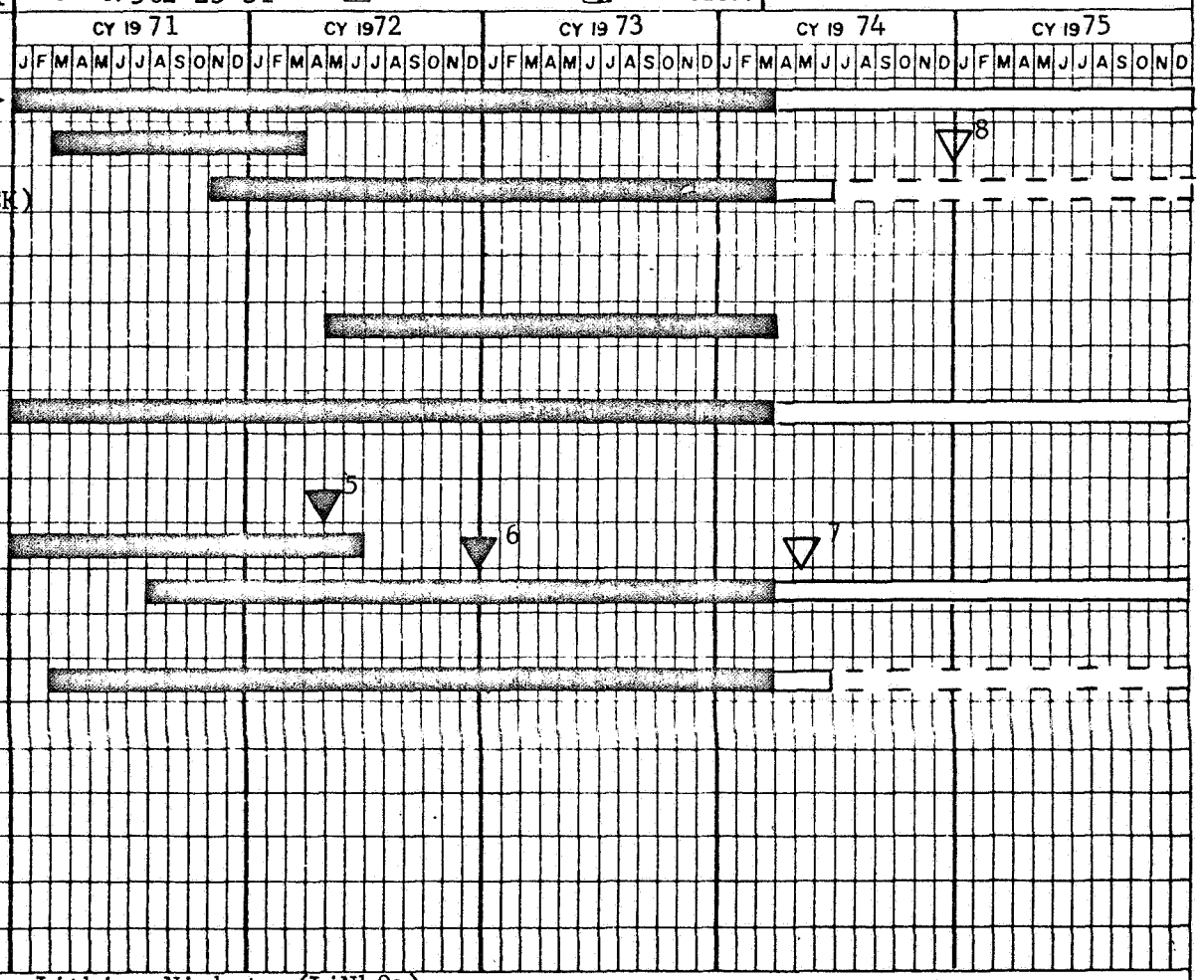
4 LEVEL

RTOP TITLE OPTICAL MASS MEMORY

RTOP NO. 502-23-31 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	OPT. MEM. COMP. DEV.
2	SURVEY HOL. STORAGE MAT
3	MULTIPLE HOL. DEV. (THICK)
4	INVESTIGATION OF USES
5	HOLOGRAPHIC OPTICAL
6	ELEMENTS
7	IN-HOUSE STUDY PLZT,
8	PLASTICS, ETC.
9	
10	FERROELECTRIC MATERIAL
11	($LiNbO_3$)
12	PHOTODETECTOR SYSTEMS
13	HOLOGRAPHIC STORAGE AND
14	PAGE COMPOSER DEVICES
15	
16	
17	
18	
19	
20	



NOTES
5. Report on Ferroelectric Lithium Niobate ($LiNbO_3$).
6. 32 x 32 phototransistor and 32 x 32 photodiode array completed and being evaluated.
7. 32 x 32 phototransistor array installed on breadboard.
8. ~~Thick holographic material available for breadboard evaluation (from LRC)~~

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

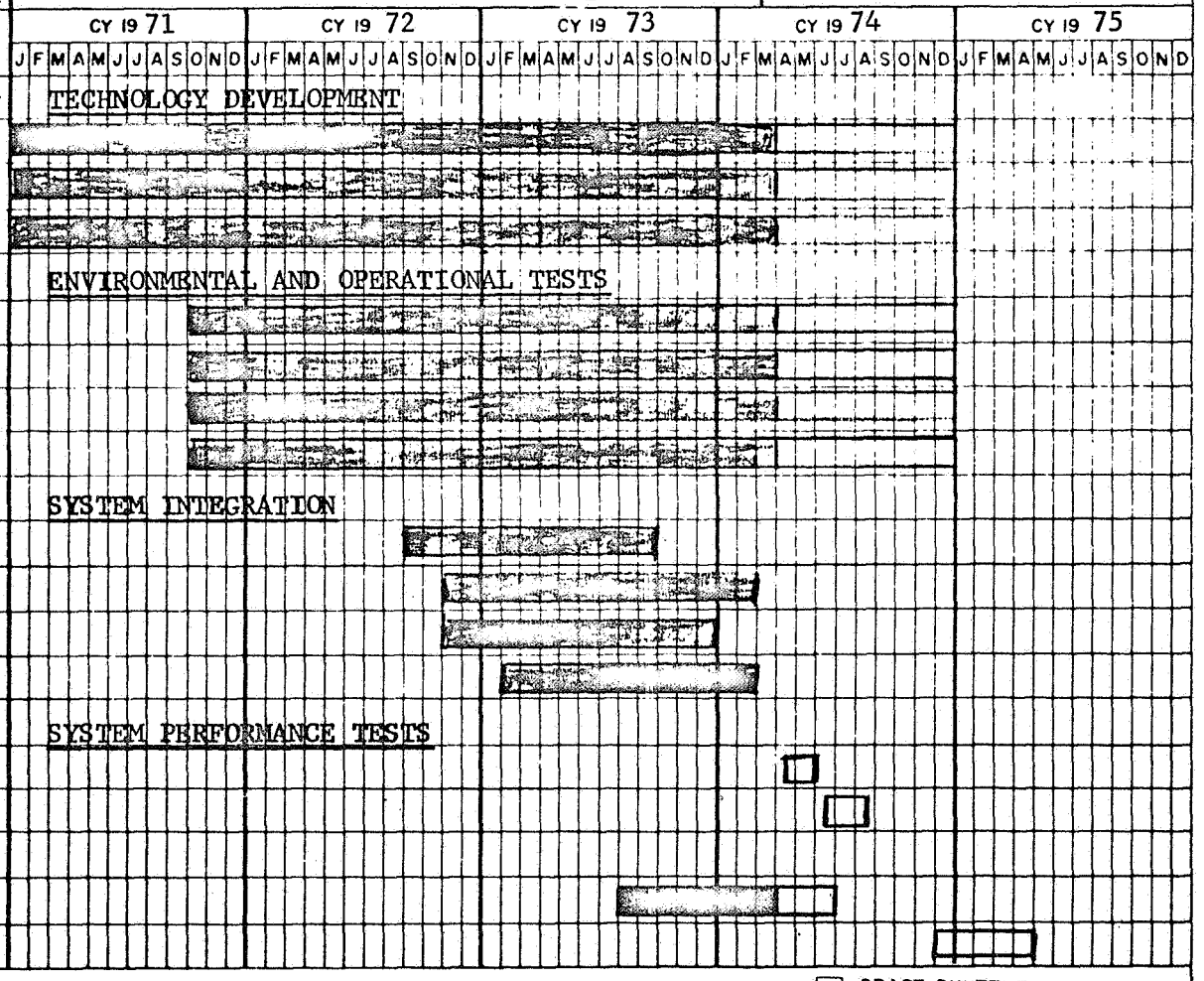
CENTER MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL R. Tutt
ACCOMPLISHMENT B. F. Walls

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE INERTIAL COMPONENTS
RTOP NO. 502-23-42 [ ] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) (Initials)



NOTES

TASK: Three-Axis Ring Laser Navigation System Development Inhouse

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[X] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Completed Work
Planned Work, Committed - but not completed
Probable Work, Planned - but not committed

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-R
APPROVAL J. C. Taylor
ACCOMPLISHMENT D. L. Anderson

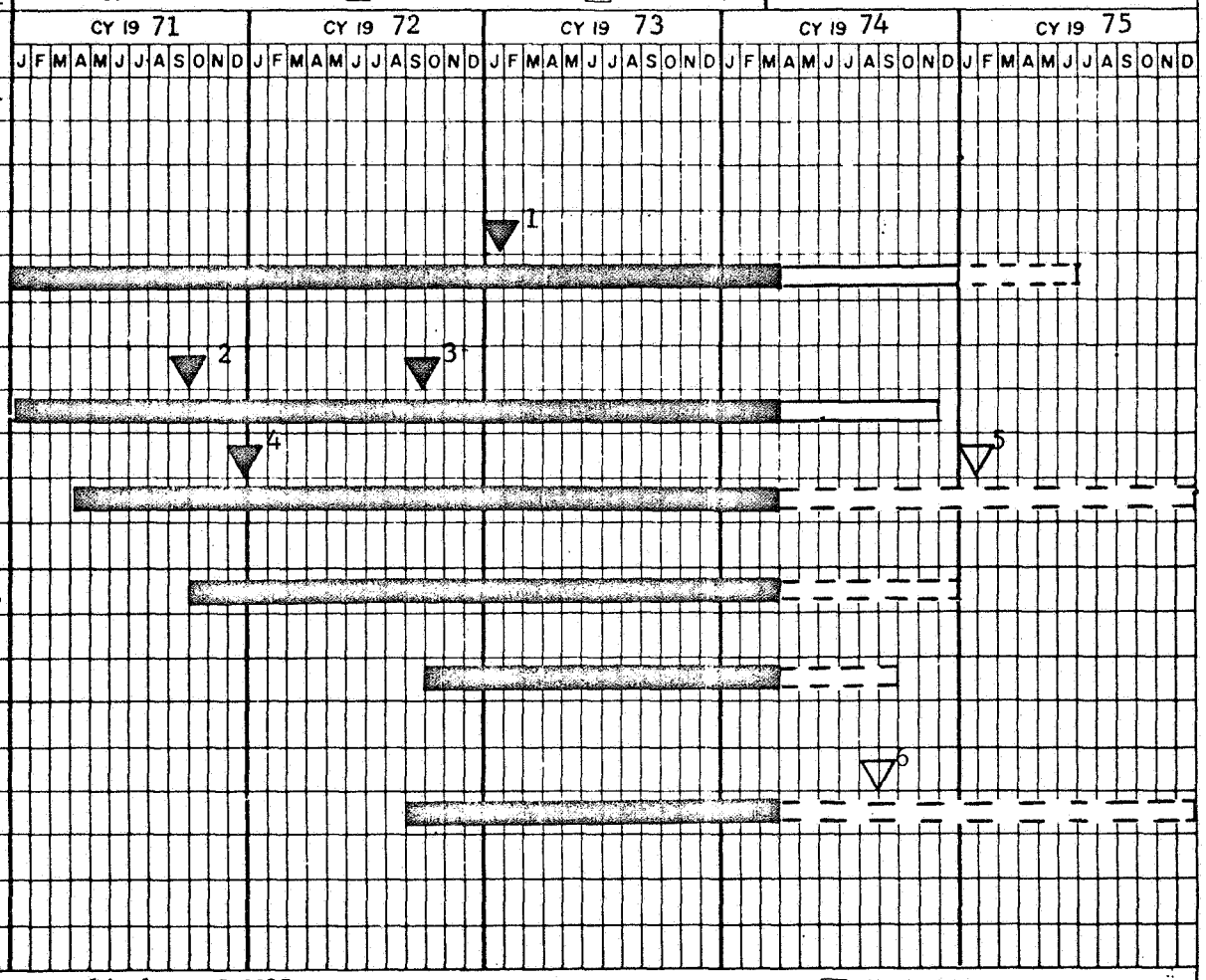
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE DESIGN, PROCESSING AND TESTING OF LSI ARRAYS
RTOP NO. 502-23-51 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	LSI MATERIALS AND
2	TECHNOLOGY
3	
4	C-MOS BEAM-LEAD SILICON-
5	GATE DEVELOPMENT
6	
7	SOS, SILICON-GATE BEAM-
8	LEAD DEVELOPMENT
9	
10	LSI PROCESS AUTOMATION
11	
12	MULTILAYER SUBSTRATE DEV.
13	
14	LSI MICROWAVE TECHNIQUES
15	
16	DEV. BULK EFFECT LSI
17	ARRAYS
18	
19	
20	



NOTES
1. Beam leads and Si gate applied to C-MOS.
2. C-MOS/SOS technology ready.
3. Silicon gate technique for C-MOS/SOS ready.

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-R
APPROVAL J. C. Taylor
ACCOMPLISHMENT D. L. Anderson

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE DESIGN, PROCESSING AND TESTING OF LSI ARRAYS

RTOP NO. 502-23-51 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 71	CY 19 72	CY 19 73	CY 19 74	CY 19 75
1	LSI MATERIALS AND					
2	TECHNOLOGY (CONTINUED)					
3						
4	CONTROL OF DISLOCATIONS					
5	IN LSI FABRICATIONS					
6						
7	TRENDS IN SPACE BASE					
8	ELECTRONICS					
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES
4. LSI automation study complete.
5. The photolithographic-diffusion sequence automated.
6. Operationsl arrays with 10^4 functions.

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-R
APPROVAL J. C. Taylor
ACCOMPLISHMENT D. L. Anderson

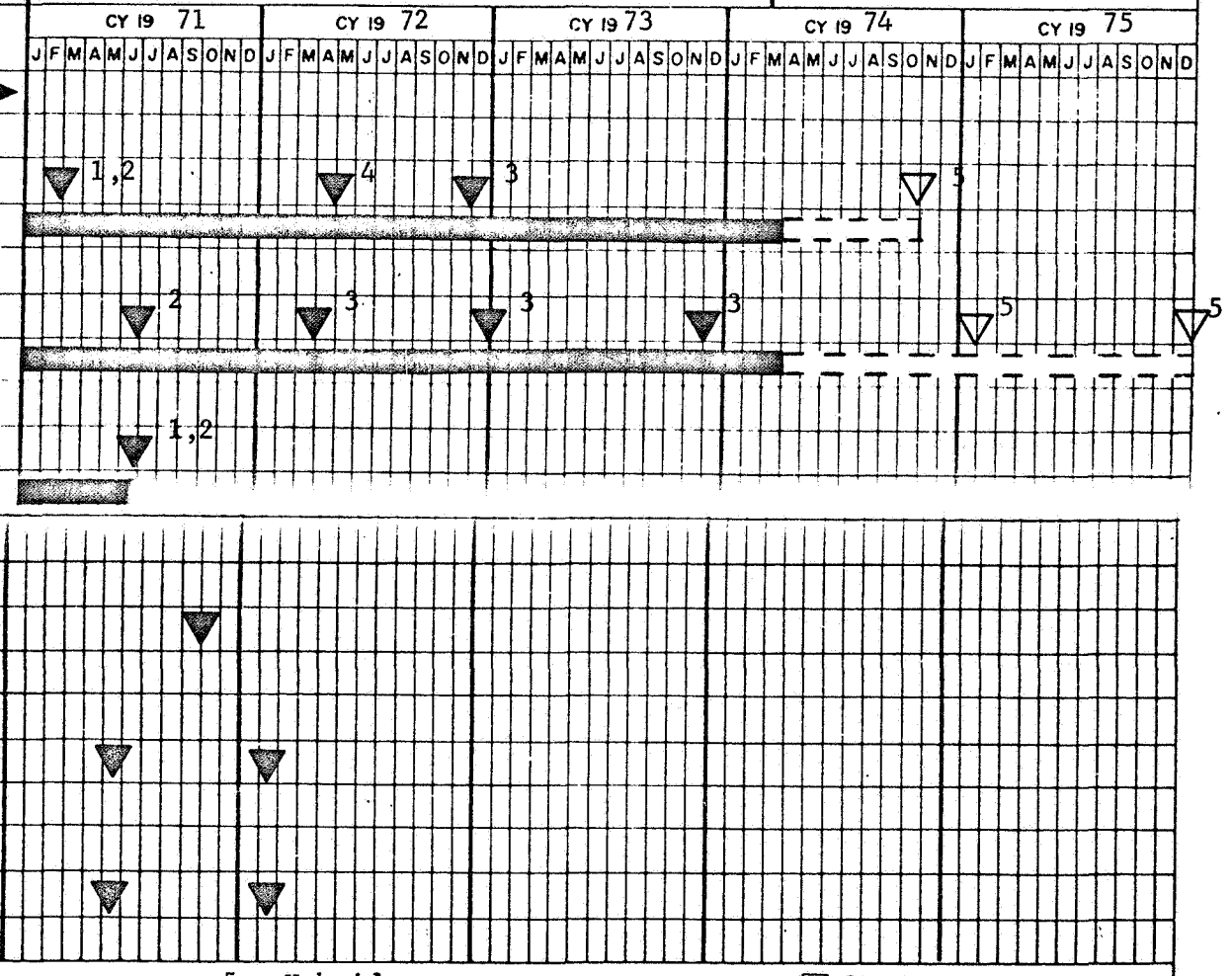
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE DESIGN, PROCESSING AND TESTING OF LSI ARRAYS
RTOP NO 502-23-51 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	ARRAY DESIGN TECHNIQUES →
2	
3	AUTOMATIC LAYOUT
4	DELIVERED
5	
6	CELLS DESIGNS
7	DELIVERED
8	
9	TRANSIENT ANALYSIS
10	DELIVERED
11	
12	LOGIC SIMULATOR
13	DELIVERED
14	
15	AUTOMATIC TEST PATTERN
16	GENERATORS DELIVERED
17	
18	FAULT INFORMATION
19	GENERATORS DELIVERED
20	



NOTES
1. P-MOS
2. C-MOS
3. Silicon Gate, Beam Lead, C-MOS
5. Hybrid
6. Silicon on Insulating Substrate

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-R
APPROVAL J.C. Taylor
ACCOMPLISHMENT D. L. Anderson

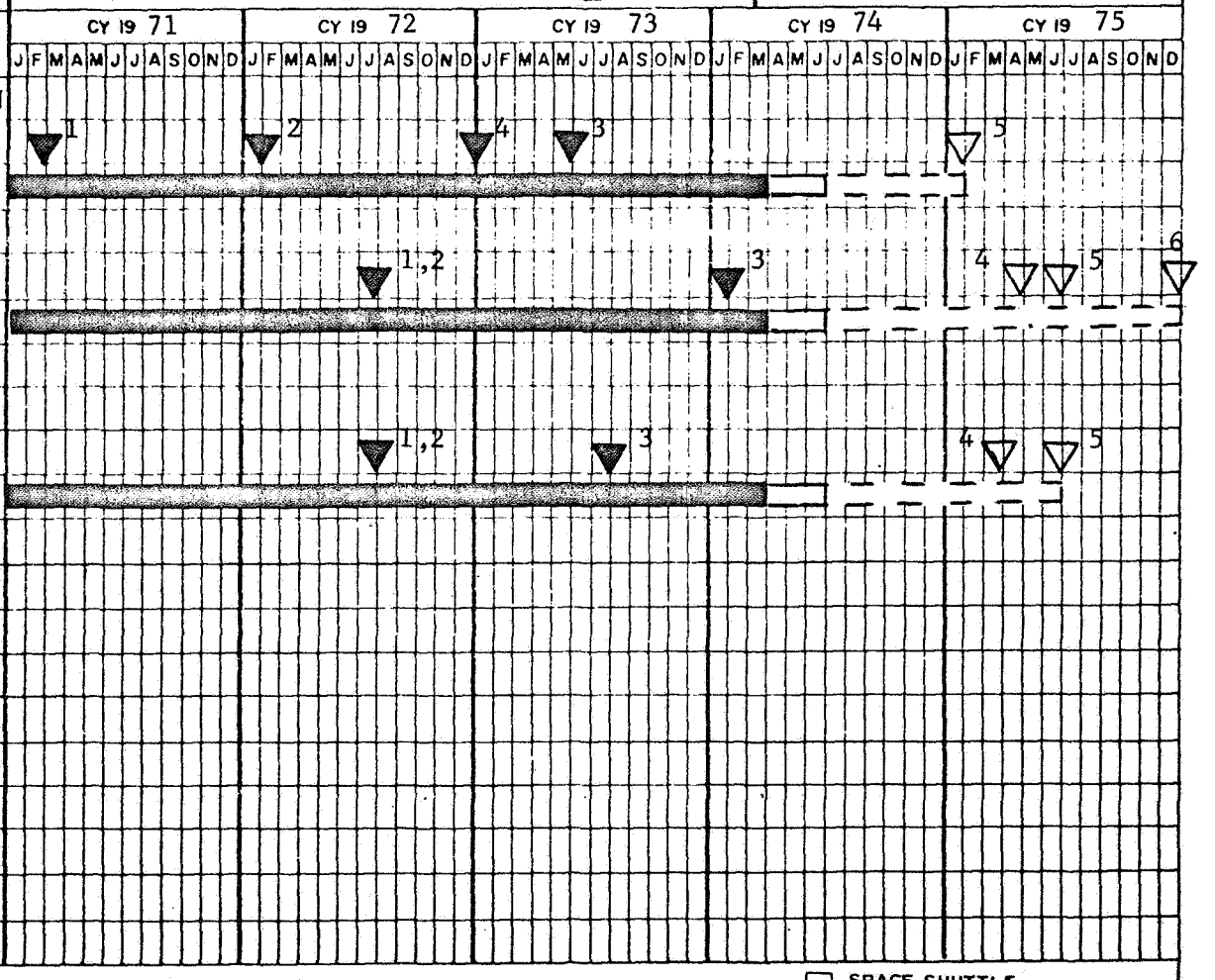
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE DESIGN, PROCESSING AND TESTING OF LSI ARRAYS
RTOP NO. 502-23-51 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	ARRAY DESIGN IMPLEMENTATION
2	
3	LAYOUT CAPABILITY
4	
5	
6	EVALUATION CAPABILITY
7	
8	
9	TEST PATTERN GENERATION
10	CAPABILITY
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES
1. P-MOS
2. C-MOS
3. Silicon Gate, Beam Lead, C-MOS
4. Hybrid
5. Silicon on Insulating Substrate
6. Hybrid Improved

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-QUAL-QT
APPROVAL S. E. Smith
ACCOMPLISHMENT L. C. Hamiter

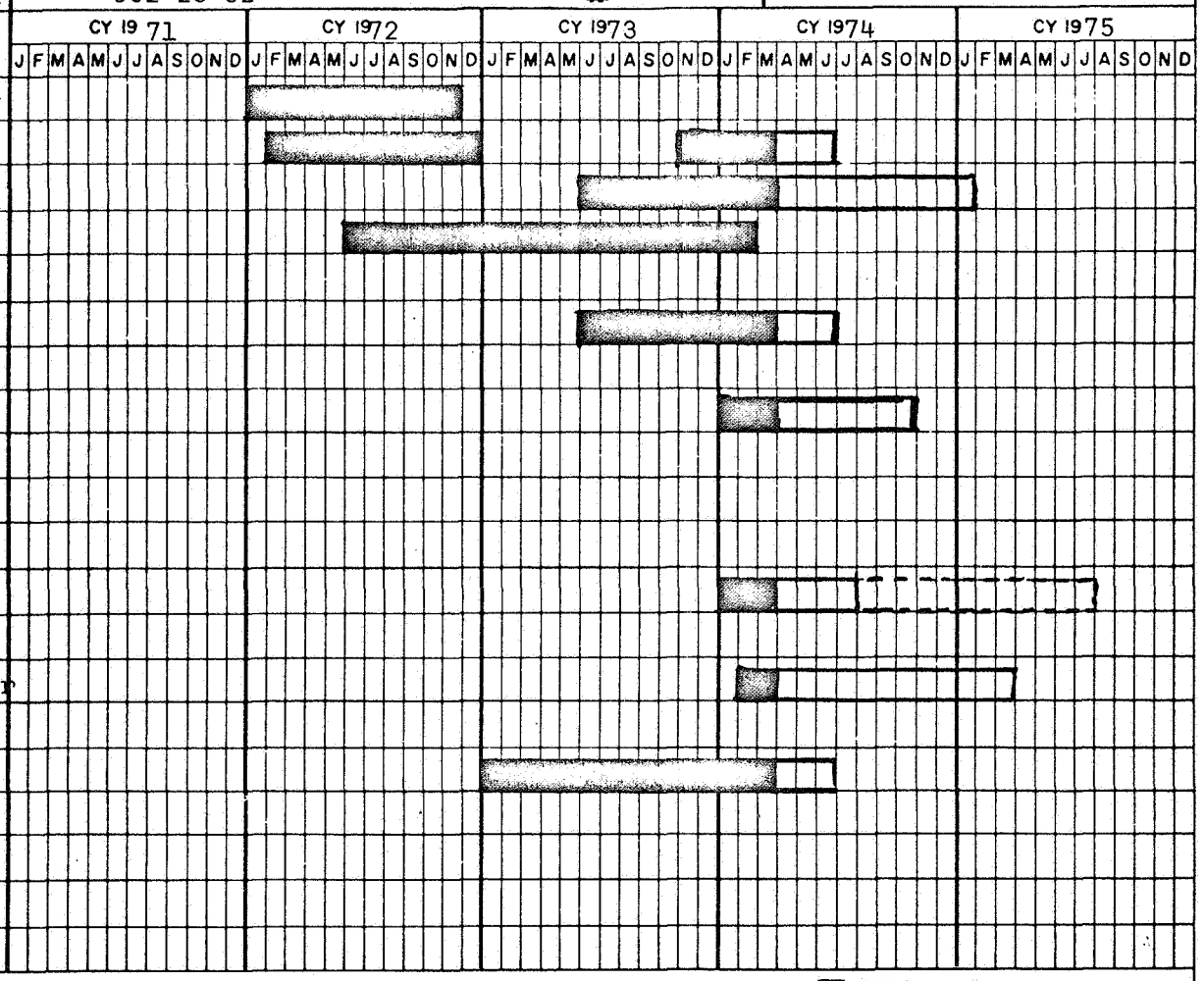
MILESTONE SCHEDULE

LEVEL

RTOP TITLE Screening & Reliability Testing of Microcircuits & Electronic Devices

RTOP NO 502-23-52 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL William W. Vaughan

ACCOMPLISHMENT J. B. Stephens

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Feasibility Study of a Solar Electric Propulsion System "SEPS" for Geosynchronous Missions

RTOP NO. 502-24-17 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73												CY 19 74												CY 19												CY 19												CY 19											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	Environmental Impact																																																											
2	of Solar Electric Propulsion																																																											
3	System Operation																																																											
4	Development and Operation																																																											
5	of Computer Programs																																																											
6	1. SPIRAL																																																											
7	2. NASA/MSFC Multilayer																																																											
8	Diffusion Program																																																											
9																																																												
10																																																												
11																																																												
12																																																												
13																																																												
14																																																												
15																																																												
16																																																												
17																																																												
18																																																												
19																																																												
20																																																												

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☒ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PP
APPROVAL J. A. Lombardo
ACCOMPLISHMENT L. A. Gross

MILESTONE SCHEDULE

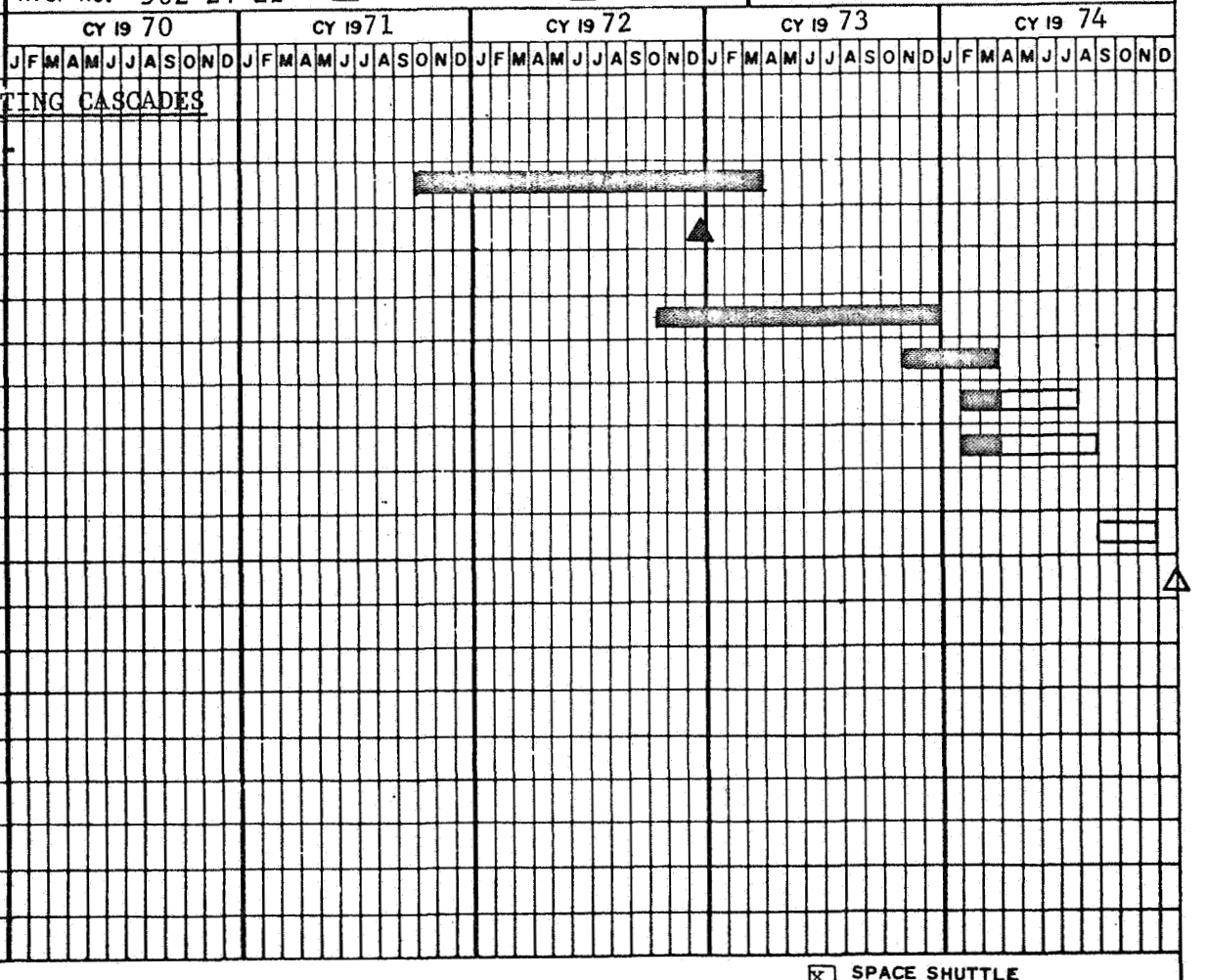
5 LEVEL

RTOP TITLE LAUNCH VEHICLE PROPULSION TECHNOLOGY

RTOP NO. 502-24-21 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	DYNAMICS OF UNSTEADY CAVITATING CASCADES
2	ANALYSIS OF CAVITATING CAS-
3	CADE AND INDUCER DYNAMICS
4	INTERIM REPORT
5	TEST FACILITY DESIGN
6	AND BUILDUP
7	SHAKEDOWN TESTS
8	TESTING
9	DATA ANALYSIS
10	CORRELATION OF ANALYTICAL
11	AND EXPERIMENTAL WORK
12	FINAL REPORT
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

Planned
Completed

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PP
APPROVAL J. A. Lombardo
ACCOMPLISHMENT K. W. Gross

MILESTONE SCHEDULE

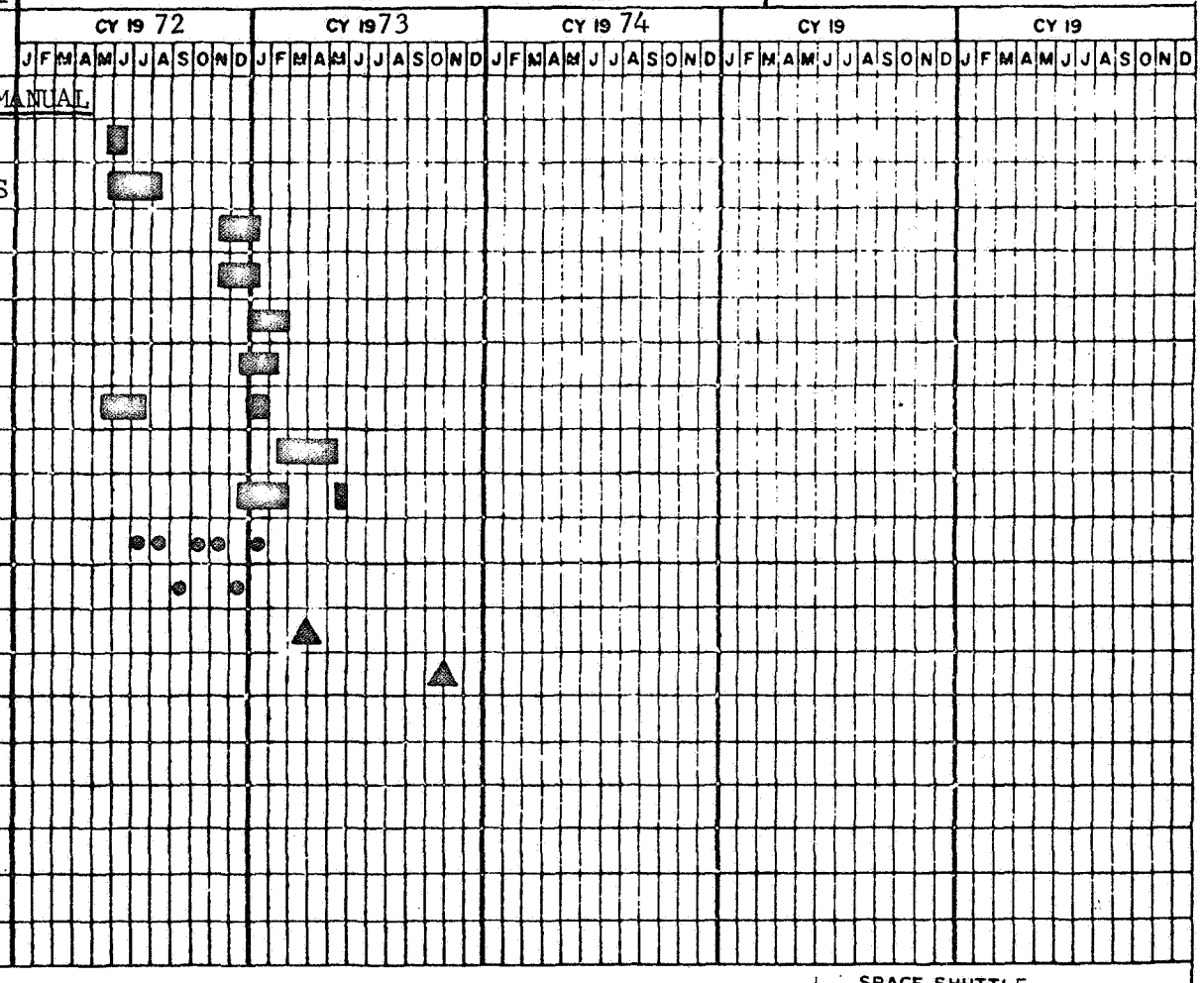
RTOP TITLE LAUNCH VEHICLE PROPULSION TECHNOLOGY

5 LEVEL

RTOP NO. 502-24-21 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	PERFORMANCE DATA ANALYSIS MANUAL
2	OUTLINE OF TOPICS
3	INSTRUMENTS & MEASUREMENTS
4	MEASUREMENT PRACTICES
5	MEASUREMENT UNCERTAINTIES
6	EXISTING DATA
7	TEST MODEL
8	PERFORMANCE DETERMINATION
9	SAMPLE CASES
10	REPORT PREPARATION
11	MONTHLY REPORTS
12	QUARTERLY REPORTS
13	FINAL DOCUMENT DRAFT
14	FINAL DOCUMENT ISSUED
15	
16	
17	
18	
19	
20	



NOTES

Completed
Planned

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PP
APPROVAL J. A. Lombardo
ACCOMPLISHMENT K. W. Gross

MILESTONE SCHEDULE

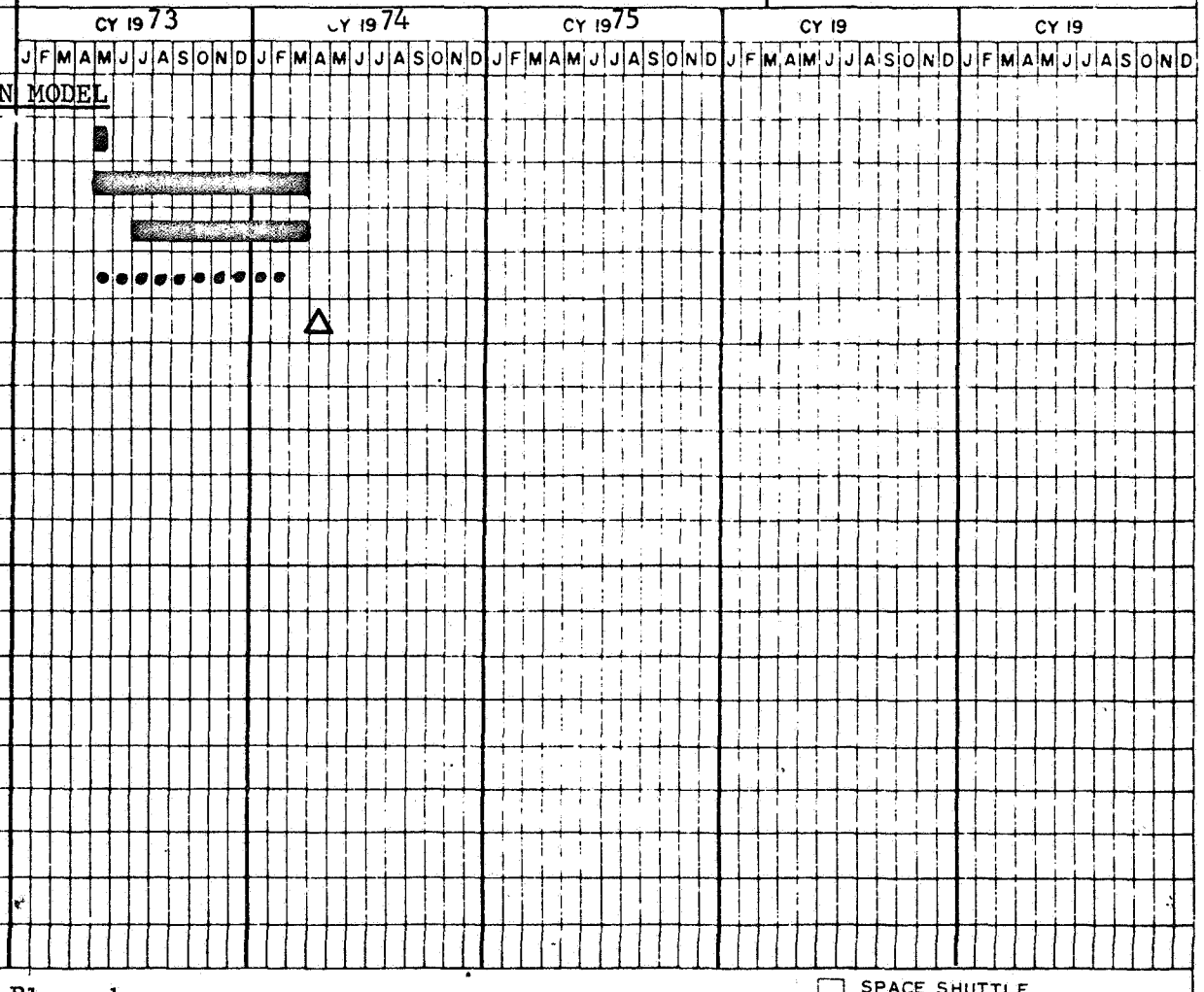
RTOP TITLE LAUNCH VEHICLE PROPULSION TECHNOLOGY

5 LEVEL

RTOP NO. 502-24-21 [ ] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	COAXIAL INJECTION COMBUSTION MODEL
2	PROGRAM PLAN
3	PROGRAM MODIFICATION
4	PROGRAM DOCUMENTATION
5	MONTHLY REPORTS
6	FINAL REPORT
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

Planned
Complete

[ ] SPACE SHUTTLE
[ ] SPACE STATION BASE
[ ] _____ PROJECT
[X] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PP
APPROVAL J. A. Lombardo
ACCOMPLISHMENT K. W. Gross

MILESTONE SCHEDULE

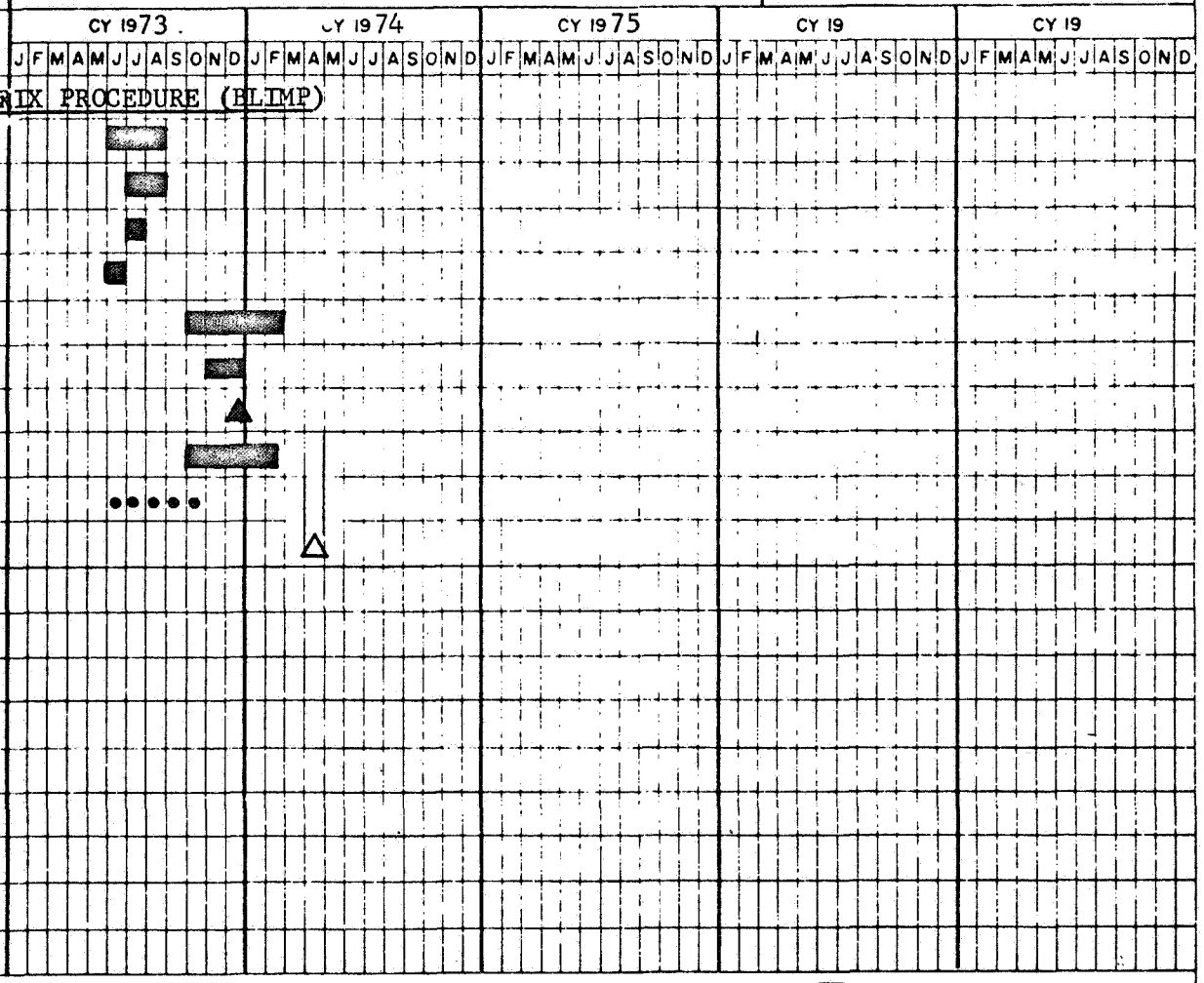
RTOP TITLE LAUNCH VEHICLE PROPULSION TECHNOLOGY

5 LEVEL

RTOP NO. 502-24-21 ☐ ADV RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE (BLIMP)
2	COMPATIBILITY WITH JANNAF
3	TAILOR TO ROCKET PROBLEM
4	THERMOCHEMICAL MODEL
5	REFIT OPTION
6	USER'S MANUAL
7	PROGRAM CHECKOUT
8	PROGRAM DELIVERY
9	CODE VERIFICATION
10	STATUS REPORT
11	FINAL REPORT
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

Completed
Planned

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY
APPROVAL R. ADEN
ACCOMPLISHMENT J. FELCH

MILESTONE SCHEDULE

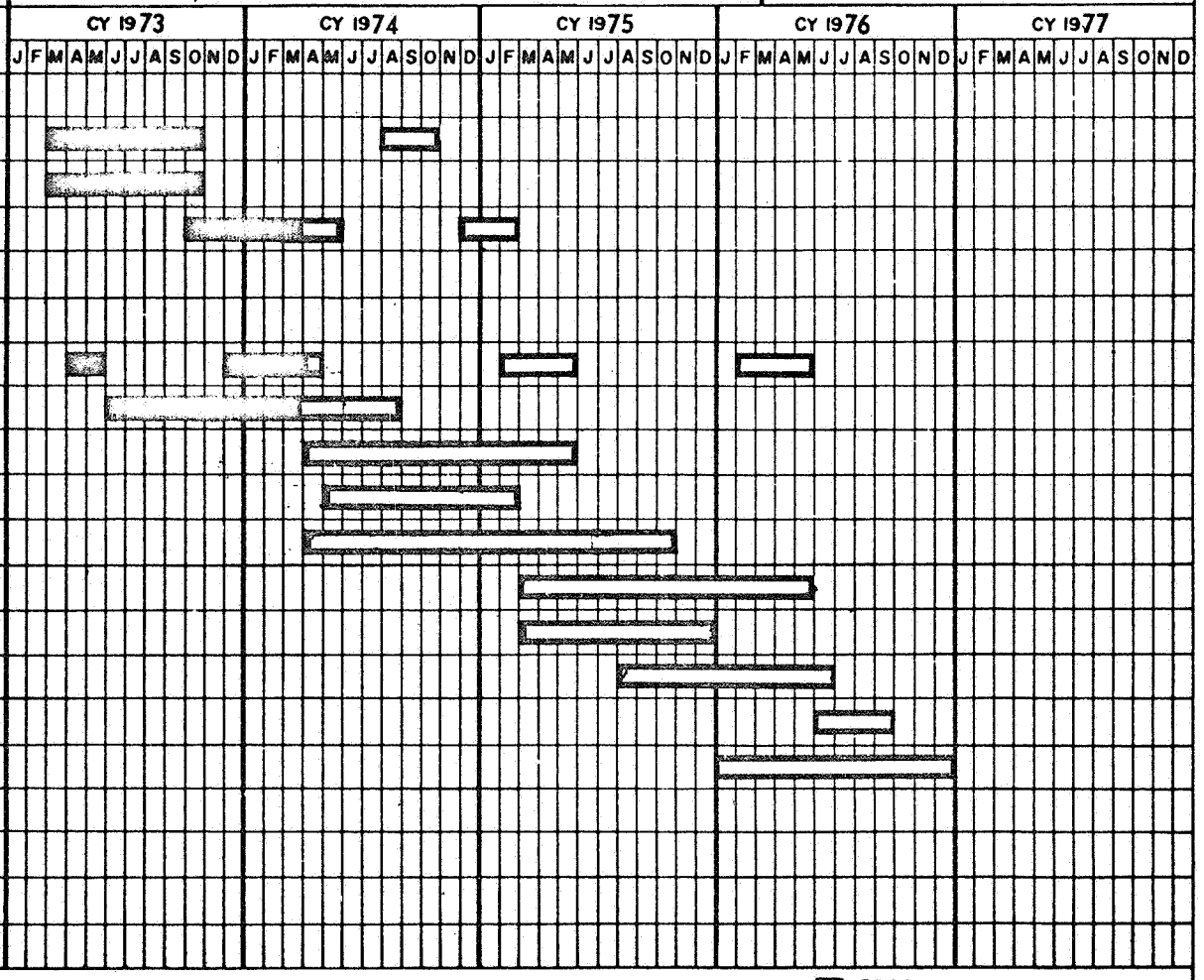
5 LEVEL

RTOP TITLE MULTI-KW DC DISTRIBUTION SYSTEM-EVALUATION AND DEMONSTRATION

RTOP NO. 502-25-73 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	MULTI-KW DC DIST SYSTEM STUDY
2	DETAILED TEST OBJECTIVES
3	ESTABLISH SYSTEM BASELINE
4	SYSTEM TEST PROCEDURES
5	
6	MSFC IN-HOUSE EFFORT
7	PROCUREMENT
8	DESIGN
9	FABRICATION
10	INSTALLATION
11	COMPONENT TESTING
12	SYSTEM TESTING
13	SYSTEM EVALUATION
14	SYSTEM CHARACTERISTICS
15	POWER QUALITY SPEC
16	ANALYSIS & RECOMMENDATIONS
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-I
APPROVAL O. T. Duggan
ACCOMPLISHMENT J. F. Hamlet

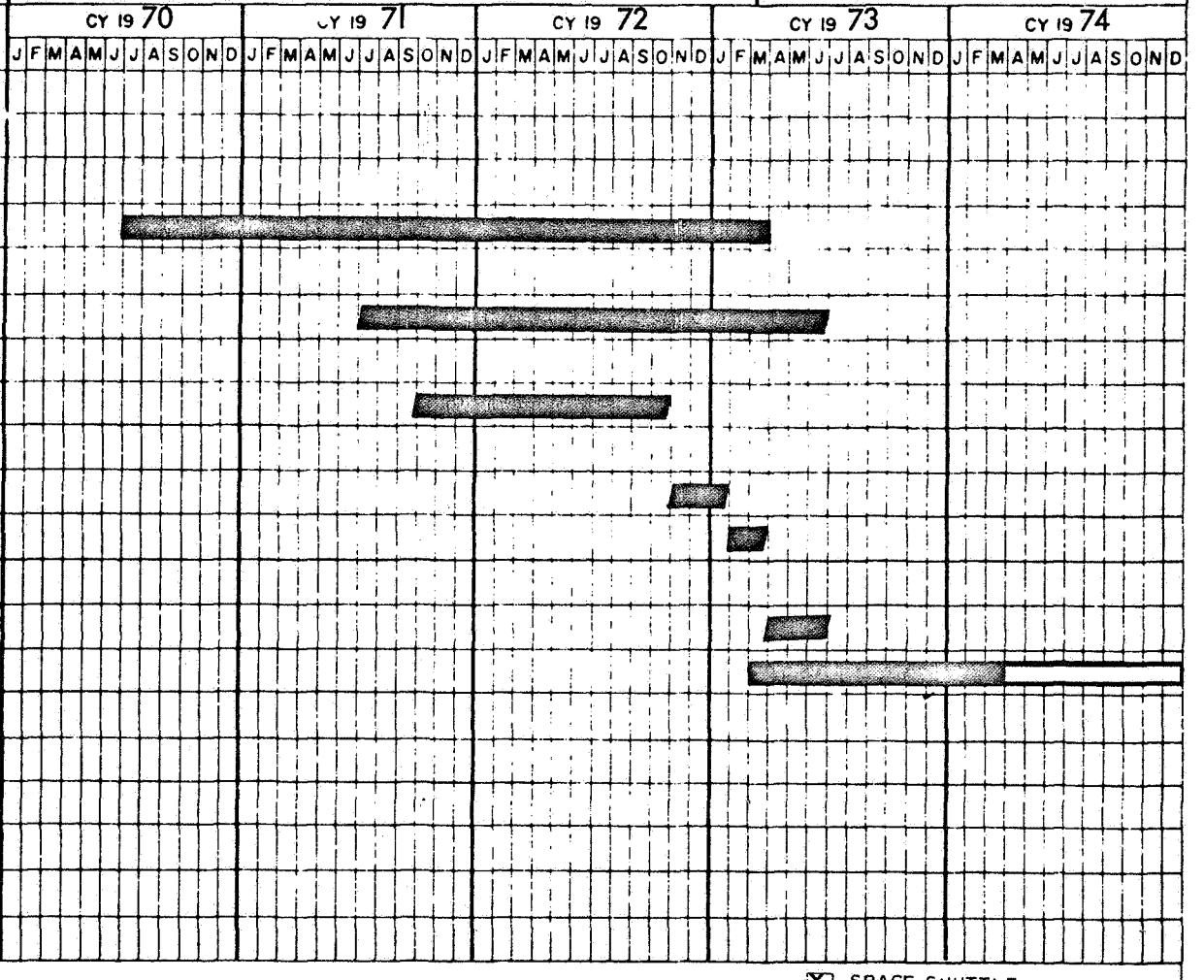
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Space Shuttle Sensors & Instrumentation
RTOP NO. 502-33-53 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Propellant Utilization/
2	Loading Instrumentation
3	
4	Systems Definition
5	
6	Electronics Development
7	(a) Design Definition
8	(b) Design & Develop-
9	ment
10	(c) Eng. Model Mfg.
11	(d) Eng. Model Test
12	(e) 2nd & 3rd Eng.
13	Model Mfg.
14	(f) Evaluation & Report
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-1
APPROVAL O. T. Duggan
ACCOMPLISHMENT J. H. Goldstein

MILESTONE SCHEDULE

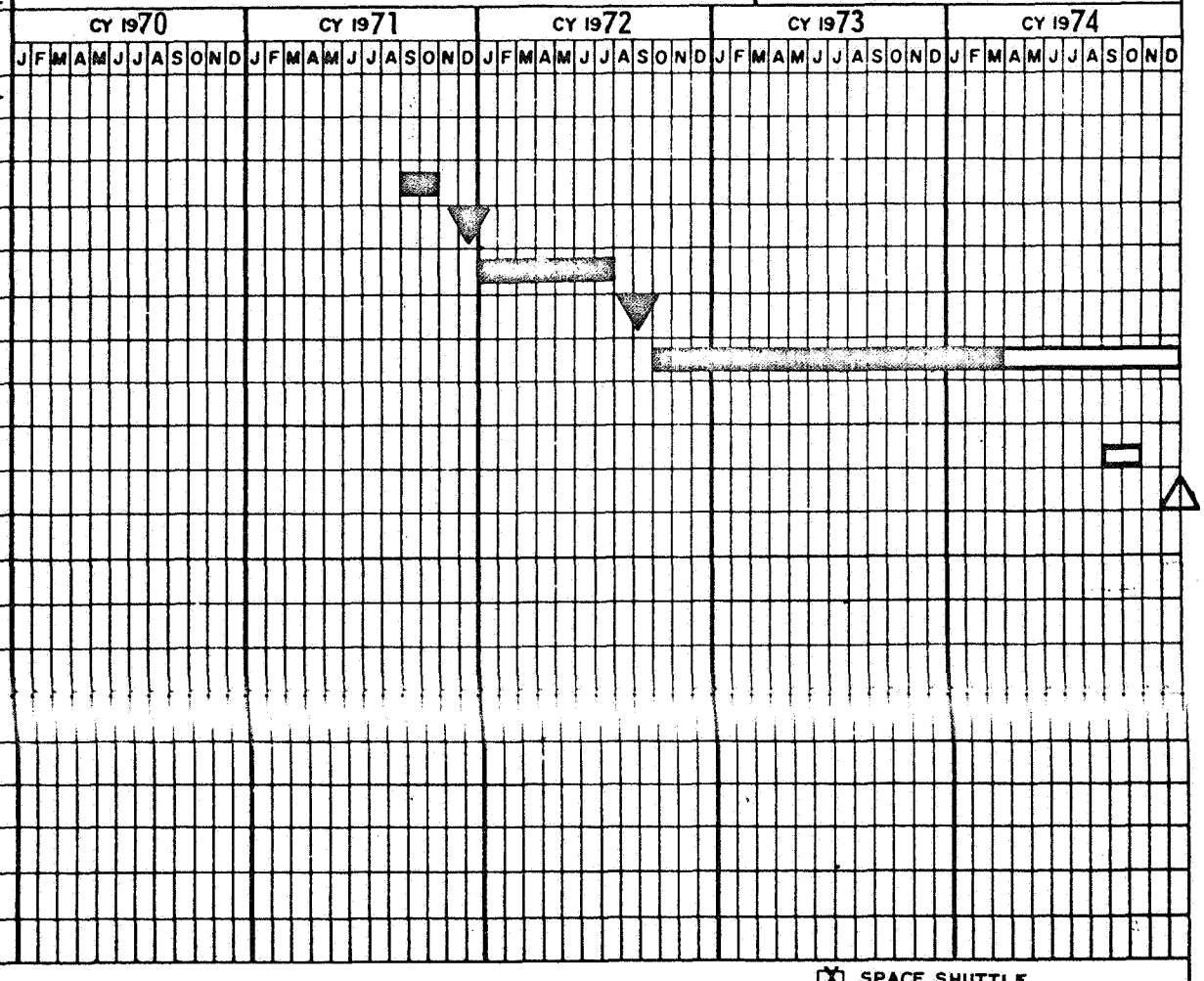
RTOP TITLE Shuttle Sensors and Instrumentation

4 LEVEL

RTOP NO. 502-33-53 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Cryogenic Mass Flowmeter
2	
3	Study & Preliminary Design
4	MSFC Review of Design
5	R&D of Selected Design
6	MSFC Review
7	Fabrication of 4" Prototype
8	& Testing
9	Review of Test Data
10	Fabrication of 10" Meters
11	Available for Engine Tests
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-I
APPROVAL O. T. DUGGAN
ACCOMPLISHMENT H. E. THOMPSON

MILESTONE SCHEDULE

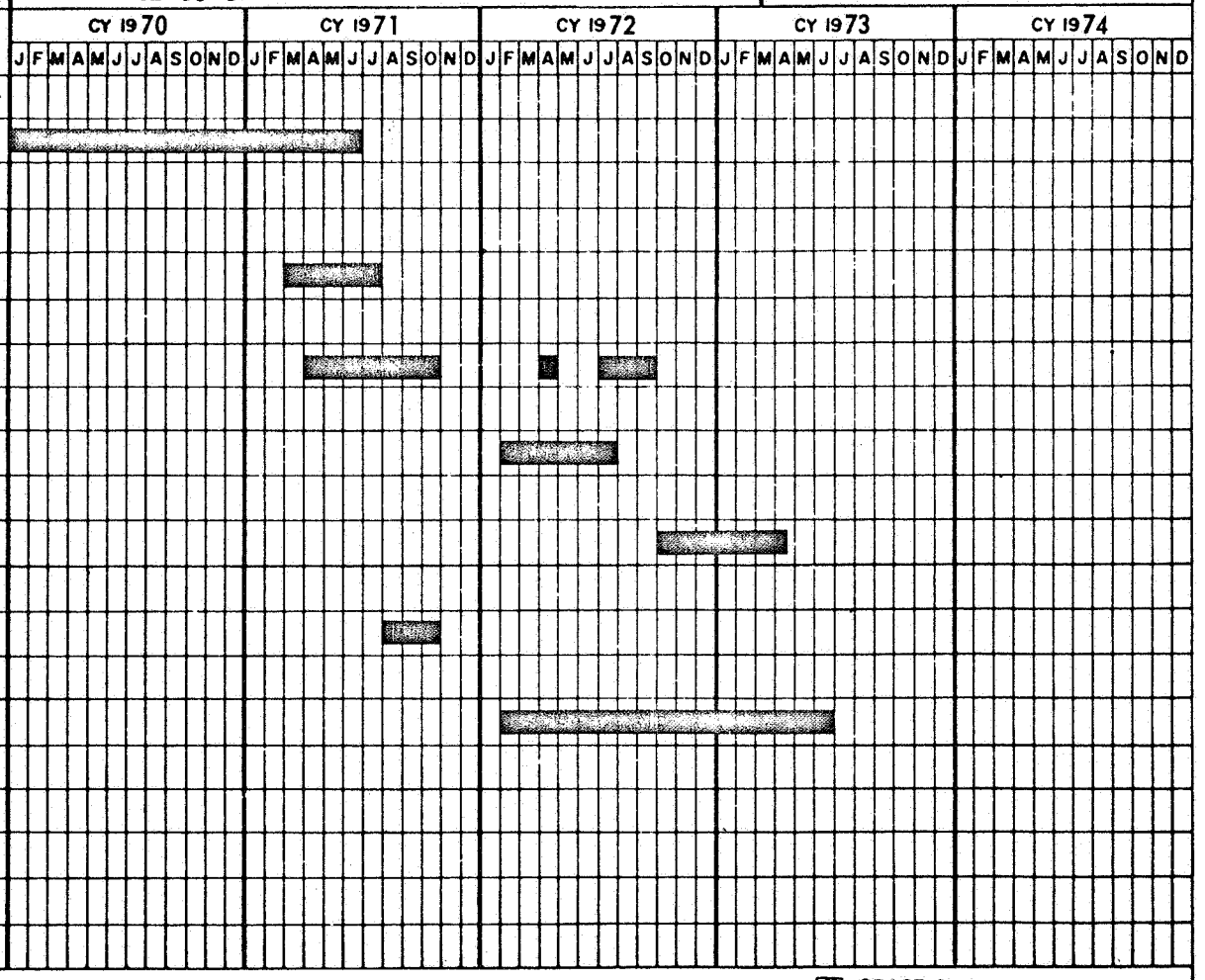
4 LEVEL

RTOP TITLE SPACE SHUTTLE SENSORS AND INSTRUMENTATION

RTOP NO. 502-33-53 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	ZERO G PROPELLANT GAGING ➔
2	BENDIX DESIGN & TEST
3	BREADBOARD UNIT WITH
4	1/10 SCALE TANK
5	TEST S-IVB TANK MSFC
6	WITH LH_2
7	FLY FLIGHT SYSTEM KC-135
8	1/10 SCALE BENZENE
9	RF TESTS WITH CAPILLARY
10	SCREENS IN MODEL TANK
11	RF GAGE 18,500 GAL.
12	LOX TANK MSFC
13	ADDITIONAL TESTS S-IVB
14	LH_2 TANK
15	SCALE TANK
16	GROUND TESTS
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-I
APPROVAL O. T. DUGGAN
ACCOMPLISHMENT H. E. THOMPSON

MILESTONE SCHEDULE

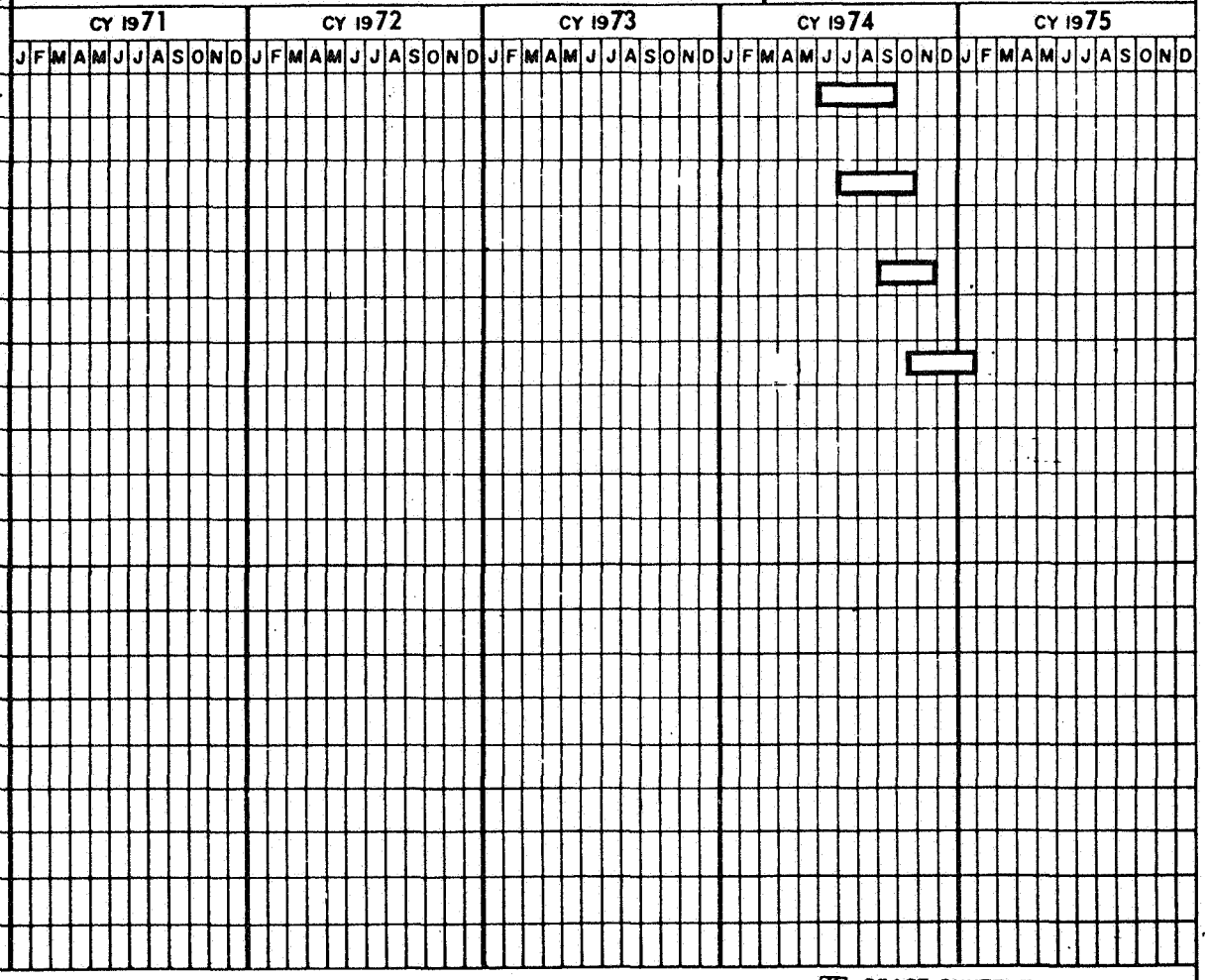
4 LEVEL

RTOP TITLE SPACE SHUTTLE SENSORS AND INSTRUMENTATION

RTOP NO. 502-33-53 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	MULTIPLE ANTENNAS WITH →
2	PERTURBATIONS EVALUATION
3	UPGRADE PROCESSING
4	ELECTRONICS
5	TANK CONFIGURATION AND
6	PRESSURE TESTS
7	ADDITIONAL CRYOGENIC
8	TESTS
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-1
APPROVAL O. T. Duggan
ACCOMPLISHMENT A. Hafner

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Space Shuttle Sensors and Instrumentation
RTOP NO. 502-33-53 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1973	CY 1974	CY 1975	CY 1976	CY 1977
1	Gas Analyzers					
2						
3	Requirements Study					
4	Sensor Evaluation					
5	CO Sensor Design					
6						
7						
8	Pulsed Gas Analyze					
9	Pre-Prototype Design					
10	Proto Development					
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-1
APPROVAL W. O. FROST
ACCOMPLISHMENT T.N. MARSHALL

MILESTONE SCHEDULE

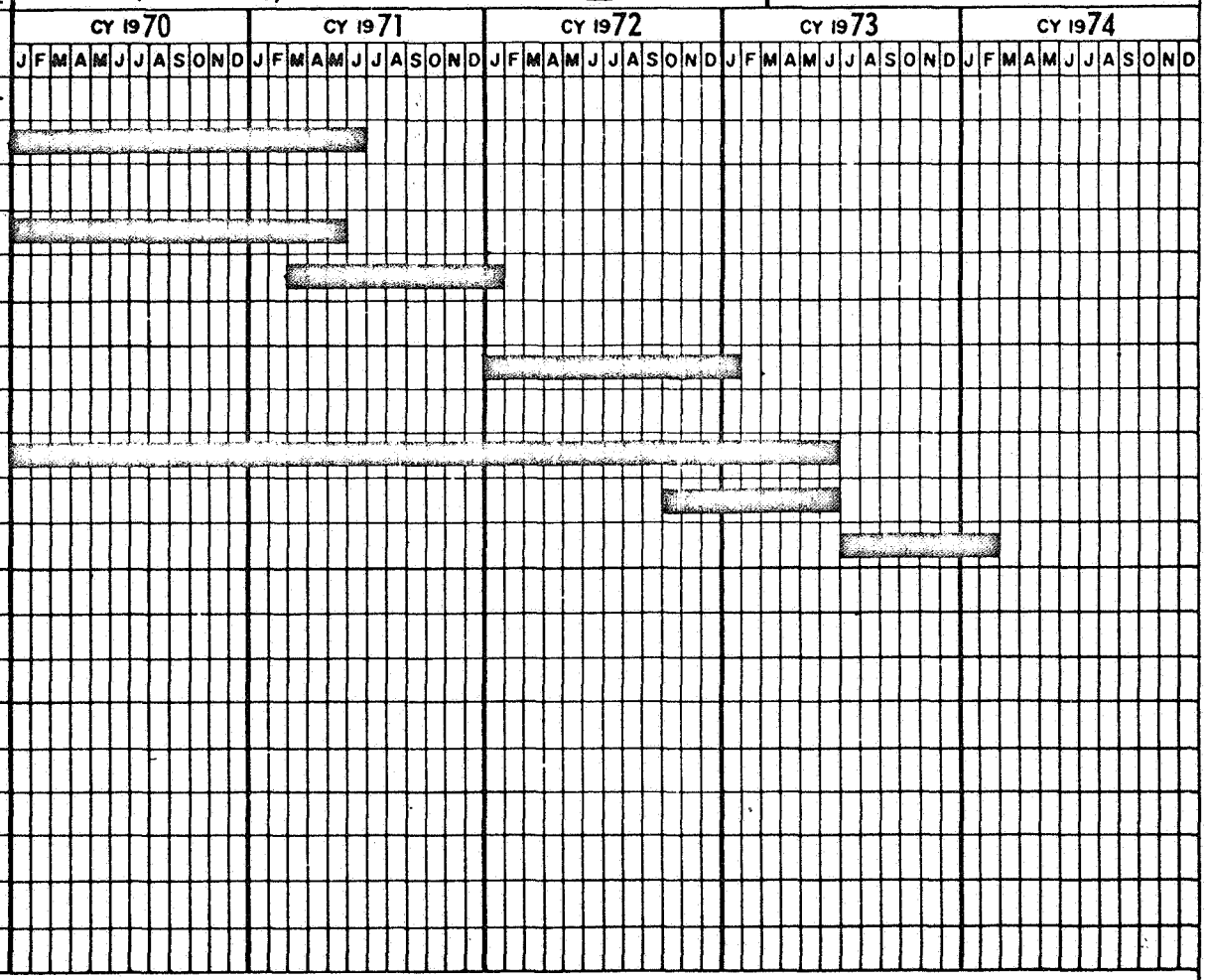
4 LEVEL

RTOP TITLE REUSABLE NUCLEAR STAGE TECHNOLOGY

RTOP NO. (503-24-06) ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	Slush Hydrogen Instr.
2	Density Instrumentation
3	Mass Flow Instrumentation
4	Labroratory Investigation
5	Development of
6	Prototypes
7	NBS Eval. of Prototype
8	In-House Instr. Dev.
9	Buildup of System
10	Verification of System
11	Development Program
12	Final Report
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Nuclear Veh. PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-1
APPROVAL O.T. Duggan
ACCOMPLISHMENT J. Zimmerman

MILESTONE SCHEDULE

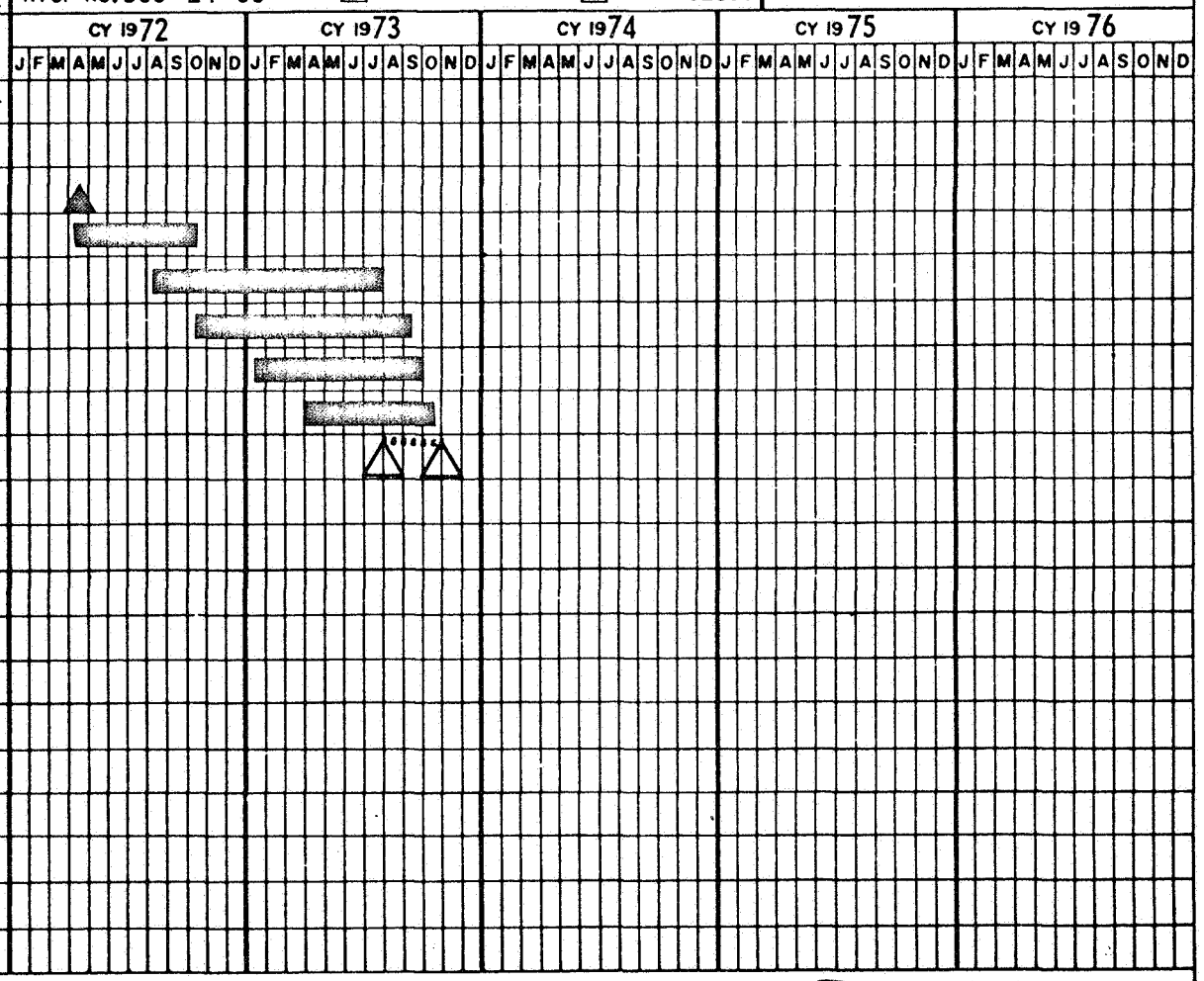
4 LEVEL

RTOP TITLE Reusable Nuclear Stage Technology

RTOP NO. 503-24-06 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Thin Film Sensors ➔
2	
3	Contract Award
4	Optimize Deposition
5	Produce Films
6	Calibrate
7	Testing
8	Delivery and Mounting
9	Final Report
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ Nuclear Stage PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S & E - ASTR-E
APPROVAL R. M. ADEN
ACCOMPLISHMENT C. B. GRAFF

MILESTONE SCHEDULE

RTOP TITLE ELECTRICAL POWER

5 LEVEL

RTOP NO. 908-51-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1970	CY 1971	CY 1972	CY 1973	CY 1974
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	THERMOELECTRIC POWER GENERATION					
2	PHASE I					
3	TEM-9U TESTS					
4	TEM-9U REPORTS					
5	TEM-X TESTS					
6	TEM-X FINAL REPORTS					
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER NASA-MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL F. Wojtalik
ACCOMPLISHMENT G. Doane III

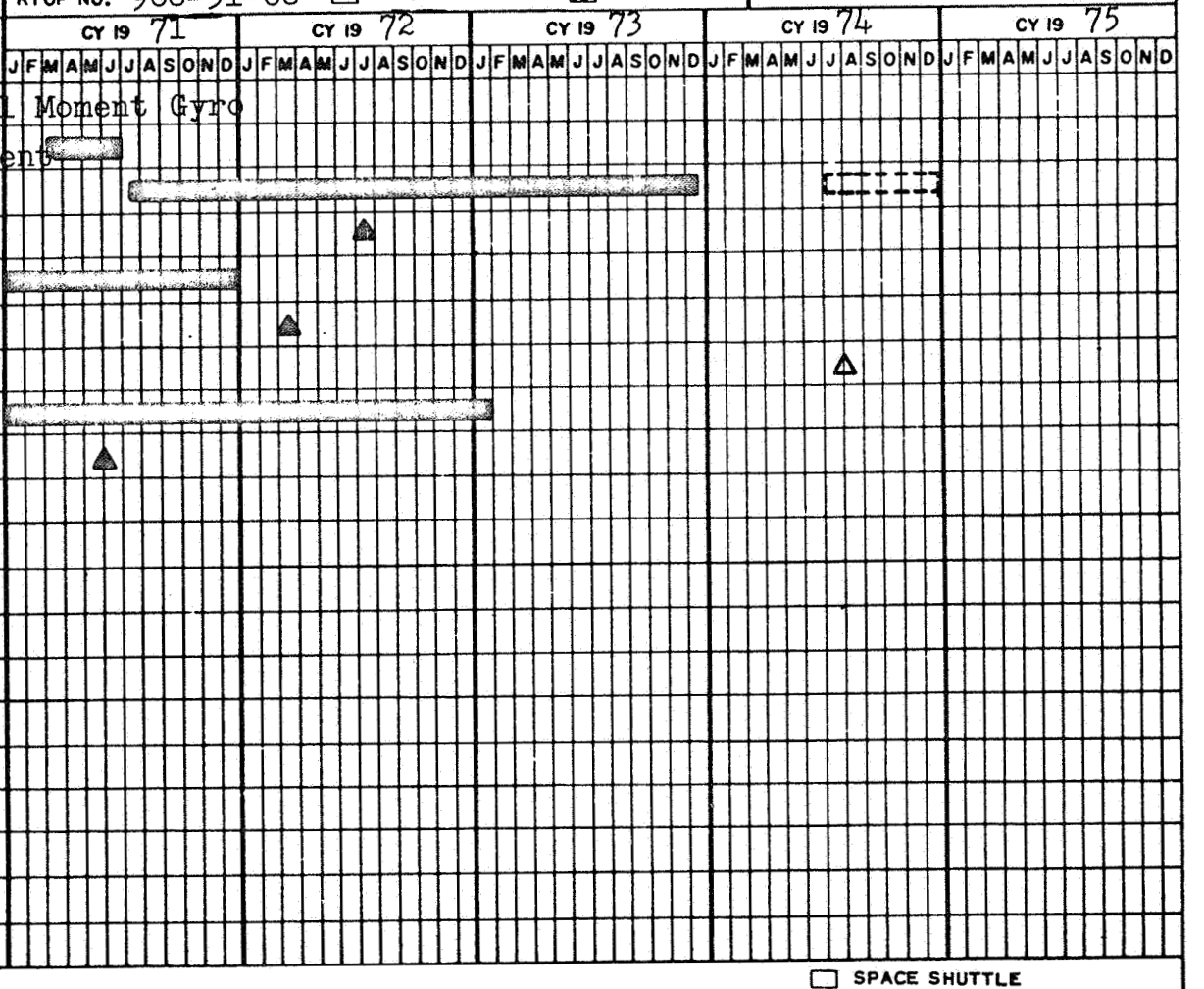
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Stabilization and Control
RTOP NO. 908-51-08 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	TASK: Advanced Control Moment Gyro
2	Fabrication & Procurement
3	Assemble and Test
4	MA2000 Delivery
5	Gimbal Freedom Study
6	Breadboard Delivery
7	Final Summary Report
8	CMG Electronics Eval.
9	Prototype Diagnostic System
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ LST PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL F. S. Wojtalik
ACCOMPLISHMENT W. A. Swords

MILESTONE SCHEDULE

RTOP TITLE Stabilization and Control

5 LEVEL

RTOP NO. 908-51-08 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 70	CY 19 71	CY 19 72	CY 19 73	CY 19 74
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK TITLE: CMG Bearing Signature Analysis					
2	Contract	▲				
3	Phase I Final Report		▲			
4	Phase II Start		▲			
5	Phase II Redirection			▲		
6	Signature Analysis Data Evaluation			▬		
7	CMG Bearing Tests			▬		
8	Final Report					△
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL S. M. Seltzer

ACCOMPLISHMENT B. C. Kuo

MILESTONE SCHEDULE

RTOP TITLE Stabilization and Control -

4 LEVEL

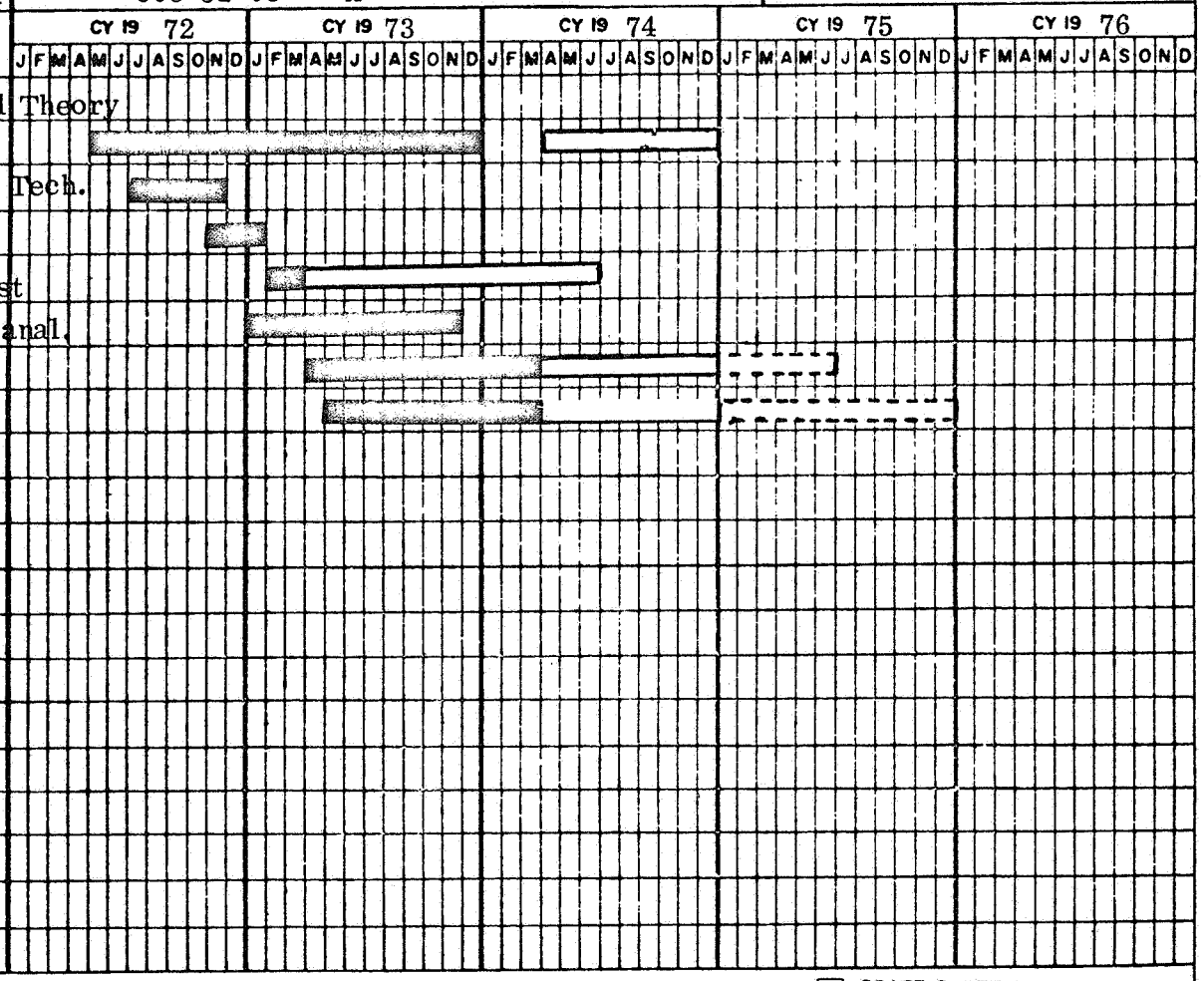
RTOP NO. 908-51-08 [x] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Modern Sampled-Data Control Theory
2	Develop Dynamic Models
3	Dev. Pt. -by-Pt. Comparison Tech.
4	Dev. Optimal Ctl. Tech.
5	Compare Results & Extend Best
6	Derive describing fn. fro NL anal.
7	Apply #6 to NL sys. Analysis
8	Computer Implementation
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[x] Space Systems PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-QUAL-AR
APPROVAL R. M. Henritze
ACCOMPLISHMENT M. C. McIlwain

MILESTONE SCHEDULE

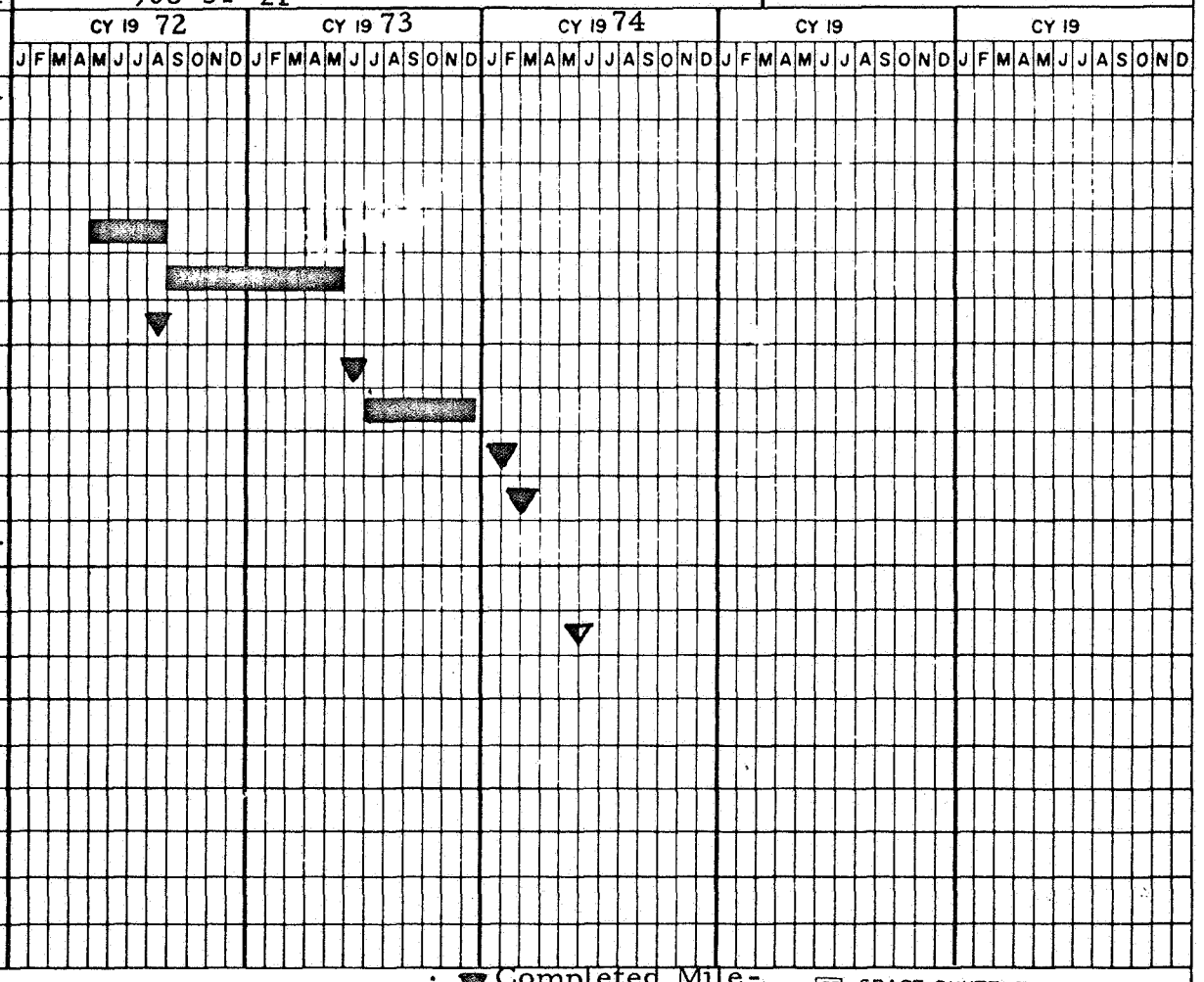
RTOP TITLE Manufacturing & Inspection

5 LEVEL

RTOP NO. 908-51-21 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Detection of Lack of
2	Fusion Using Opaque
3	Additives
4	Phase I
5	Phase II
6	Phase I Report
7	Final Report
8	In-House Work
9	In-House Report
10	Summary Report (Draft to
11	Dr. Haeussermann, S&E-
12	DIR)
13	Final Summary Report
14	
15	
16	
17	
18	
19	
20	



NOTES
Completed work
Planned work, committed but not completed
Probable work, planned but not committed
Completed Milestones
Scheduled Milestones

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ OMSF PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-DDD
APPROVAL Robert S. Ryan
ACCOMPLISHMENT S. W. Winder

MILESTONE SCHEDULE

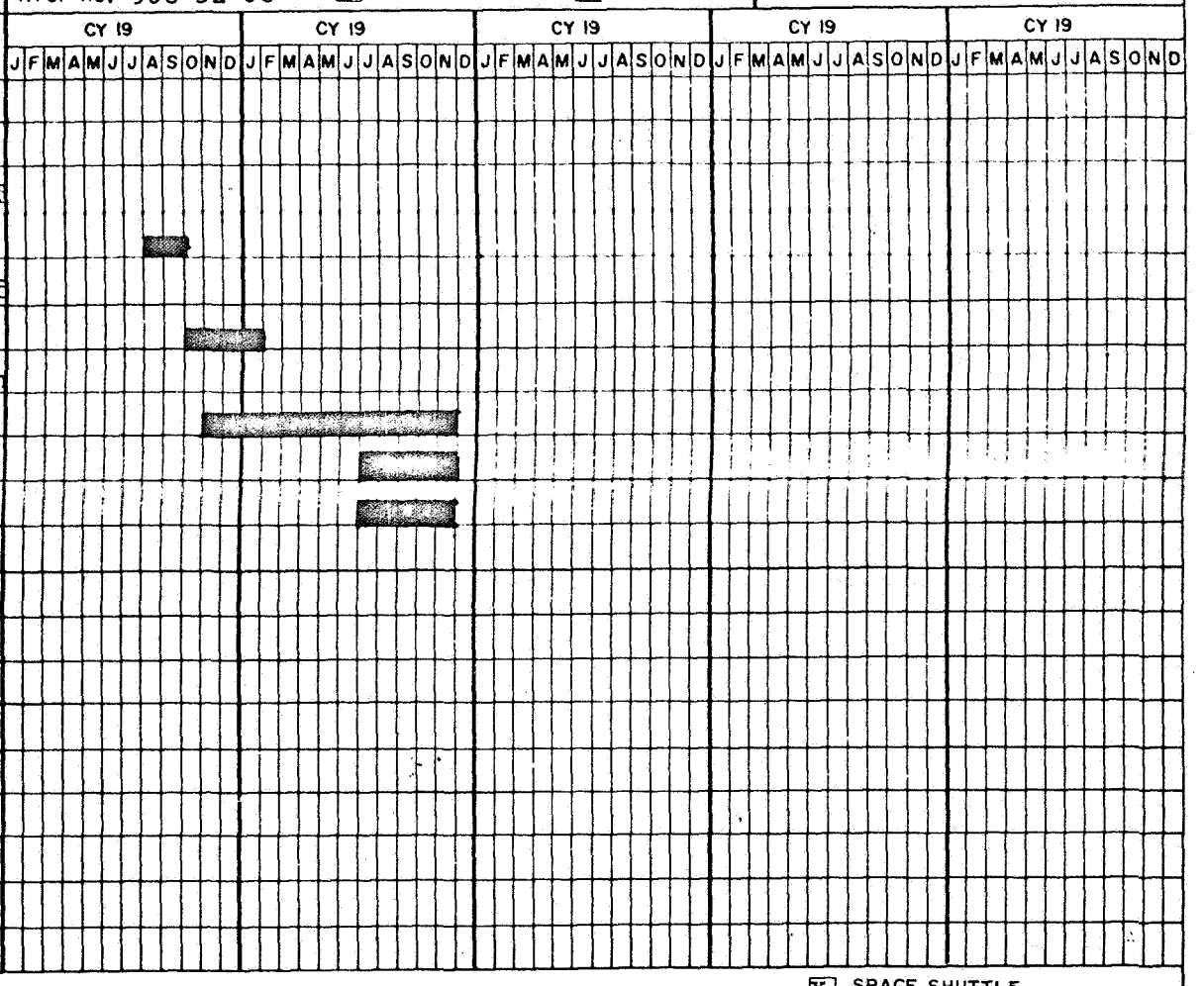
RTOP TITLE Stabilization and Control

4 LEVEL

RTOP NO. 908-52-08 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	ADVANCED CONTROL CONCEPTS ➔
2	Task I
3	Phase I - Formulation of
4	Constraints
5	Phase II - Evaluation of
6	Trim Boundaries
7	Phase III - Optimization
8	of Trim Solution
9	Task 2 - Sample Problem
10	Task 3 - Dynamic Response
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[X] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER NASA-MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL F. Wojtalik
ACCOMPLISHMENT P. Golley

MILESTONE SCHEDULE

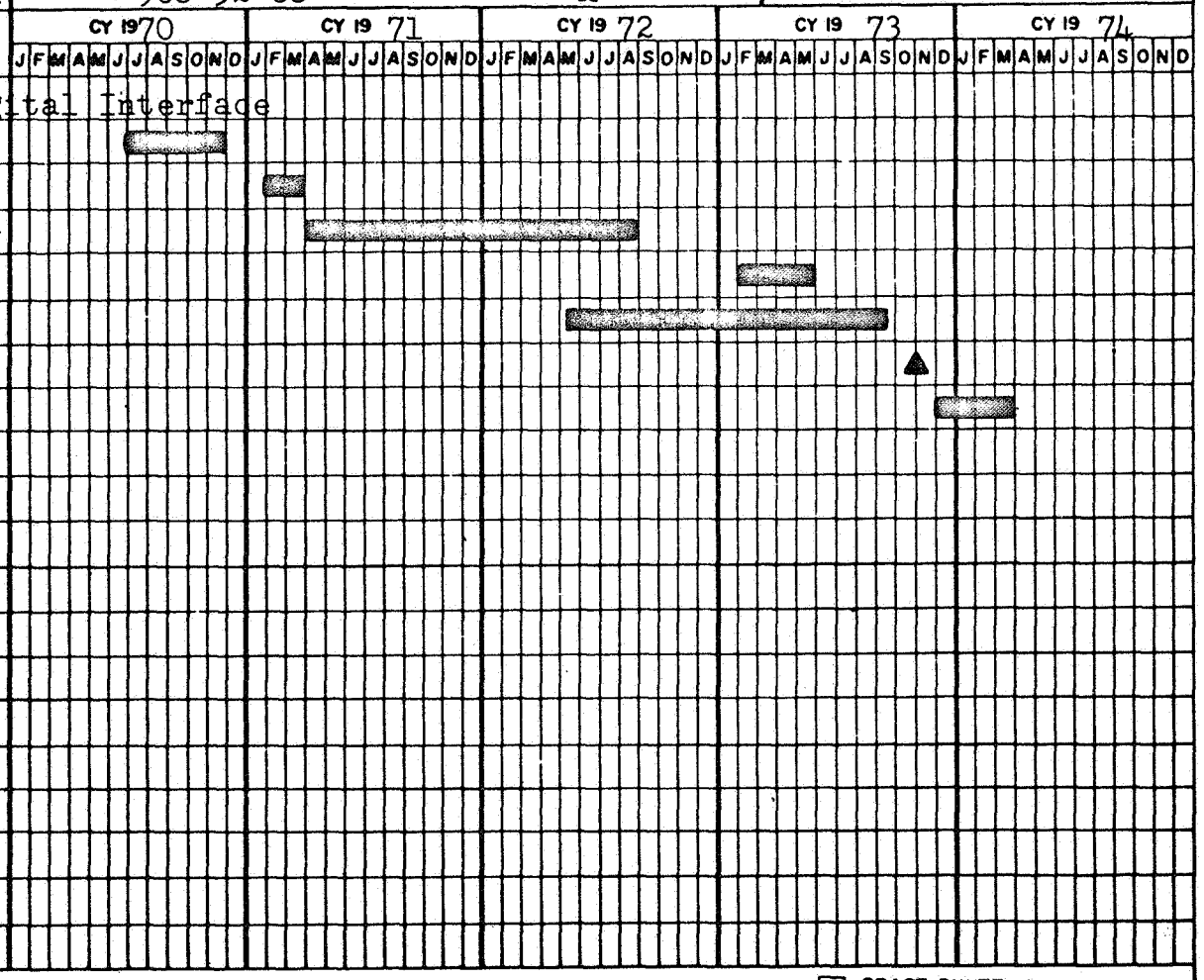
RTOP TITLE Stabilization and Control

5 LEVEL

RTOP NO. 908-52-08 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Actuator-to-Digital Interface
2	Prel. Trade Study
3	Preliminary Design
4	Breadboard Fabrication and Test
5	Test of Actuator (Majority Vote)
6	Fabricate Look and Switch DIU
7	Delivery of Look and Switch DIU
8	Test Look and Switch on Actuator
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-DDD
APPROVAL Robert S. Ryan
ACCOMPLISHMENT S. W. Winder

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Stabilization and Control

RTOP NO. 908-52-08 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES	CY 1972	CY 1973	CY 19	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	ADVANCED CONTROL CONCEPTS					
2	Phase I - Computer Program					
3	Development & Trim					
4	SOLUTION					
5	Phase II - Investigation					
6	of Trim Solution on					
7	Controlability and					
8	Dynamic Response					
9	(a) Controllability Study					
10	(b) Dynamic Response Study					
11	(c) Computer Program					
12	Support					
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL Fred Wojtalik
ACCOMPLISHMENT R. Kissel

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE
GUIDANCE AND NAVIGATION
RTOP NO. 908-52-10 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1972	CY 1973	CY 1974	CY 1975	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK TITLE:	STRAPDOWN SYSTEMS DEVELOPMENT AND FIELD TESTS				
2						
3	Study					
4	FDIC Simulations					
5	FDIC Analysis					
6	Final Report					
7						
8	Software					
9	Develop & Debug					
10	Intergrated Test					
11						
12	Hardware					
13	Fabricate & Assemble					
14	Equip. Mobile Van					
15						
16	Test Program					
17	Lab Test					
18	Field Test					
19	Data Analysis					
20						

NOTES

[X] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PF
APPROVAL A. L. Worlund
ACCOMPLISHMENT G. M. Young

MILESTONE SCHEDULE

RTOP TITLE CRYOGENICS

4 LEVEL

RTOP NO. 908-52-37 (FY72) 976-30-37 (FY74) ADV. RESEARCH [x] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1971	CY 1972	CY 1973	CY 1974	CY 1975
1	ZERO-G FLUID RETENTION AND EXPULSION					
2	PHASE I					
3	Analysis					
4	Trade Studies					
5	PHASE II					
6	Shuttle APS Design					
7	ASPM Design					
8	Bench Tests					
9	Test Article Design					
10	PHASE III					
11	Fabrication					
12	Ship to MSFC					
13	PHASE IV					
14	Settling System Weight Comparison					
15	Effects of Screens on Settling					
16	Thermal Effects on Screens					
17	FINAL REPORT					
18						
19						
20						

NOTES
PLANNED
COMPLETED

[x] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[x] TUG PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3456 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-EM
APPROVAL G. A. Kroll
ACCOMPLISHMENT K. Anthony

MILESTONE SCHEDULE

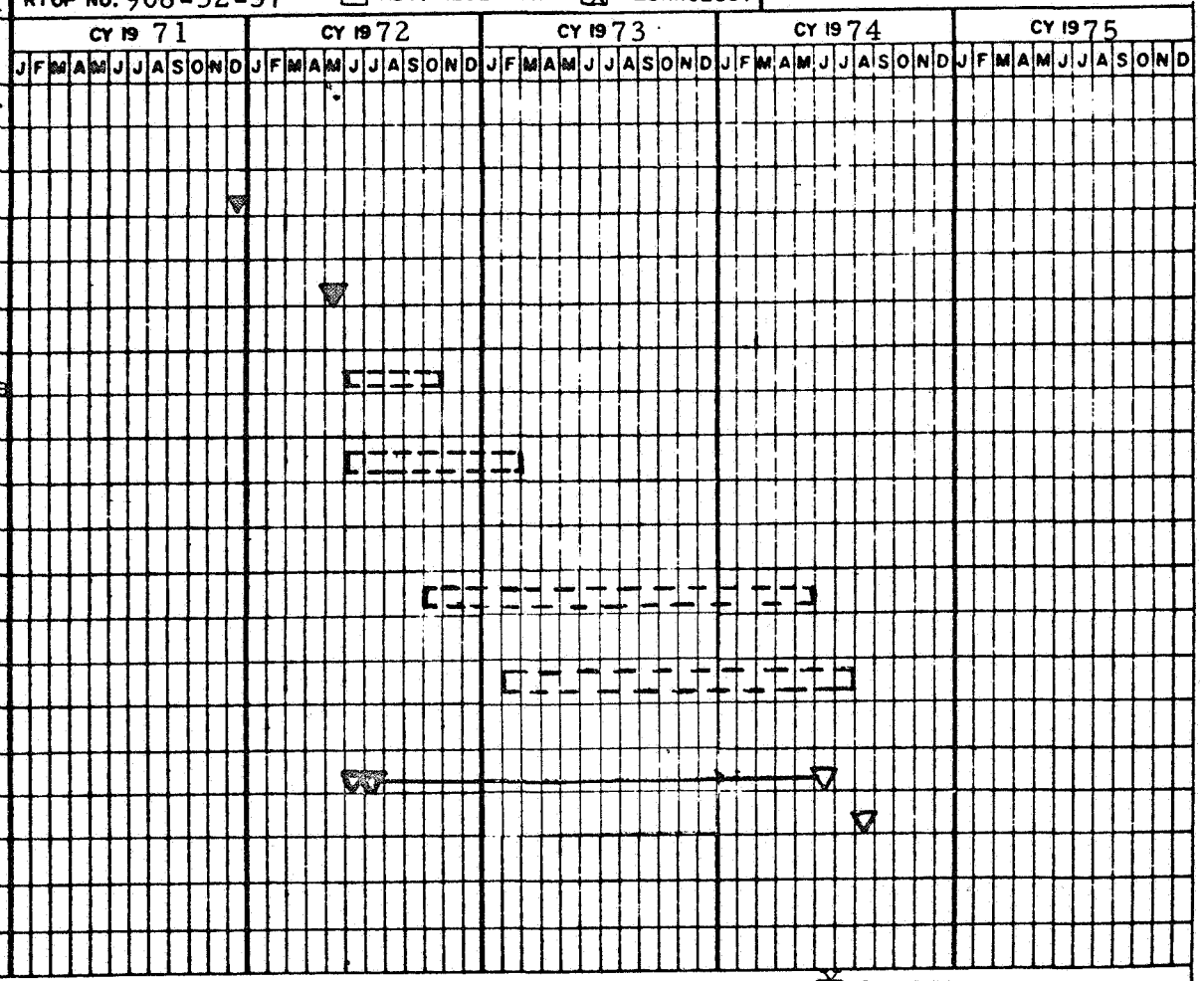
4 LEVEL

RTOP TITLE Cryogenics

RTOP NO. 908-52-37 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ _____ (Initials)
STATUS AS OF 31-03-74 (Date) _____ (Initials)

	ACTIVITIES
1	Long Life Valve Design
2	Concepts
3	Scope of Work & RFQ
4	Submitted
5	Contract Awarded
6	Phase I
7	Analysis & Design Criteria
8	Preparation
9	Conceptual Design
10	
11	Phase II
12	Manufacture & Preform
13	Breadboard Testing
14	Confirm & Publish Design
15	Criteria
16	Monthly Reports
17	Final Report
18	
19	
20	



NOTES
Requested
Planned
Completed
Milestone
Completed

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-M
APPROVAL R. J. Schwinghamer
ACCOMPLISHMENT L. M. Thompson

MILESTONE SCHEDULE

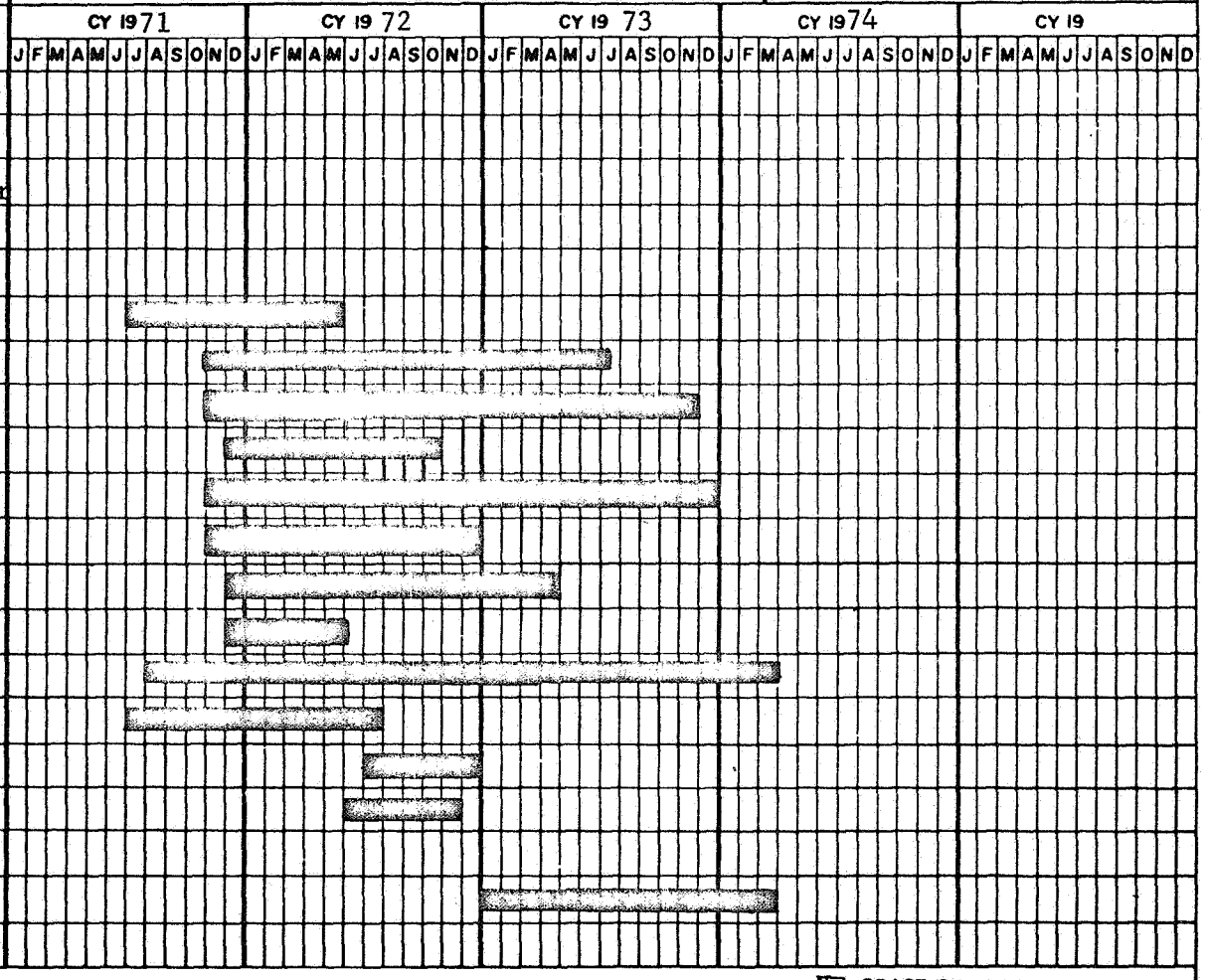
5 LEVEL

RTOP TITLE Cryogenics

RTOP NO. 908-52-37 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	"Design & Dev. of Poly-
2	phenylene Oxide Foam as a
3	Reusable Internal Insul. for
4	LH_2 Tanks", NAS8-27566
5	Contract Award
6	Effect of thermal cycling
7	Specifications
8	Surface preparation
9	Close-outs
10	Fabrication of Foam
11	Panel Joints
12	Repair Procedures
13	Foam Surface Rigidization
14	Properties-thermal correlation
15	Geometric Properties
16	Configuration Screening
17	Properties on 2 new
18	configurations
19	Evaluation of Close-Outs
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-EM
APPROVAL G. A. Kroll
ACCOMPLISHMENT L. A. Hein

MILESTONE SCHEDULE

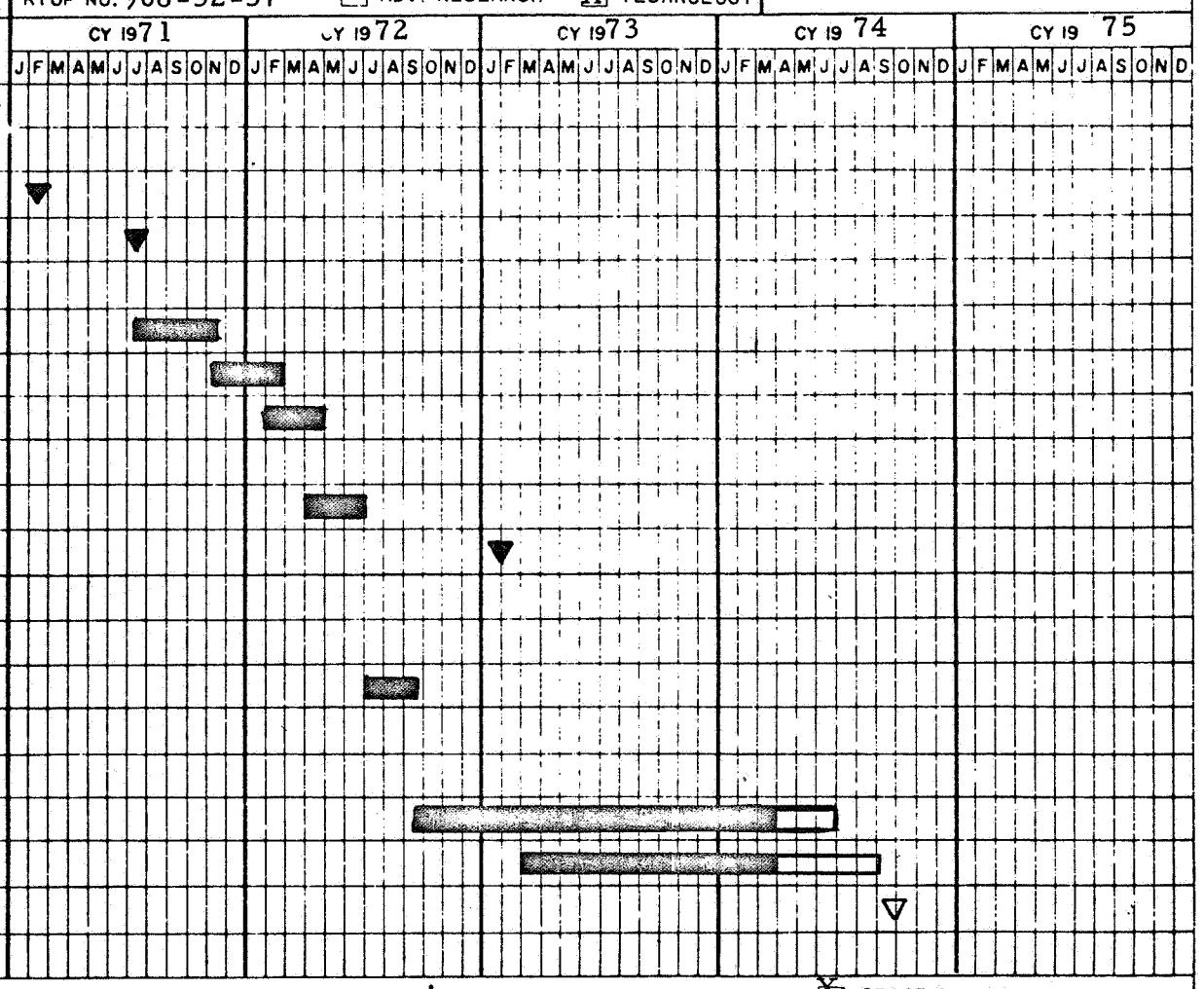
RTOP TITL Cryogenics

4 LEVEL

RTOP NO. 908-52-37 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Vacuum Jacketed Ducting
2	
3	RFQ Processed
4	Contract
5	Phase I
6	State-of-the-Art Survey
7	Create & Analyze Designs
8	Design Duct Segments
9	Design Cryogenic Flow
10	Loop
11	Interim Report
12	
13	Phase II
14	Design Baseline
15	Manufacture Baseline,
16	New Segments, Flow
17	Loop
18	Test
19	Final Report
20	



NOTES
Planned
Completed
Milestone
Completed

☒ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-EM
APPROVAL G. A. Kroll
ACCOMPLISHMENT S. B. Wynn

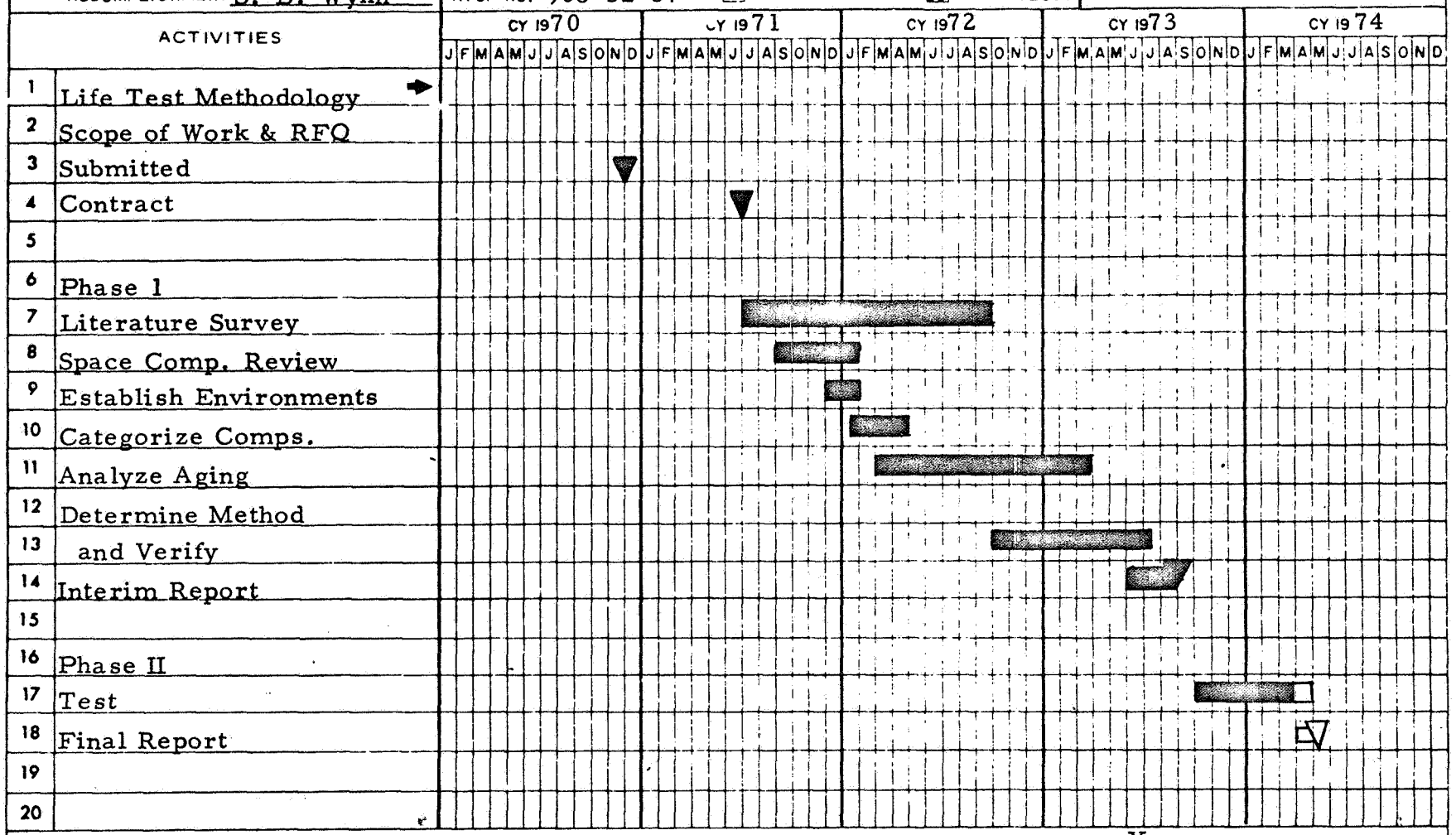
MILESTONE SCHEDULE

RTOP TITLE Cryogenics

5 LEVEL

RTOP NO. 908-52-37 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)



NOTES
Completed
Planned
Completed Milestone

☒ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-AT
APPROVAL W. K. Dahm
ACCOMPLISHMENT H. B. Wilson

MILESTONE SCHEDULE

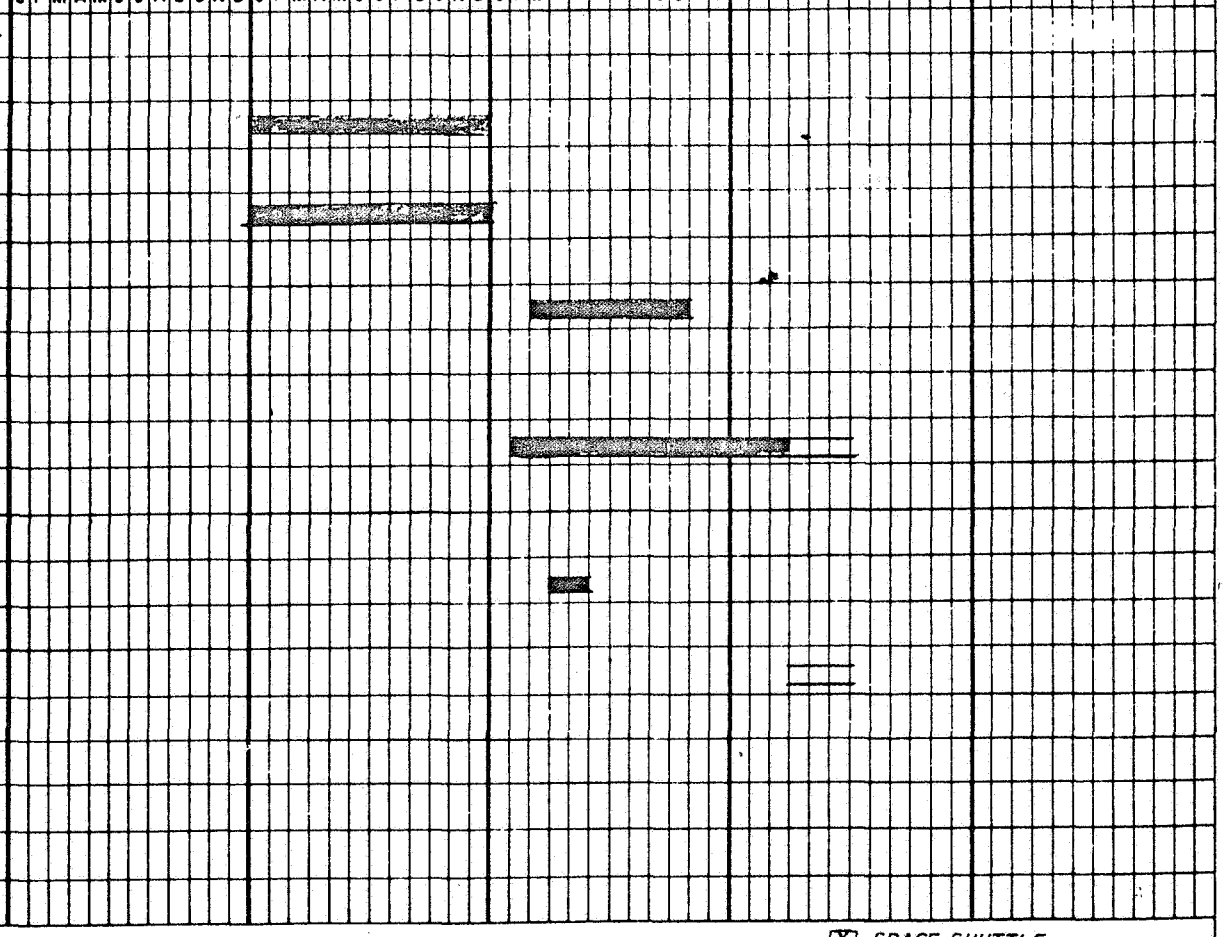
4 LEVEL

RTOP TITLE Aerothermodynamics

RTOP NO. 908-52-39 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Aerodynamic Astronautical Heating Tests for Advanced Saturn Configurations
2	
3	Model Engine System Preliminary Design
4	
5	Facility Modification Definition
6	
7	Design and Installation of Heaters to Ludwieg Tube Facility
8	
9	
10	Development of New Instrumentation for Shuttle Base Heating Model System
11	
12	
13	Design Nozzles for Ludwieg Tube Facility
14	
15	Final Report
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-A

APPROVAL W. K. Dahm

ACCOMPLISHMENT P. E. Ramsey

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Aerothermodynamics

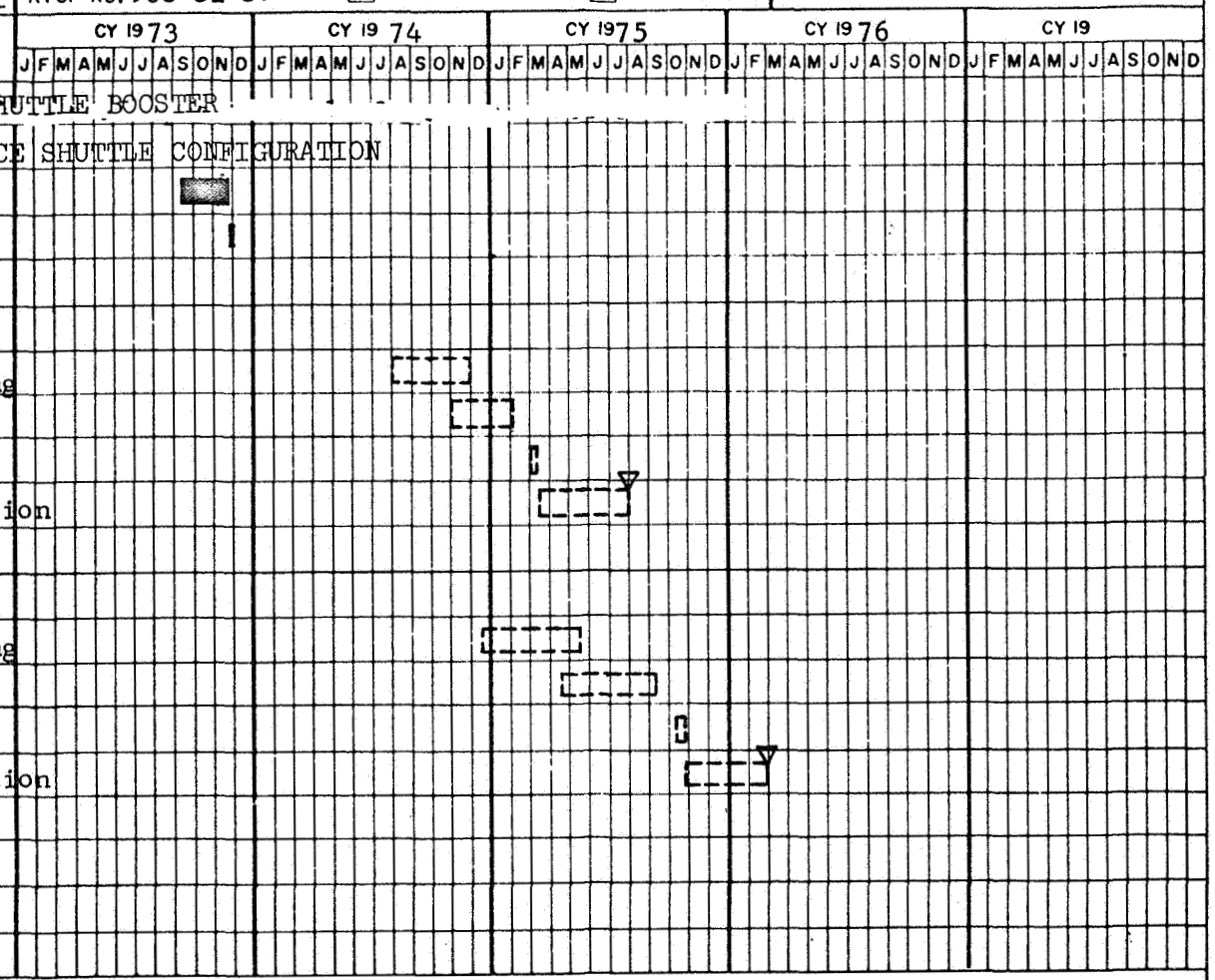
RTOP NO. 908-52-39 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	AERODYNAMIC OF THE SPACE SHUTTLE BOOSTER
2	WIND TUNNEL TESTING ON SPACE SHUTTLE CONFIGURATION
3	Rocket Engine Dev.
4	Rocket Engine Checkout
5	
6	SRB Entry Static Stability
7	a. Planning & Engineering
8	b. Model Procurement
9	c. Tests
10	d. Analysis & Documentation
11	
12	SRB Load Distributions
13	a. Planning & Engineering
14	b. Model Procurement
15	c. Tests
16	d. Analysis & Documentation
17	
18	
19	
20	



NOTES

▽ Final Report

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3.

5 YEAR

MILESTONE SCHEDULE

RESPONSIBILITY

APPROVAL W. H. Sieber

ACCOMPLISHMENT W.J.Robinson

RTOP TITLE ELECTRICAL POWER

RTOP NO. 908-54-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

LEVEL

LAST SCHED. CHANGE (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 70	CY 19 71	CY 19 72	CY 1973	CY 19 74
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	Microwave Syst. Engr.					
2	Contract NAS8-25374					
3	In-House Microwave Effort					
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER RESPONSIBILITY MSFC

APPROVAL S. M. Seltzer

ACCOMPLISHMENT P. W. Likins

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Stabilization and Control

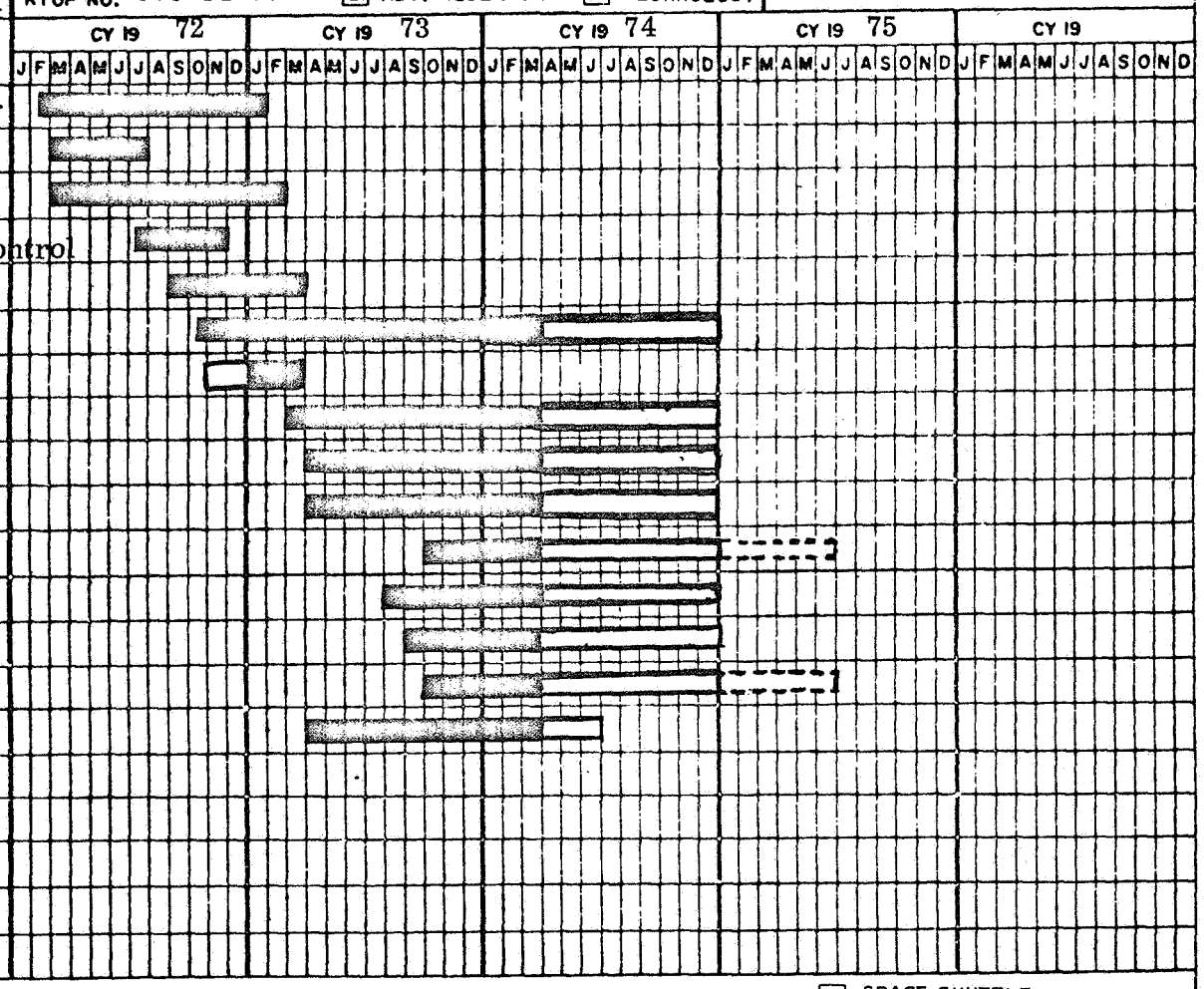
RTOP NO. 908-54-08 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Dynamic Modeling Studies
2	Modal Analysis Methods
3	System Synthesis Methods
4	Truncation for Articulation Control
5	Sensor Study
6	Control System Studies
7	Final Report
8	Sensors and Controllability
9	Sensors and Observability
10	Sensors and Stability
11	Sensors and Performance
12	Actuators and Controllability
13	Actuators and Stability
14	Actuators and Performance
15	System Equations
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[X] Space Systems PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL S. M. Seltzer

ACCOMPLISHMENT D.D. Siljak

MILESTONE SCHEDULE

Stabilization & Control

RTOP TITLE

4 LEVEL

ORIGINAL SCHED APPROVAL _____ (Date)

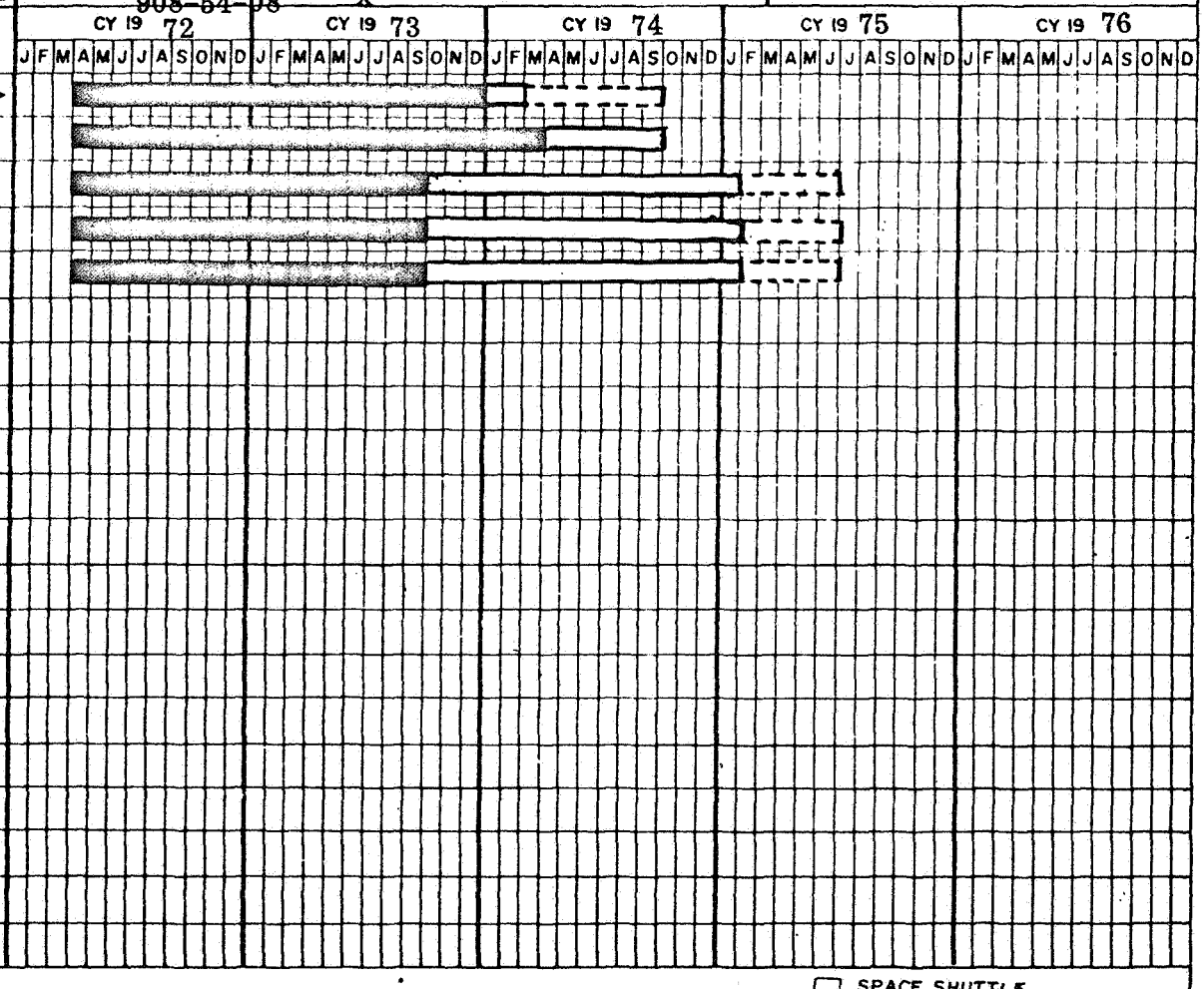
LAST SCHED. CHANGE _____

STATUS AS OF 31 03 74 (Date) (Initials)

RTOP NO. 908-54-08

☒ ADV. RESEARCH ☐ TECHNOLOGY

	ACTIVITIES
1	Literature survey
2	Model survey
3	Linear model analysis
4	Nonlinear analysis
5	Computer application
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Systems PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY W. C. Snoddy
APPROVAL W. C. Snoddy
ACCOMPLISHMENT D. Wilkes, J. Trenkle

MILESTONE SCHEDULE

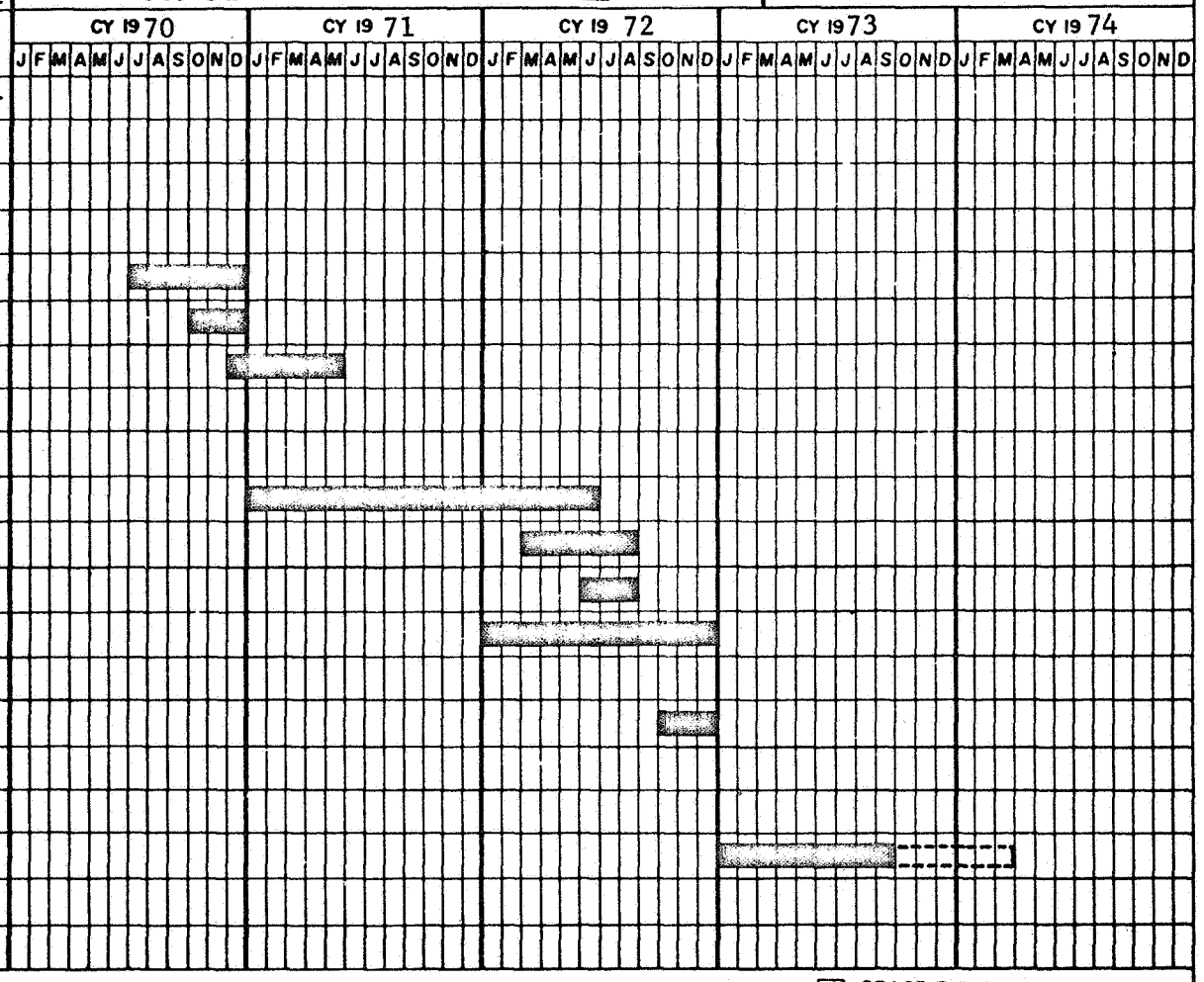
5 LEVEL

RTOP TITLE THERMAL CONTROL

RTOP NO. 909-51-02 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Thermal Control Surfaces
2	Long-Term Testing
3	
4	Design of Facility
5	a. Vacuum System
6	b. Solar UV Simulator
7	c. Optical Measuring Sys.
8	
9	Fabrication
10	a. Purchasing of Hardware
11	b. Vacuum System
12	c. Solar UV Simulator
13	d. Optical Measuring Sys.
14	
15	Checkout of all Systems
16	
17	Long-Term Testing of
18	Thermal Control Surfaces
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PT
APPROVAL C. C. Wood
J. Vaniman/J. Loose
ACCOMPLISHMENT

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Thermal Control

RTOP NO. 909-51-02 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL (Date)
LAST SCHED. CHANGE (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TRANSVERSE HEADER					
2	HEAT PIPE					
3						
4	1. Analysis					
5						
6	2. Fabrication					
7						
8	3. Test					
9						
10	4. Correlation					
11						
12	5. Applications &					
13	Report					
14						
15						
16						
17						
18						
19						
20						

NOTES
Completed
Planned

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PT
APPROVAL C. C. Wood
J. Vaniman/K. McCoy
ACCOMPLISHMENT

MILESTONE SCHEDULE

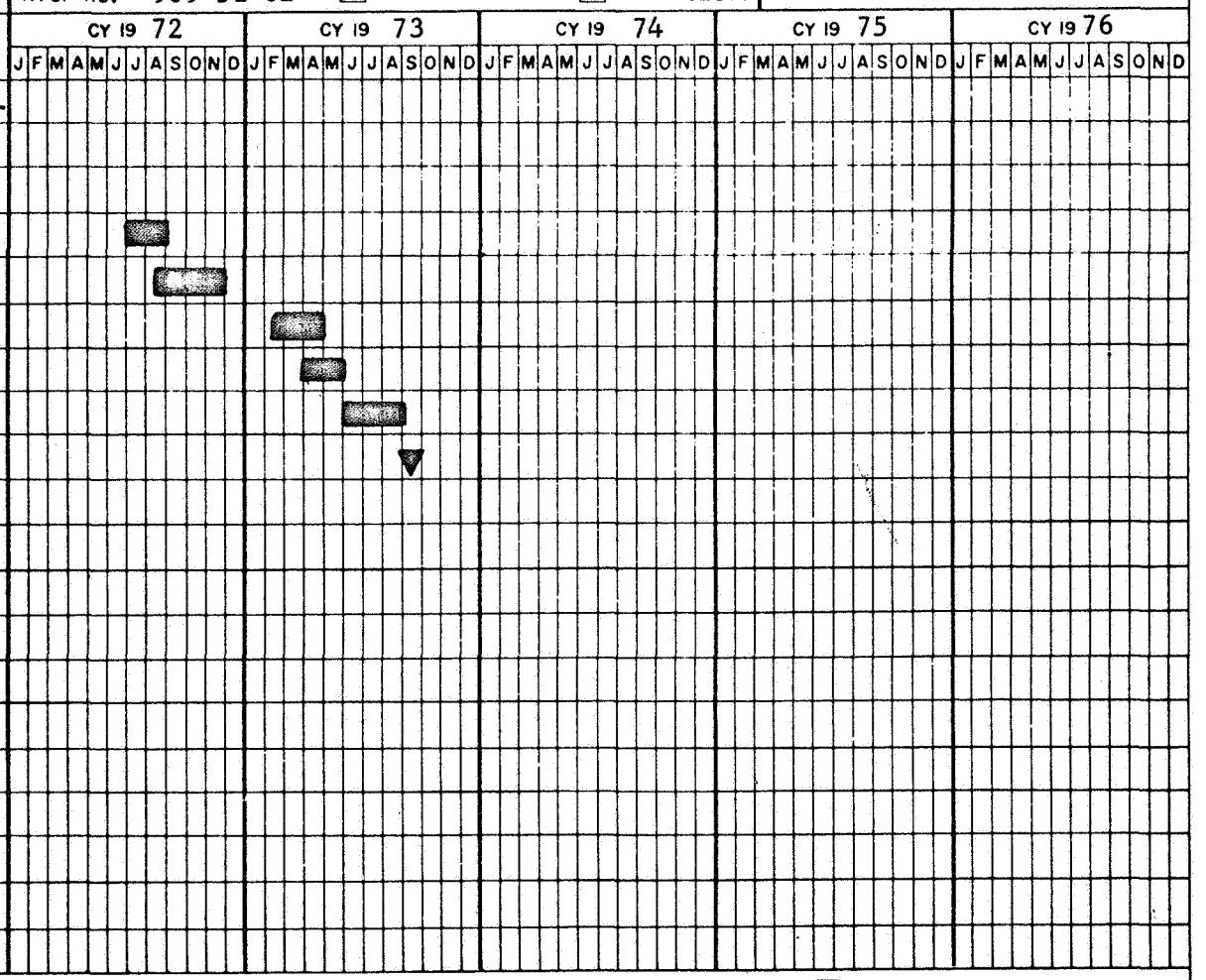
4 LEVEL

RTOP TITLE THERMAL CONTROL

RTOP NO. 909-51-02 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials) KEM

	ACTIVITIES
1	HEAT PIPE THERMAL CONDITION-
2	ING PANEL
3	
4	Phase 1 - Applications
5	Phase 2 - Design
6	Phase 3 - Fabricate
7	Phase 4 - Test
8	Phase 5 - Second Panel
9	Report
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES
PLANNED
COMPLETED

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-ASTN-PT

APPROVAL C. C. Wood

J. Vaniman/G. Robinson

ACCOMPLISHMENT

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE THERMAL CONTROL

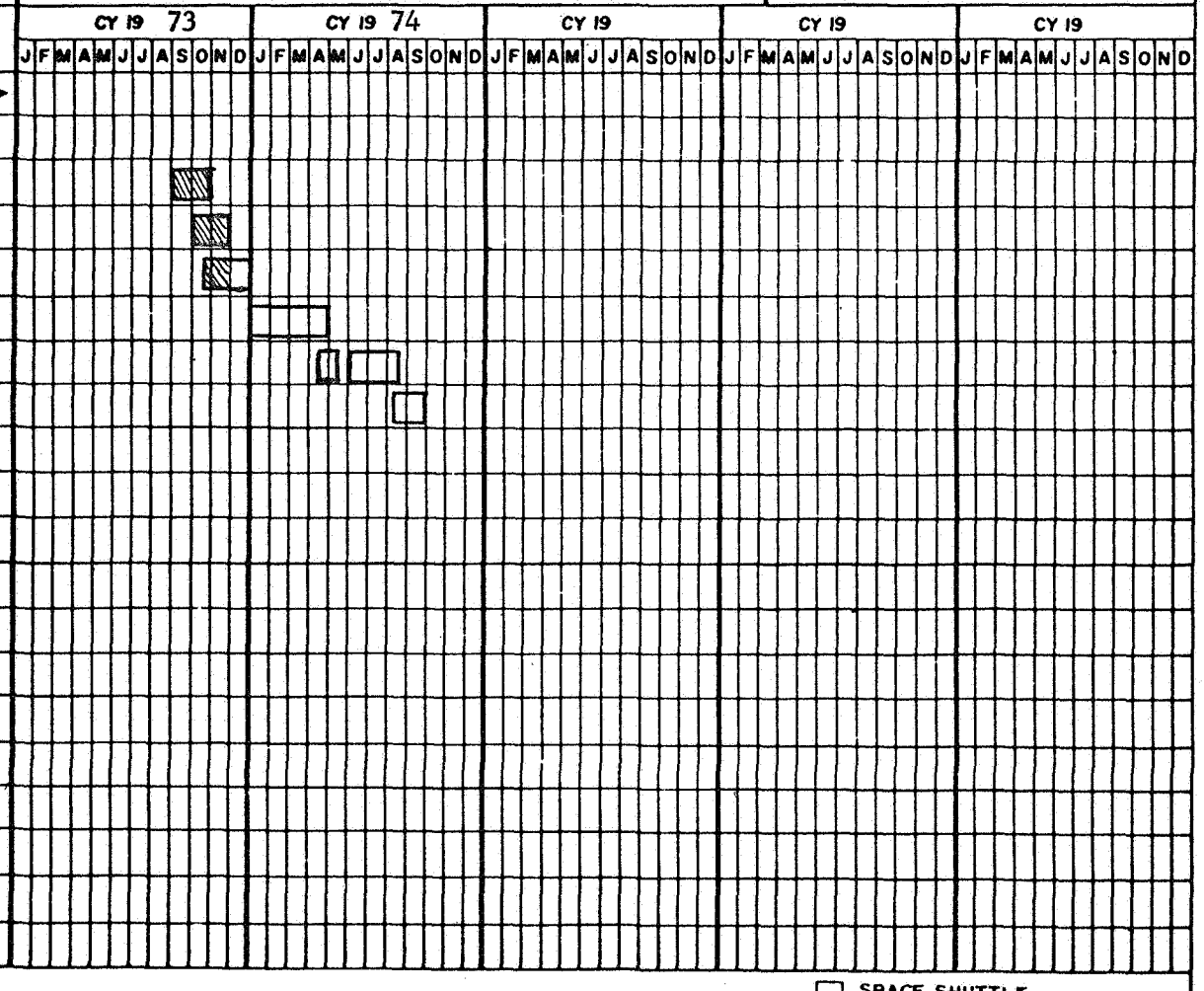
RTOP NO. 909-51-02 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	DEPLOYABLE HEAT PIPE ➔
2	RADIATOR
3	- Concept Analyses
4	- Flexible Header
5	- Detailed Design
6	- Fabrication
7	- Test
8	- TV Test Plan & Report
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ PLANNED

▨ COMPLETED

☐ SPACE SHUTTLE

☐ SPACE STATION/BASE

☒ Sortie Lab PROJECT

☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-E
APPROVAL R. M. ADEN
ACCOMPLISHMENT C. B. GRAFF

MILESTONE SCHEDULE

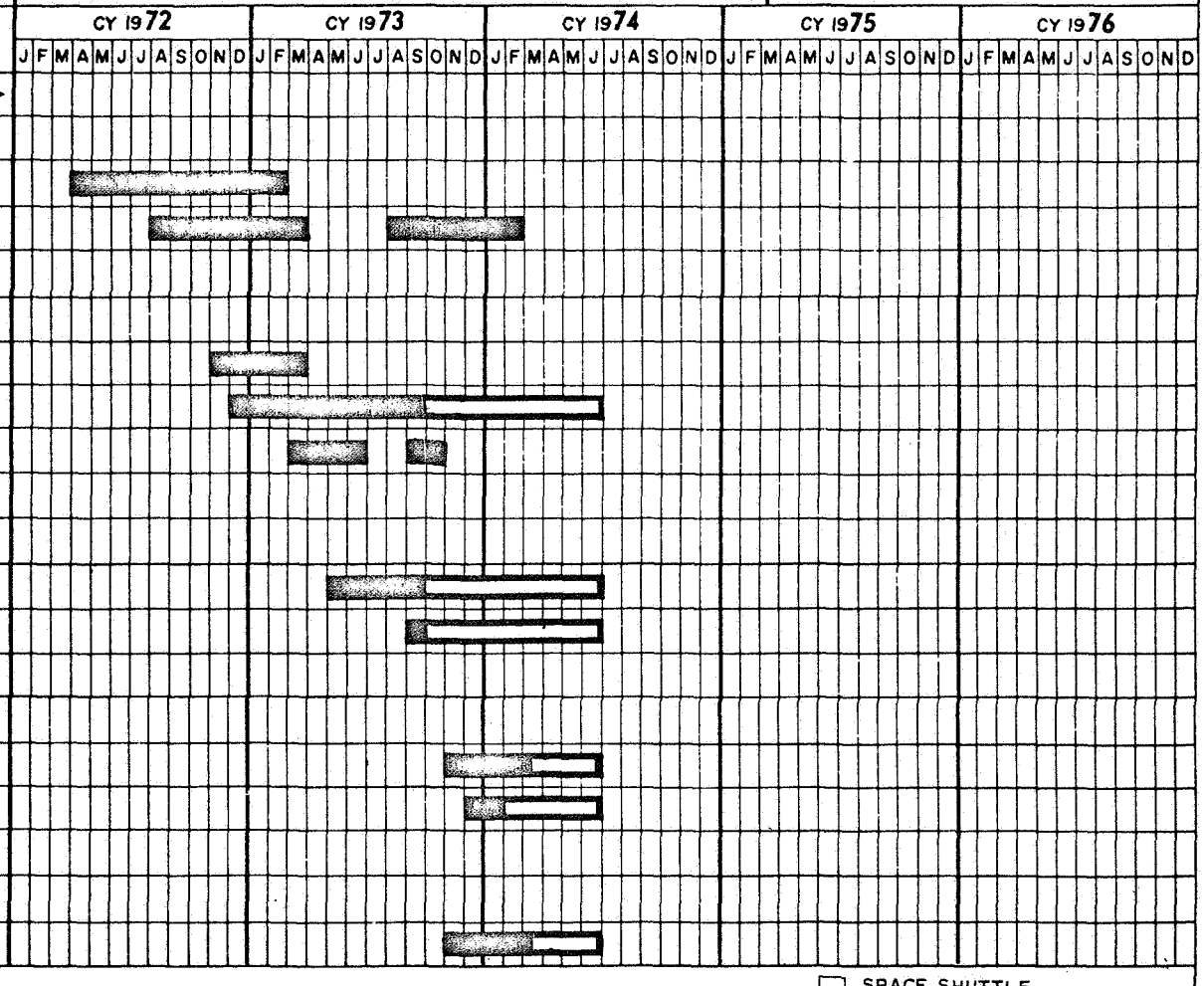
RTOP TITLE
ELECTRICAL POWER

5 LEVEL

RTOP NO. 909-51-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	SOLAR ARRAY DEVELOPMENT
2	PHASE I
3	MATERIAL PROPERTIES
4	FAB PROCESSES
5	
6	PHASE II
7	ESTABLISH REQUIREMENTS
8	DESIGN MODULE
9	FAB TEST MODULES
10	
11	PHASE III
12	TEST MODULES
13	ANALYZE DATA
14	
15	PHASE IV
16	ESTABLISH ATP METHOD
17	GENERATE CRITERIA
18	
19	PHASE V
20	DEVELOP RETRACT TECH



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-E
APPROVAL R. M. ADEN
ACCOMPLISHMENT C. B. GRAFF

MILESTONE SCHEDULE

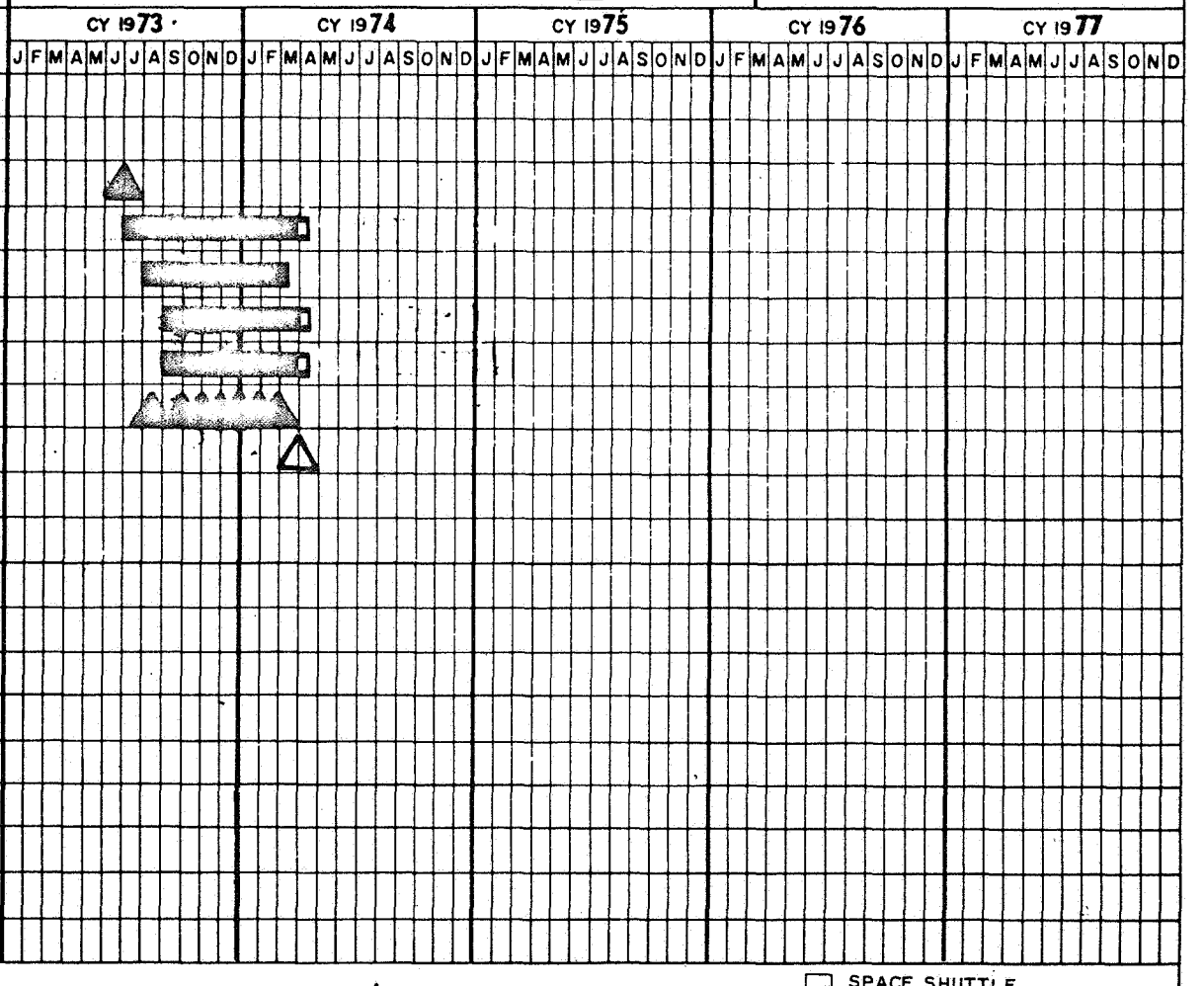
5 LEVEL

RTOP TITLE
ELECTRICAL POWER

RTOP NO. 909-51-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	EVALUATION OF SHALLOW-DIFFUSED (VIOLET), HIGH-
2	EFFICIENCY SOLAR CELLS
3	CONTRACT AWARD
4	PRODUCTION STUDIES
5	ESTABLISH PRODUCTION
6	PRODUCE CELLS
7	TEST CELLS
8	MONTHLY REPORTS
9	FINAL REPORT
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES (SHADING INDICATES COMPLETION)

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-I
APPROVAL W. O. FROST
ACCOMPLISHMENT D.O. Lowrey

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Communications

RTOP NO. 909-51-07 [X] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1970	CY 1971	CY 1972	CY 1973	CY 1974
1	Electronically Steerable					
2	Phased Array					
3						
4	Phased Array Design					
5						
6	Array Fabrication					
7						
8	TRAPATT Circuit Development					
9						
10	Circuit Test & Analysis					
11						
12	Array Model Test &					
13	Performance Evaluation					
14						
15	Studies of Element Matching					
16	Techniques					
17						
18	Ku Band Trade Off					
19	Evaluation					
20						

NOTES

[ ] SPACE SHUTTLE
[X] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-AT

APPROVAL W. K. Dahm

ACCOMPLISHMENT J.D. Warmbrod

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Aerothermodynamics

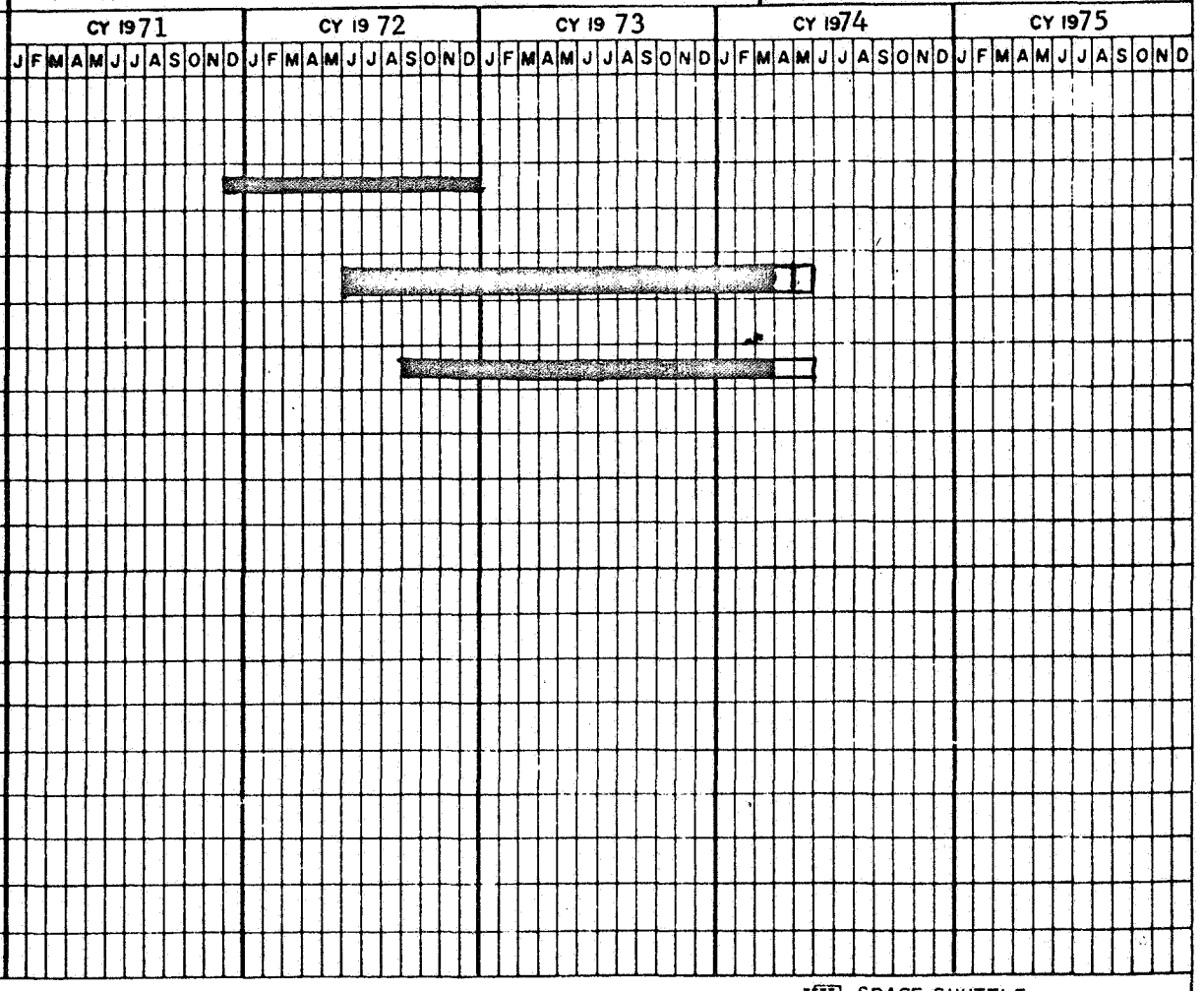
RTOP NO. 909-52-39 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Booster Aerodynamics
2	~~Heating Test Support~~
3	Aeroheating Test Support
4	
5	Rarefied Aerodynamic Heating
6	
7	IBFF Development
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

MILESTONE SCHEDULE

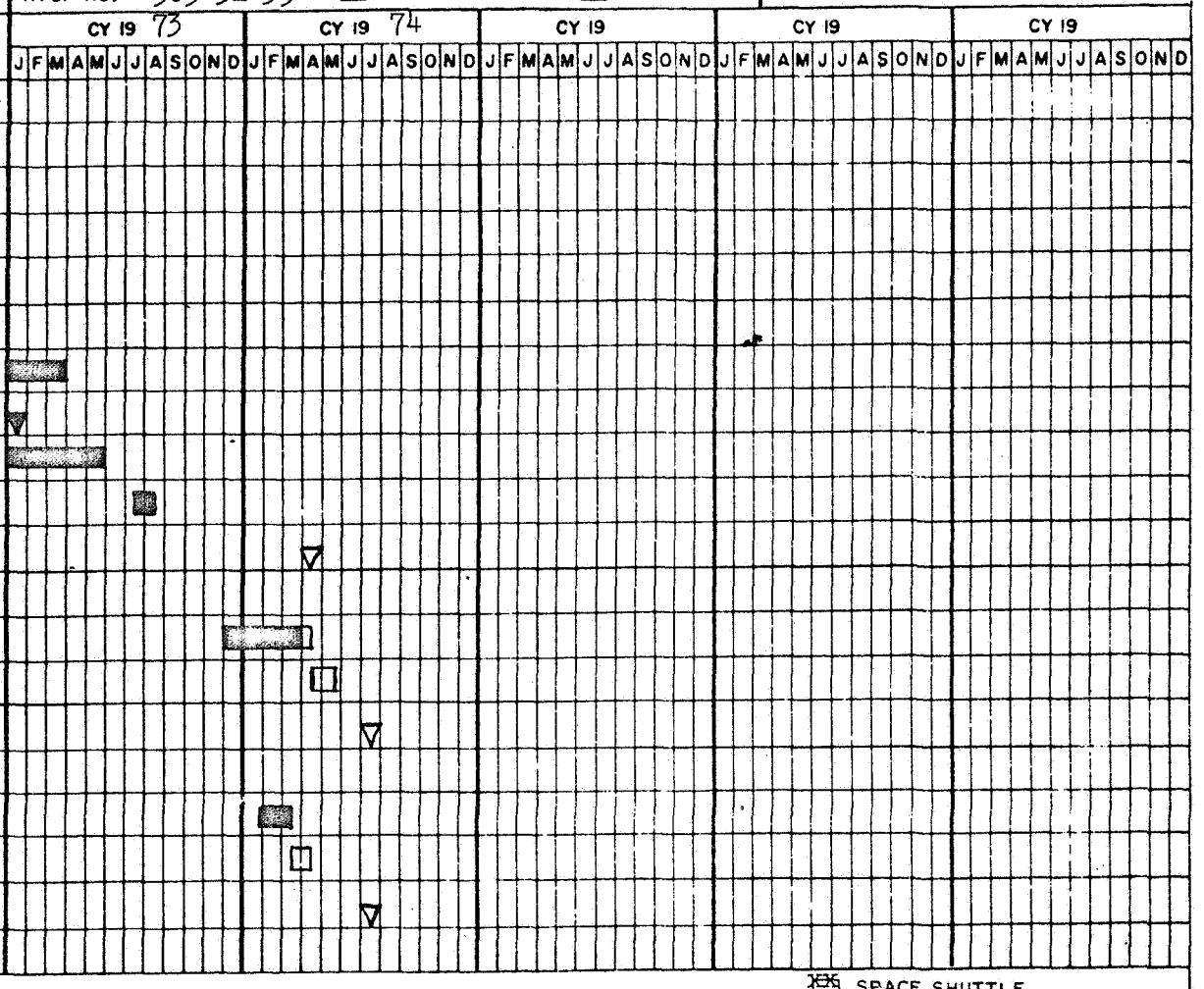
CENTER: MSFC
RESPONSIBILITY: S&E-AERO-AA
APPROVAL: W. K. Dahm
ACCOMPLISHMENT: K. Blackwell

RTOP TITLE: Aerothermodynamics
RTOP NO. 909-52-39 ☐ ADV. RESEARCH ☒ TECHNOLOGY

4 LEVEL

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Two-Phase Flow Field Effects on Space Shuttle
2	Plume Simulation
3	Study of the Aerothermodynamic Characteristics of
4	Shuttle Vehicles During Staging
5	Space Shuttle Plume Simula-
6	tion Effect on Aerodynamics
7	Pretest Analysis (CF_4/Air)
8	Model Specification
9	Pretest Planning MSFC 14" TWT
10	Test-MSFC 14" TWT
11	Post Test Data Report
12	
13	Pretest Plan - ARC 6 x 6'
14	Test ARC 6 x 6'
15	Post Test Data Report
16	
17	Pretest Plan (Triple Air)
18	Test MSFC 14" TWT
19	Post Test Data Report
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-AA
APPROVAL W. K. Dahm
ACCOMPLISHMENT K. Blackwell

MILESTONE SCHEDULE

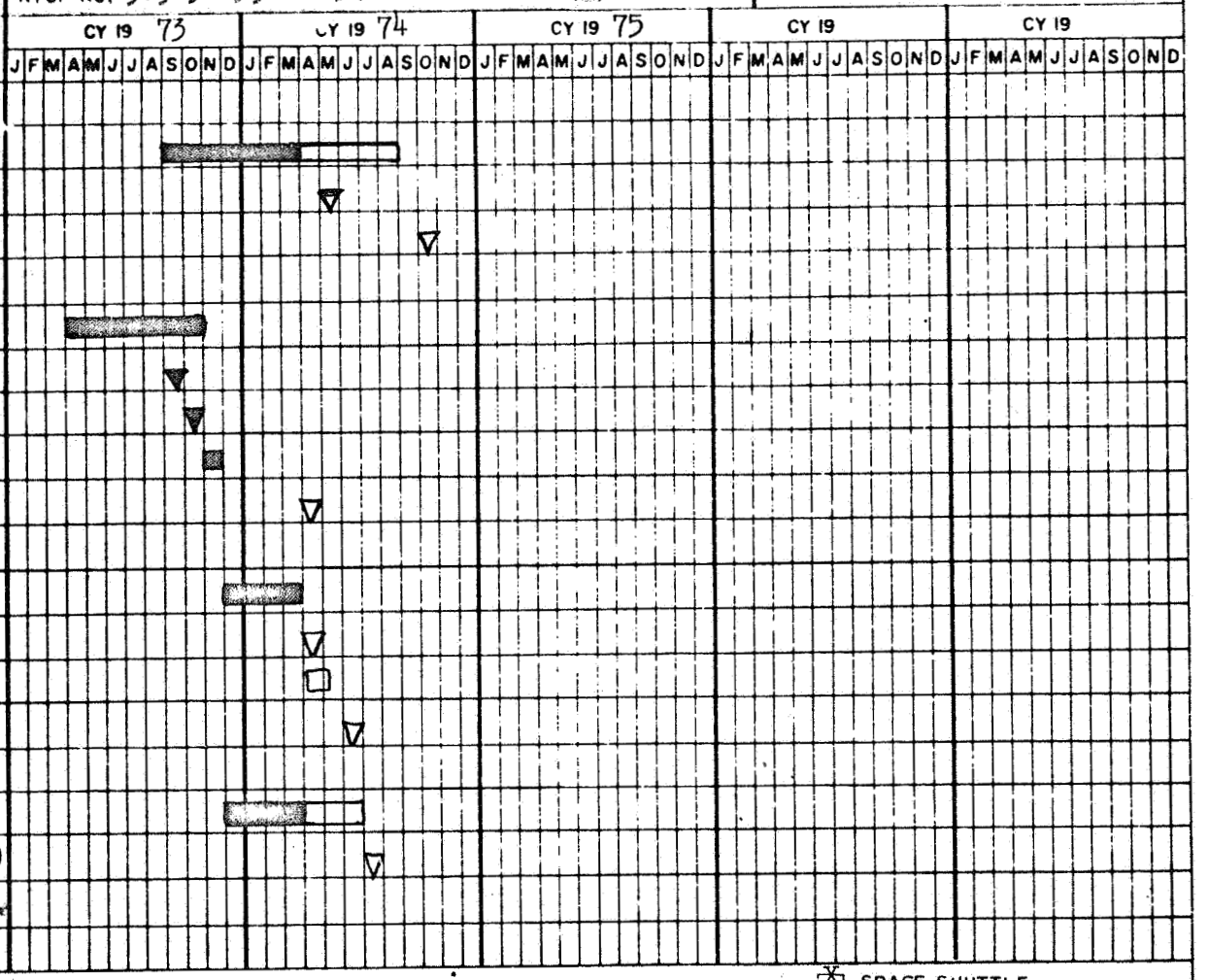
4 LEVEL

RTOP TITLE Aerothermodynamics

RTOP NO. 909-52-39 [ ] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	(CONTINUED)
2	Analysis CF_4/Air Data
3	Preliminary Report
4	Final Report
5	
6	Pretest Analysis (Hot)
7	Model Specifications
8	Pretest Report
9	Test MSFC 14" TWT
10	Post Test Data Report
11	
12	Pretest Plan ARC 6x6'
13	Pretest Report
14	Test ARC 6x6' (Hot)
15	Post Test Data Report
16	
17	Analysis (Hot)
18	Final Analysis Report (Hot)
19	
20	



NOTES

[X] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-AA
APPROVAL W. K. Dahm
ACCOMPLISHMENT K. Blackwell

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Aerothermodynamics

RTOP NO. 909-52-39 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	(CONCLUDED)					
2	(Two-Phase Impingement)					
3	Pretest Analysis					
4	Proposed Test Approach					
5						
6	Oral Presentations					
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-AT

APPROVAL W. K. Dahm

ACCOMPLISHMENT J.D. Warmbrod

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Aerothermodynamics

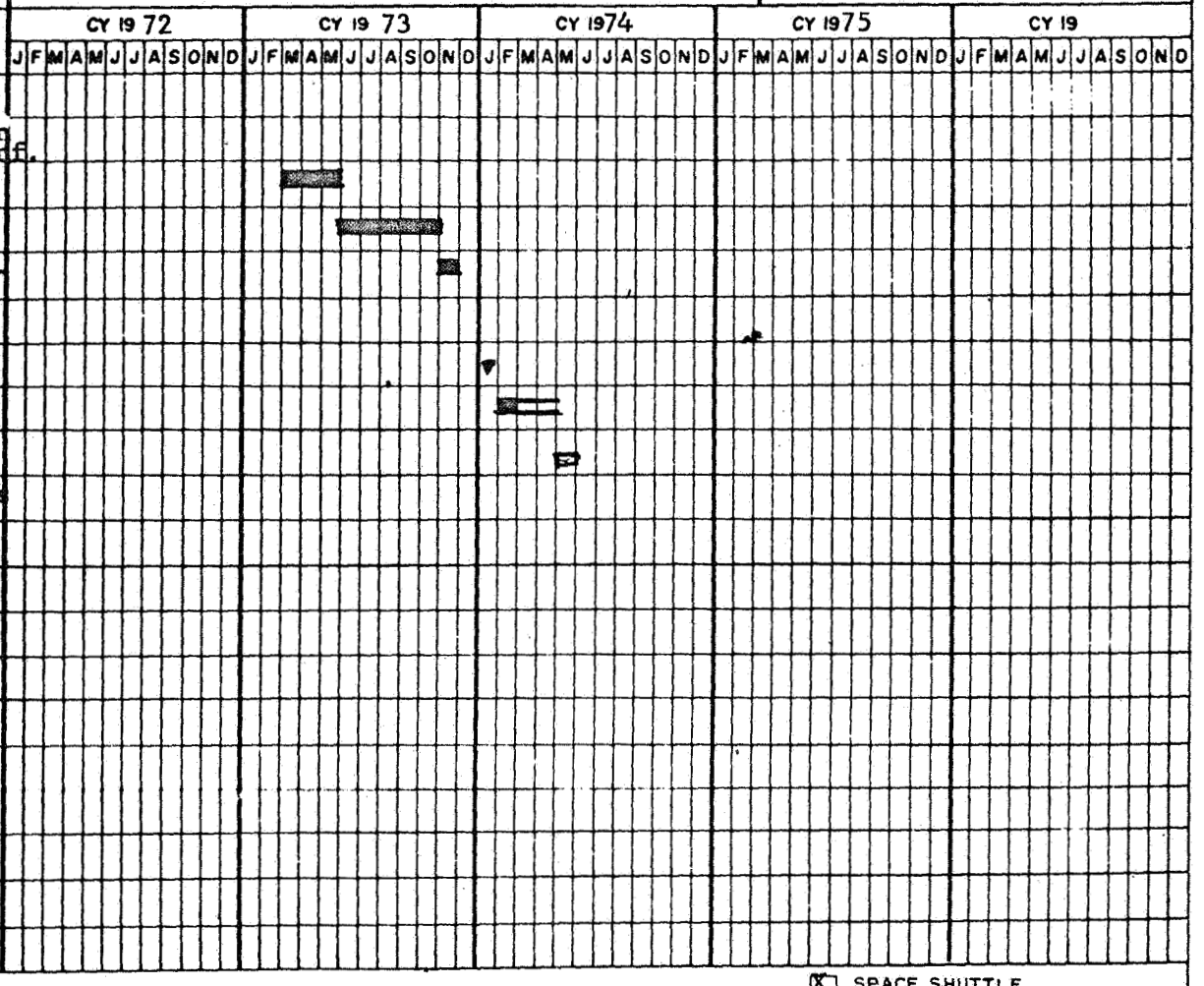
RTOP NO. 909-52-39 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date)

STATUS AS OF 31 03 74 (Date) (No) (Initials)

	ACTIVITIES
1	Wind Tunnel F Occupancy Time for High Mach Number Shock Interference Test on the Shuttle/Orbiter/ET Conf.
2	
3	ET Model Design
4	ET Model Fabrication
5	Instrumentation Install-
6	ation and Checkout
7	Wind Tunnel Test
8	Data Reduction and
9	Analysis
10	Documentation of Results
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

▼ Scheduled Milestone

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL William W. Vaughan

ACCOMPLISHMENT G. H. Fichtl

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Physical Standards

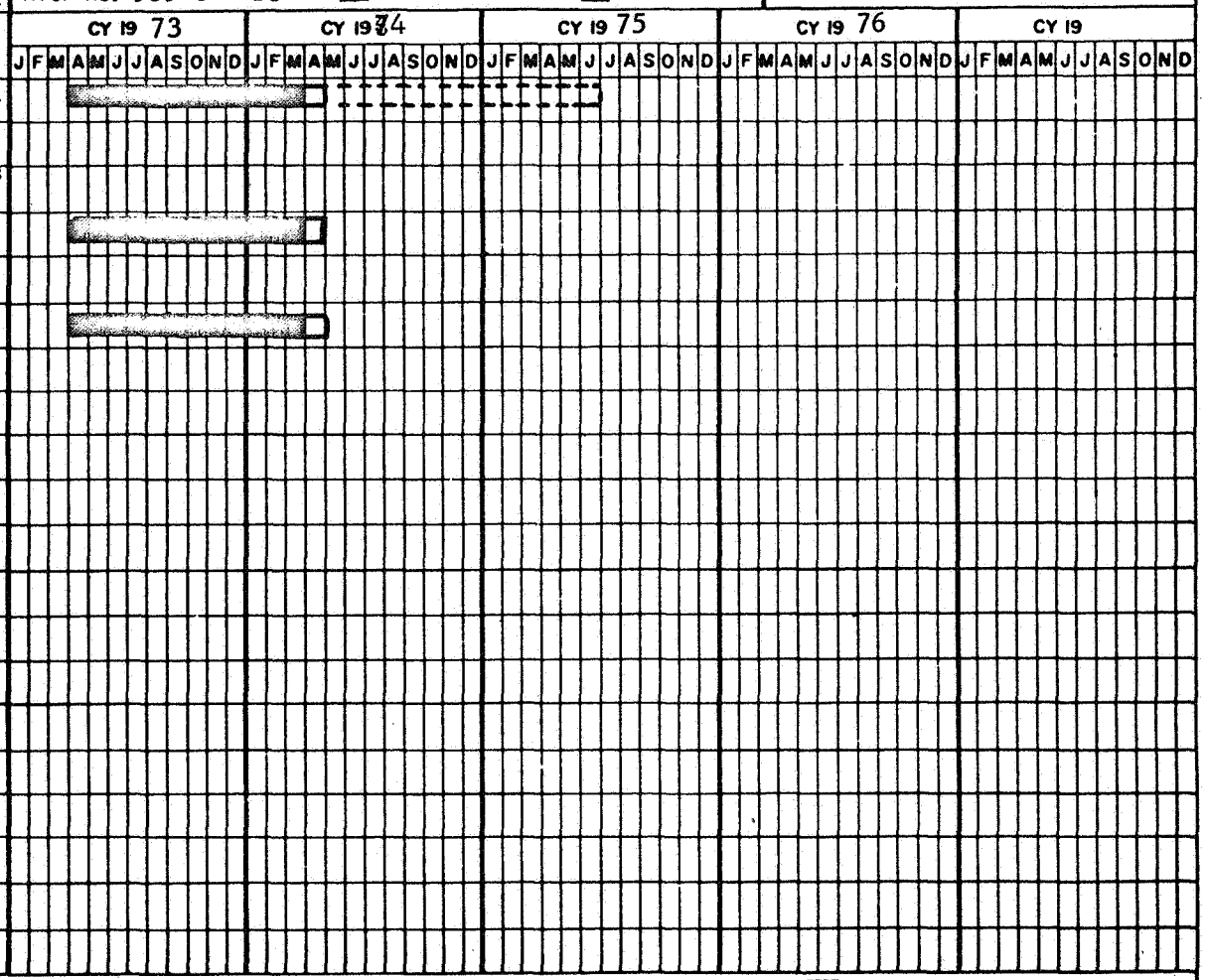
RTOP NO. 909-52-46 [X] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Assessment of Atmospheric
2	Relationships in Support
3	of Space Shuttle Operations
4	- Lift-off & Ascent Atmos.
5	Relationships
6	- Model Merging Procedure
7	-
8	
9	-
10	
11	-
12	
13	-
14	
15	-
16	
17	-
18	-
19	-
20	



NOTES

[XX] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[XX] All Vehicle PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-YT
APPROVAL William W. Vaughan
ACCOMPLISHMENT O. E. Smith

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Physical Standards

RTOP NO. 909-52-46 [X] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1973	CY 1974	CY 1975	CY 1976	CY 1977
1	Engineering Atmospheric →					
2	Model for Space Shuttle					
3	Reentry and Return					
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

[X] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[X] all vehicle PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

CENTER MSFC
RESPONSIBILITY
APPROVAL W. W. Vaughan
ACCOMPLISHMENT John Kaufman

MILESTONE SCHEDULE

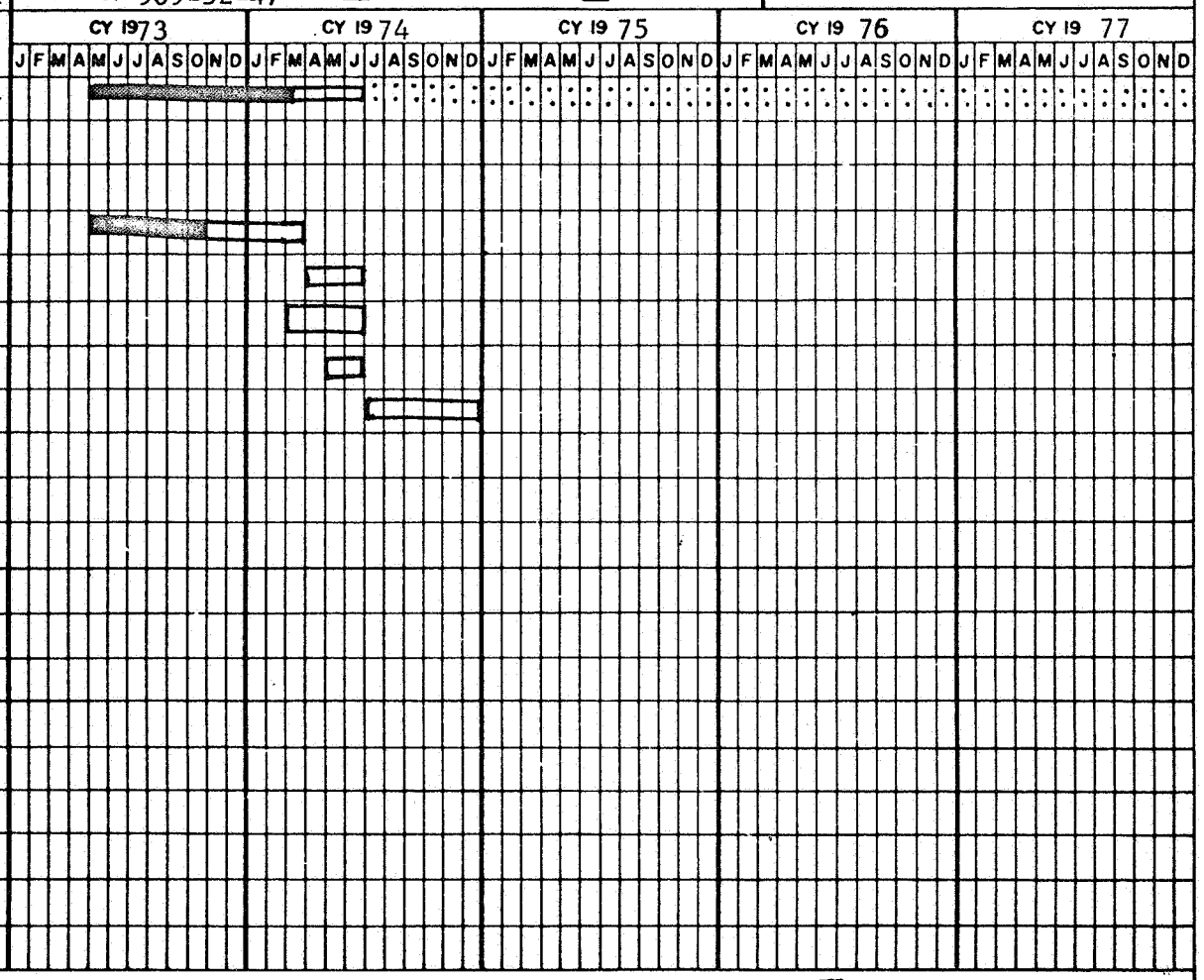
4 LEVEL

RTOP TITLE Environmental Quality

RTOP NO. 909-52-47 [X] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Study of Space Shuttle Booster Engine Exhaust
2	Chemistry
3	
4	Literature Review
5	Controlled Tests
6	Final Assessment
7	Report & Final Assessment
8	Contract Extension
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[X] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY
APPROVAL W. W. Vaughan
ACCOMPLISHMENT L. L. DeVries

MILESTONE SCHEDULE

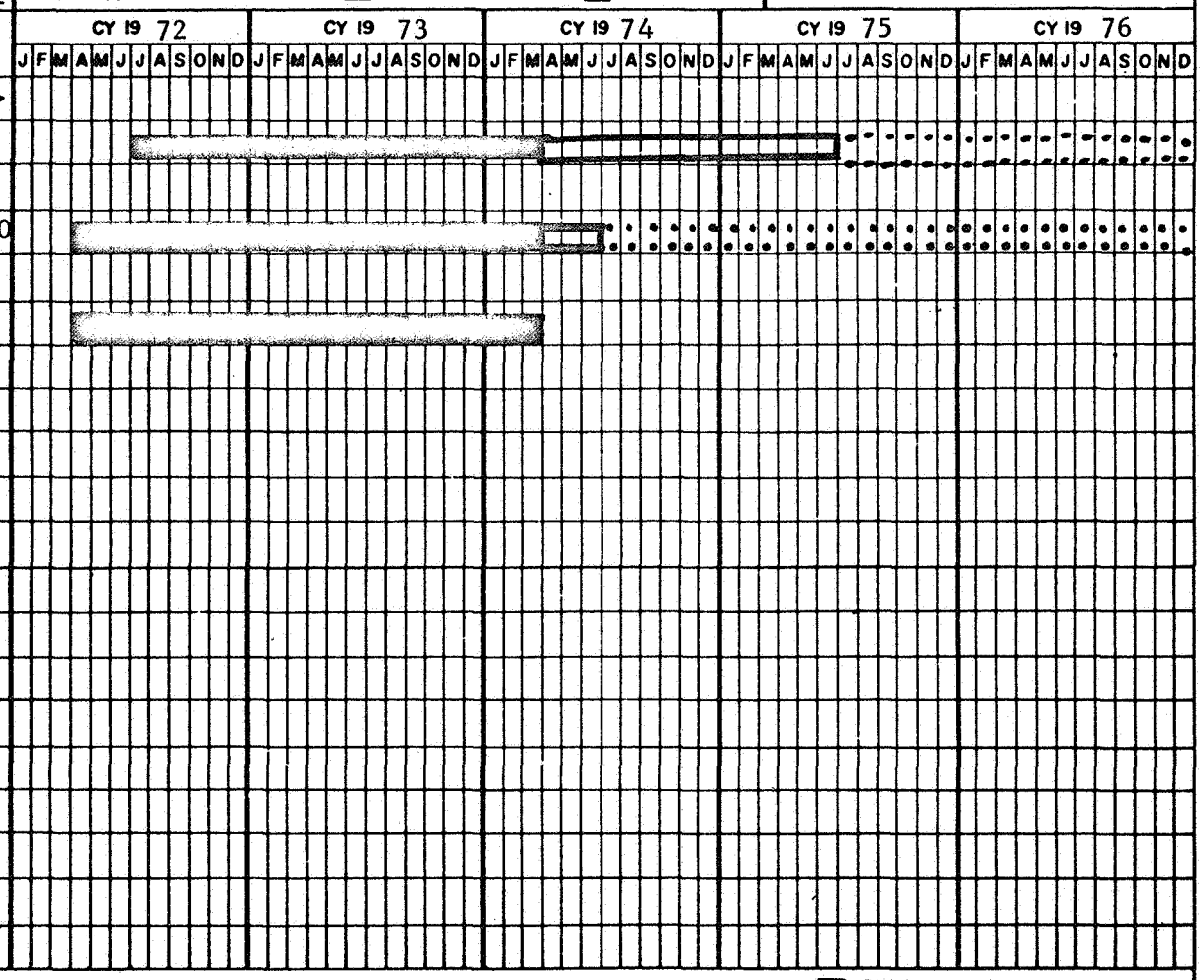
RTOP TITLE Environmental Quality

LEVEL 4

RTOP NO. 909-52-47 [X] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Update and Refine MSFC
2	Multilayer Diffusion
3	Program
4	Behavior of Al_2O_3 - HCl-H_2O
5	
6	Afterburn of H_2 and CO
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[X] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC

RESPONSIBILITY

APPROVAL W. W. Vaughan

ACCOMPLISHMENT John Kaufman

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Environmental Quality

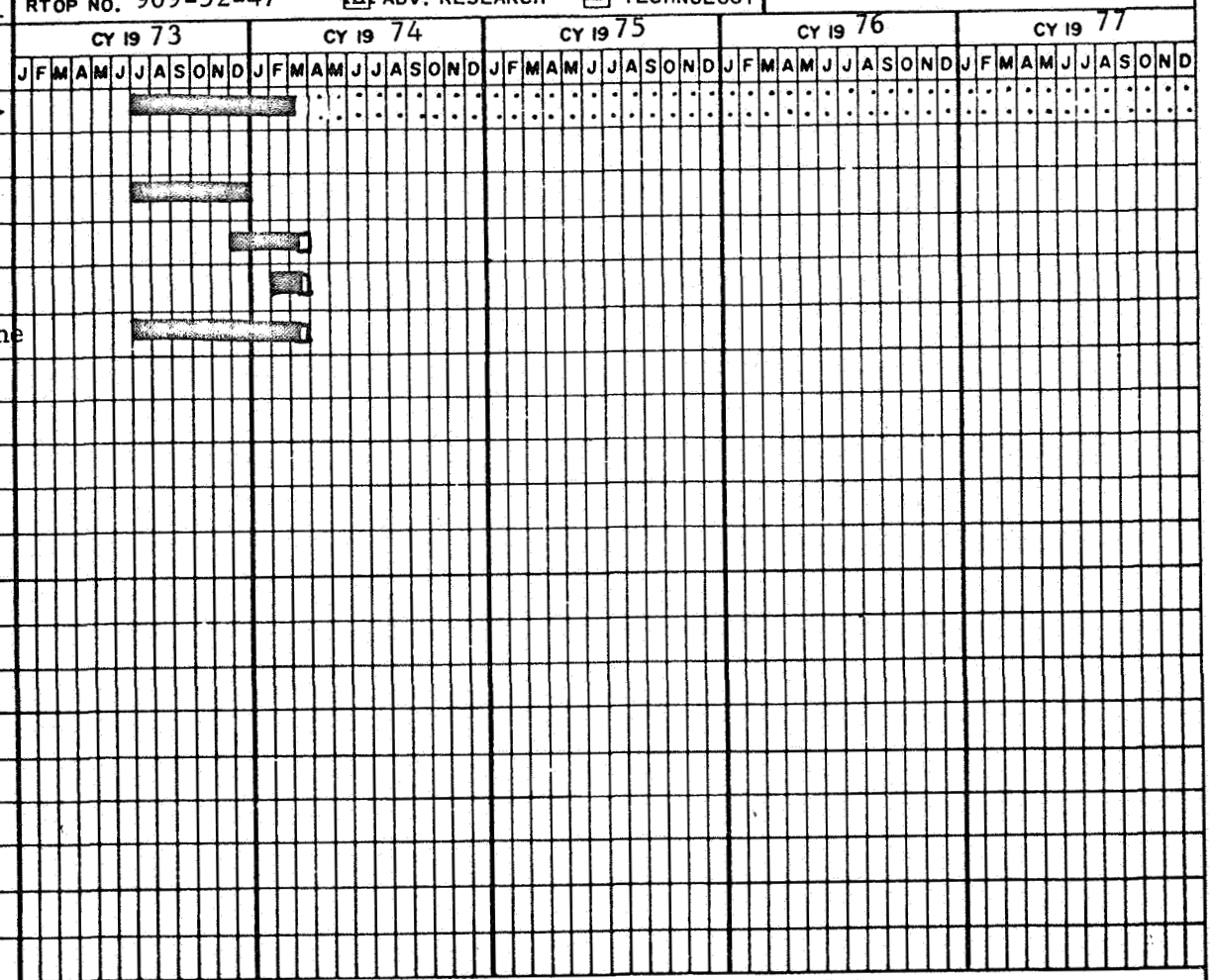
RTOP NO. 909-52-47 [XX] ADV. RESEARCH [XX] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Atmospheric Scavenging of Hydrochloric Acid
2	Literature Review
3	Controlled Tests
4	Final Assessment
5	Report & Final Recommendations
6	Space Shuttle Booster Engine Exhaust Chemistry in
7	Controlled Environment
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[XX] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[X] SRM PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-PE-MES
APPROVAL W. Angele
ACCOMPLISHMENT R. H. Herndon

MILESTONE SCHEDULE

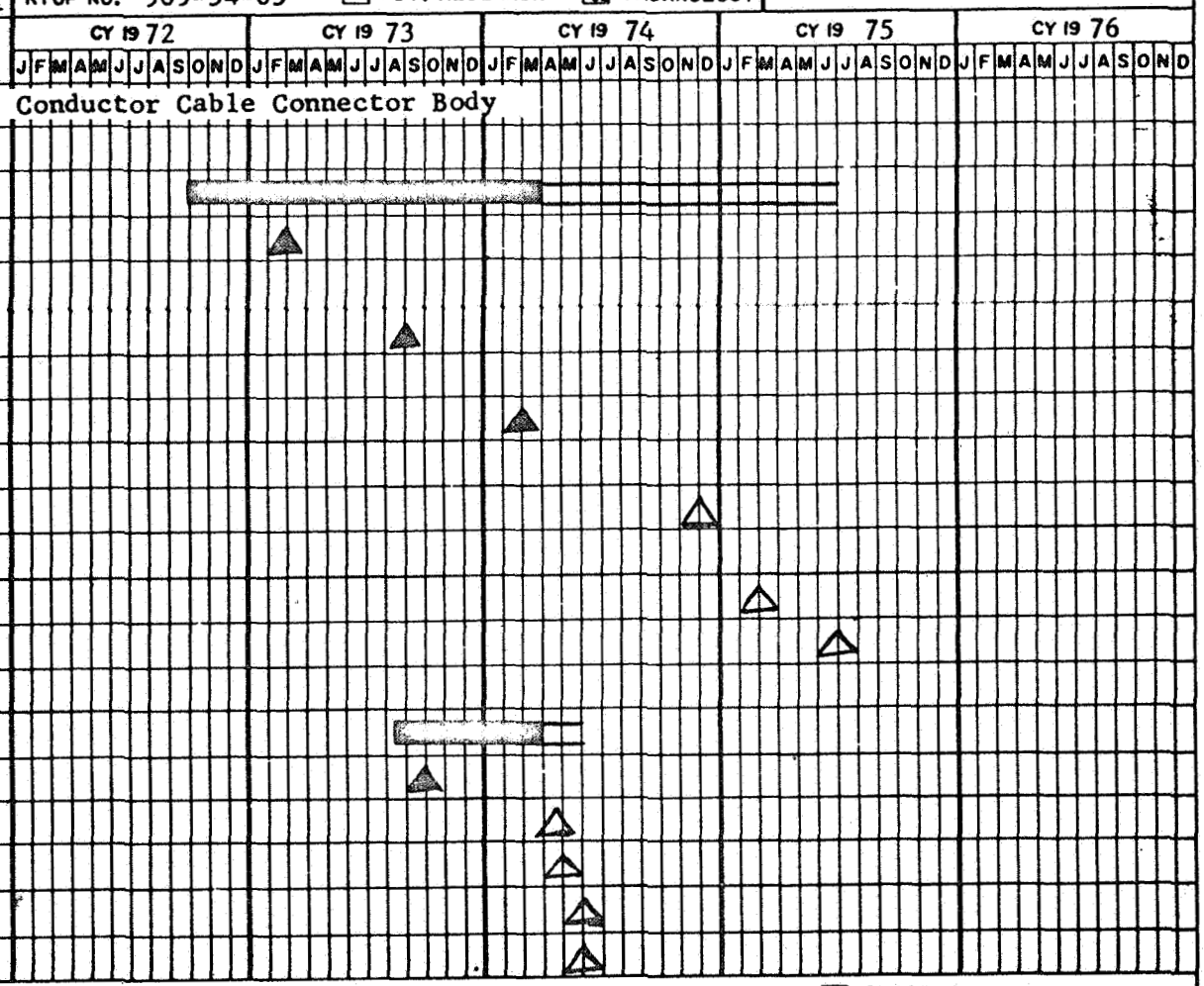
5 LEVEL

RTOP TITLE Electrical Power

RTOP NO. 909-54-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Development of Flat Conductor Cable Connector Body
2	
3	In-House
4	Investigation of Various
5	Materials
6	Material Selection and
7	Tests
8	Preliminary Design of
9	Connector Body
10	Prototype Fabrication
11	and Tests
12	Connector Assembly
13	Complete Specifications
14	
15	NAS8-30287
16	Material Selection
17	Connector Mfg Tooling
18	Termination Tooling
19	Deliver Connectors
20	Final Documentation



NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Space Systems PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-PE-MES
APPROVAL W. Angele
ACCOMPLISHMENT R. H. Herndon

MILESTONE SCHEDULE

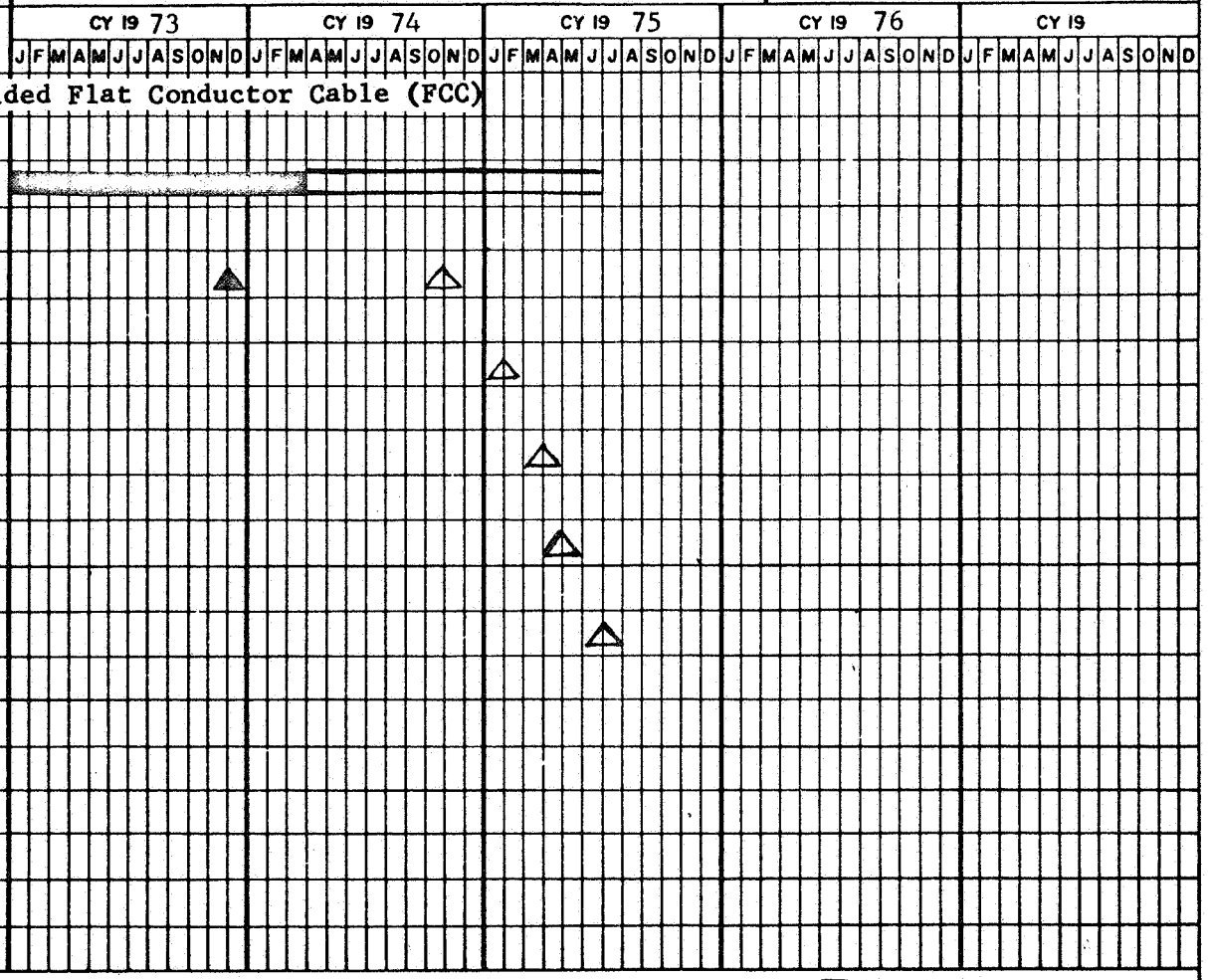
5 LEVEL

RTOP TITLE Electrical Power

RTOP NO. 909-54-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Development of Shielded Flat Conductor Cable (FCC)
2	
3	In-House (Five Phases)
4	
5	1 - Dev. Shielded FCC
6	Prototypes
7	2 - Test & Evaluate
8	Various Prototypes
9	3 - Dev. Processes &
10	Termination Hardware
11	4 - Fab. Prototype Cables
12	for Engrg. Appl. Studies
13	5 - Final Report and
14	Documentation
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Space Systems PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-PE-MES
APPROVAL W. Angele
ACCOMPLISHMENT R. H. Herndon

MILESTONE SCHEDULE

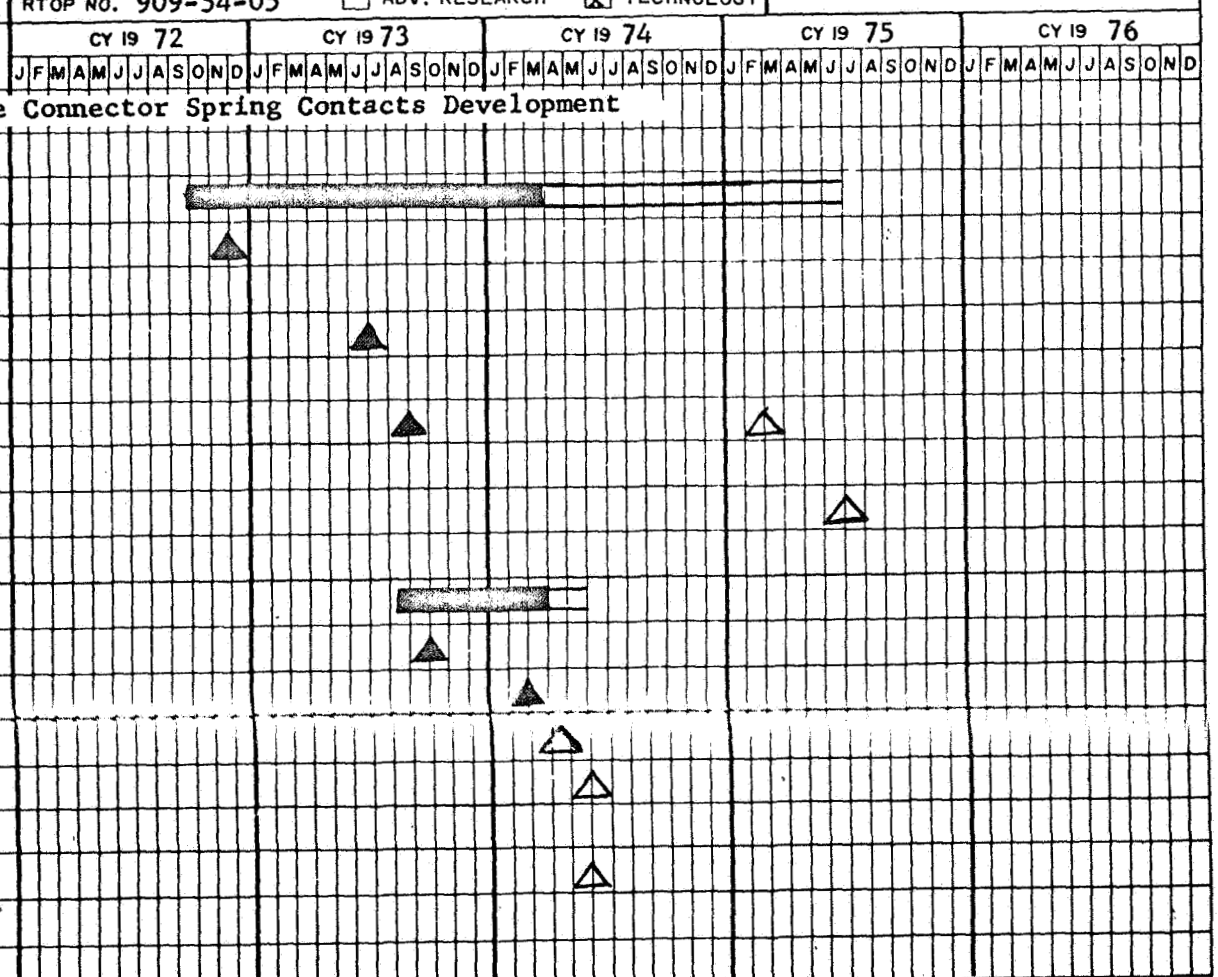
5 LEVEL

RTOP TITLE Electrical Power

RTOP NO. 909-54-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Flat Conductor Cable Connector Spring Contacts Development
2	
3	In-House
4	Configuration and
5	Materials Study
6	Preliminary Design of
7	Contacts
8	Prototype Fabrication
9	and Tests
10	Complete Specifications
11	
12	NAS8-30287
13	Evaluation of Contacts
14	Tooling Design for Parts
15	Contact Mfg. & Tests
16	Manufacture, Assembly and
17	Delivery of Connectors
18	Final Documentation
19	
20	



NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Space Systems PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-PE-MES
APPROVAL W. Angele
ACCOMPLISHMENT R. H. Herndon

MILESTONE SCHEDULE

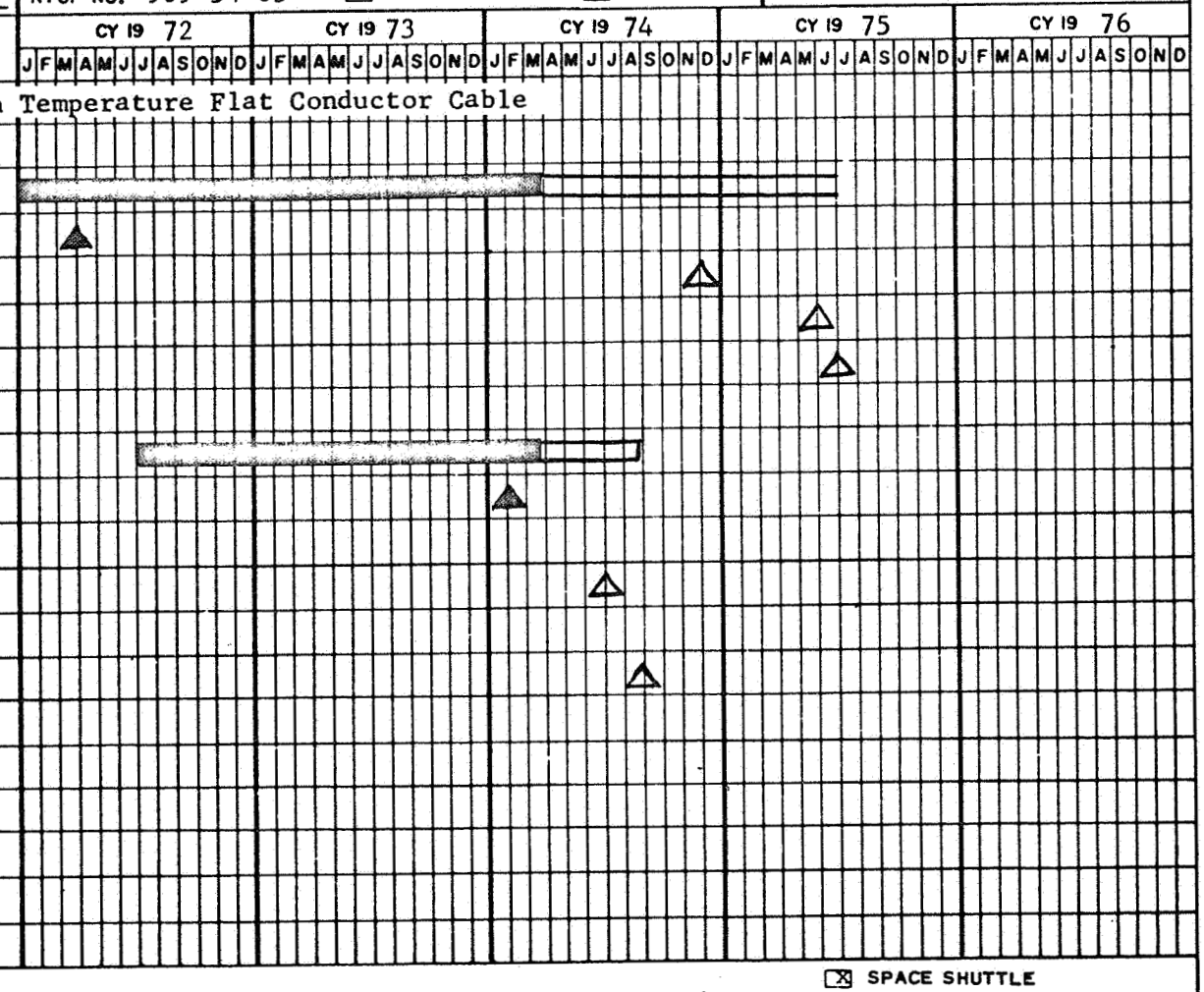
5 LEVEL

RTOP TITLE Electrical Power

RTOP NO. 909-54-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Development of High Temperature Flat Conductor Cable
2	
3	In-House
4	Complete Scope of Work
5	Tests & Evaluation
6	Termination Hardware
7	Specifications
8	
9	Contract NAS8-29076
10	Phase 1 - Deliver Proto-
11	type Cables - 2 sizes
12	Phase 2 - Final Shipment
13	of Cables - 2 sizes
14	Final Report
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Space Systems PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY
APPROVAL Dr. W. K. Polstorff
ACCOMPLISHMENT Mr. B. Hodges

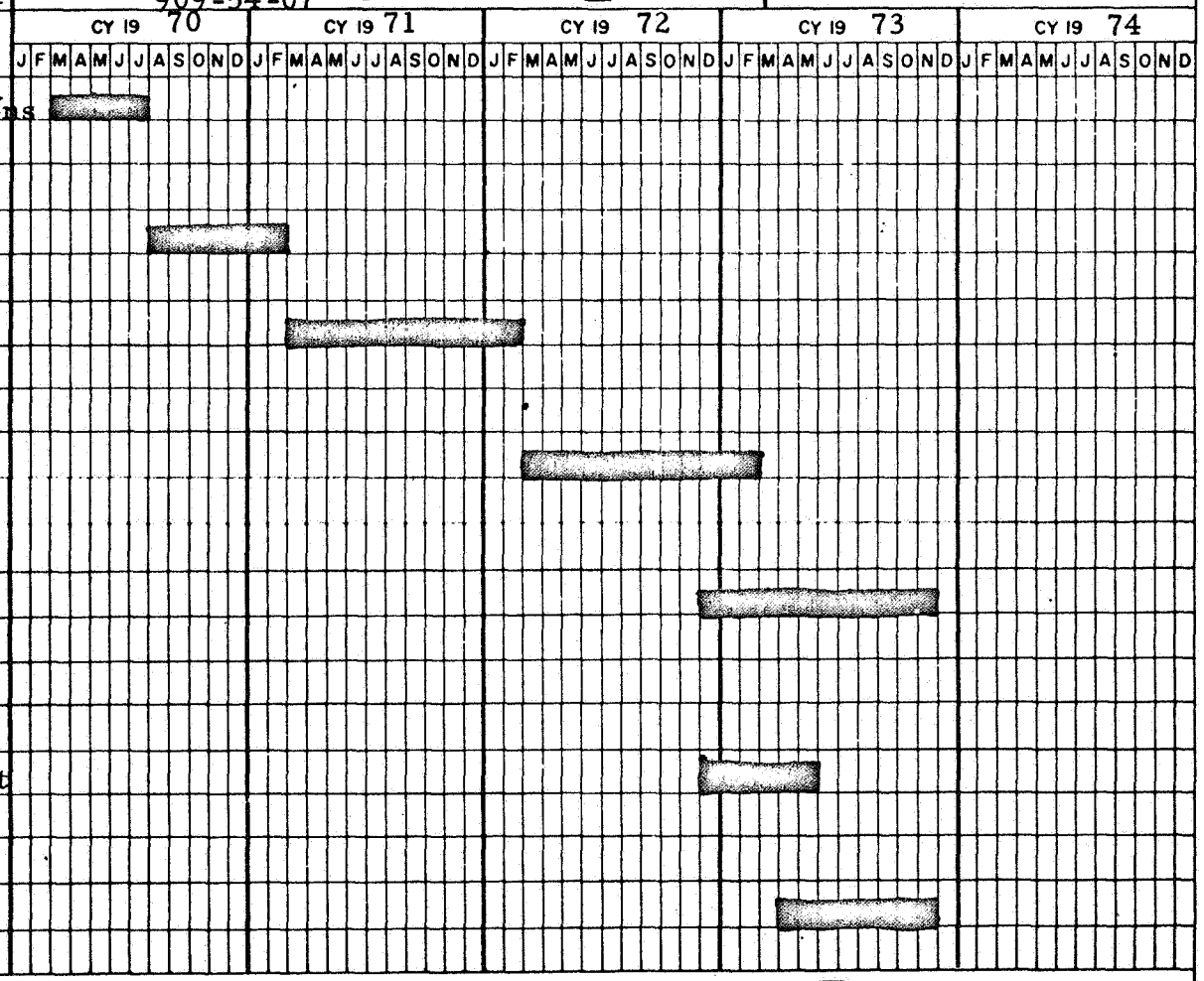
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Communications
RTOP NO. 909-54-07 ☒ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Identify On-Board Functions
2	
3	Develop Structured
4	Vocabulary
5	
6	Demonstrate Interactive
7	Techniques
8	
9	Develop 25-Word Speech
10	Communication System
11	
12	Develop and Deliver 100-
13	Word Speech Communi-
14	cation
15	
16	Identify Crew-Experiment
17	Interactions
18	
19	Develop and Demonstrate
20	~~Interactive Payload/Ex-~~ periment System



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MS
APPROVAL W. Angele
ACCOMPLISHMENT J. L. Splawn

MILESTONE SCHEDULE

RTOP TITLE Manufacturing and Inspection

5 LEVEL

RTOP NO. 909-54-21 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 72	CY 19 73	CY 19 74	CY 19 75	CY 19 76
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Development of Simulation Techniques and Capabilities					
2	In-House					
3	Measurement of Metabolic					
4	Rates					
5	Heart-rate/respiration					
6	Thermal Output					
7	Gas Analysis					
8						
9	Large Mass Handling					
10	Techniques					
11						
12	Other Simulation Techniques					
13	Add Remote Controls to					
14	Free-Flying Platforms					
15	Rendezvous and Docking					
16	Simulation Techniques					
17	Solar Lighting Simulation					
18	Development					
19						
20						

NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Space Systems PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-ME
APPROVAL W. Angele
ACCOMPLISHMENT J. D. Hankins

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Manufacturing and Inspection

RTOP NO. 909-54-21 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Development of Fabrication Technology for Electronic Circuitry Components				
2					
3	In-House				
4					
5	Task Terminated				
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Space Systems PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MW
APPROVAL W. Angele
ACCOMPLISHMENT H. L. Siler *

MILESTONE SCHEDULE

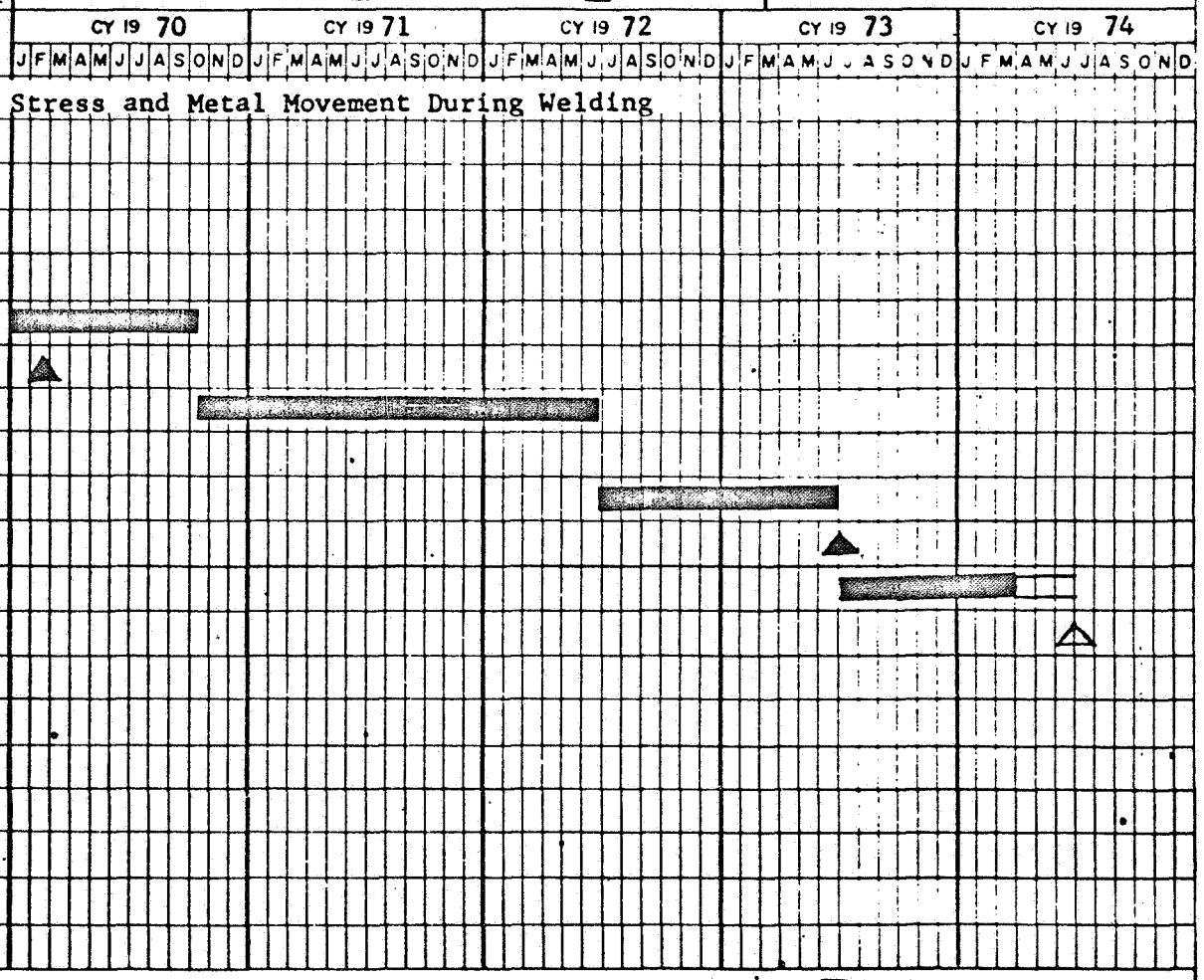
RTOP TITLE Manufacturing and Inspection

5 LEVEL

RTOP NO. 909-54-21 ☐ ADV RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	TASK: Analysis of Thermal Stress and Metal Movement During Welding
2	
3	Contract NAS8-24365
4	(Starting May 15, 1969)
5	
6	Perform Phases A, B & C
7	Delete Phase C
8	Add Phase D & Extend Time
9	Add Phases E & F &
10	Extend Time
11	Submit Phase Report
12	Add Phase G & Extend Time
13	Submit Final Report
14	
15	
16	
17	
18	
19	
20	



NOTES

* Mr. R. M. Poorman, S&E-ASTN-MM, has been designated as COR

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Space Systems PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MS
APPROVAL W. Angele
ACCOMPLISHMENT J. L. Splawn

MILESTONE SCHEDULE

RTOP TITLE Manufacturing and Inspection

5 LEVEL

RTOP NO. 909-54-21 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL (Date)
LAST SCHED CHANGE (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19 76	CY 19 77
1	TASK: Development of Maneuvering and Manipulating Units					
2	In-House					
3	Controller Modifications					
4	for Underwater Capture and					
5	Maintenance Pilot					
6						
7	Modify Joystick/Analog					
8	Controller					
9						
10	Detail Design Drawings for					
11	Modular Manipulator					
12	Elbow Module					
13	Pitch/Yaw Module					
14	Shoulder Azimuth/Pitch					
15						
16	Modify Air Bearing Lift Pad					
17	Maneuverable Platform					
18						
19						
20						

J F M A M J J A S O N D

NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Space Systems PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3458 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-ME
APPROVAL W. Angele
ACCOMPLISHMENT J. D. Hankins

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Manufacturing and Inspection

RTOP NO. 909-54-21 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Process Development for Electronic Interconnection of Microcircuit Devices					
2						
3	In-House					
4						
5	Task Terminated					
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Space Systems PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3456 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-QUAL-AR
APPROVAL R. M. Henritze
ACCOMPLISHMENT T. F. Morris

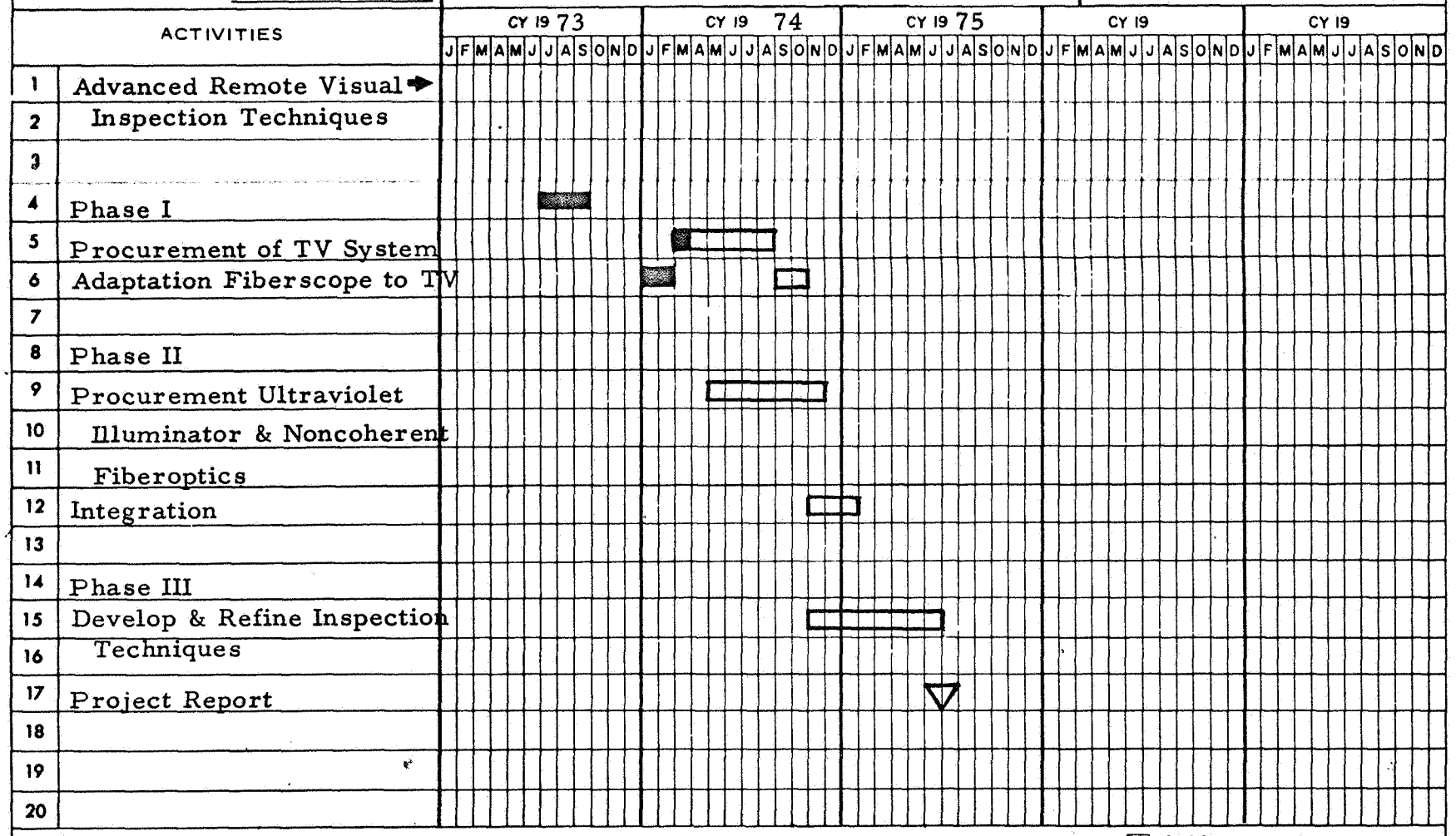
MILESTONE SCHEDULE

RTOP TITLE Manufacturing & Inspection

5 LEVEL

RTOP NO. 909-54-21 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)



NOTES
Completed work
Planned work, committed but not completed
Probable work, planned but not committed
▼ Completed Milestones
▽ Scheduled Milestones

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Future PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-DIR
APPROVAL J.A. Lovingood
ACCOMPLISHMENT J. v. Puttkamer

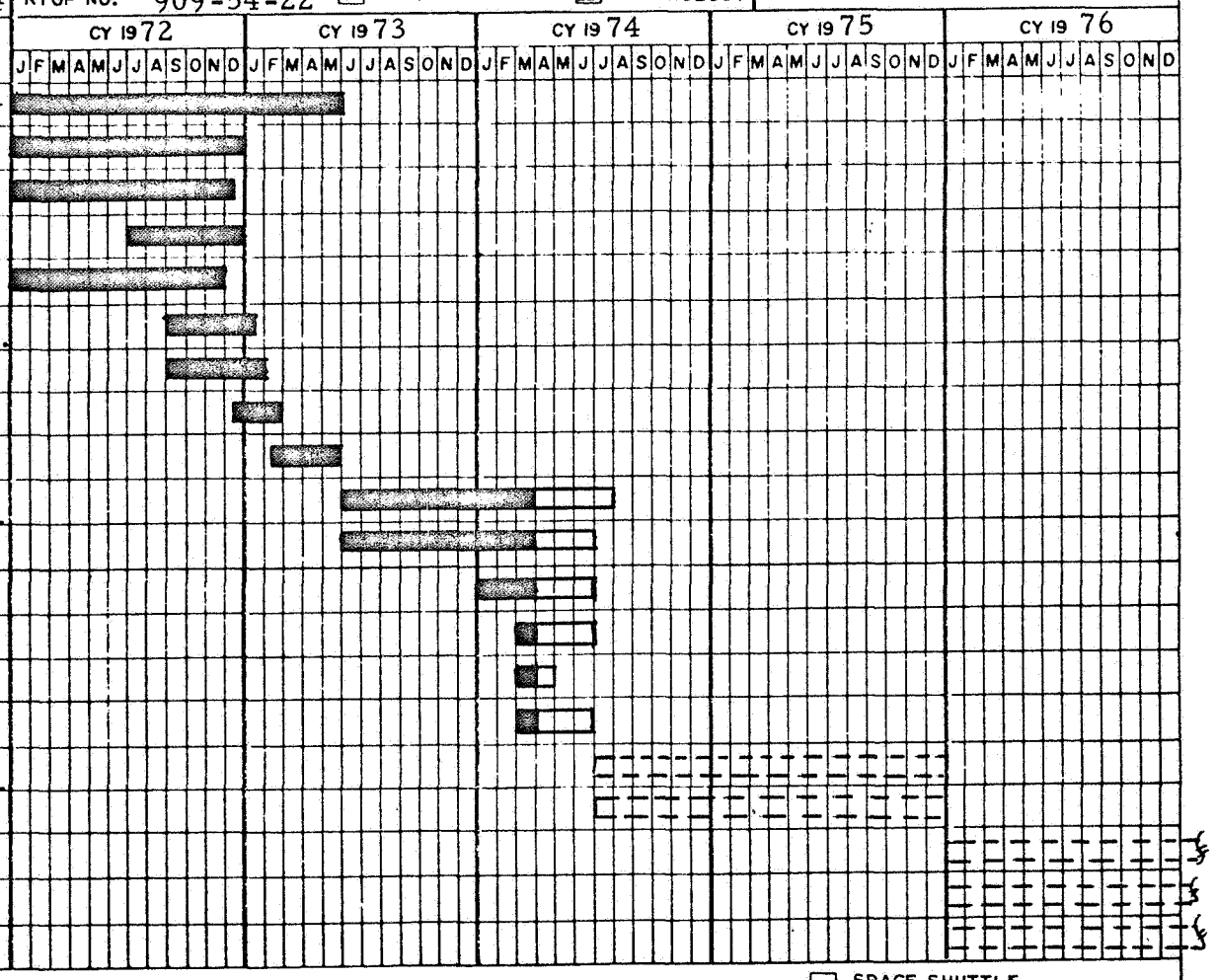
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Transportation

RTOP NO. 909-54-22 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED CHANGE _____ (Date) (No.)
STATUS AS OF 31 03 74 (Date) (Initials) J.v.P.



	ACTIVITIES
1	I. Concept Selection
2	Feasibility Assessment
3	Literature Survey
4	Definition of Reqmts.
5	Select Candidate Configs.
6	Analysis of Flight Envirmt.
7	Parameterization
8	Tradeoff/Optimiz. Studies
9	Select Prime Candidates
10	II/1. Concept Evaluation 1
11	Concept(s) Analyses
12	Trade Studies
13	Operations Analysis
14	Technology Identification
15	Economics Analysis
16	II/2. Concept Evaluation 2
17	In-depth Studies
18	III. Concept Design
19	Conceptual Design
20	Supporting Studies

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ AMOOS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-AA
APPROVAL W. K. Dahm
ACCOMPLISHMENT J. D. Johnson

MILESTONE SCHEDULE

RTOP TITLE Transportation

4 LEVEL

RTOP NO. 909-54-22 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 1974	CY 19	CY 19	CY 19
1	Wind Tunnel Testing on the					
2	AMCOS Vehicle					
3	Test Planning					
4	Model & Hardware Design					
5	Fabricate Model & Hardware					
6	Pretest Report Preparation					
7	Tests					
8	Data Analysis					
9	Data Report Preparation					
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

▽ Report due date

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ AMOOS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL C. N. Swearingen

ACCOMPLISHMENT H. Garrett

MILESTONE SCHEDULE

RTOP TITLE Information Management Systems (IMS)

LEVEL

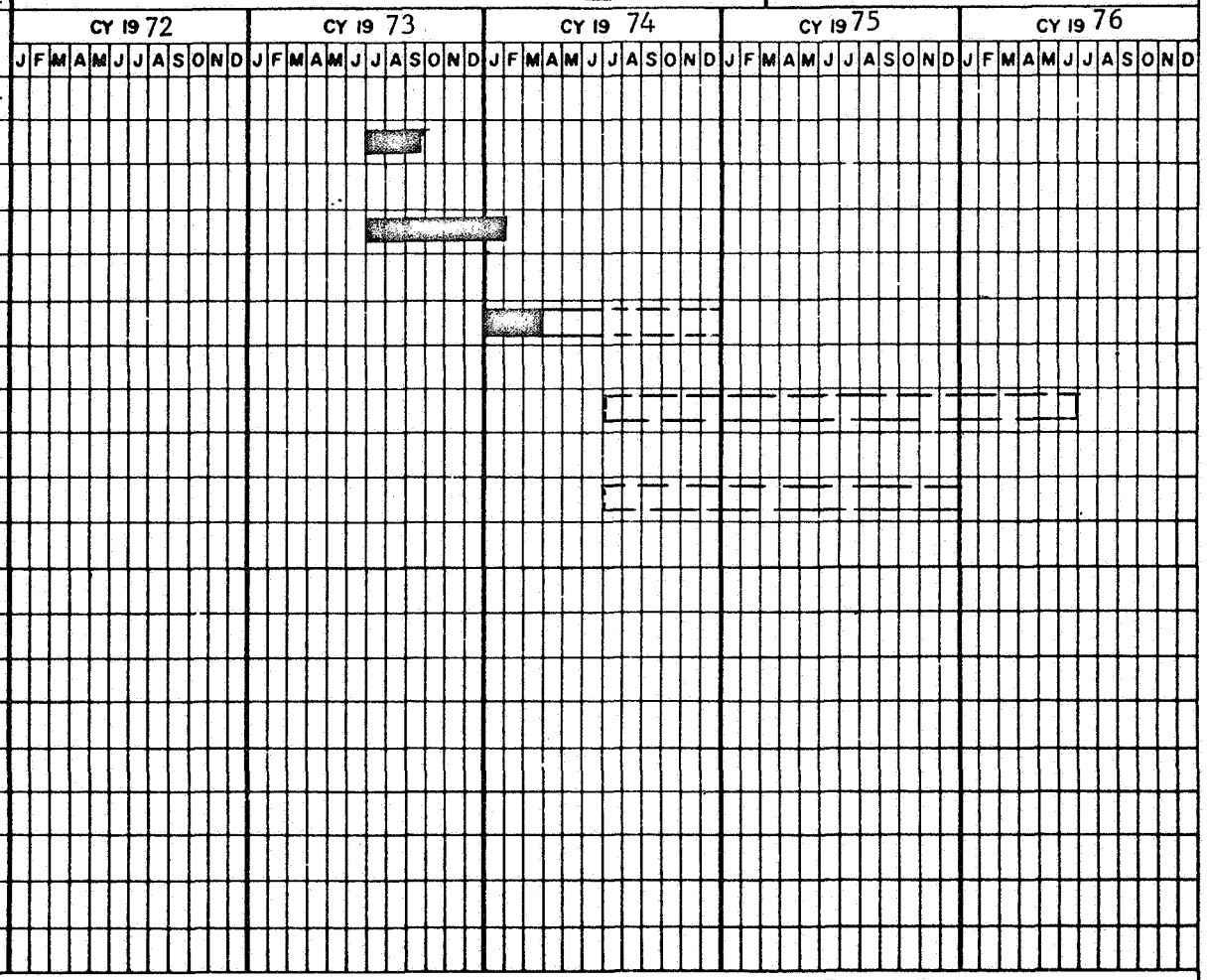
RTOP NO. 909-54-33 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Space Tug Requirements ➔
2	Assessment
3	
4	Technology Impacts
5	
6	Development Test
7	
8	Storage Unit
9	
10	Space Qualify
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL C. N. Swearingen

ACCOMPLISHMENT H. Garrett

MILESTONE SCHEDULE

RTOP TITLE Information Management System (IMS)

LEVEL

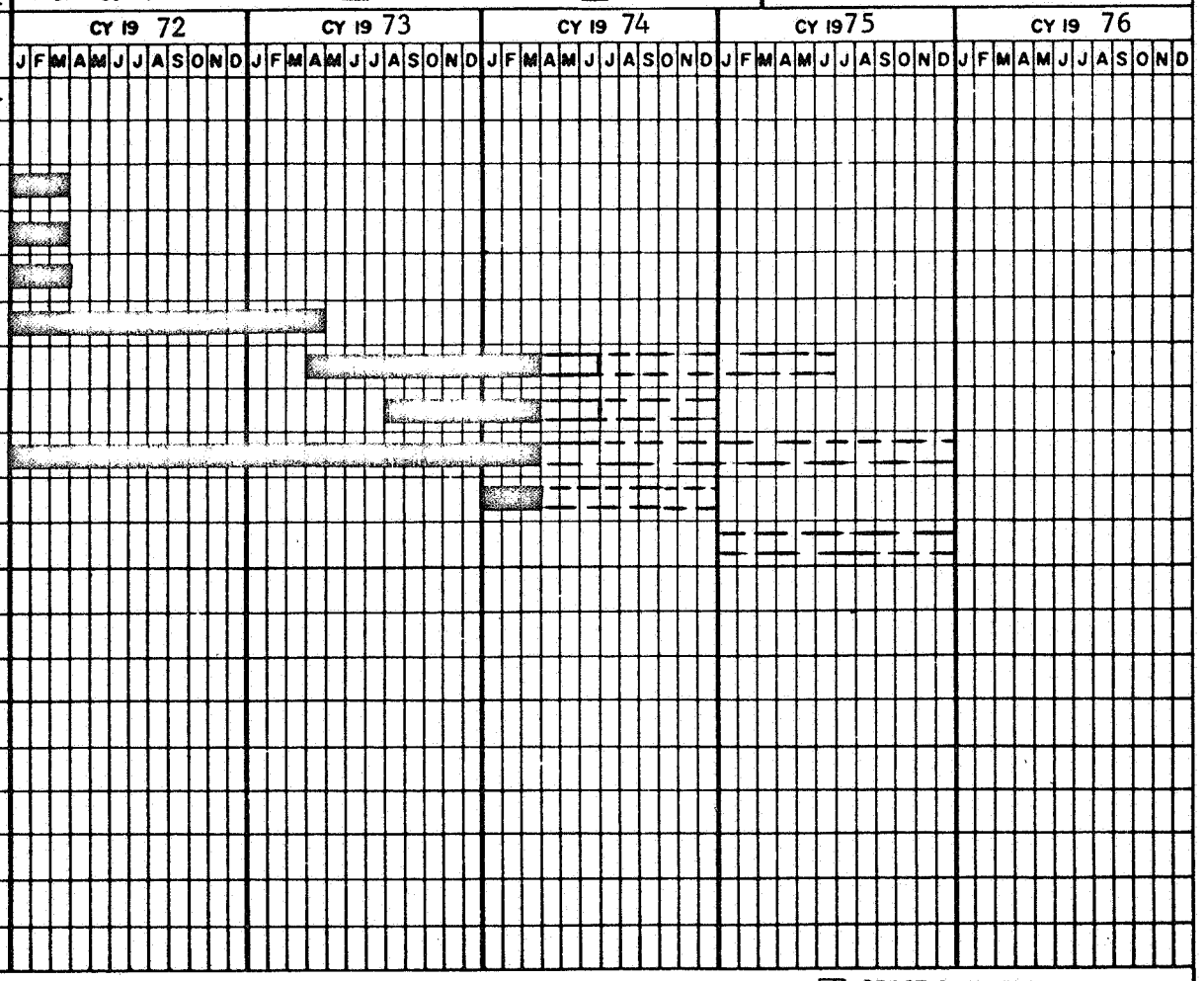
RTOP NO. 909-54-33 ☐ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	
2	SUMC
3	SYSTEM STUDY
4	ENGINEERING BREADBOARD
5	DEMONSTRATION MODEL
6	TECHNOLOGY MODEL
7	TECHNOLOGY EVALUATION
8	MEMORY DEVELOPMENT
9	SOFTWARE DEVELOPMENT
10	PROTOTYPE UNIT
11	DESIGN EVALUATION TESTS
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ CVT, Tug PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-AAS
APPROVAL H. R. Coldwater
ACCOMPLISHMENT J. E. Key

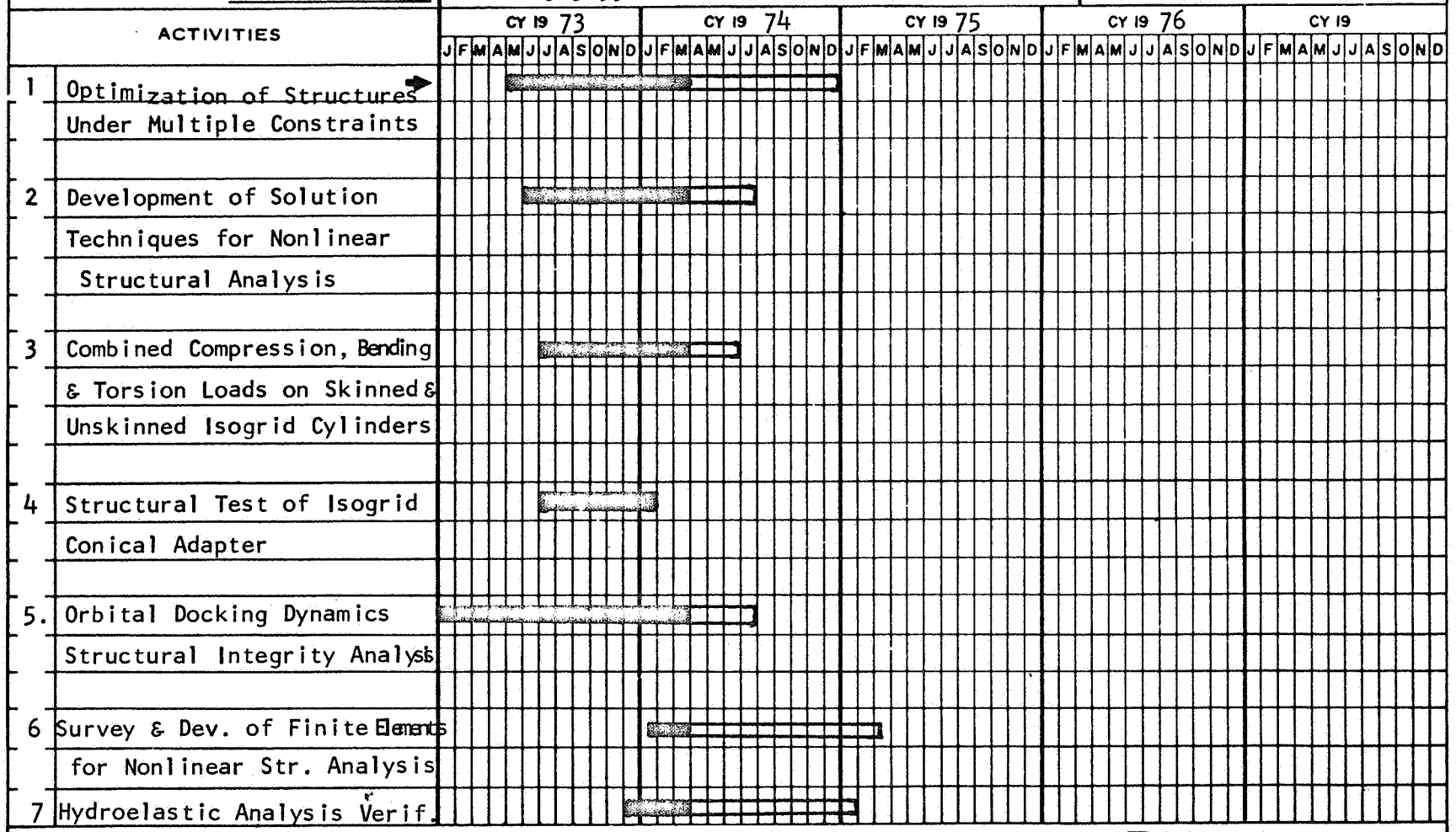
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Structural

RTOP NO. 909-55-01 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Tug PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-ES
APPROVAL G. A. Kroll
ACCOMPLISHMENT E. E. Engler

MILESTONE SCHEDULE

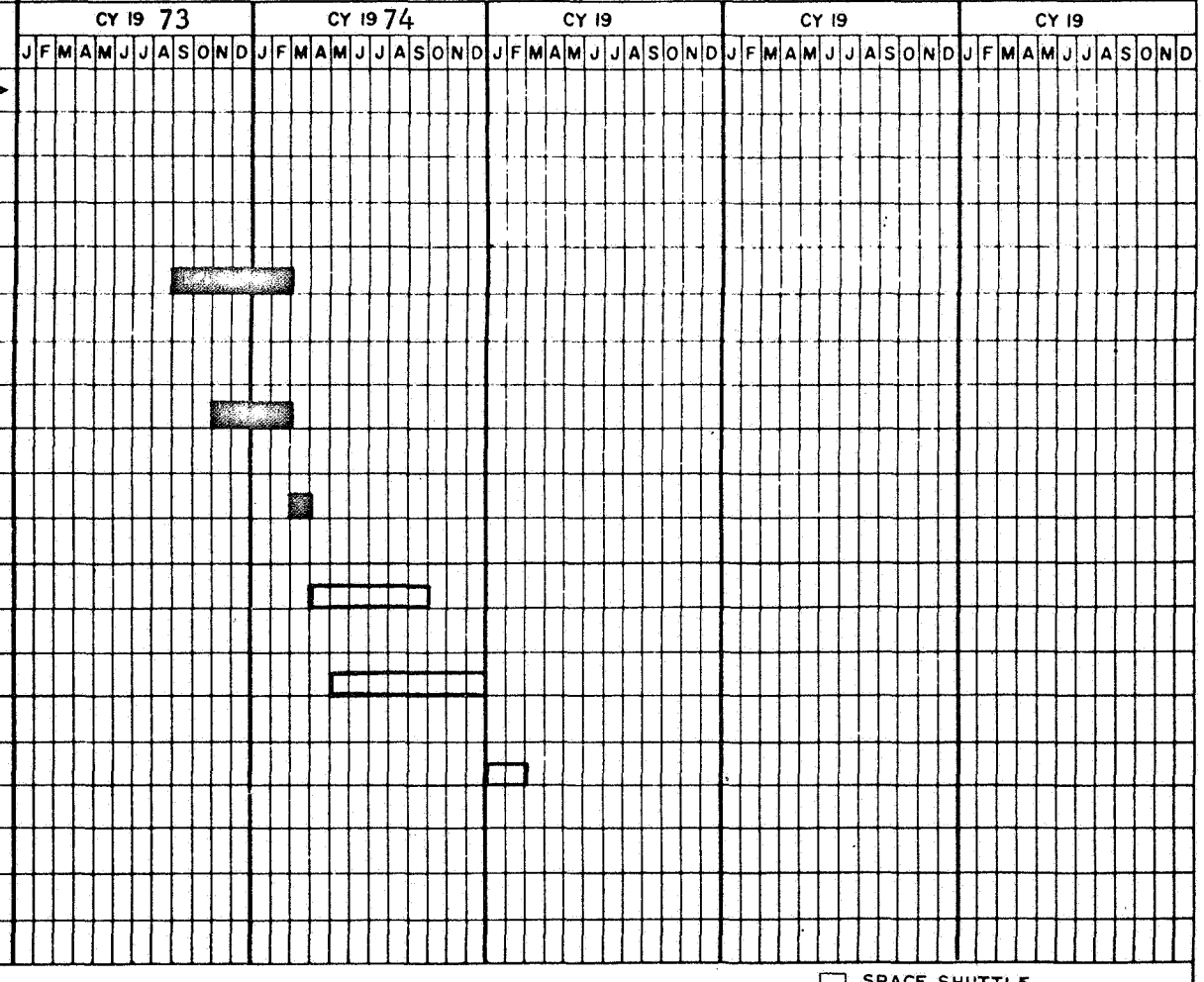
5 LEVEL

RTOP TITLE Structural

RTOP NO. 909-55-01 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	LIGHTWEIGHT SHELL
2	STRUCTURES
3	
4	CONCEPT DESIGN AND
5	MATERIAL STUDY
6	
7	SMALL PANEL FABRICATION
8	AND TEST
9	
10	DETAIL DESIGN
11	
12	PANEL FABRICATION
13	
14	PANEL TEST
15	
16	FINAL REPORT
17	
18	
19	
20	



NOTES
COMPLETED
PLANNED
PROBABLE

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Tug PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PT
APPROVAL C. C. Wood
J. Vaniman/J. Loose
ACCOMPLISHMENT

MILESTONE SCHEDULE

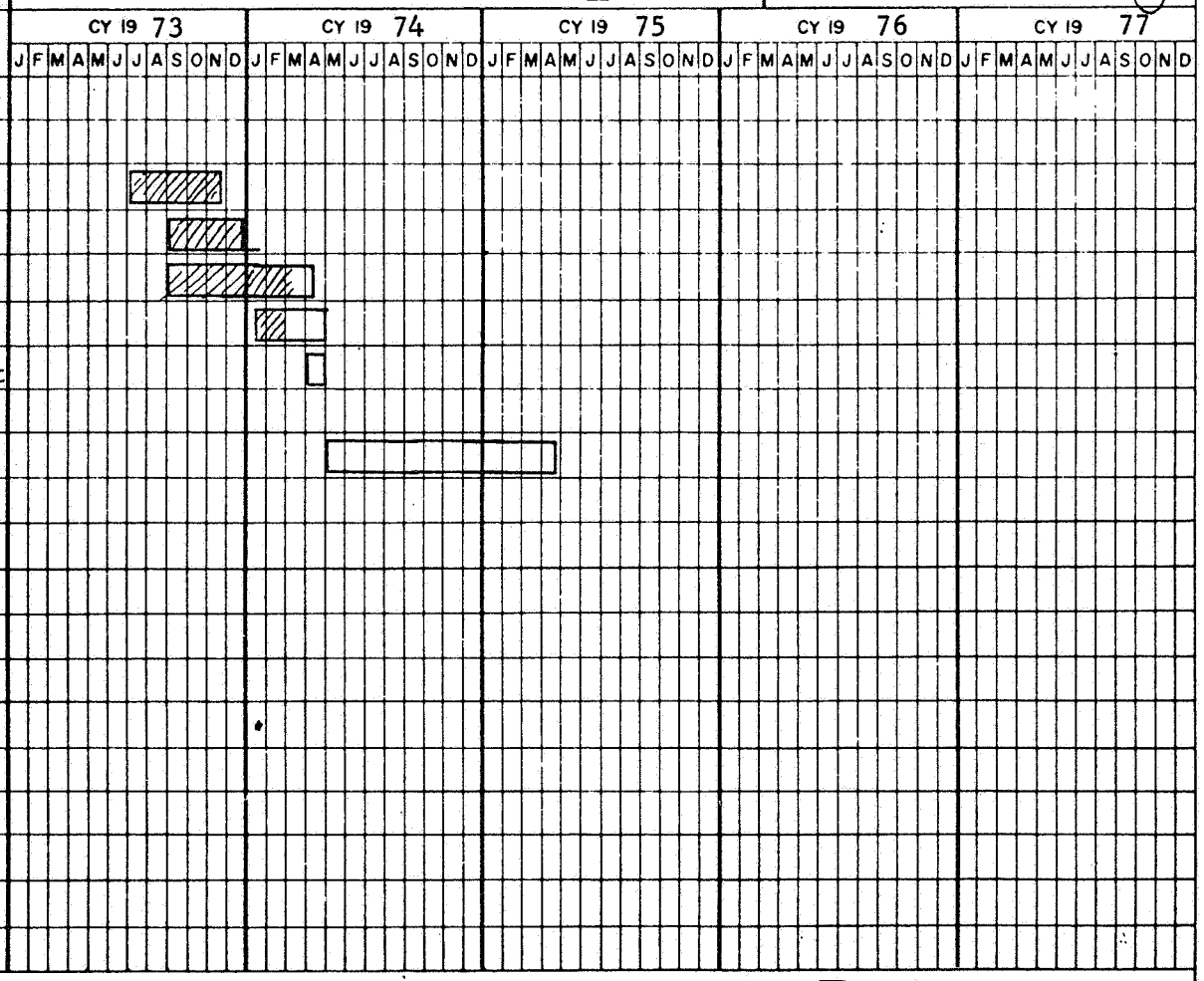
4 LEVEL

RTOP TITLE Thermal Control

RTOP NO. 909-55-02 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL (Date)
LAST SCHED. CHANGE (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	SPACE TUG THERMAL
2	CONTROL
3	1. Requirements
4	2. Environments
5	3. Parametrics
6	4. Systems Design
7	5. Follow-On Plan & Report
8	
9	Breadboard Development and
10	Testing (Extension)
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

Planned

Completed

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Tug PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PP
APPROVAL J. A. Lombardo
ACCOMPLISHMENT C. D. Miller

MILESTONE SCHEDULE

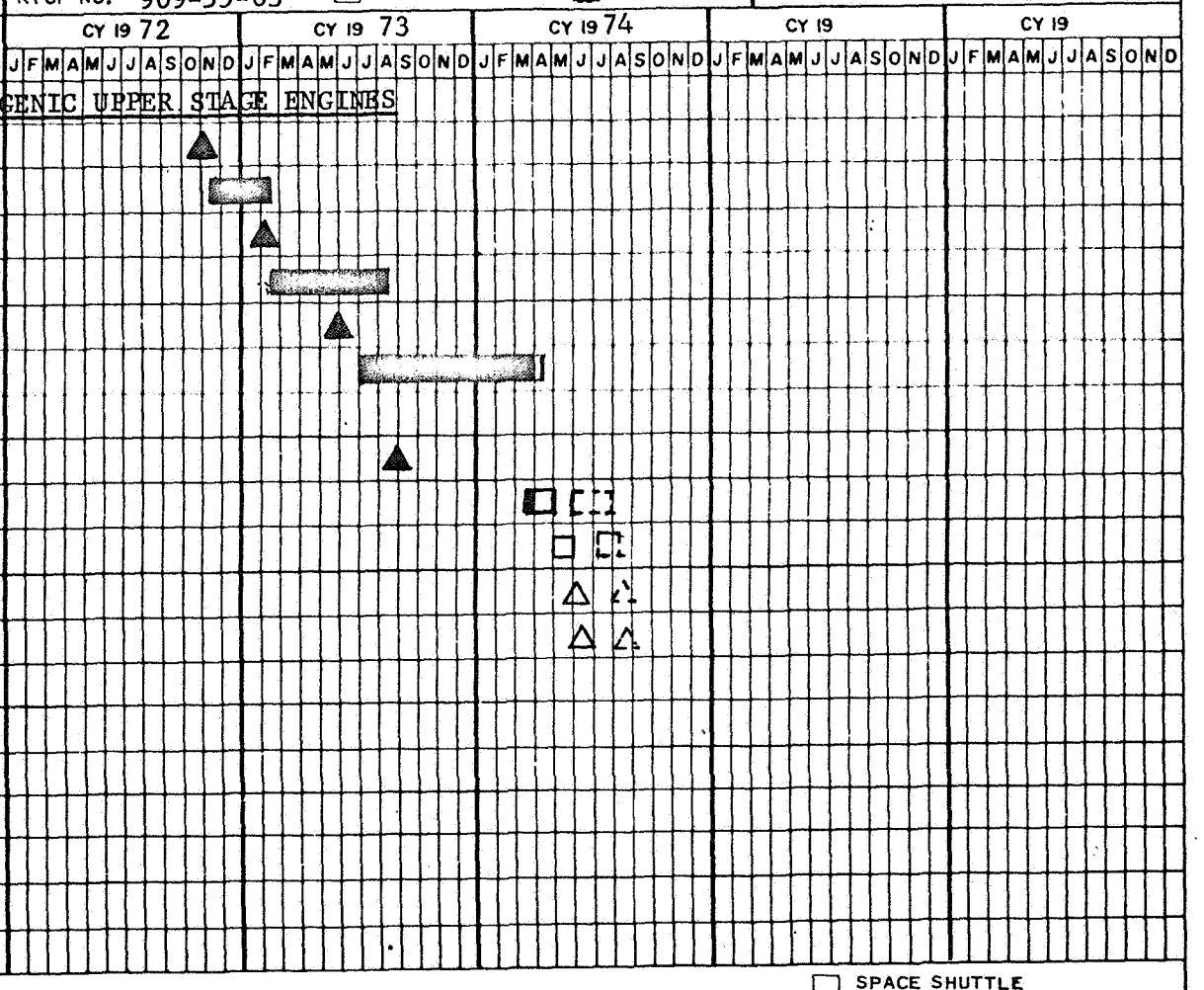
RTOP TITLE PROPULSION

5 LEVEL

RTOP NO. 909-55-03 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	LOW SPEED INDUCERS FOR CRYOGENIC UPPER STAGE ENGINES
2	CONTRACT INITIATION
3	PHASE I ANALYSIS
4	PHASE I REVIEW
5	PHASE II DESIGN
6	DESIGN REVIEW
7	PHASE III FABRICATION
8	TEST PLAN & FACILITIES
9	REVIEW
10	PHASE IV TESTING
11	HARDWARE REFURBISHMENT
12	HARDWARE DELIVERY
13	FINAL REPORT
14	
15	
16	
17	
18	
19	
20	



NOTES

Completed
Planned
New Schedule

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ TUG PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PP
APPROVAL J. A. Lombardo
ACCOMPLISHMENT F. W. Braam

MILESTONE SCHEDULE

RTOP TITLE PROPULSION

5 LEVEL

RTOP NO. 909-55-03 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 JB (Date) (Initials)

	ACTIVITIES	CY 1973	CY 1974	CY 19	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	DESIGN STUDY OF RL10 DERIVATIVES					
2	CONTRACT START	▼				
3	PROGRAM PLAN	▼ ▼				
4	ENGINE CONFIG. DEFINED	▼				
5	PROGRAM PLAN REVISED	▼				
6	1ST DATA DUMP & REV.	▼				
7	2ND DATA DUMP & REV.	▼				
8	3RD DATA DUMP & REV.	▼				
9	DRAFT FINAL REPORT	▼				
10	ISSUE FINAL REPORT	▼				
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

▼ Completed
▽ Planned

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ TUG PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL R. M. ADEN

ACCOMPLISHMENT C. B. GRAFF

MILESTONE SCHEDULE

RTOP TITLE ELECTRICAL POWER

LEVEL

RTOP NO. 909-55-06

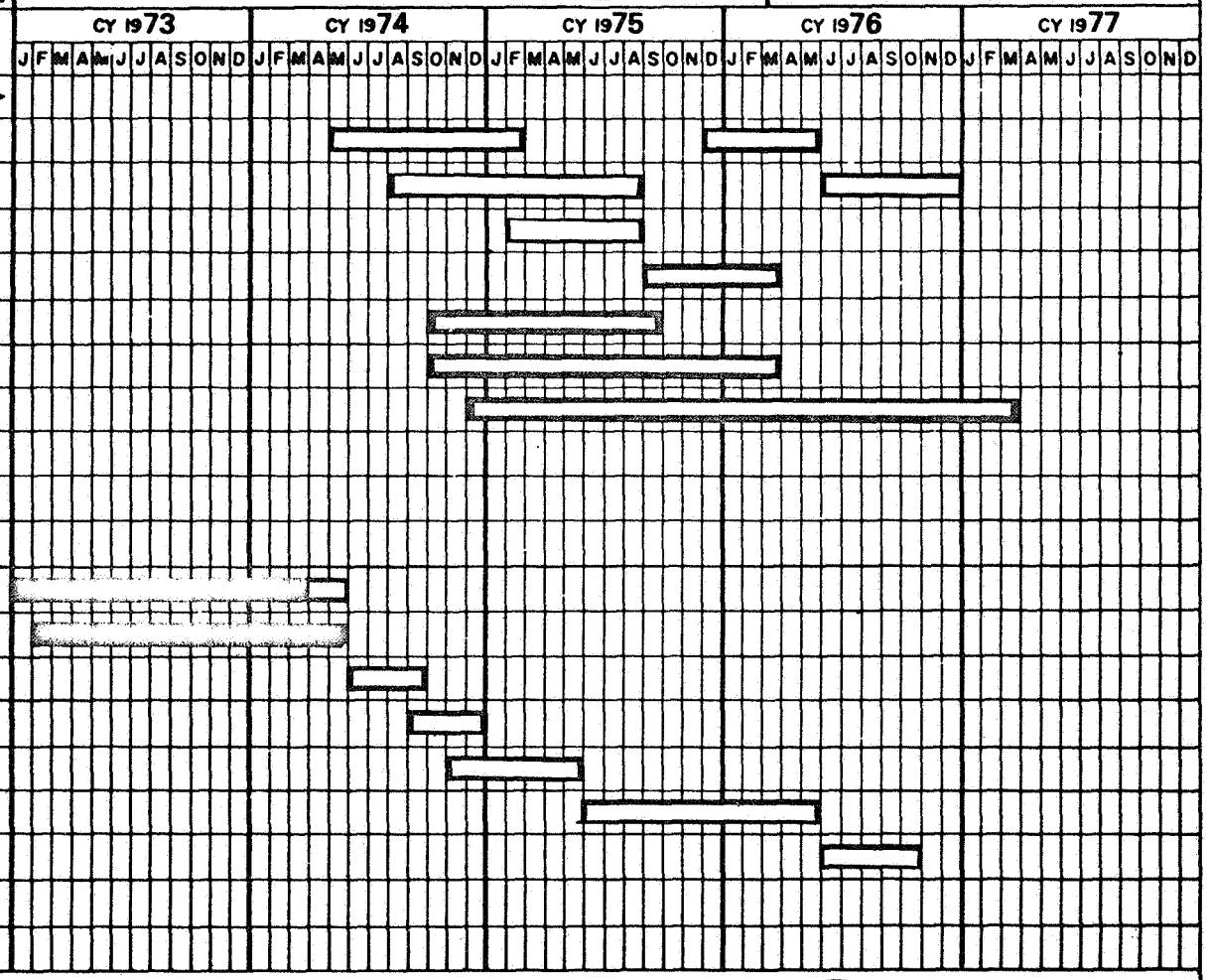
☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	FUEL CELL TECHNOLOGY
2	MULTICELL FAB
3	MULTICELL TEST
4	STACK FAB
5	STACK TEST
6	LOW PWR. DESTINY ANALYSIS
7	ANCILLARY COMP. DES.
8	PWR PLANT DESIGN
9	DESIGN COMPLETE
10	
11	FEED THRU ELECT. CONNECTORS
12	REQM'T ANAL & ASSESS
13	COMCEPTUAL DESIGN
14	PROTOTYPE DESIGN
15	TOOLING
16	PROTO. HDW. MFG.
17	PROTO. TEST & EVAL.
18	TEST REPORT
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY
APPROVAL R. M. ADEN
ACCOMPLISHMENT C. B. GRAFF

MILESTONE SCHEDULE

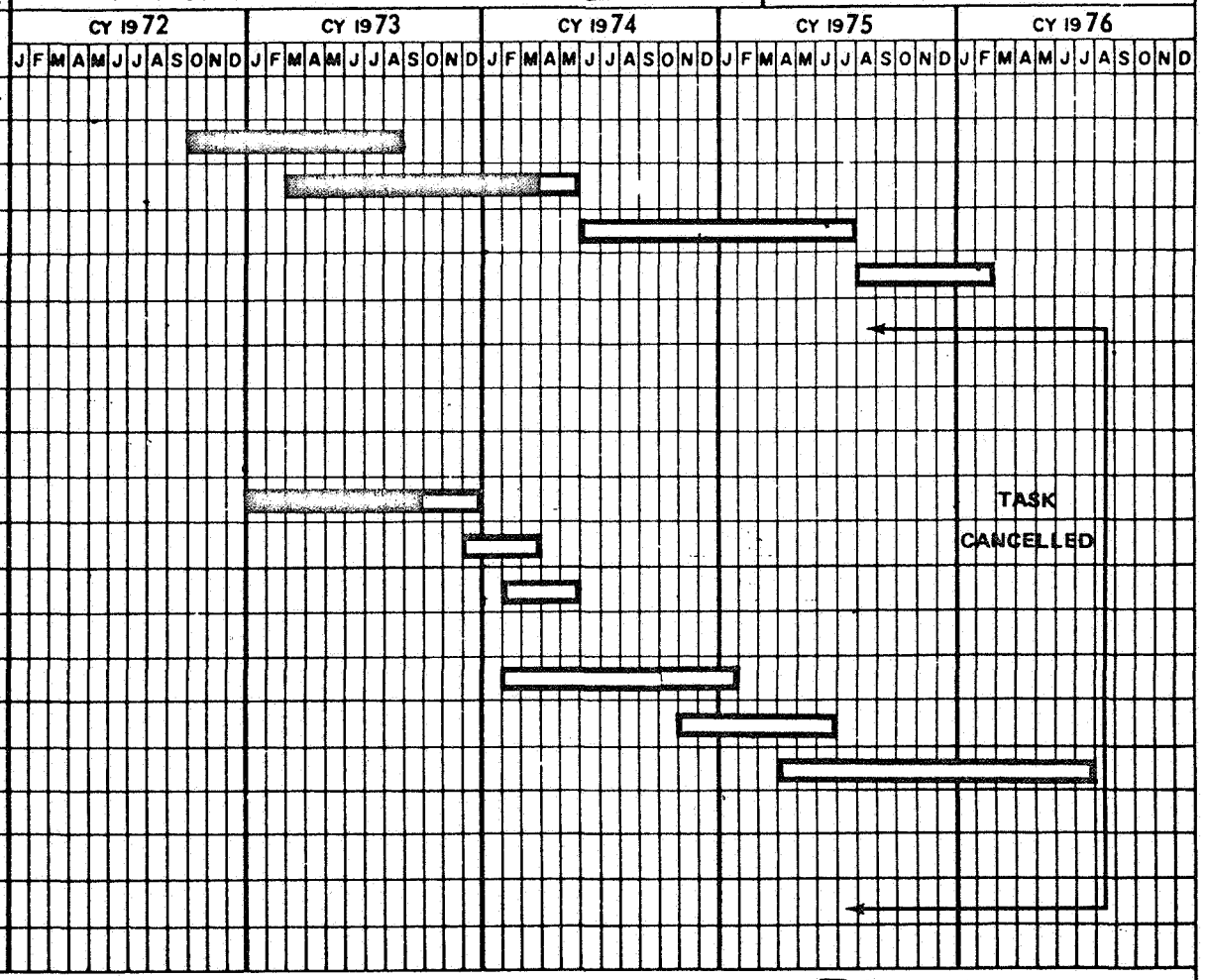
RTOP TITLE ELECTRICAL POWER

5 LEVEL

RTOP NO. 909-55-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	LIGHT WEIGHT CABLES/ CONNECTORS
2	TECHNOLOGY ASSESSMENT
3	HARDWARE PROCUREMENT
4	TEST & EVALUATION PROGRAM
5	FINAL REPORT
6	
7	DEVEL. MOTORS & CONTROLS
8	FOR LATCHING & DOCKING
9	PHASE 1
10	DEFINE MOTOR REQMTS
11	TRADE OFF ANALYSIS
12	IDENT & PREP SPECS
13	PHASE 2
14	DESIGN MOTOR SYS
15	MFG. HARDWARE
16	TEST & EVALUATE
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ TUG PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-ASTR-E

APPROVAL R. M. ADEN

ACCOMPLISHMENT C. B. GRAFF

MILESTONE SCHEDULE

RTOP TITLE ELECTRICAL POWER

5 LEVEL

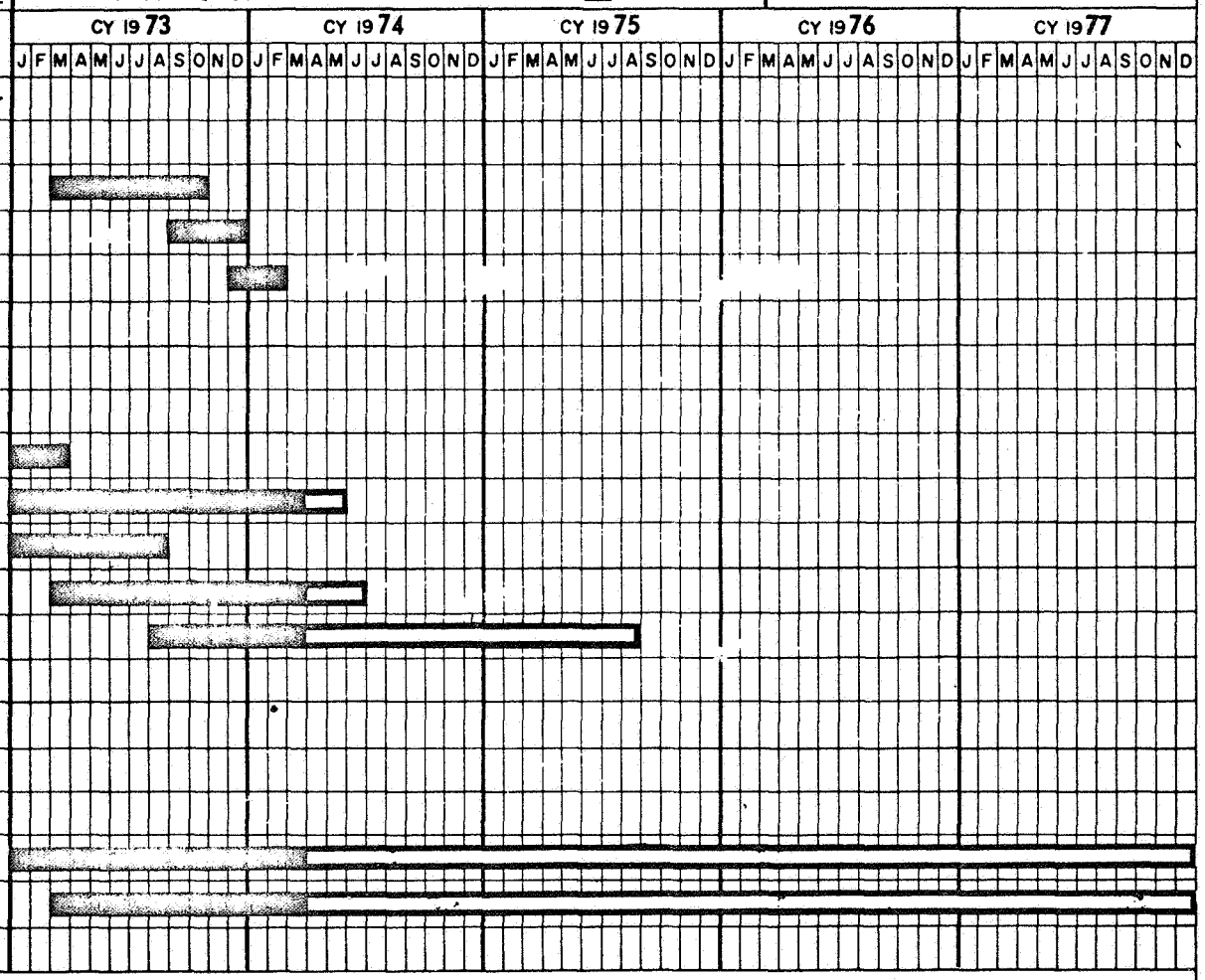
RTOP NO. 909-55-05 ☐ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (No.) (Initials)

	ACTIVITIES
1	PWR. COND. ANAL & DEVEL.
2	TASK I DYNAMIC & STABILITY ANALYSIS
3	1. DEV. TRANSFER FUNCTION
4	2. DEV. MATH. MODELS
5	3. TEST AND VERIFY
6	
7	TASK 2 STAND. & MOD. OF POWER COND. EQUIP.
8	
9	PH. 1 – DEFINE REQ'T
10	PH. 2 – CKT. SELECTION & STUDIES
11	PH. 3 – IDENT. MICRO CKTS
12	PH. 4 – PACKAGE DESIGN
13	PH. 5 – CONST. & EVAL. PROTO
14	
15	TASK 3 CIRCUIT & EQUIP. DEVELOPMENT
16	
17	PH. 1 – CIRCUIT DEV.
18	a. GENERATE CIRCUITS
19	b. GENERATE PARA. DATA
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ TUG PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-E
APPROVAL R. M. ADEN
ACCOMPLISHMENT C. B. GRAFF

MILESTONE SCHEDULE

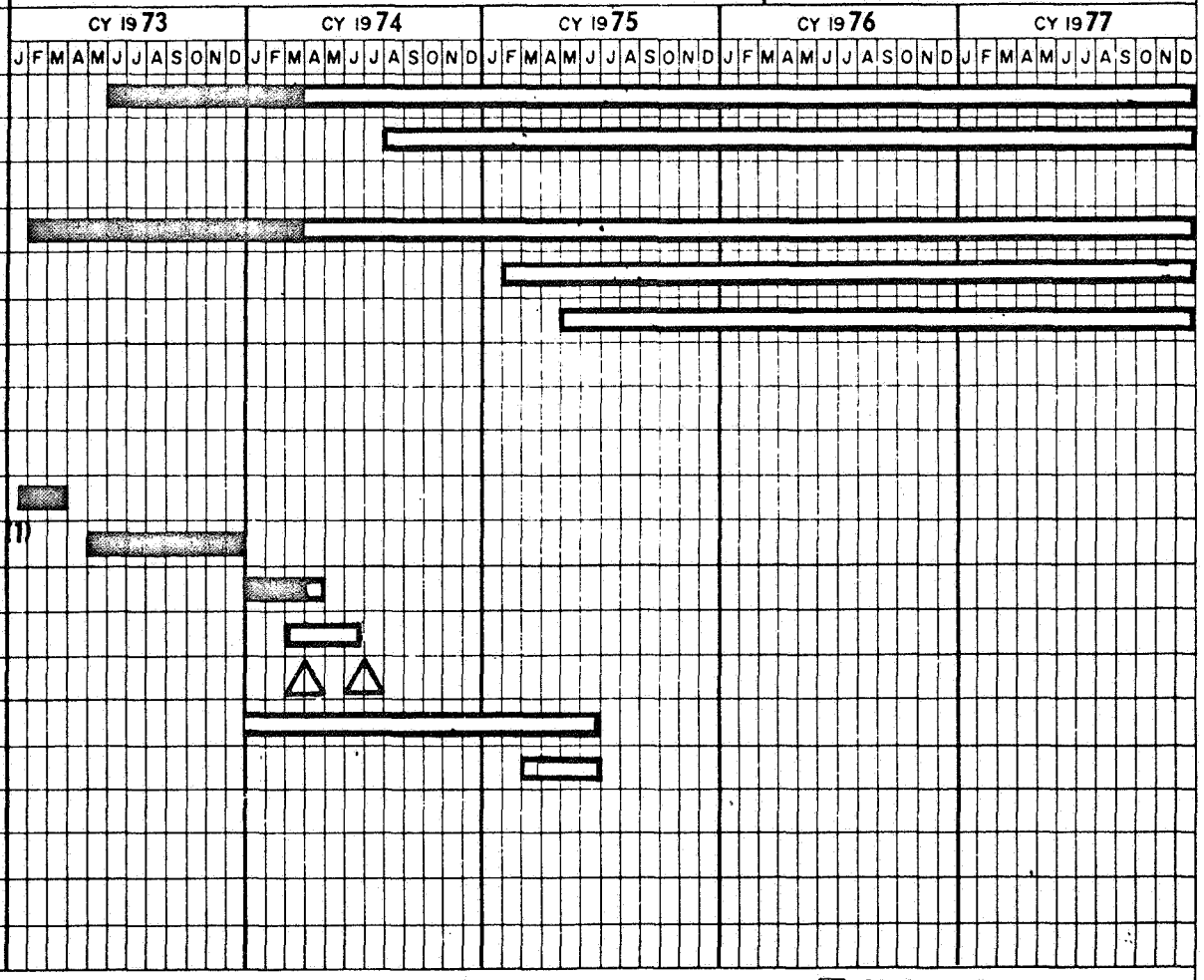
RTOP TITLE ELECTRICAL POWER

5 LEVEL

RTOP NO. 909-55-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	c. TRADE-OFF ANALYSIS
2	d. IDENTIFY CKT. SPEC'S
3	PH. 2 - EQUIPMENT DEV.
4	a. PIECE PART DEV.
5	b. MFG. PROTOTYPES
6	c. TEST
7	
8	
9	SWITCH GEAR & CKT. PROT.
10	404 PREPARATION
11	PROPOSAL EVAL. & CONTR. AWARD (1)
12	COMPONENT EVALUATION
13	BREADBOARD DESIGN & EVAL.
14	DESIGN REVIEW
15	PH. II H'DW DESIGN
16	PH II H'DW FAB. & DELIV.
17	
18	
19	
20	



NOTES
(1) DELAY DUE TO CONTRACT PROTEST

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ TUG PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MES
APPROVAL W. Angele
ACCOMPLISHMENT R. H. Herndon

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Electrical Power

RTOP NO. 909-55-05 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 72	CY 19 73	CY 19 74	CY 19 75	CY 19 76
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Light Weight Flat Conductor Cables (FCC) and Connectors					
2	In-House					
3	Light Weight FCC					
4	Materials Procurement					
5	Evaluation & Tests					
6	Documentation & Spec.					
7	Contract Scope of Work					
8						
9	Light Weight Connectors					
10	Materials Procurement					
11	Evaluation & Tests					
12	Prototype Fabrication					
13	Connector Evaluation					
14	Documentation & Spec.					
15	Contract Scope of Work					
16						
17	Supporting Contracts					
18	Dev. Aluminum Clad FCC					
19	Dev. FCC Terminations					
20	Dev. New Type Connectors					

NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Space Tug&SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY
APPROVAL J. L. Mack
ACCOMPLISHMENT J. D. Ellsworth

MILESTONE SCHEDULE

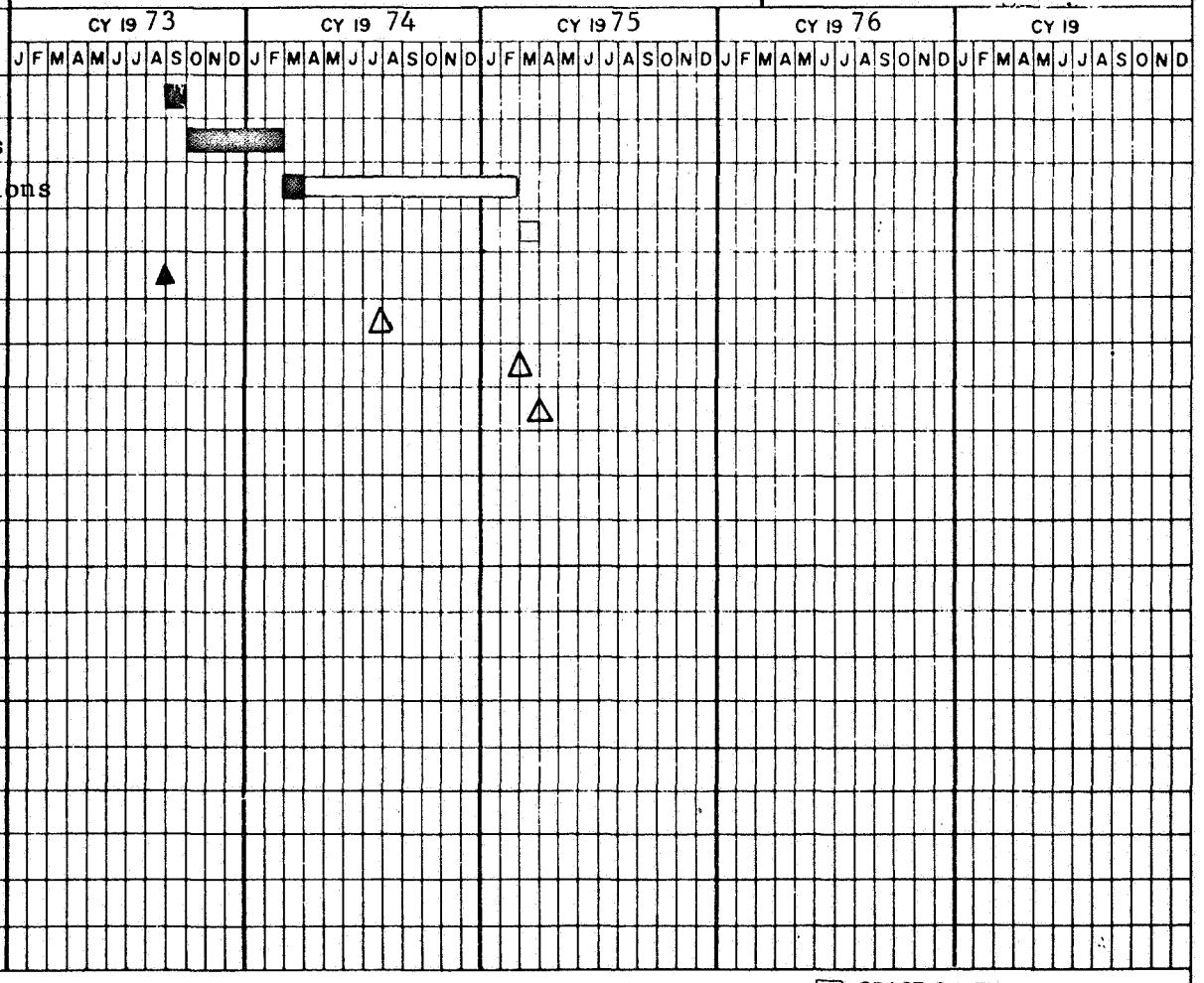
5 LEVEL

RTOP TITLE Guidance and Navigation

RTOP NO. 909-55-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Identify Areas of Concern
2	Identify Proposed Solutions
3	Analysis of Proposed Solutions
4	Final Report Preparation
5	Initial Review
6	Interim Review
7	Final Review
8	Final Report
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

Schedule Reflects Expected 6 Month No Cost Contract Extension

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Tug PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-I
APPROVAL W. O. Frost
ACCOMPLISHMENT D. O. Lowrey

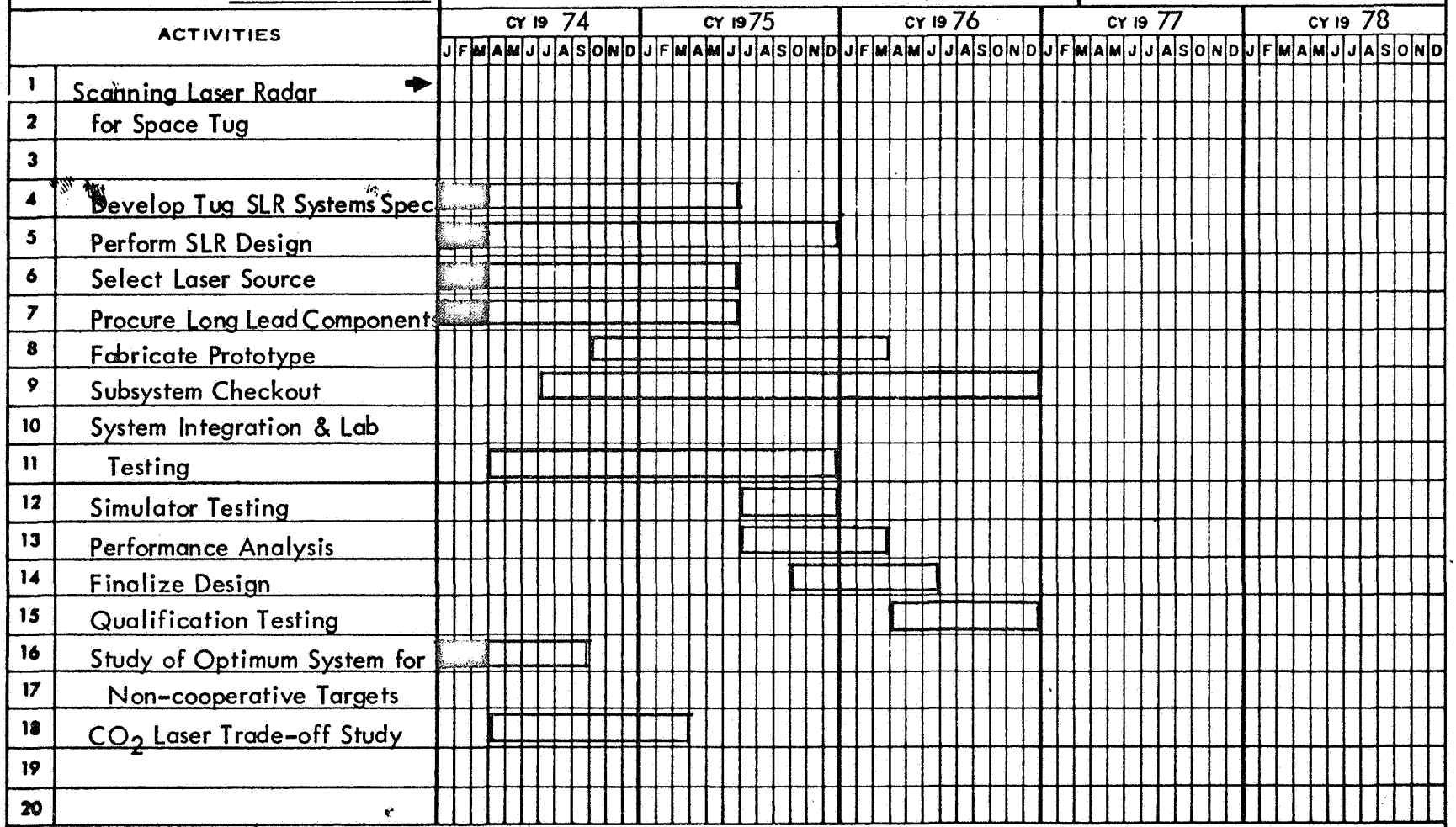
MILESTONE SCHEDULE

RTOP TITLE Space Tug Scanning Lasar Radar

4 LEVEL

RTOP NO. 909-55-10-32 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[X] Space Tug PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PF
APPROVAL A. L. Worlund
ACCOMPLISHMENT R. E. Stonemetz

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE CRYOGENICS
908-52-37 (FY 72)
RTOP NO. 909-55-37 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1971	CY 1972	CY 1973	CY 1974	CY 1975
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASKS - SPACE LOX VENT SYSTEM					
2	Parametric Studies					
3	Detail Design					
4	Component Procurement					
5	Prototype Fab					
6	Testing					
7	Contract Completion					
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PF
APPROVAL A. L. Worlund
ACCOMPLISHMENT Eric H. Hyde

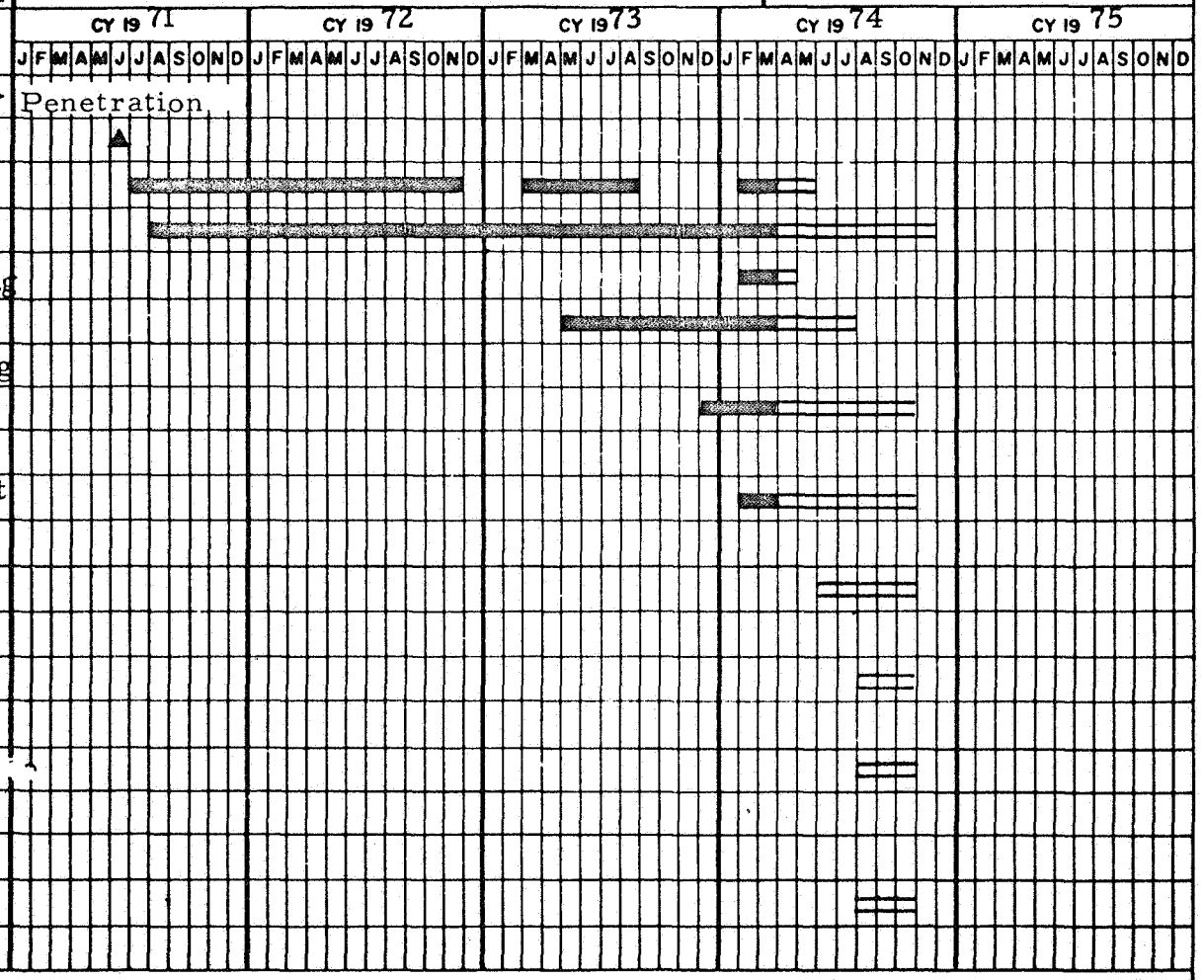
MILESTONE SCHEDULE

RTOP TITLE Cryogenics
RTOP NO. 909-55-37 112-30-19
☐ ADV. RESEARCH ☐ TECHNOLOGY

4 EVEL

ORIGINAL SCHED. APPROVAL (Date)
LAST SCHED. CHANGE (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Study of Multilayered Pipe Penetration
2	Let Contract
3	Penetration Analysis
4	Penetration Testing
5	Hybrid Penetration Testing
6	Thermoacoustic Oscilla-
7	tions Analytical Modeling
8	Thermoacoustic Oscilla-
9	tions Testing
10	Cryogenic Storage Concept
11	Generation
12	Cryogenic Storage Para-
13	metric Analysis
14	Cryogenic Storage Hand-
15	book Development
16	Spectral Analysis of
17	Thermo-Acoustic Wave
18	Motion
19	Experimental Verification
20	



NOTES
Reports
Completed
In Progress

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Nuclear Stage PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-ASTN-AAD

APPROVAL H. R. Coldwater

ACCOMPLISHMENT R. L. McComas

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Aeroelasticity

RTOP NO. 909-55-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	Development of Curved					
2	Shell Finite Element for					
3	Space Tug (Continuation of					
4	Finite Element Modeling					
5	Optimization)					
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Tug PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-DD
APPROVAL Robert S. Ryan
M. H. Rheinfurth
ACCOMPLISHMENT

MILESTONE SCHEDULE

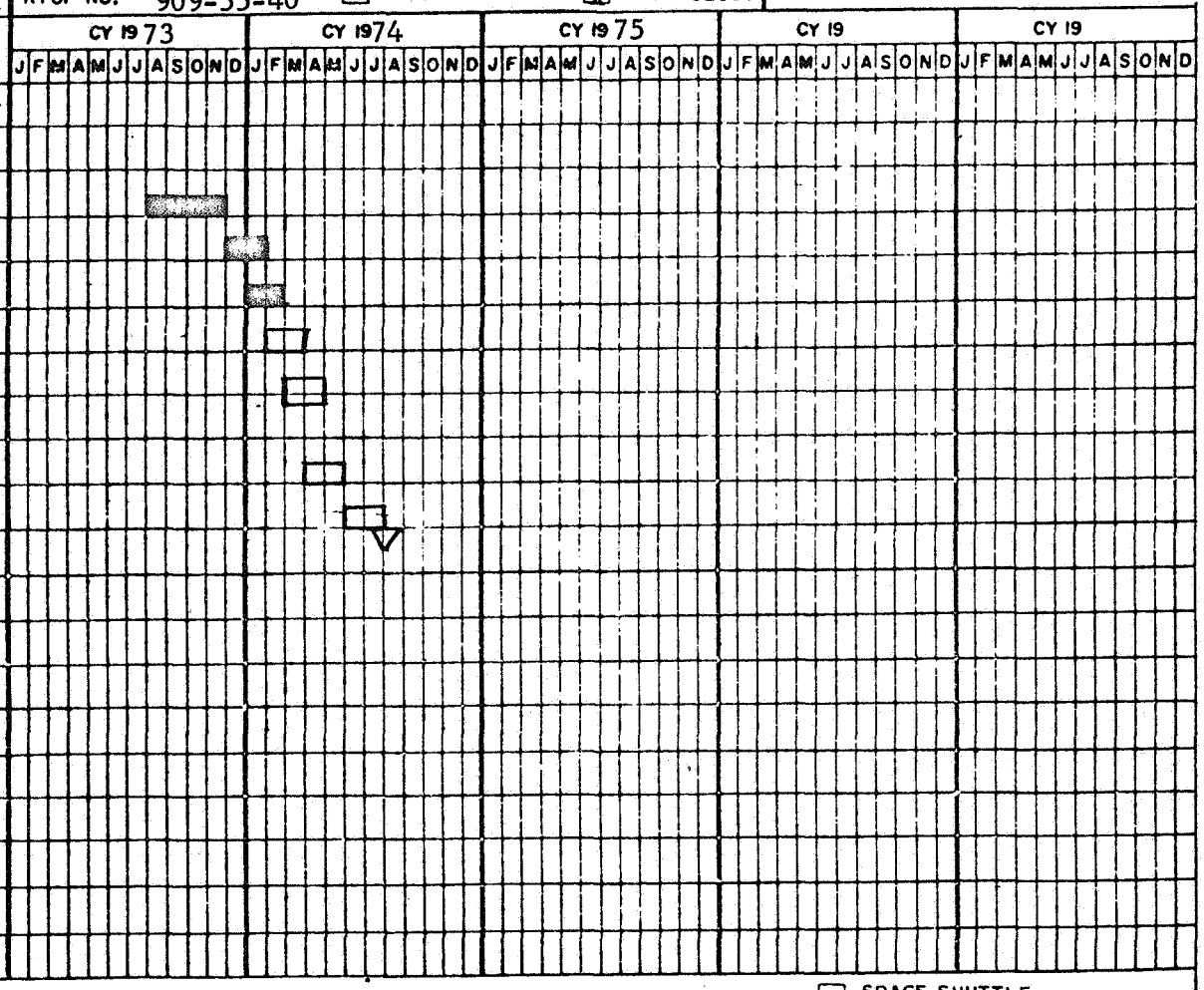
4 LEVEL

RTOP TITLE Aeroelasticity

RTOP NO. 909-55-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	SPACE TUG AUTOMATIC
2	DOCKING CONTROL STUDY
3	DOCKING CONTROL STRATEGIES
4	SENSOR REQUIREMENTS
5	DOCKING MECHANISM DESIGN
6	DATA REQUIREMENTS
7	PROBABILITY OF SUCCESSFUL
8	DOCKING
9	EFFECT OF MISSED DOCKING
10	DOCUMENTATION
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Tug PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-DD
APPROVAL Robert S. Ryan
M. H. Rheinfurth
ACCOMPLISHMENT

MILESTONE SCHEDULE

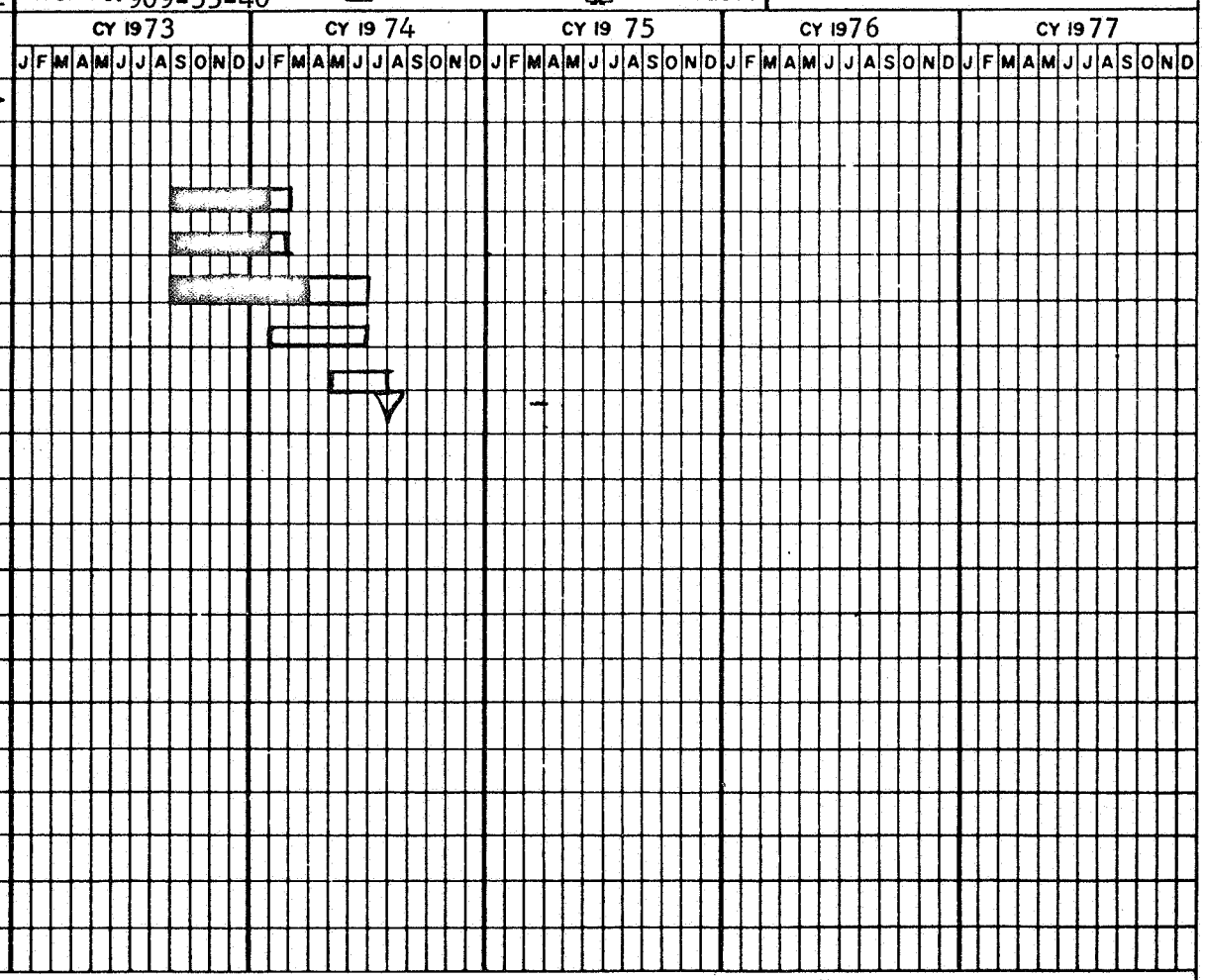
4 LEVEL

RTOP TITLE Aeroelasticity

RTOP NO. 909-55-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL (Date)
LAST SCHED. CHANGE
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	SPACE TUG RECOVERY OF
2	SPINNING SATELLITE
3	DOCKING MECHANISM
4	CAPTURE BOUNDARIES
5	STABILITY ANALYSIS
6	SENSORS/CONTROL LOGIC
7	DOCUMENTATION
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Tug PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY
APPROVAL R. S. Ryan
ACCOMPLISHMENT Frank M. Bugg

MILESTONE SCHEDULE

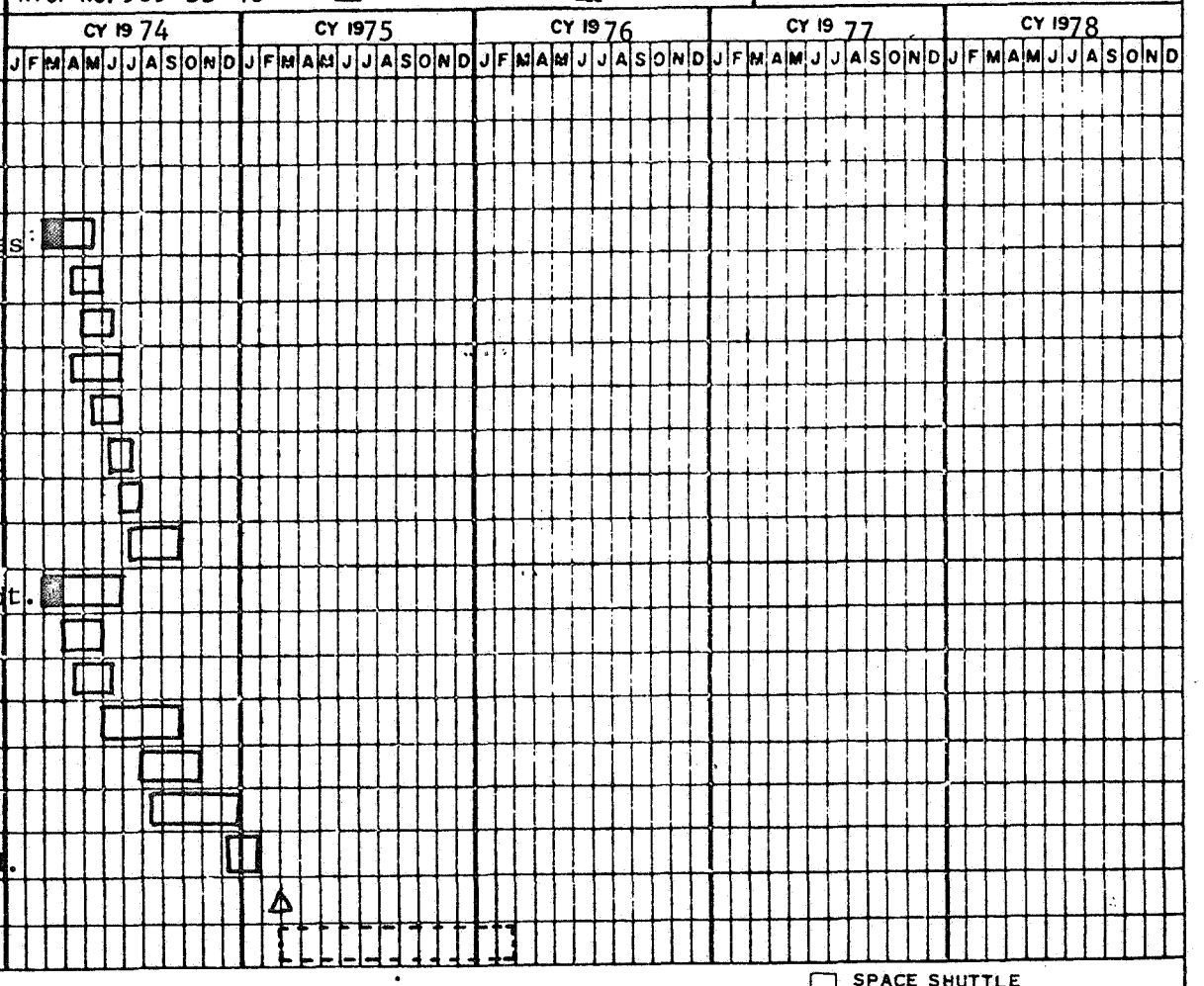
4 LEVEL

RTOP TITLE Aeroelasticity

RTOP NO. 909-55-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	EXPERIMENTAL STUDY OF
2	TRANSIENT LIQ. MOT. IN
3	ORBITING SPACECRAFT
4	Dyn. Model Scaling Studies
5	Test Fluid Selection
6	Total Model Definition
7	Test Plan Definition
8	Model Construction
9	Test Package Installation
10	Instrumentation
11	Drop Test & Data Acquis.
12	Formulation of Equ. of Mot.
13	Spec. of Ell. Surface
14	Constraint Equations
15	Computer Coding
16	Check-out
17	Correlation Exp./Anal.
18	Simulation of Proto. Cond.
19	Final Report
20	Slosh Model Improvements



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Tug PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-A

APPROVAL W. K. Dahm

ACCOMPLISHMENT W. K. Dahm

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Environmental Quality

RTOP NO. 909-55-47 ☐ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	STUDY OF SPACE TUG PROPELLANT					
2	DUMPING DURING SPACE SHUTTLE					
3	ABORT					
4	MSFC Flow Field Estimates					
5						
6	Contract Study					
7						
8	Final Report					
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 2 of 2.

CENTER MSFC
RESPONSIBILITY S&E-AERO-YS
APPROVAL William W. Vaughan
ACCOMPLISHMENT R. E. Smith

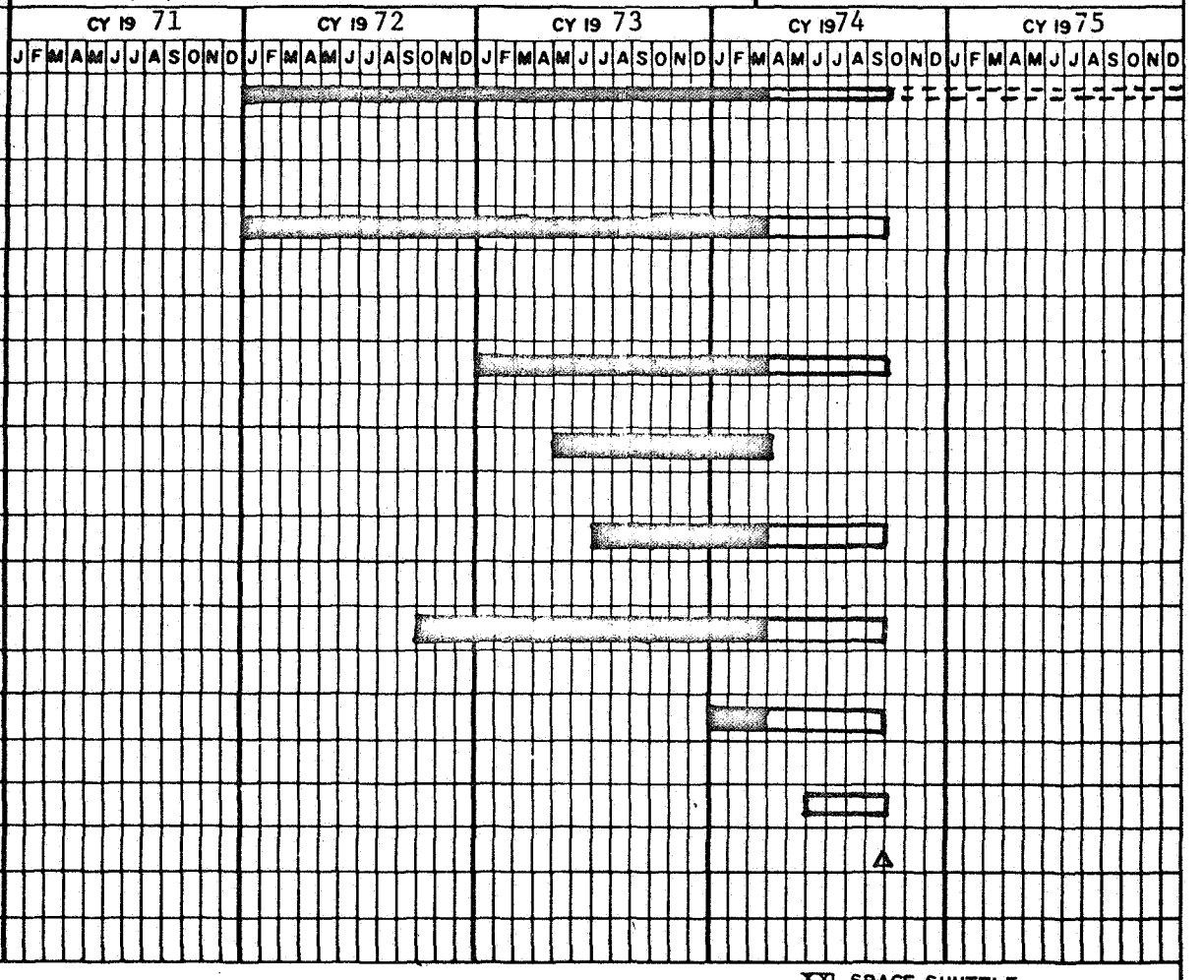
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Environmental Quality
RTOP NO. 909-55-47 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Three-Dimensional Atmospheric Model
2	Gas Surface Interaction Model
3	Speed Ratio Effect
4	Shape Effect
5	Falling Sphere Data
6	Lift and Drag Effect
7	Preliminary Model
8	Model Verification Reports



NOTES

[XX] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

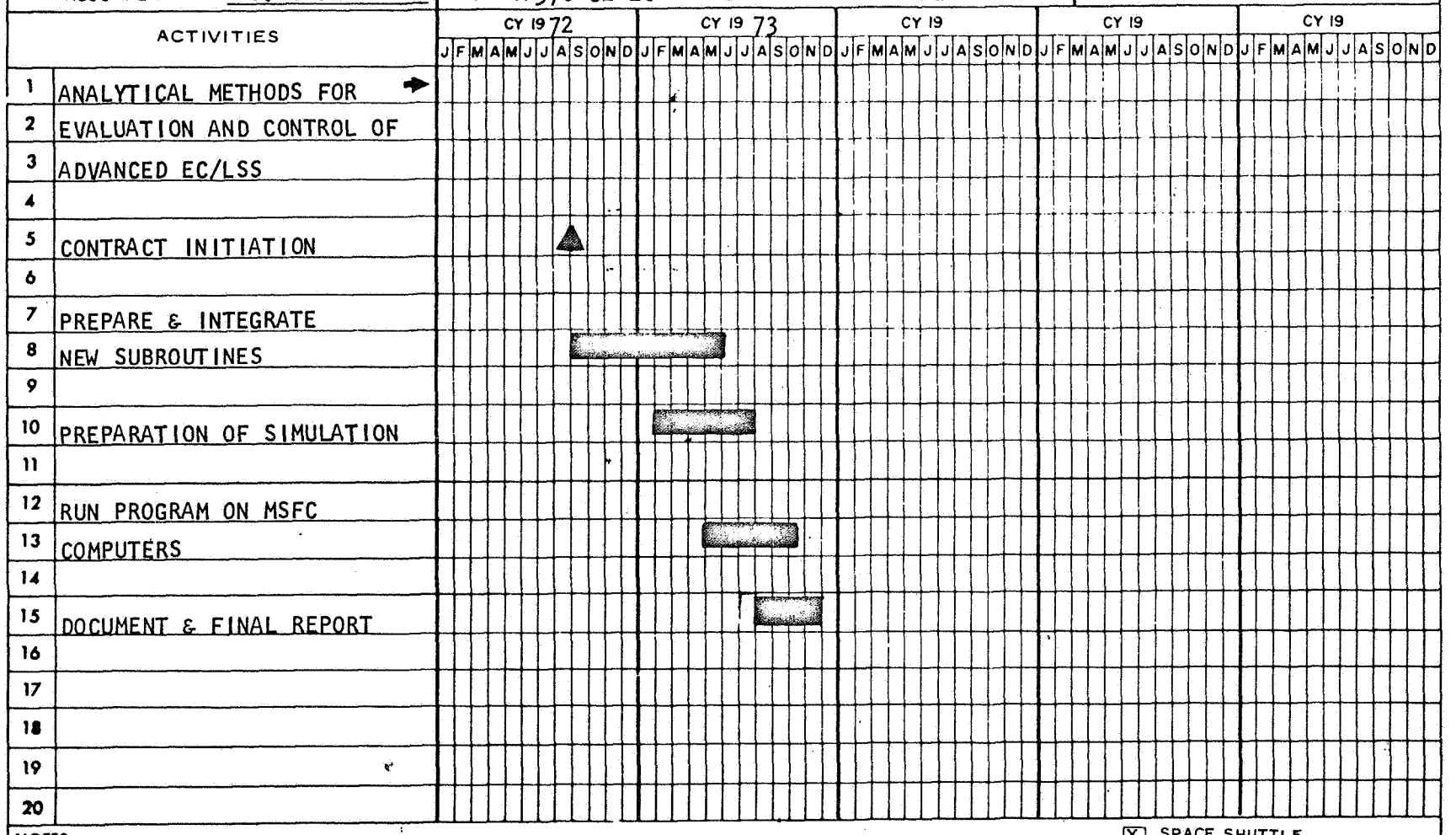
CENTER MSFC
RESPONSIBILITY S&E-ASTN-P
APPROVAL G. D. Hopson
ACCOMPLISHMENT S. Clonts

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Food, Atmosphere, Water and Waste Management
RTOP NO. 970-62-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)



NOTES

WORK COMPLETED

WORK TO BE COMPLETED

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-P
APPROVAL G. D. Hopson
ACCOMPLISHMENT J. L. Moses

MILESTONE SCHEDULE

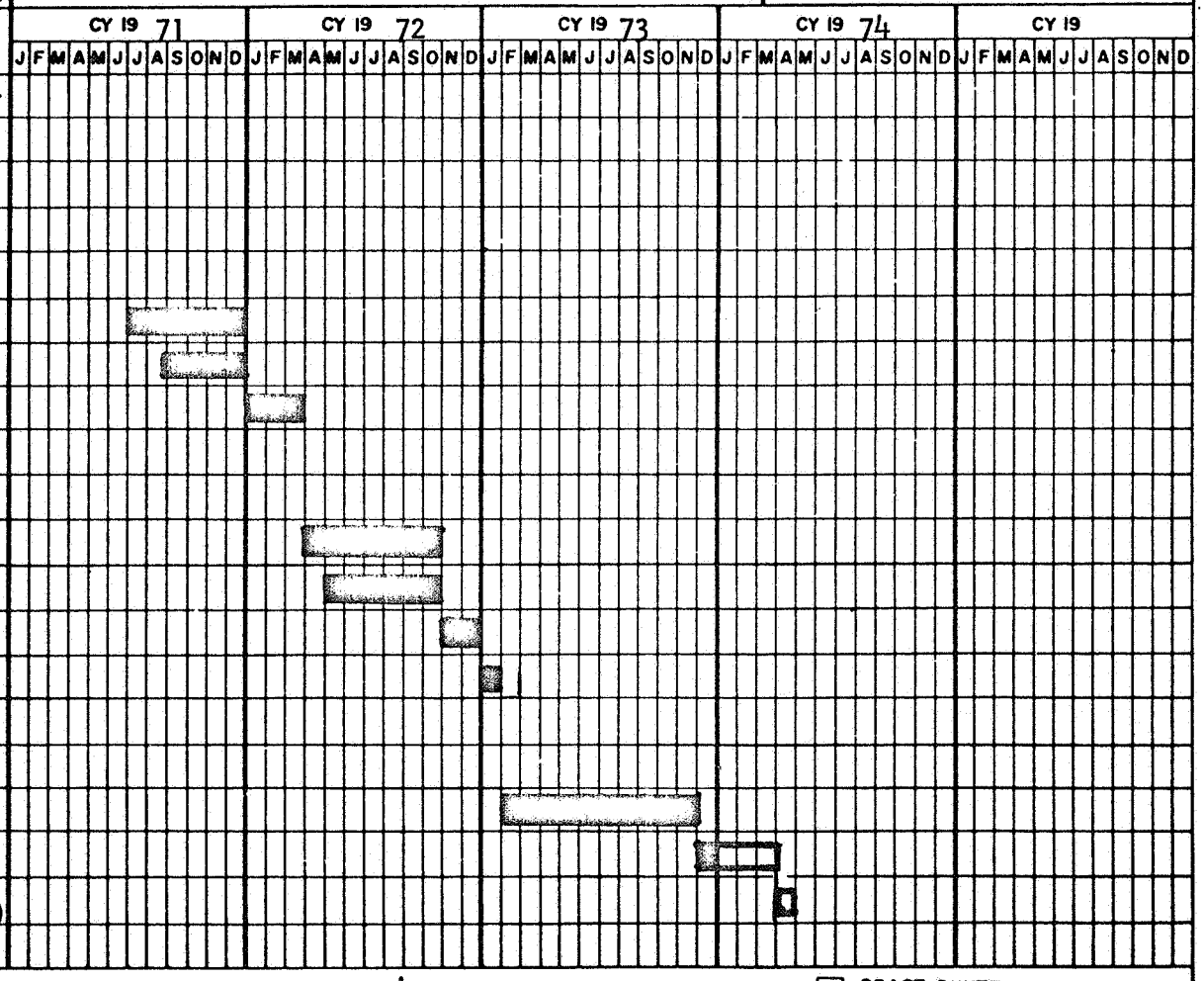
RTOP TITLE Water & Waste Management

4 LEVEL

RTOP NO. 970-62-23 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	VACUUM DISTILLATION/
2	VAPOR FILTRATION (VD/VF)
3	WATER RECOVERY SYSTEM
4	
5	PHASE I - DESIGN & BUILD
6	EVAPORATOR/CATALYST
7	- BENCH TESTS
8	- SUBSYSTEM TESTS
9	
10	PHASE II - DESIGN & BUILD
11	VAPOR CONDENSER/SEPARATOR
12	- BENCH TESTS
13	- SUBSYSTEM TESTS
14	COMBINED SYSTEM TESTS
15	
16	PHASE III - DESIGN MODS
17	FOR LOW GRAVITY TESTING
18	- PREPARE FOR FLIGHT
19	- FLIGHT TEST (CANCELLED)
20	



NOTES

WORK COMPLETED
WORK TO BE COMPLETED

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-P
APPROVAL G. D. Hopson
ACCOMPLISHMENT D. C. Clark

MILESTONE SCHEDULE

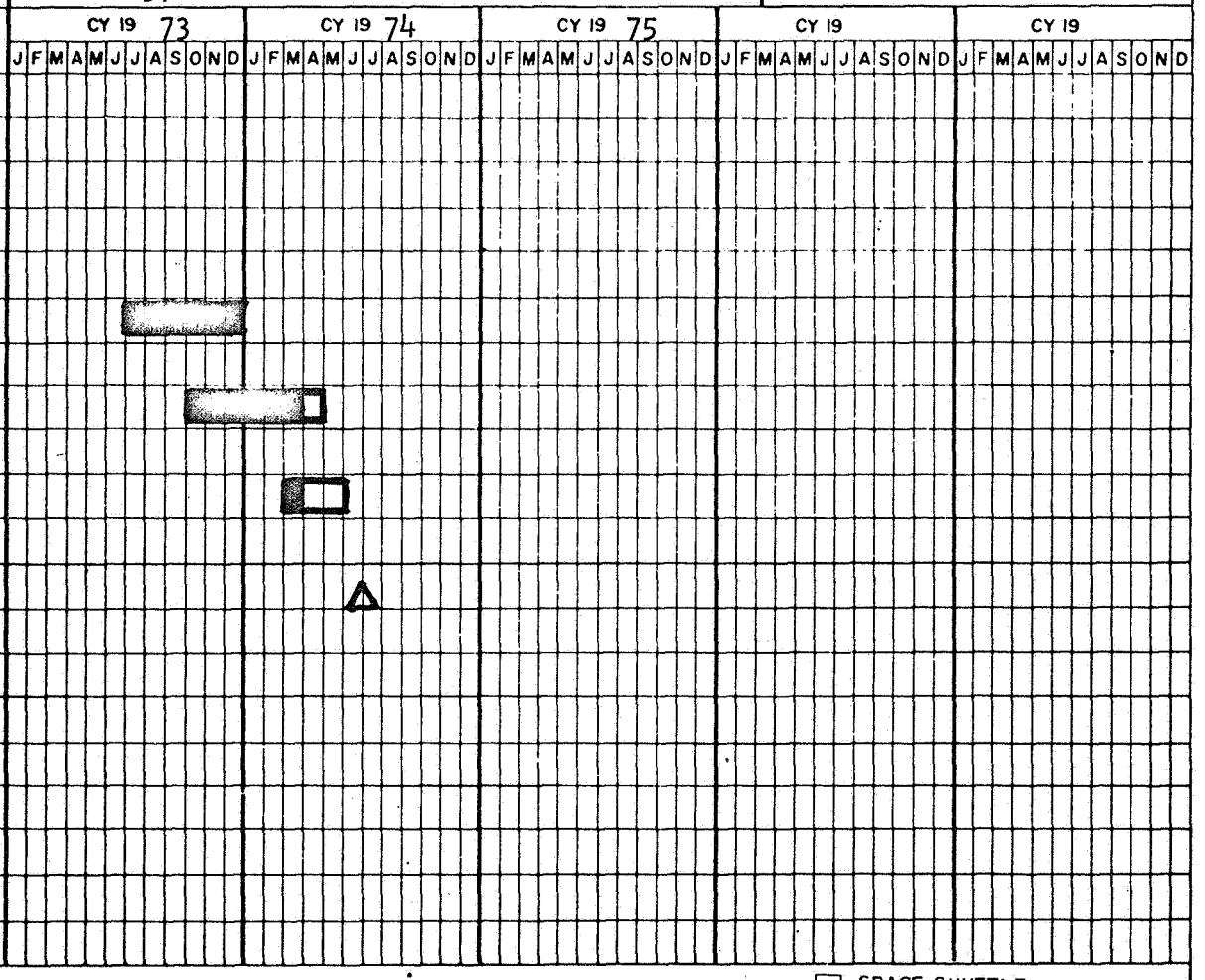
RTOP TITLE CVT EC/LSS Support Program

4 LEVEL

RTOP NO. 970-62-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	STUDY/INTEGRATION OF THE
2	BOSCH CO_2 CONCENTRATOR WITH
3	THE HYDROGEN DEPOLARIZED
4	CELL CO_2 CONCENTRATOR
5	
6	ANALYTICAL EVALUATION
7	
8	COMPUTER MODELING
9	
10	TEST AND EVALUATION
11	
12	FINAL REPORT
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

WORK COMPLETED

WORK TO BE COMPLETED

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

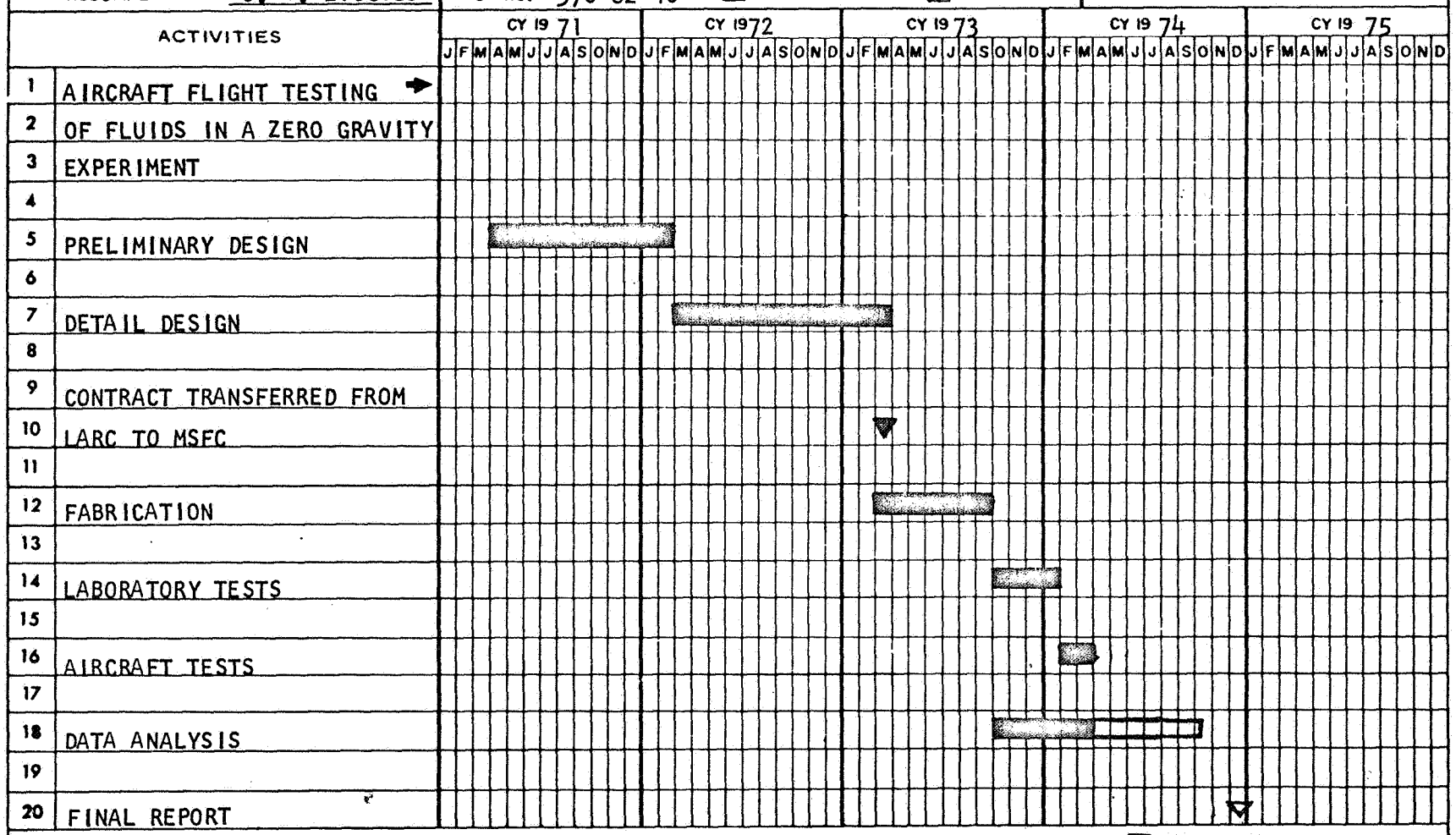
CENTER MSFC
RESPONSIBILITY S&E-ASTN-P
APPROVAL G. D. Hopson
ACCOMPLISHMENT J. W. Littles

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE CVT EC/LSS Support Program
RTOP NO. 970-62-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 JWL (Date) (Initials)



NOTES

WORK COMPLETED
WORK TO BE COMPLETED

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Sortie Lab PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PL
APPROVAL G. D. Hopson
ACCOMPLISHMENT J. L. Moses

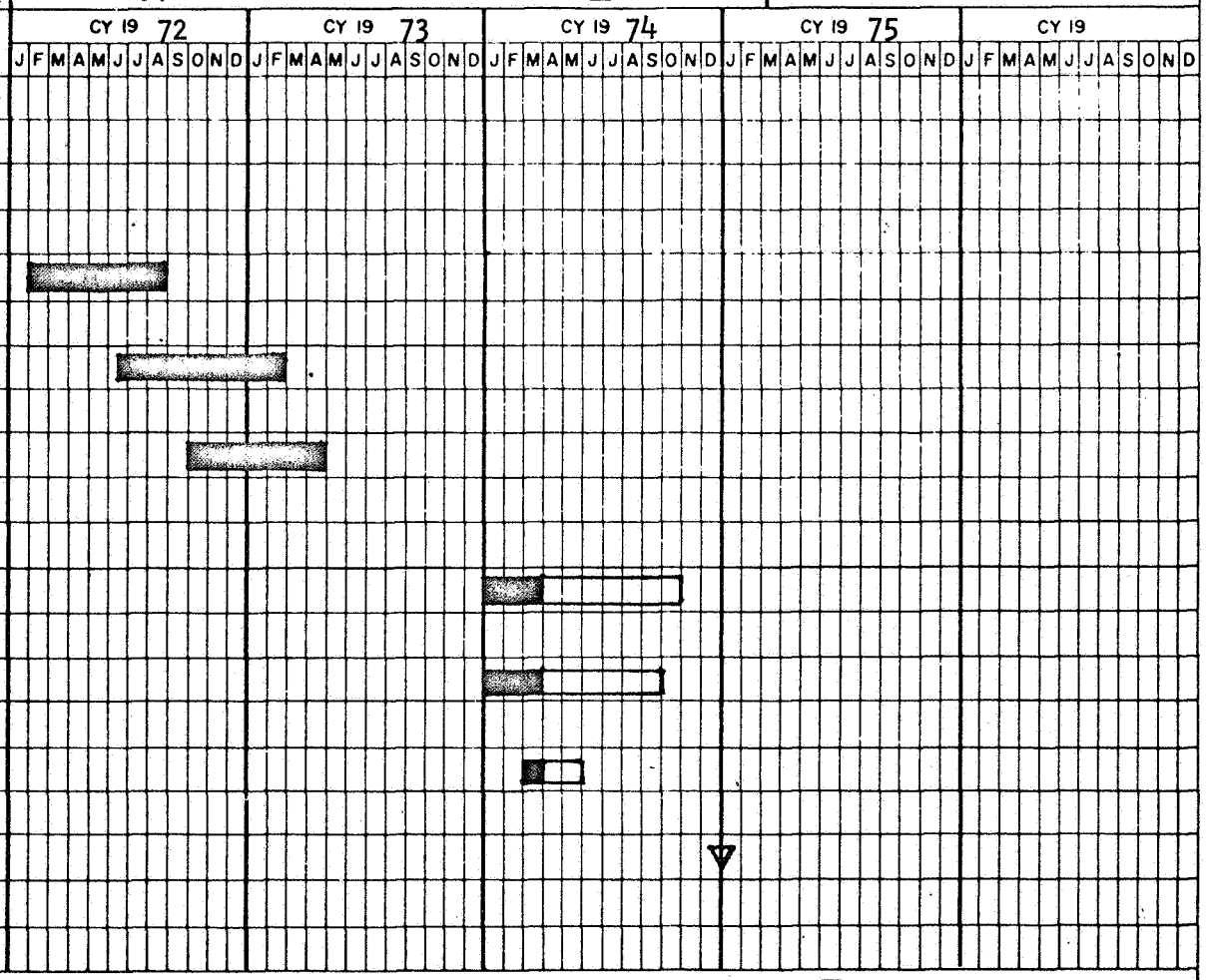
MILESTONE SCHEDULE

RTOP TITLE CVT EC/LSS Support Program

4 LEVEL

RTOP NO. 970-62-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)



NOTES
WORK COMPLETED
WORK TO BE COMPLETED

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PL
APPROVAL G. D. Hopson
ACCOMPLISHMENT R.L. Middleton

MILESTONE SCHEDULE

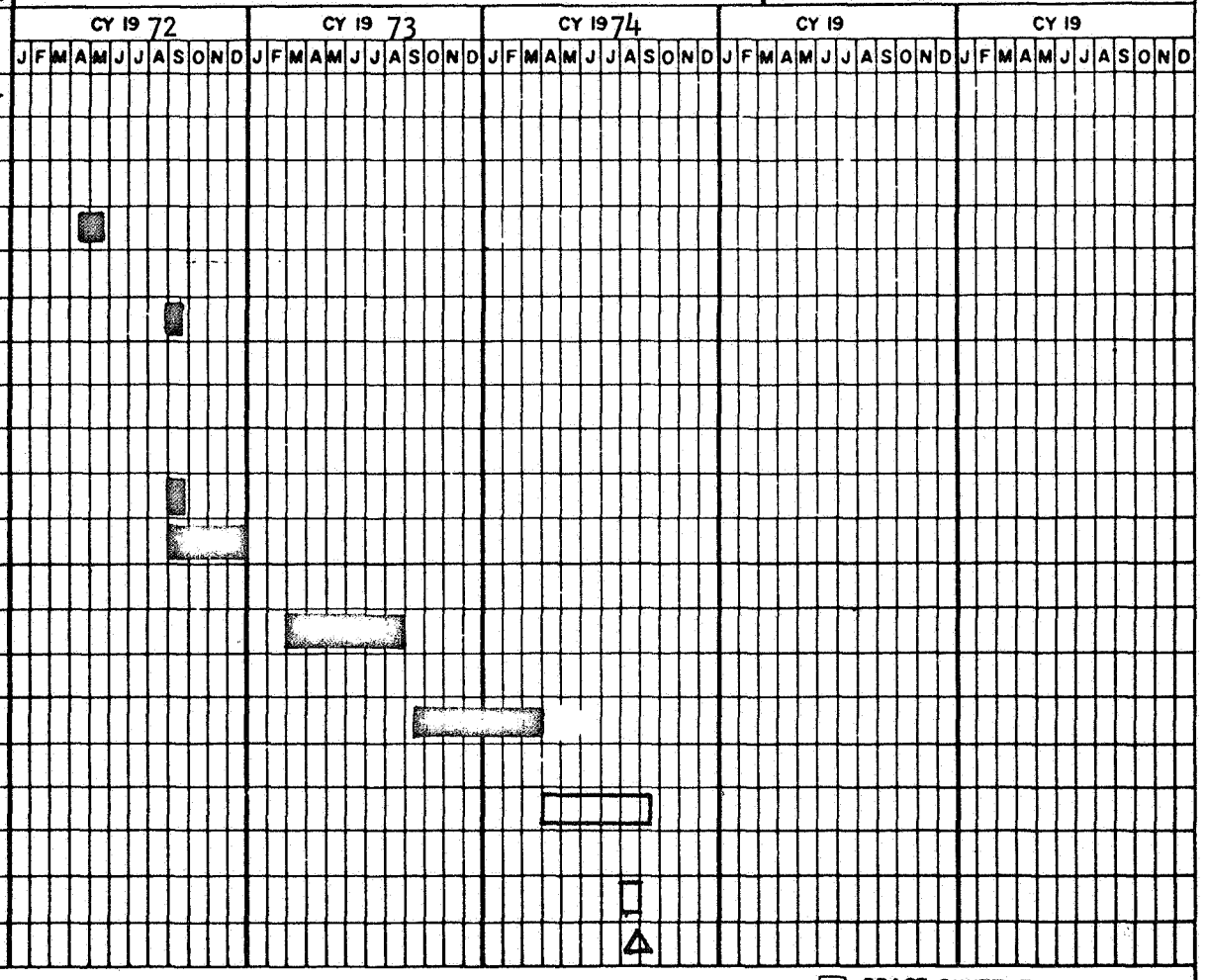
RTOP TITLE CVT EC/LSS Support Program

4 LEVEL

RTOP NO. 970-62-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL (Date)
LAST SCHED. CHANGE (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	RADIOISOTOPE WATER AND
2	WASTE MANAGEMENT SYSTEM
3	
4	FIRST 10 DAY TEST
5	
6	SECOND 10 DAY TEST
7	
8	SYSTEM REFURBISHMENT
9	
10	REPLACE PYROLYSIS TUBE
11	MODIFY SOLIDS PUMP
12	
13	RUN 180 DAY TEST
14	
15	SYSTEM MODIFICATION
16	
17	NO OVERBOARD VENT MODS
18	
19	CHECKOUT TEST
20	FINAL REPORT



NOTES
WORK COMPLETED
WORK TO BE COMPLETED

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-EM
APPROVAL G. A. Kroll
ACCOMPLISHMENT W. Langston

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE CVT EC/LSS Support Program

RTOP NO. 970-62-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1973	CY 1974	CY 1975	CY 19	CY 19
1	Fail Anticipator					
2	Method Study & Testing					
3	Design					
4	MFG					
5	Test					
6	Report					
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-EM
APPROVAL G. A. Kroll
ACCOMPLISHMENT B. Elkins

MILESTONE SCHEDULE

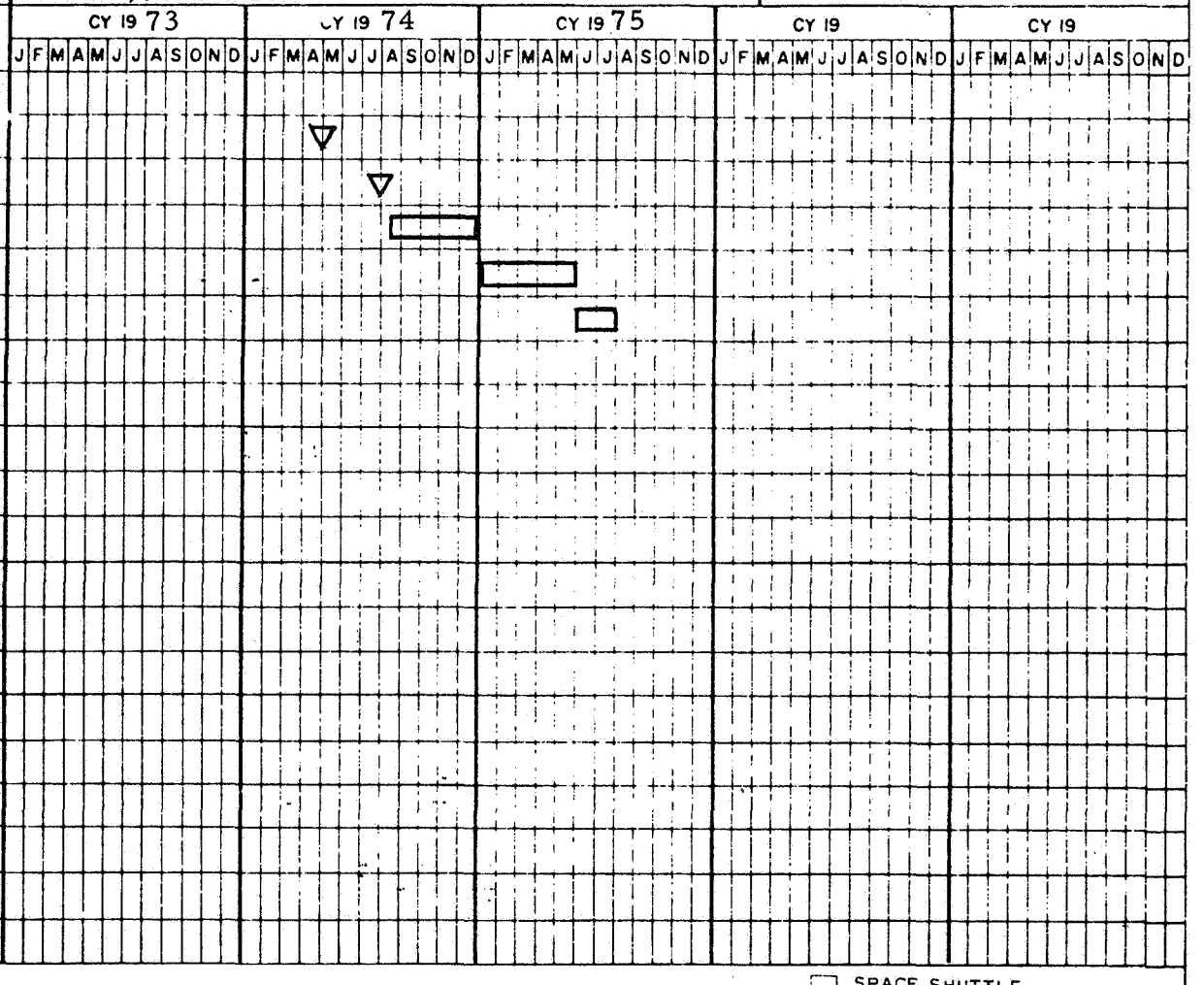
RTOP TITLE CVT EC/LSS Support Program

4 LEVEL

RTOP NO. 970-62-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Temp. Control Valve
2	Release RFQ
3	Contract Award
4	Valve Design & Dev.
5	Qualification Testing
6	Final Report
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-P
APPROVAL G. D. Hopson
ACCOMPLISHMENT D. C. Clark

MILESTONE SCHEDULE

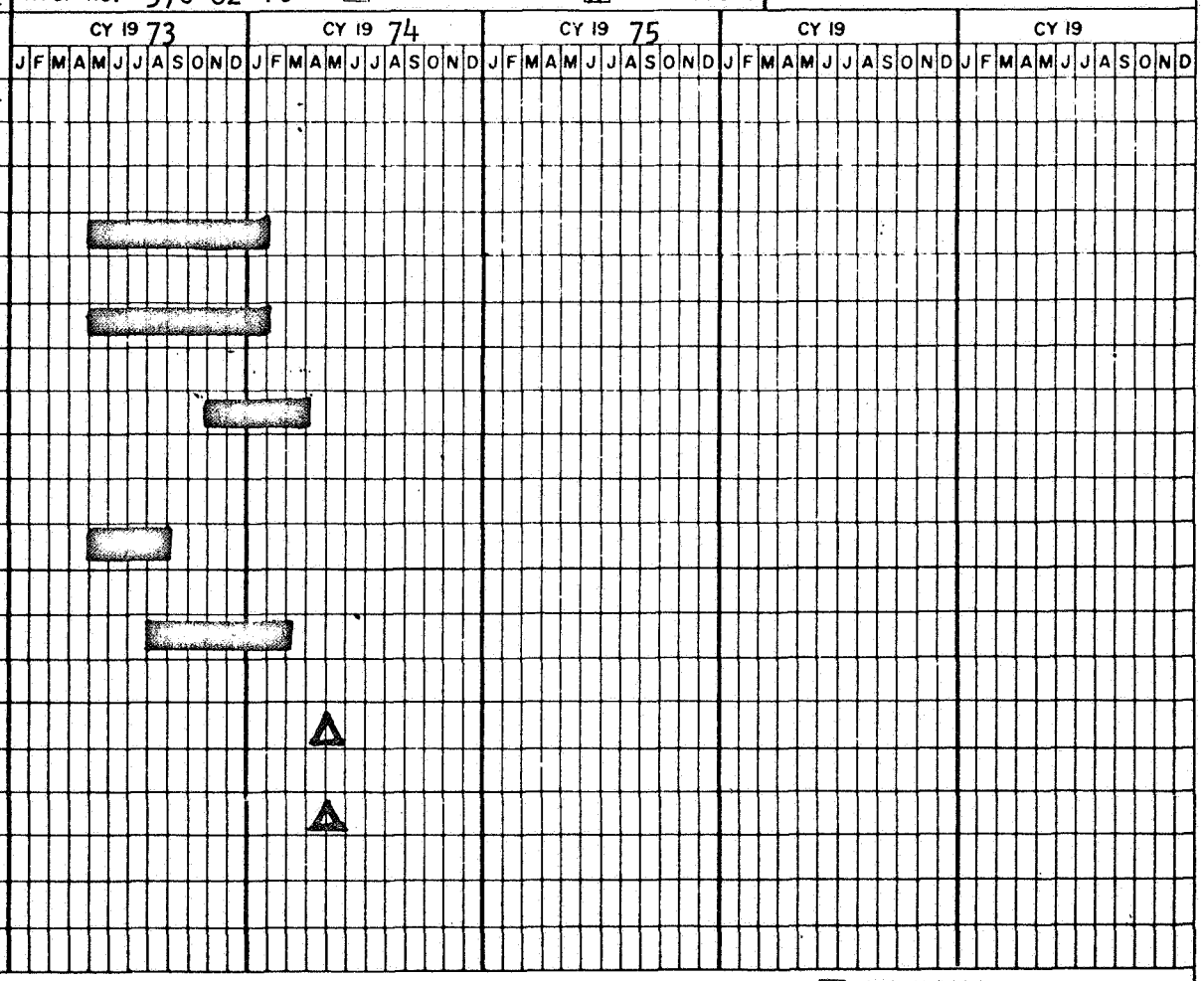
RTOP TITLE CVT EC/LSS Support Program

4 LEVEL

RTOP NO. 970-62-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 Dcc (Date) (Initials)

	ACTIVITIES
1	DEVELOPMENT OF BOSCH CO_2
2	REDUCTION SYSTEM
3	
4	ENGINEERING OPTIMIZATION
5	
6	MATERIALS EVALUATION
7	
8	COMPRESSOR, MOTOR, CONTROLS
9	STUDY
10	
11	CARBON UTILIZATION
12	
13	BOSCH/HDC INTEGRATION
14	
15	FINAL REPORT
16	
17	UNIT DELIVERY
18	
19	
20	



NOTES

WORK COMPLETED
WORK TO BE COMPLETED

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-SM
APPROVAL T. P. Isbell
ACCOMPLISHMENT H. Watters

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE REQUIREMENT FOR WORK PERFORMANCE DESIGN

RTOP NO. 970-63-10 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	Dev. Universal Stowage Module (USM)					
2	Concept Selection Review					
3	Final Design Review					
4	Delivery of USM					
5	Final Report Submittal					
6						
7						
8	Design Criteria for Payload					
9	Workstation Accommodation					
10	(123K Contracted Effort)					
11	Contract Initiation (EST)					
12	Completion					
13						
14						
15						
16						
17						
18						
19						
20						

NOTES
Completed Work
Planned Work, Committed but not Completed
Completed Milestone
Scheduled Milestone

[X] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-SM
APPROVAL T. P. Isbell
ACCOMPLISHMENT J. Stokes

MILESTONE SCHEDULE

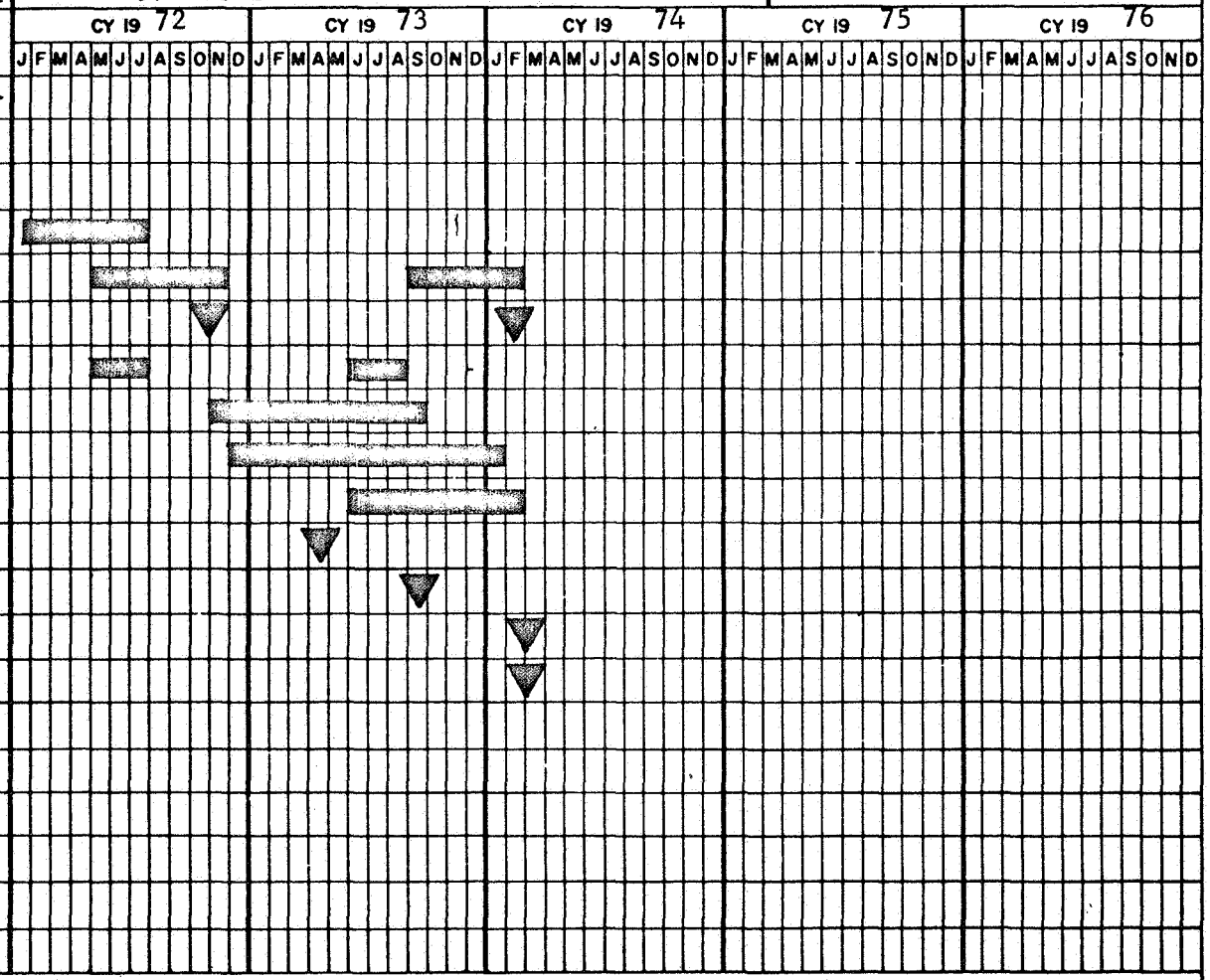
5 LEVEL

RTOP TITLE REQUIREMENTS FOR WORK PERFORMANCE DESIGN

RTOP NO. 970-63-10 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	BioEngineering Test
2	Administrator (BETA)
3	
4	Identification of Hdwre
5	Assembly of BETA
6	Delivery of BETA
7	Design of Checkout Tests
8	Testing with Simulators
9	Evaluation of Results
10	Data Management Development
11	PCS Integrated Test
12	BETA Test
13	Final Report Delivery
14	Control Completion
15	
16	
17	
18	
19	
20	



NOTES
Completed Work:
Completed Milestones:

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[X] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-SM
APPROVAL T. P. Isbell
ACCOMPLISHMENT L. B. Gardner

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Requirements for Work Performance Design

RTOP NO. 970-63-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1972	CY 1973	CY 1974	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	Development of Experiment →					
2	Crew Station Design Criteria					
3	Phase I (Data Requirements)					
4						
5	Phase II (Data Collection)					
6	- Ground Data Collection					
7	- SL/2 Data Collection					
8	- Data Reduction					
9	- Data Analysis					
10	- Design Criteria					
11	Publication					
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES
Completed Work
Planned Work, Committed--But Not Completed
Completed Milestone ▲ Projected Milestones △

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-M
APPROVAL G. Barr
ACCOMPLISHMENT W. Thornton

MILESTONE SCHEDULE

RTOP TITLE Teleoperator Manipulation and Control

RTOP NO. 970-63-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

5 LEVEL

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES	CY 1972	CY 1973	CY 1974	CY 1975	CY 1976
1	Task 11. Development of Advanced Manipulators					
2						
3	Manipulator Sys. Eval.					
4	System Simulation					
5	Rancho Manipulator					
6	Ames Manipulator					
7	MSFC ESAM					
8	MSFC MMKA					
9	Term Kit Ass.					
10	Adv. End Effector					
11						
12	Man. Design & Control					
13	Feasibility Studies					
14	Design & Control Study					
15	Mod. Man. Kit Sys.					
16	Adv. Man. Sys.					
17	Config. & Des. Study					
18	Terminator Kit Ass.					
19	Design Criteria					
20						

NOTES 1. Preliminary
2. Final

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Payload PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-M
APPROVAL G. Barr
ACCOMPLISHMENT W. Thornton

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Teleoperator Manipulation and Control
RTOP NO. 970-63-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES	CY 1972	CY 1973	CY 1974	CY 1975	CY 1976
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	Task 11. Development of Advanced Manipulators (Continued)					
2						
3	Retrieval Mechanisms					
4	Dynamic Analysis					
5	Model Design & Dev.					
6	Evaluation					
7	Vehicle Control					
8	Dynamic Analysis					
9	Control Analysis					
10	Retrieval Simulation					
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Payload PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL F. S. Wojtalik
ACCOMPLISHMENT J.D. Johnston

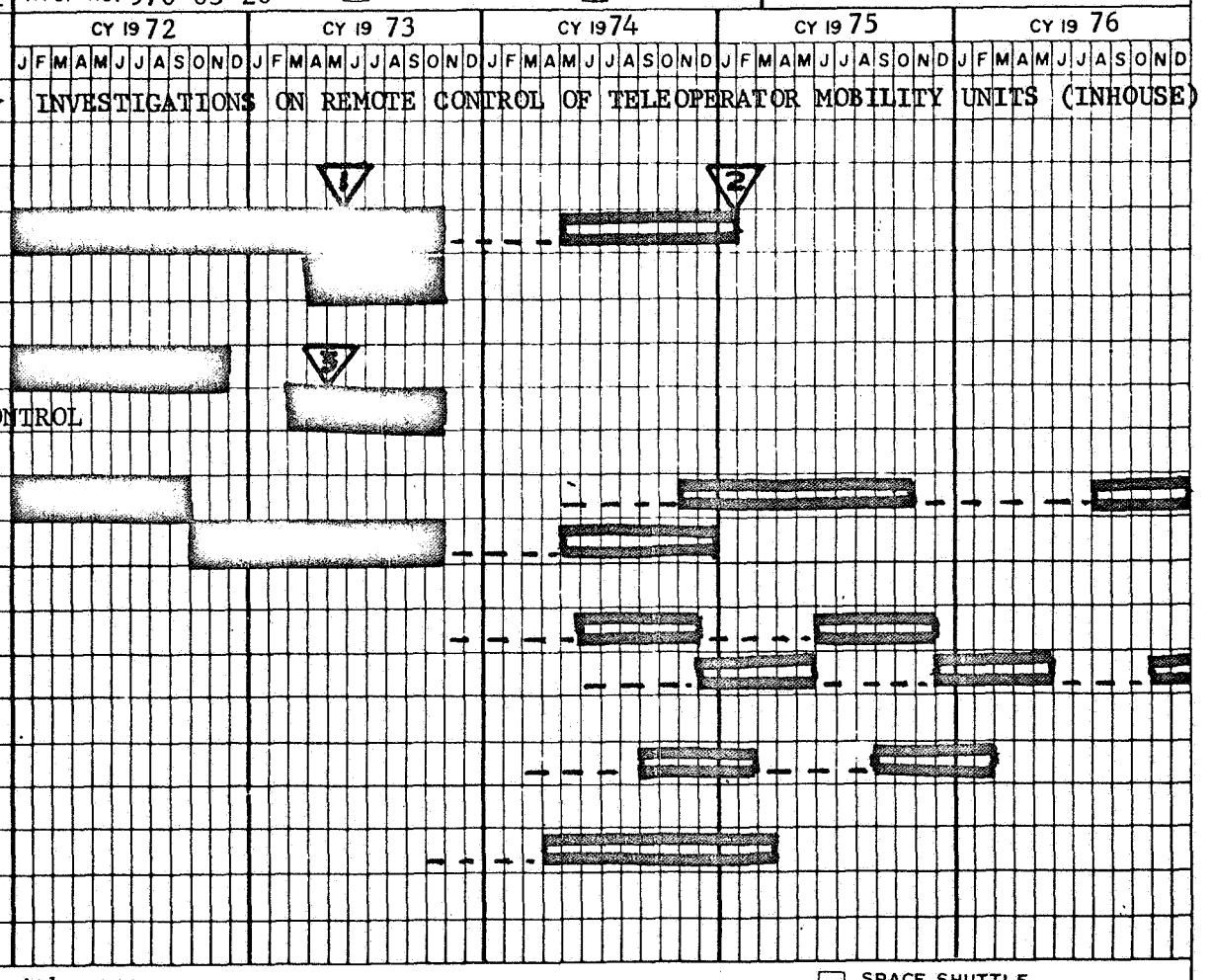
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE TELEOPERATOR MANIPULATION AND CONTROL

RTOP NO. 970-63-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03-74 JDJ (Date) (Initials)



NOTES
1. Basic MU operational with rate gyros.
2. Reaction wheels operational/updated visual system/radar/grapplers
3. MU operational on test bed

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

---------Estimated delay due to Center Management's decision to relocate Teleoperator Facility

5 YEAR

CENTER MSFC
RESPONSIBILITY
APPROVAL W. O. Frost
ACCOMPLISHMENT C. T. Huggins

MILESTONE SCHEDULE

RTOP TITLE Teleoperator Control and Manipulation

4 LEVEL

RTOP NO. 970-63-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1972	CY 1973	CY 1974	CY 1975	CY 1976
1	Task 30. Study and Development of a Teleoperator Viewing System					
2	Requirements Analysis					
3	Visual System Tests					
4	Static					
5	Motion					
6	Dynamic/Docking					
7	System Breadboard					
8	Conceptual Design					
9	Preliminary Design					
10	Develop/Assemble					
11	Integrated Dyn. Testing					
12	Design Criteria			1		2
13						
14	Engineering Prototype					
15	Design/Dev.					
16	Integrated Dynamic Opn.					
17	Advanced Concepts					
18	Image Enh. (Research)					
19	Pattern Recognition					
20	3D Displays					

NOTES
1. Preliminary
2. Final

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Payload PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-M
APPROVAL G. Barr
ACCOMPLISHMENT W. Thornton

MILESTONE SCHEDULE

RTOP TITLE Teleoperator Manipulation and Control

5 LEVEL

RTOP NO. 970-63-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES	CY 19 71	CY 19 72	CY 19 73	CY 19 74	CY 19 75
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK 40 RMS MAN-MACHINE INTEGRATION REQUIREMENTS					
2	OPEN LOOP VISUAL TESTS					
3	CLOSED LOOP TESTS					
4	MANIPULATOR TESTS					
5	VEHICLE MANEUVERING TESTS					
6	HUMAN FACTORS ANALYSES					
7	ACCELERATION TESTS					
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3456 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. O. Frost

ACCOMPLISHMENT C. T. Huggins

MILESTONE SCHEDULE

4 LEVEL

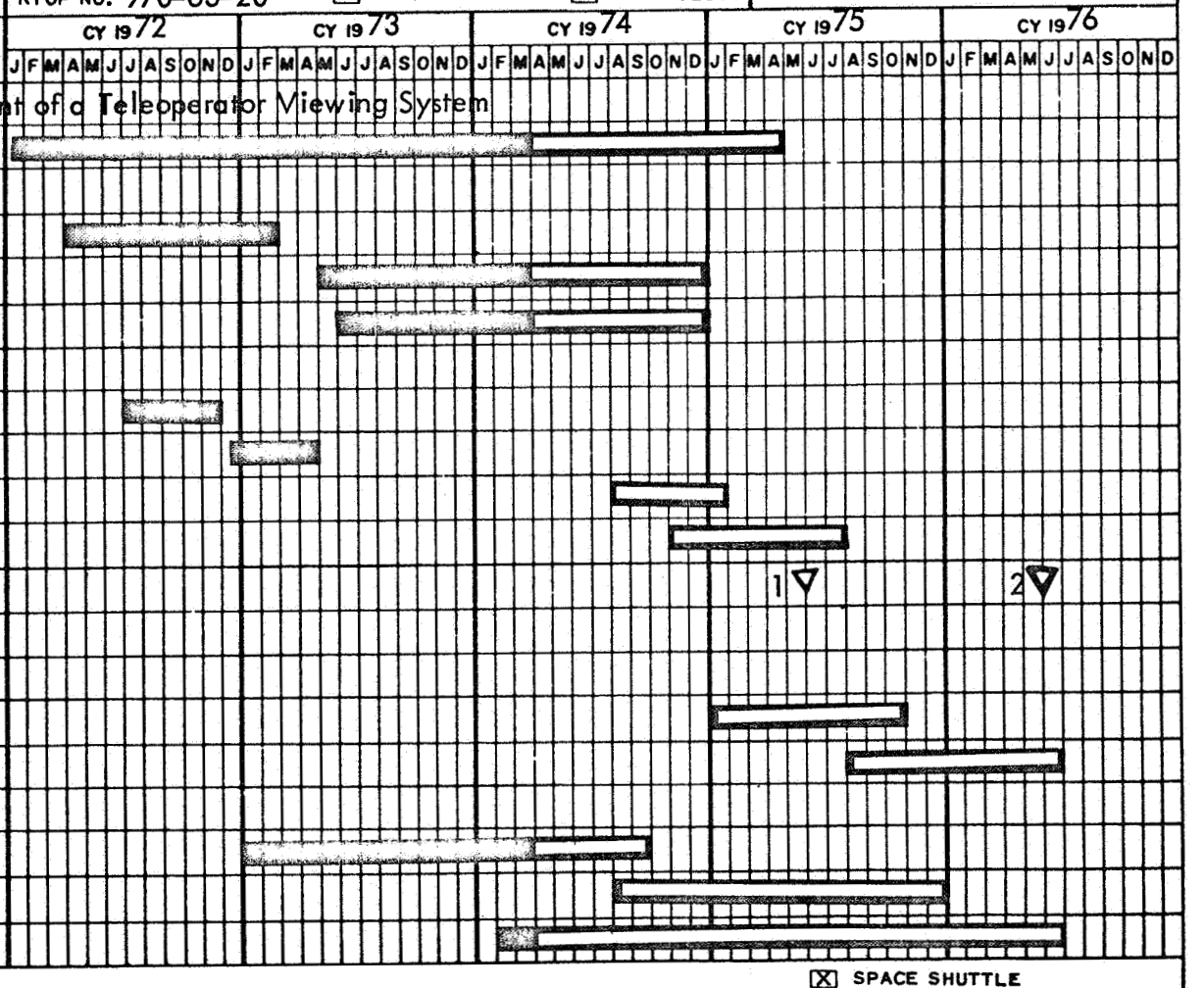
RTOP TITLE Teleoperator Control and Manipulation

RTOP NO. 970-63-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) _____ (Initials)

STATUS AS OF 31 03 74 (Date) _____ (Initials)



	ACTIVITIES
1	Task 30. Study and Development of a Teleoperator Viewing System
2	Requirements Analysis
3	Visual System Tests
4	Static
5	Motion
6	Dynamic/Docking
7	System Breadboard
8	Conceptual Design
9	Preliminary Design
10	Develop/Assemble
11	Integrated Dyn. Testing
12	Design Criteria
13	
14	Engineering Prototype
15	Design/Dev.
16	Integrated Dynamic Opn.
17	Advanced Concepts
18	Image Enh. (Research)
19	Pattern Recognition
20	3D Displays

NOTES
1. Preliminary
2. Final

☒ SPACE SHUTTLE
☒ SPACE STATION/BASE
☒ Payload PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-AU
APPROVAL W. K. Dahm
ACCOMPLISHMENT R. Walker

MILESTONE SCHEDULE

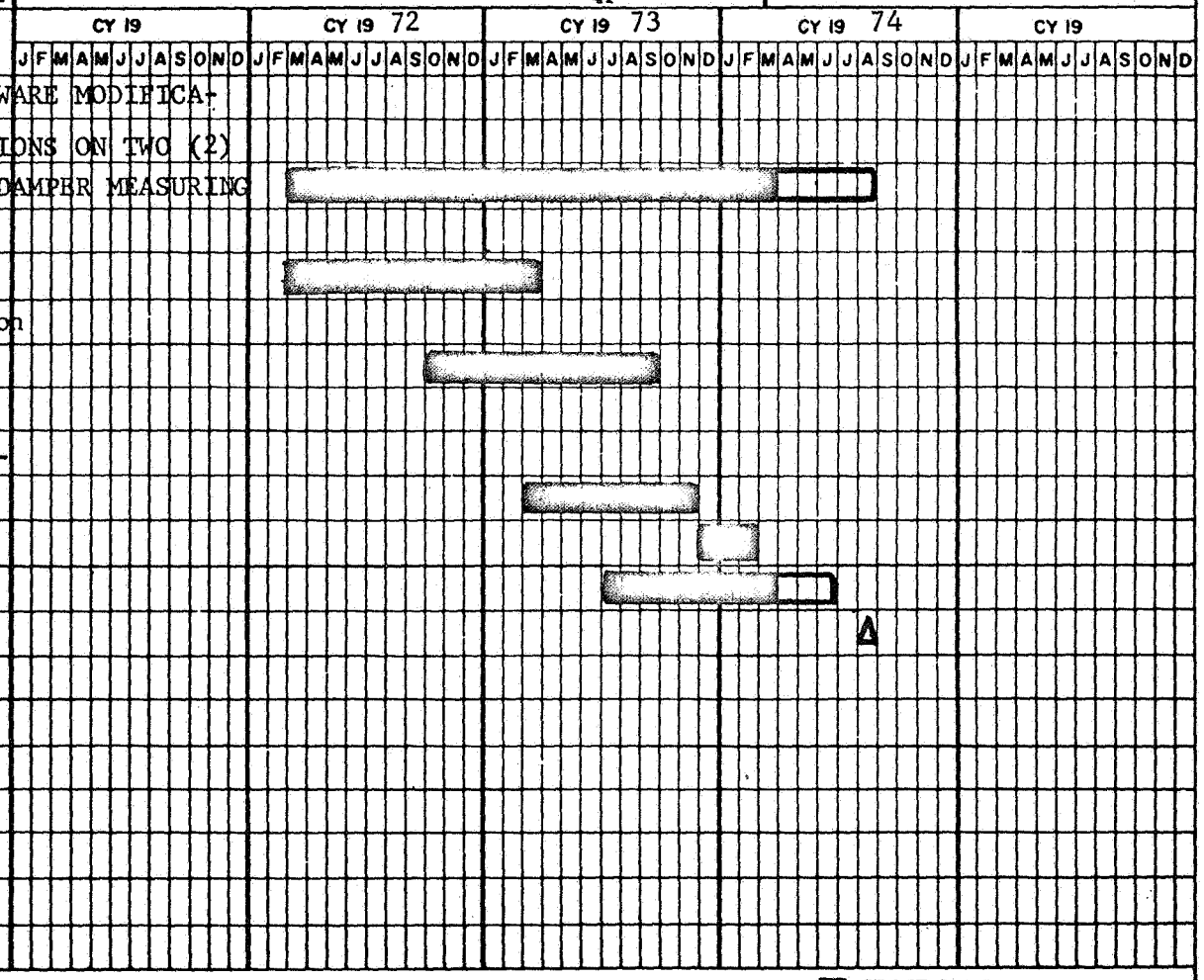
4 LEVEL

RTOP TITLE Aeroelasticity

RTOP NO. 972-30-00 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	PERFORM THE NECESSARY HARDWARE MODIFICA-
2	TIONS, CHECKOUT & CALIBRATIONS ON TWO (2)
3	EXISTING ELECTRO-MAGNETIC DAMPER MEASURING
4	SYSTEMS
5	Damper/Force Measuring
6	System Design Modification
7	Develop Data Reduction/
8	Analysis Methods
9	Model System Set-up/Check-
10	out
11	Model Dynamic Tests
12	Data Reduction/Analysis
13	Final Report
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Skylab PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

CENTER MSFC
RESPONSIBILITY S&E-AERO-AU
APPROVAL W. K. Dahm
ACCOMPLISHMENT R. G. Beranek

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Aeroelasticity

RTOP NO. 972-50-00 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 71	CY 19 72	CY 19 73	CY 19 74	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	DATA REDUCTION OF THE SATURN					
2	IB/LC-39 WIND TUNNEL TEST					
3	DATA					
4	Prepare for Wind Tunnel					
5	Test					
6	Wind Tunnel Test					
7	First Mode Lower Level Resp.					
8	First Mode Upper Level Resp.					
9	Second Mode Resp. Analys.					
10	Damping Analysis					
11	Acceleration Data Analys.					
12	Final Report					
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Skylab PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-YS
APPROVAL William W. Vaughan
ACCOMPLISHMENT R. E. Smith

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Zero-G atmospheric Cloud Physics Program

RTOP NO. 975-61- 05 ☒ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 (Date) 03 (Initials) 74

	ACTIVITIES	CY 19 73	CY 19 74	CY 19	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	Experimental Concepts →					
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Plasma Physics PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 2 of 2

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-I
APPROVAL O. T. Duggan
ACCOMPLISHMENT W. T. Powers

MILESTONE SCHEDULE

RTOP TITLE Spacecraft Surfaces

4 LEVEL

RTOP NO. 975-72-01 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) (initials)

	ACTIVITIES	CY 1970	CY 1971	CY 1972	CY 1973	CY 1974
1						
2	System Design					
3						
4	Development Units					
5						
6						
7						
8	Final Documentation					
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY
APPROVAL Hoyt M. Weathers
S&E-SSL-X
ACCOMPLISHMENT Hoyt M. Weathers

MILESTONE SCHEDULE

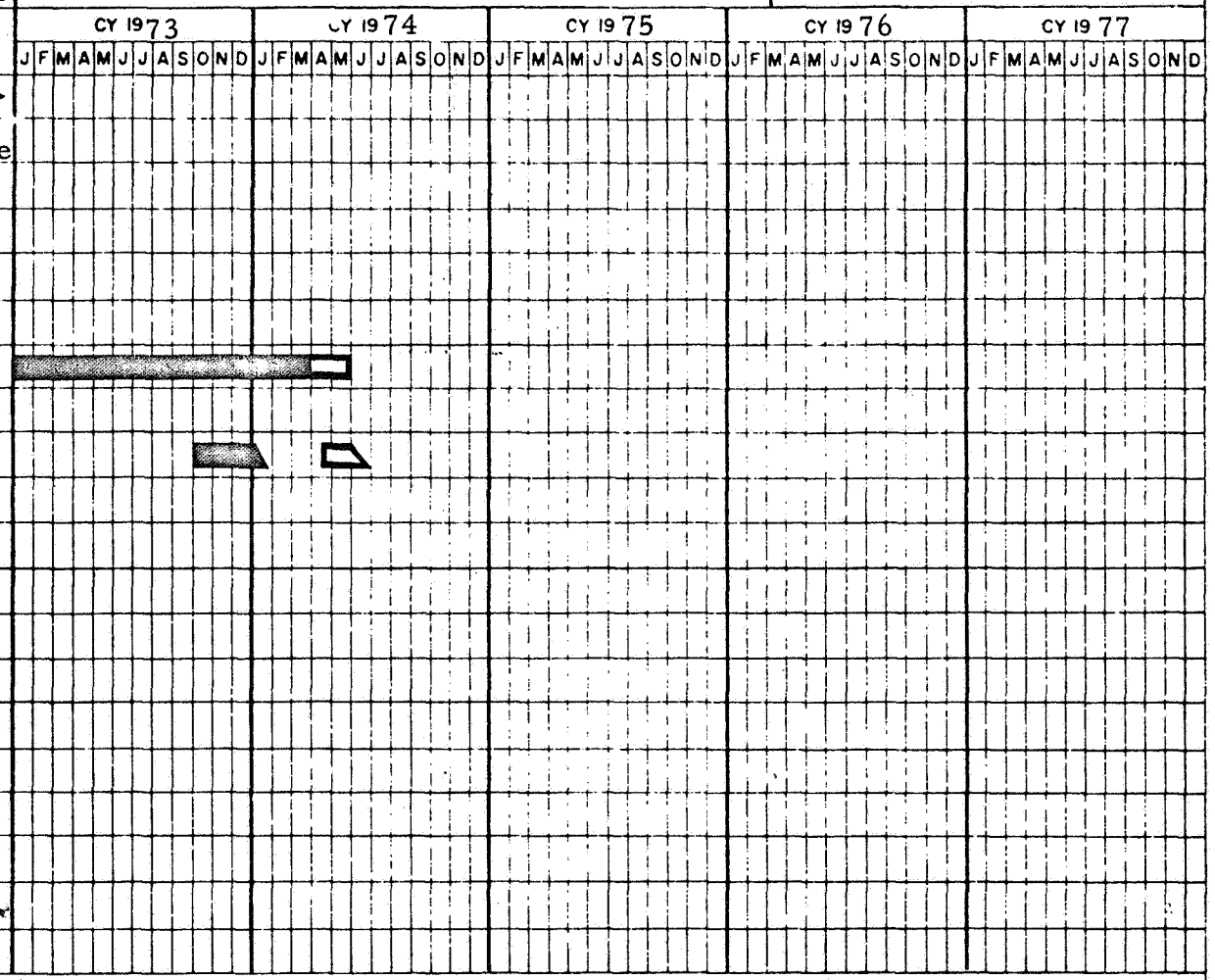
5 LEVEL

RTOP TITLE Optical Contamination

RTOP NO. 975-72-39 ☐ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED. APPROVAL 3-2-73 (Date)
LAST SCHED. CHANGE 9-30-73
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Definition of the separate
2	sensors which comprise the
3	Integrated Real Time
4	Contamination Monitor
5	(IRTCM) System
6	
7	Eval. of Lab Demo models
8	
9	Shuttle SRB Sim. Tests
10	using Lab Demo models
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION BASE
☒ Spacelab PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-AAS
APPROVAL H. R. Coldwater
ACCOMPLISHMENT J. E. Key

MILESTONE SCHEDULE

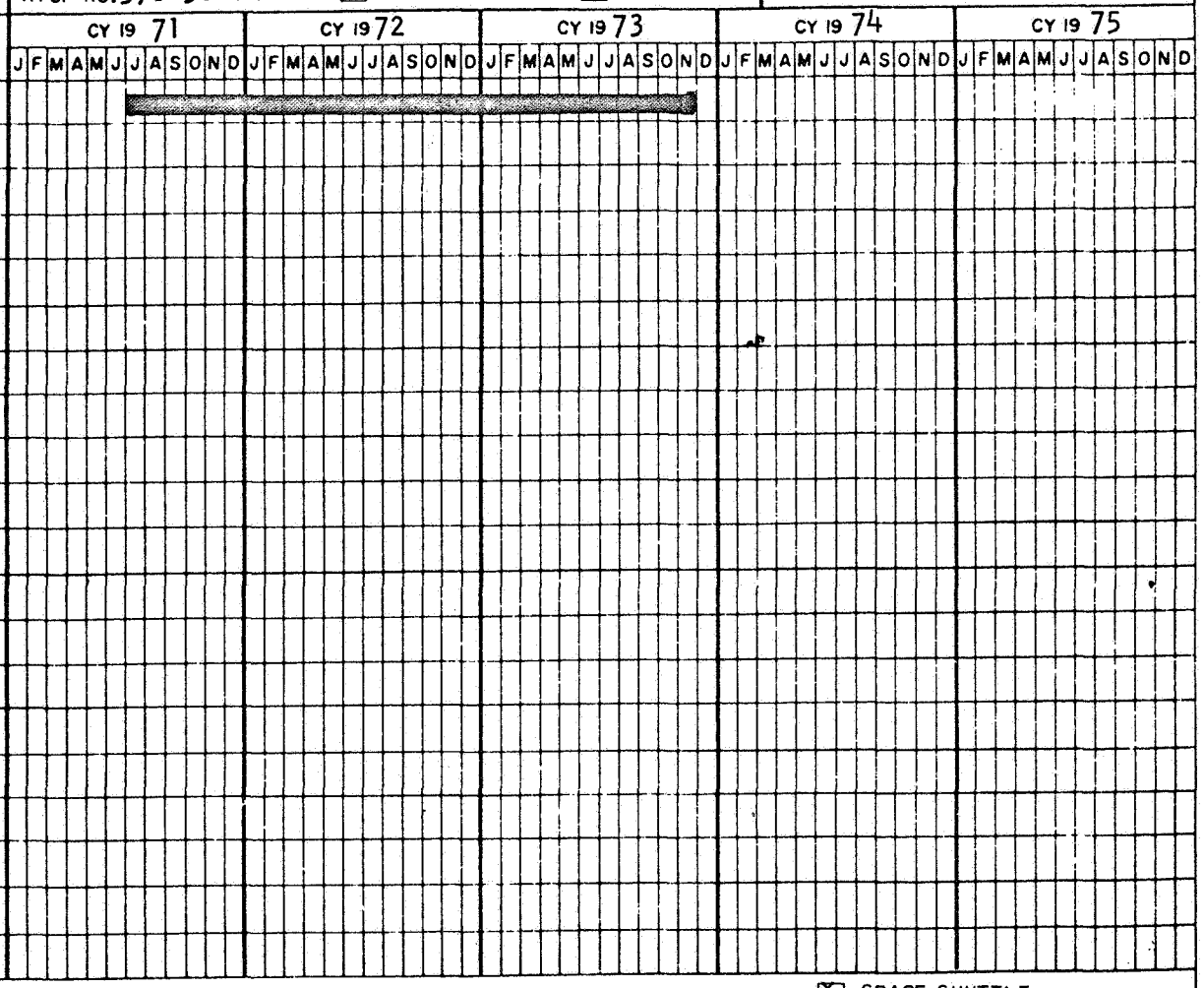
4 LEVEL

RTOP TITLE Thermal Control

RTOP NO. 976-30-02 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Structural Analysis of
2	Non-Metallic Thermal
3	Protection Systems
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PP
APPROVAL J. A. Lombardo
ACCOMPLISHMENT C. Miller

MILESTONE SCHEDULE

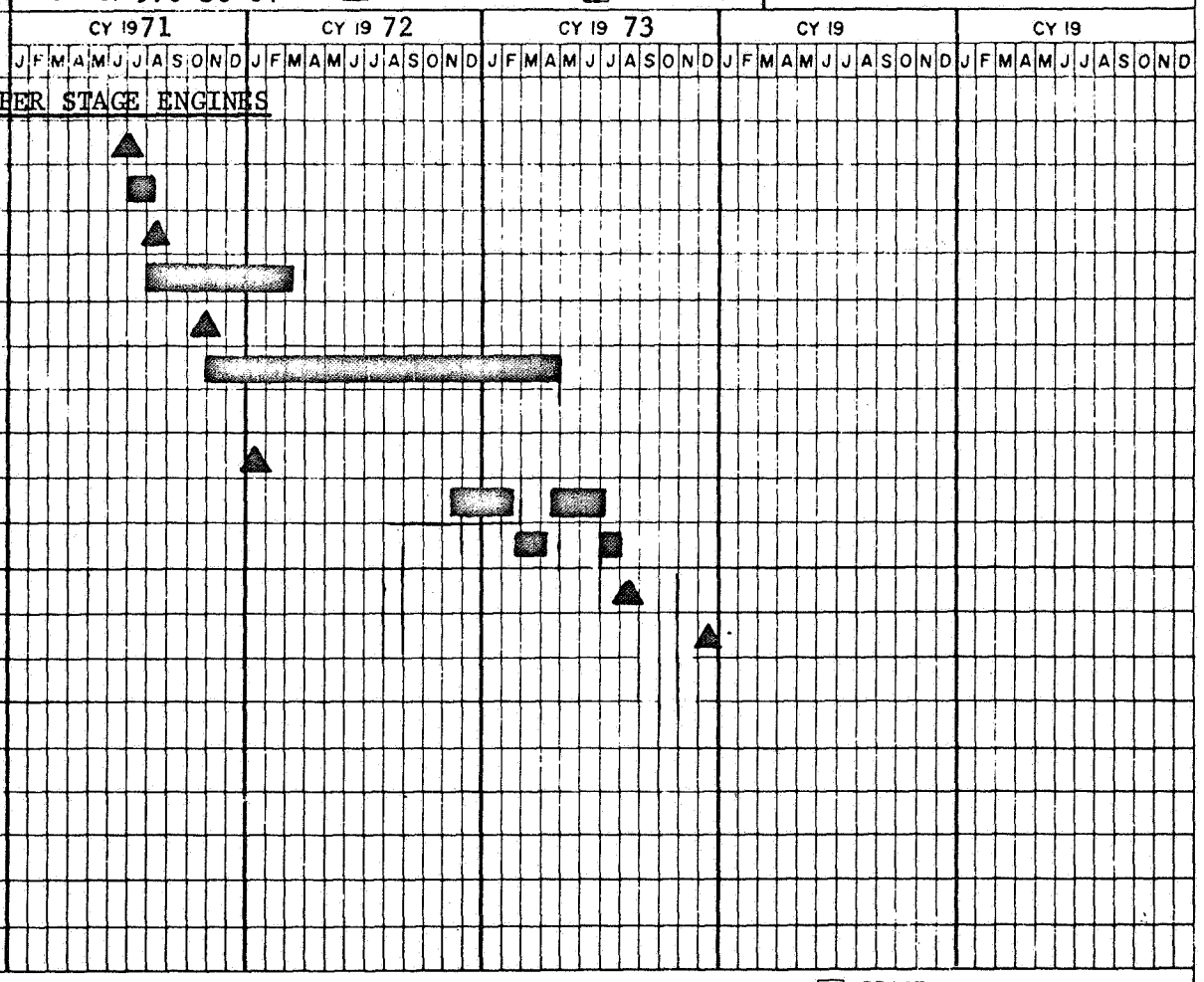
5 LEVEL

RTOP TITLE SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM (APS)

RTOP NO. 976-30-04 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TURBOPUMPS FOR CRYOGENIC UPPER STAGE ENGINES
2	CONTRACT START
3	PHASE I ANALYSIS
4	PHASE I REVIEW
5	PHASE II DESIGN
6	PHASE II REVIEW
7	PHASE III FABRICATION
8	TEST PLAN & FACILITIES
9	REVIEW
10	PHASE IV TESTING
11	PHASE V REFURBISHMENT
12	DELIVERY OF HARDWARE
13	FINAL REPORT
14	
15	
16	
17	
18	
19	
20	



NOTES

Completed
Planned

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ TUG PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-PE-MXS
APPROVAL Wilhelm Angele
ACCOMPLISHMENT R. L. Nichols

MILESTONE SCHEDULE

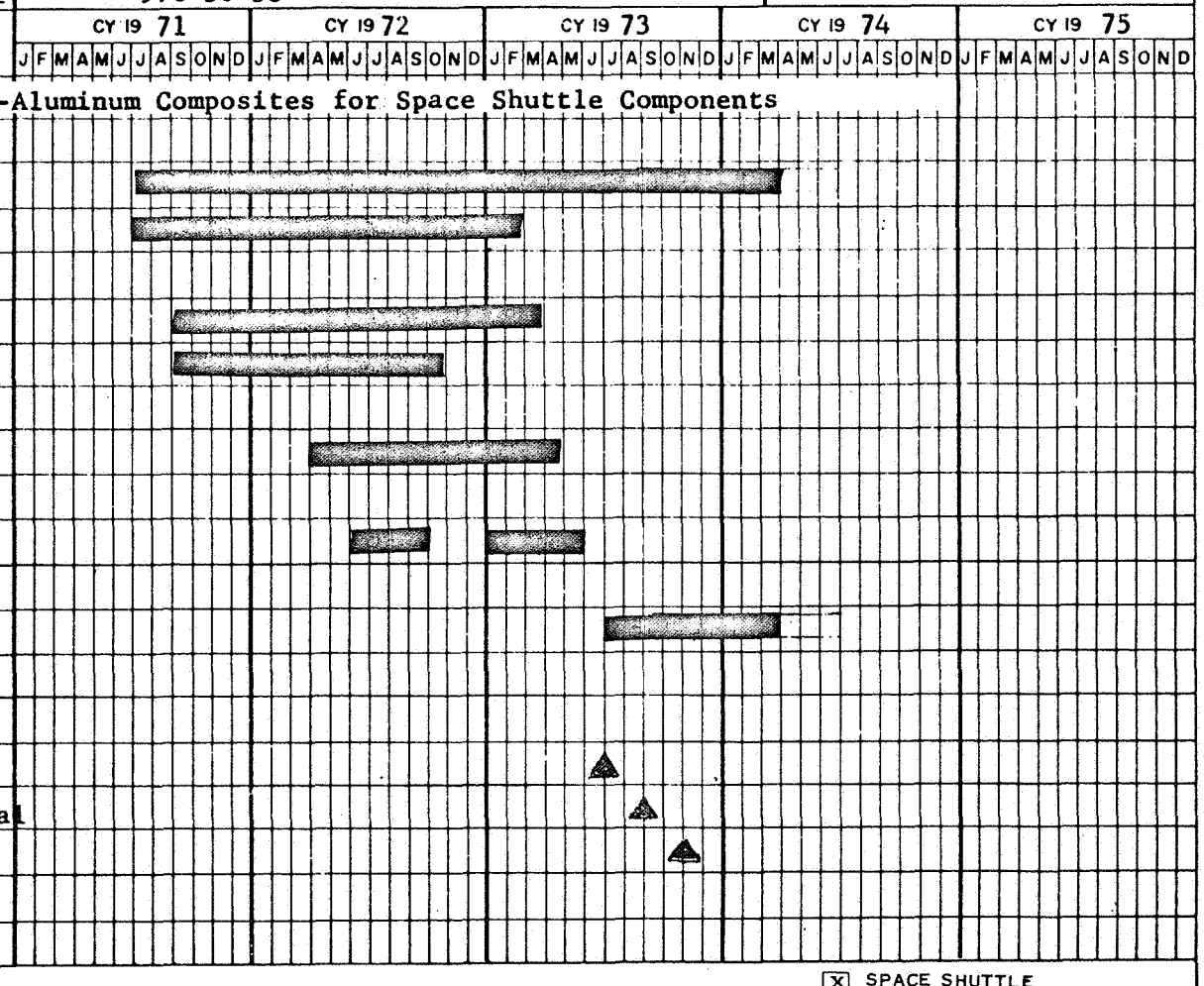
5 LEVEL

RTOP TITLE Materials

RTOP NO. 976-30-38 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Evaluation of Boron-Aluminum Composites for Space Shuttle Components
2	
3	Contract NAS8-27735
4	Phase I - Material
5	Evaluation
6	Phase II - Design Studies
7	Phase III - Process
8	Technology Development
9	Phase IV - Fabrication
10	and Assembly
11	Phase V - Test and
12	Evaluation
13	Phase VI - Analysis of
14	Structural Test of the
15	Boron-Aluminum Panel
16	Deliver Components
17	Final Report - For Approval
18	Final Report - Delivery
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL Robert S. Ryan

ACCOMPLISHMENT Larry Kiefling

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Aeroelasticity

RTOP NO. 976-30-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1971	CY 1972	CY 1973	CY 1974	CY 1975
1	LAUNCH VEHICLE DYNAMIC					
2	LOADS OPTIMIZATION					
3	FSD Program					
4	Dynamics Loads					
5	Feedback Parameter					
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

J F M A M J J A S O N D

NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-AAD
APPROVAL H. R. Coldwater
ACCOMPLISHMENT R. W. Schock

MILESTONE SCHEDULE

RTOP TITLE Aeroelasticity

4 LEVEL

RTOP NO. 976-30-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

ACTIVITIES	CY 19 70	CY 19 71	CY 19 72	CY 19 73	CY 19 74
	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1 Evaluation of Modal Analysis Techniques					
2 Flexible Body/Water Interaction During Water Impact					

NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-AU
APPROVAL W. K. Dahm
ACCOMPLISHMENT Jess H. Jones

MILESTONE SCHEDULE

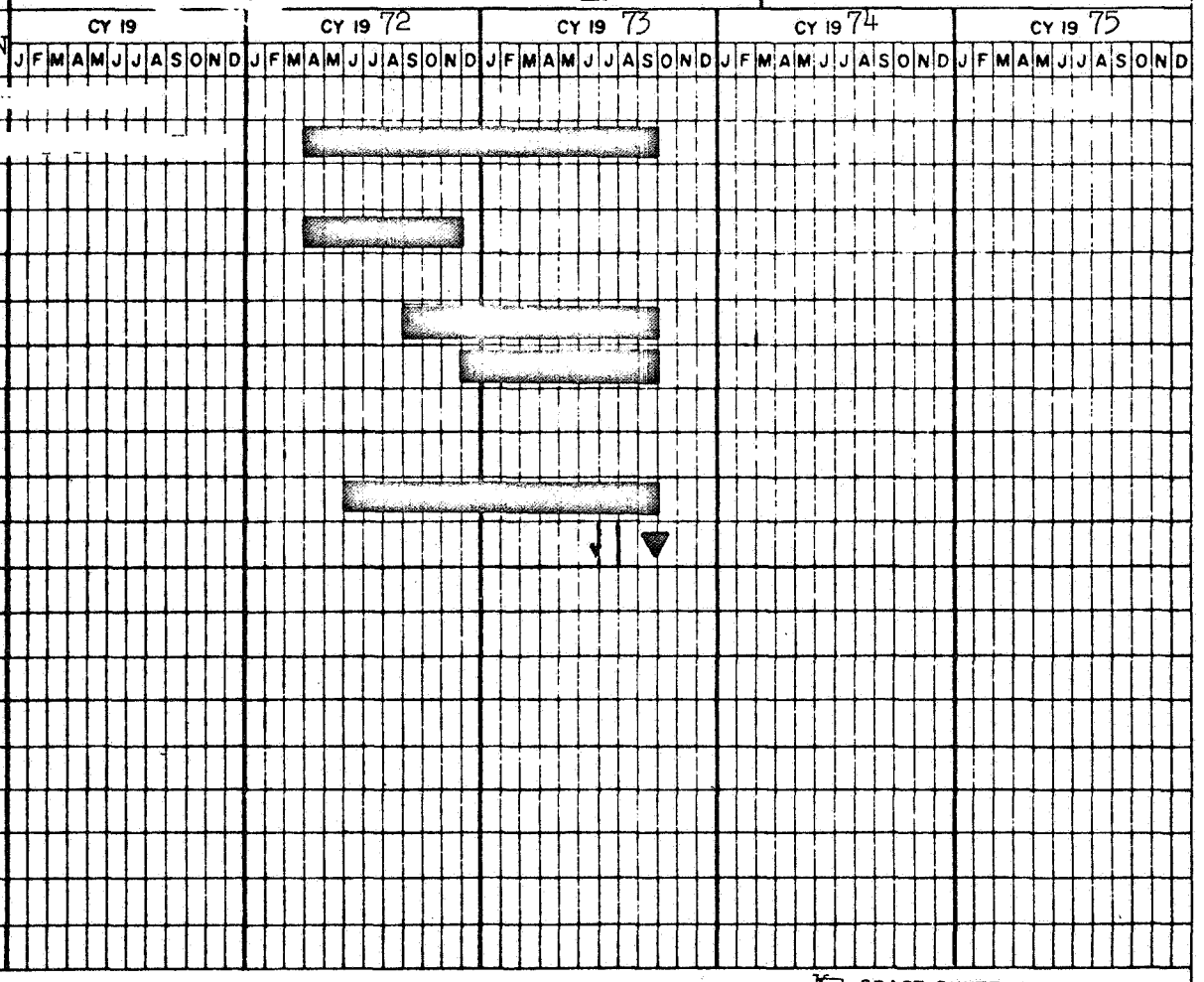
RTOP TITLE Aeroelasticity

4 LEVEL

RTOP NO. 976-30-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date)
STATUS AS OF 31 03 74 (Date) JHJ (Initials)

	ACTIVITIES	PREDICTION
1	Investigation of the Jet Noise Prediction Theory	
2	and Application Utilizing the PAO Formulation	
3	Refine Prediction	
4	Technique	
5	Evaluate Directivity	
6	Characteristics	
7	Evaluate Mach No. Effects	
8	Theoretical Analysis of	
9	Important Noise Radia-	
10	tion Effects	
11	Study Report	
12		
13		
14		
15		
16		
17		
18		
19		
20		



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-AU
APPROVAL W. K. Dahm
ACCOMPLISHMENT J.Jones/S.Guest

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Aeroelasticity
RTOP NO. 976-30- 40 [ ] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES	CY 19	CY 19 72	CY 19 73	CY 19 74	CY 19 75
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	ANALYTICAL/EXPERIMENTAL STULY OF NOISE SUPPRESSION DURING					
2	HOLDDOWN OF THE SPACE SHUTTLE					
3	Design & fabricate model					
4	Design & implement test					
5	Analyze data for deflector					
6	design characteristics					
7	Analyze data for noise					
8	suppression potential					
9	Develop noise suppression					
10	prediction technique					
11	Diffraction effects study					
12	Deflector design charac-					
13	teristics					
14	Final report					
15						
16						
17						
18						
19						
20						

NOTES

[X] SPACE SHUTTLE
[ ] SPACE STATION BASE
[ ] _____ PROJECT
[X] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-AU

APPROVAL W. K. Dahm

ACCOMPLISHMENT Jess H. Jones

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Aeroelasticity

RTOP NO. 976-30-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Initials)

STATUS AS OF 31 03 74 (Date) JHJ (Initials)

	ACTIVITIES	CY 19	CY 19 72	CY 19 73	CY 19 74	CY 19 75
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	WAVE PROPAGATION IN THERMOVISCOUS MEDIA					
2	Analyze one-dimensional					
3	solution					
4	Develop three-dimensional					
5	solution					
6	Numerical analysis					
7	Analyze energy dissipation					
8	mechanisms					
9	Interim report					
10	Final report					
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-YT

APPROVAL William W. Vaughan

ACCOMPLISHMENT S. C. Brown

MILESTONE SCHEDULE

RTOP TITLE Eastern Test Range Statistics for Space Shuttle Booster Design and Recovery Operations

4 LEVEL

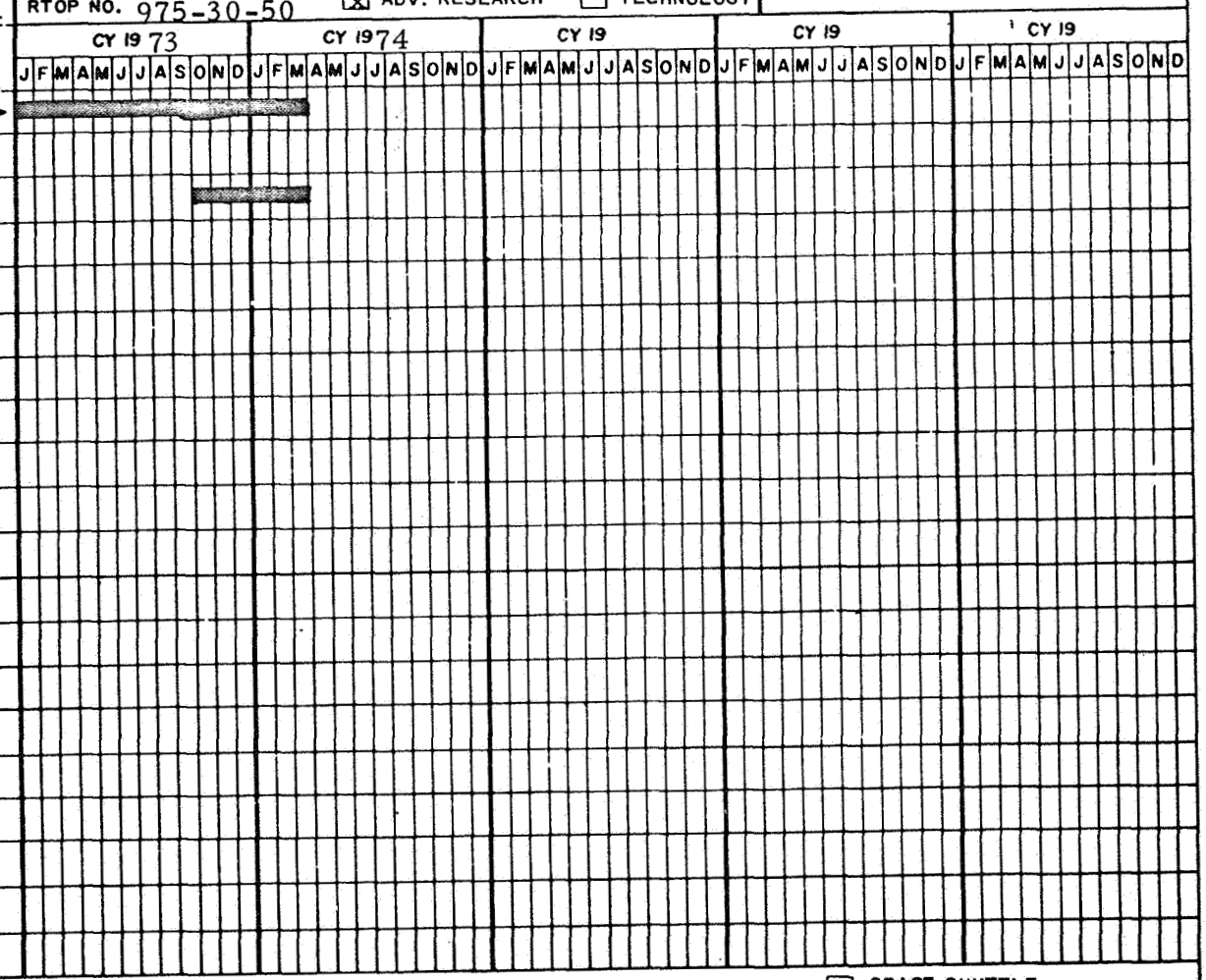
RTOP NO. 975-30-50 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Develop Wave Forecasting
2	Model
3	Atlantic Sea State Spectra
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[X] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-AT
APPROVAL W. K. Dahm
ACCOMPLISHMENT D.C. Seymour

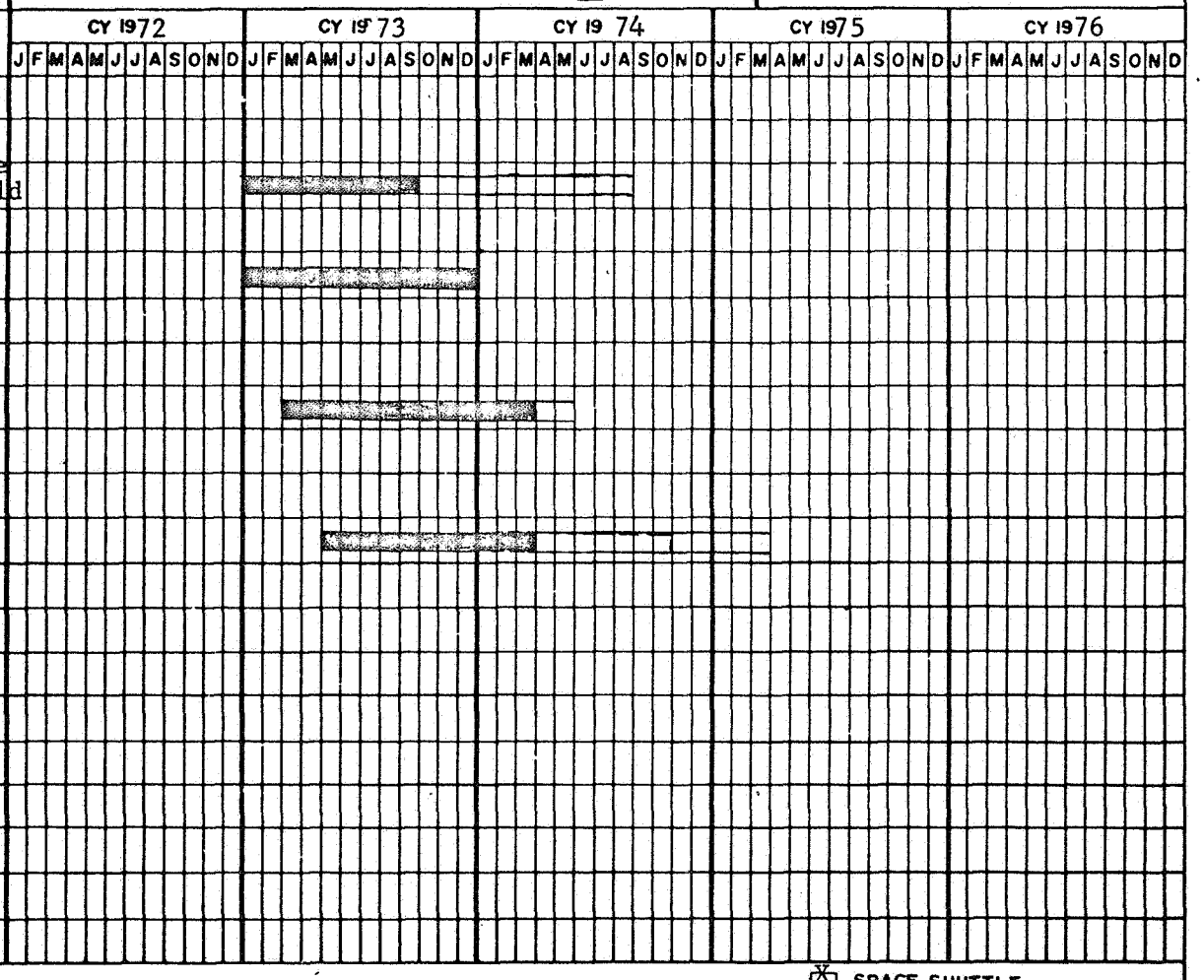
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Shuttle Development
976-30-50
RTOP NO. 976-30-84
☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL ✓ (Date)
LAST SCHED. CHANGE (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	SSME Orbiter Radiation Analysis
2	
3	Develop Model of Shuttle Orbiter Plume Flow Field
4	
5	Modify Gaseous Plume Radiation Computer Program
6	
7	
8	Compare S-II Plume Radiation Model to Flight Data
9	
10	
11	Generate Space Shuttle Base Environments Resulting from SSME Plume Radiation
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-A
APPROVAL W. K. Dahm
ACCOMPLISHMENT J. D. Johnson

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Shuttle Development
976-30-50
976-30-84
RTOP NO. 908-52-40
☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES	CY 19 72	CY 19 73	CY 1974	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	Water Impact Tests of Solid Rocket Booster Models - 908-52-40					
2	Hydrodynamic Testing & Model Hardware Design for Space Shuttle Water Impact Tests - 976-30-88					
3	Uninstrumented Model Tests					
4	Prepare Model					
5	Plan Tests					
6	Tests					
7	Data Analysis					
8						
9	Instrumented Model					
10	Purchase Instrumentation					
11	Prepare Model					
12	Plan Tests					
13	Tests					
14	Data Analysis					
15						
16						
17						
18						
19						
20						

NOTES

▽ Data and Analysis Reports

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-AT
APPROVAL W. K. Dahm
ACCOMPLISHMENT T.F. Greenwood

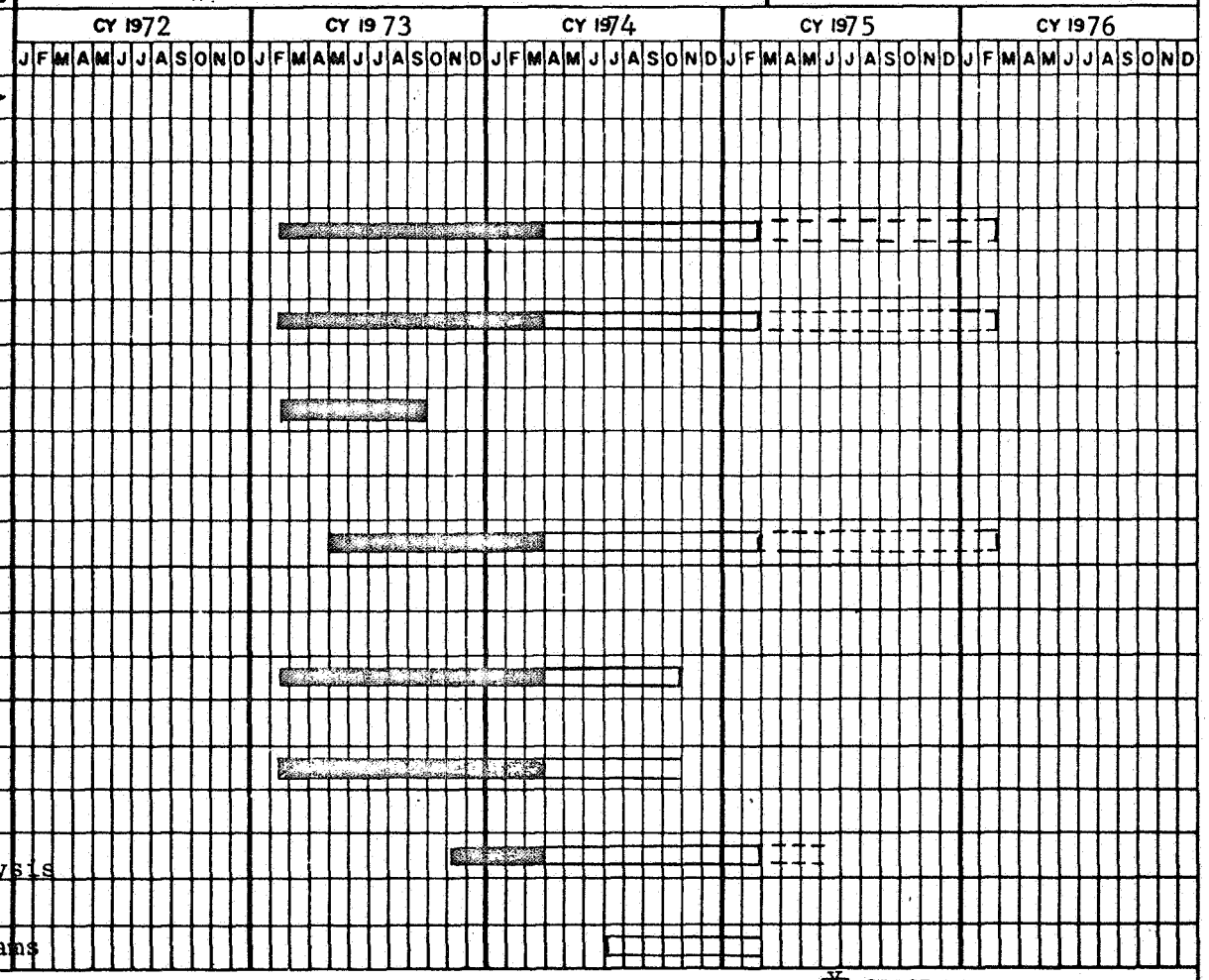
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Shuttle Development
976-30-50
RTOP NO. 976-30-84
☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Study on Solid Rocket
2	~~Motor Plume Flow Field~~ and Radiation Analysis
3	
4	Develop Two-Phase Plume Flow Field Program
5	
6	~~Develop Two-Phase Plume~~ Impingement Program
7	
8	~~Incorporate Uncoupled~~ Two-Phase Plume Flow
9	Field into PLIMP
10	
11	~~Review Solid Motor~~ Radiation Data and
12	Improve Existing ~~Technique~~
13	
14	Boundary Layer Analysis
15	
16	~~Low Altitude Plume~~ Afterburning Analysis
17	
18	Monte Carlo Radiation Analysis
19	
20	Documentation of New Programs



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-AAS
APPROVAL H. R. Coldwater
ACCOMPLISHMENT J. E. Key

MILESTONE SCHEDULE

RTOP TITLE Structures

4 LEVEL

RTOP NO. 976-30-61 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 71	CY 19 72	CY 19 73	CY 19 74	CY 19 75
1	Incremental Proof Test Feasibility					
2	Development of a Method for Elastic Plastic					

NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PT
APPROVAL C. C. Wood
J. Vaniman/K. McCoy
ACCOMPLISHMENT

MILESTONE SCHEDULE

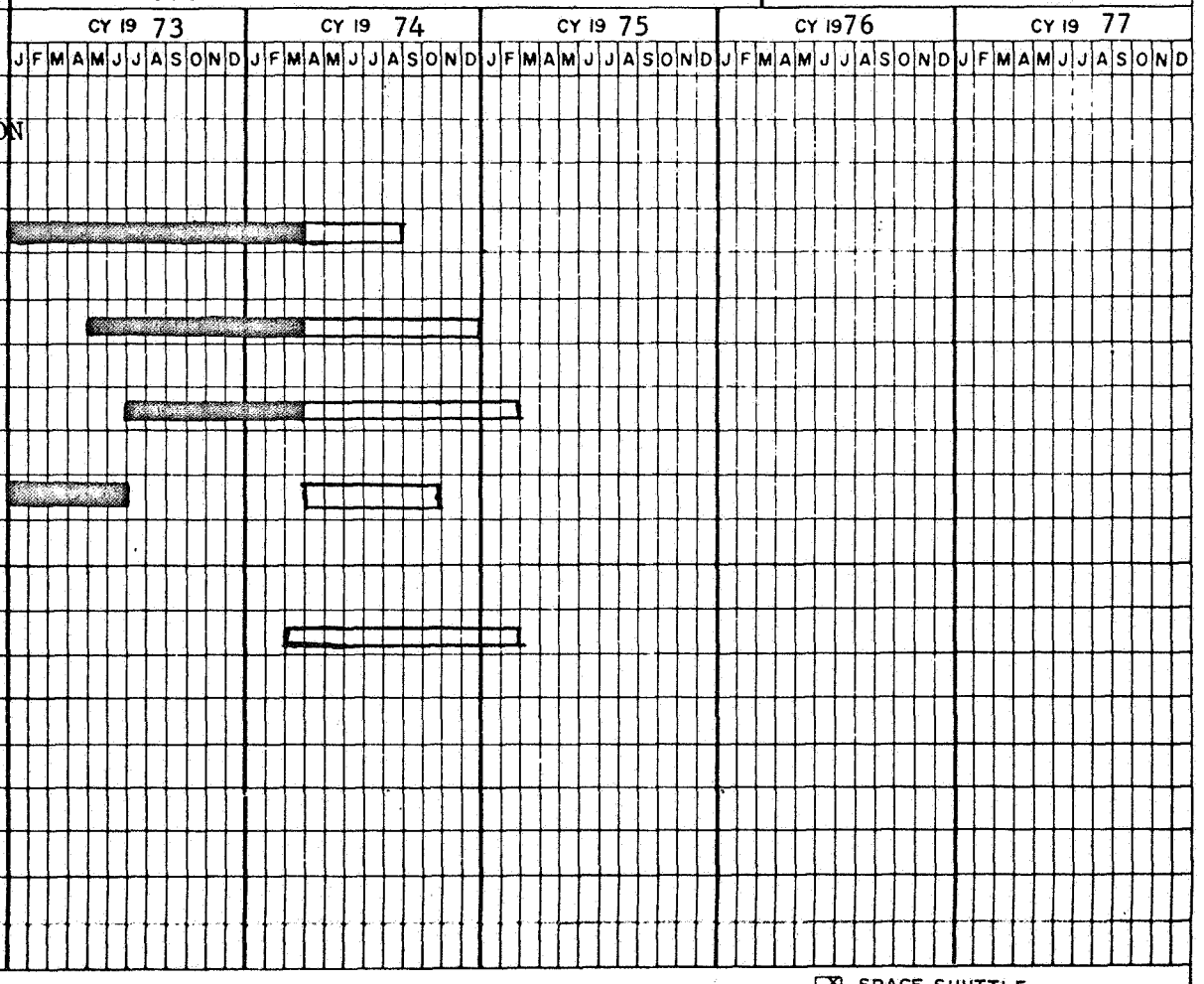
4 LEVEL

RTOP TITLE STRUCTURES

RTOP NO. 976-30-61 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL (Date)
LAST SCHED. CHANGE (Date) (No.) (Initials)
STATUS AS OF (Date) 31 03 74 (Initials) KEM

	ACTIVITIES
1	THERMAL ENGINEERING FOR
2	STRUCTURAL MISSION SIMULATION
3	TESTING
4	Generate ET TPS Test
5	Program
6	Develop ET TPS Analytical
7	Model
8	Correlate ET TPS Test Data
9	
10	Generate Foam Panel
11	Test Procedure
12	
13	Predict Performance
14	During Flight
15	
16	
17	
18	
19	
20	



NOTES

COMPLETED

FIRMLY COMMITTED, NOT COMPLETED

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-D
APPROVAL Robert S. Ryan
ACCOMPLISHMENT Robert S. Ryan

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Structural

RTOP NO. 976-30-61 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 1974	CY 19	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	CONTROL TRAJECTORY AND					
2	LOADS OPTIMIZATION					
3	Phase I					
4	Programs Together					
5	Optimization Techniques					
6	Phase II					
7	Structural Module					
8	Weight Model					
9	Build-into Program					
10	Phase III					
11	Computer Program					
12	Documentation					
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-DDD
APPROVAL Robert S. Ryan
ACCOMPLISHMENT G. L. Watts

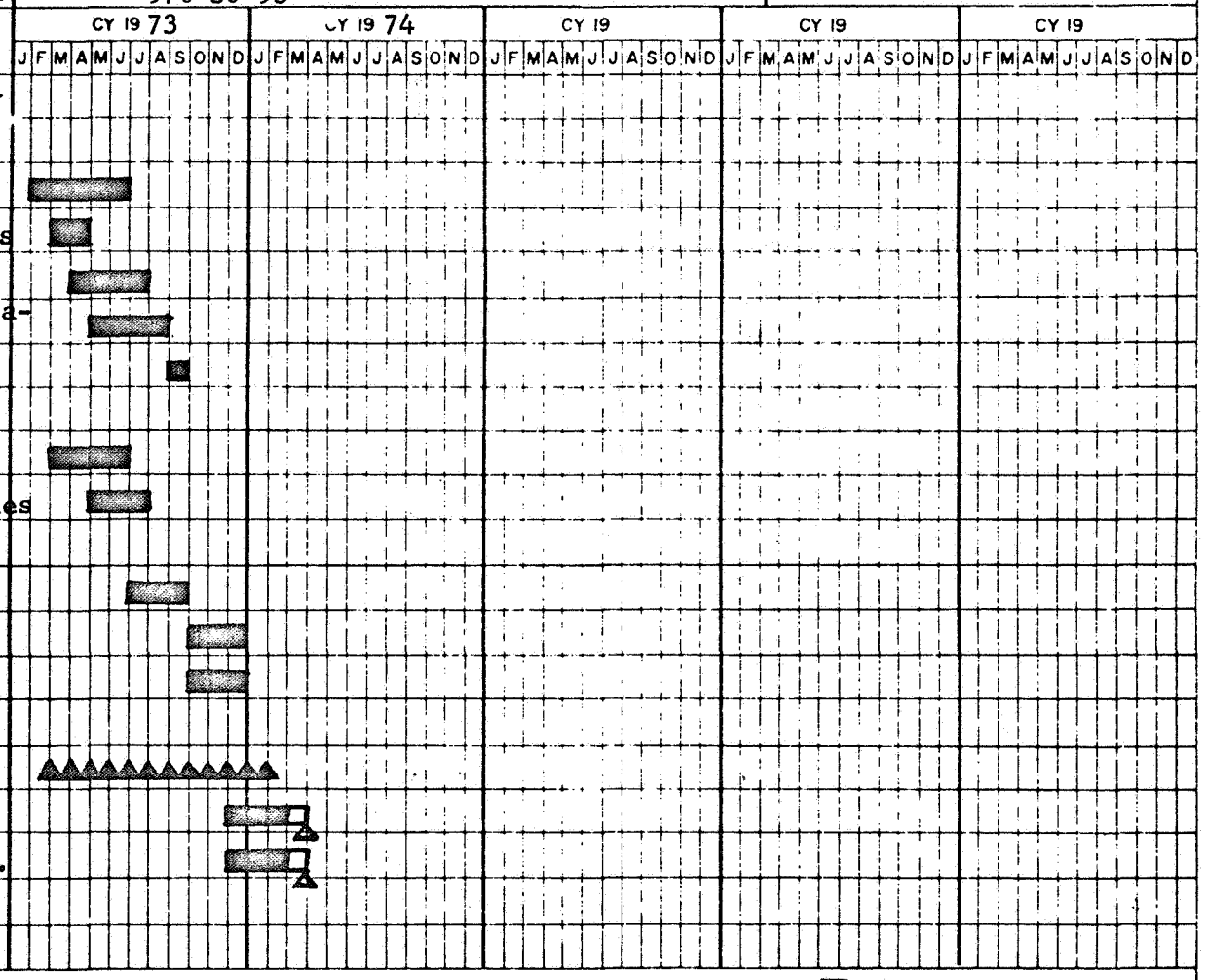
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Structural
RTOP NO. 976-30-61 976-30-93
☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	PARACHUTE DYNAMICS & STABILITY ANALYSIS
2	Formulate Equations of Motion
3	Revise Assumptions
4	Elastic Canopy Analysis
5	Augment Current Models
6	Assess Significant Para-Meters
7	Wind Gust Model
8	Nonlinear Analysis
9	Softwear Development
10	Select Nom. Trajectories
11	Linear Analysis
12	Validate Model
13	Root Locus
14	Nyquist
15	Reporting
16	Progress Reports
17	Final Report
18	Document Computer Prog.
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PP
APPROVAL J. A. Lombardo
ACCOMPLISHMENT L. A. Gross

MILESTONE SCHEDULE

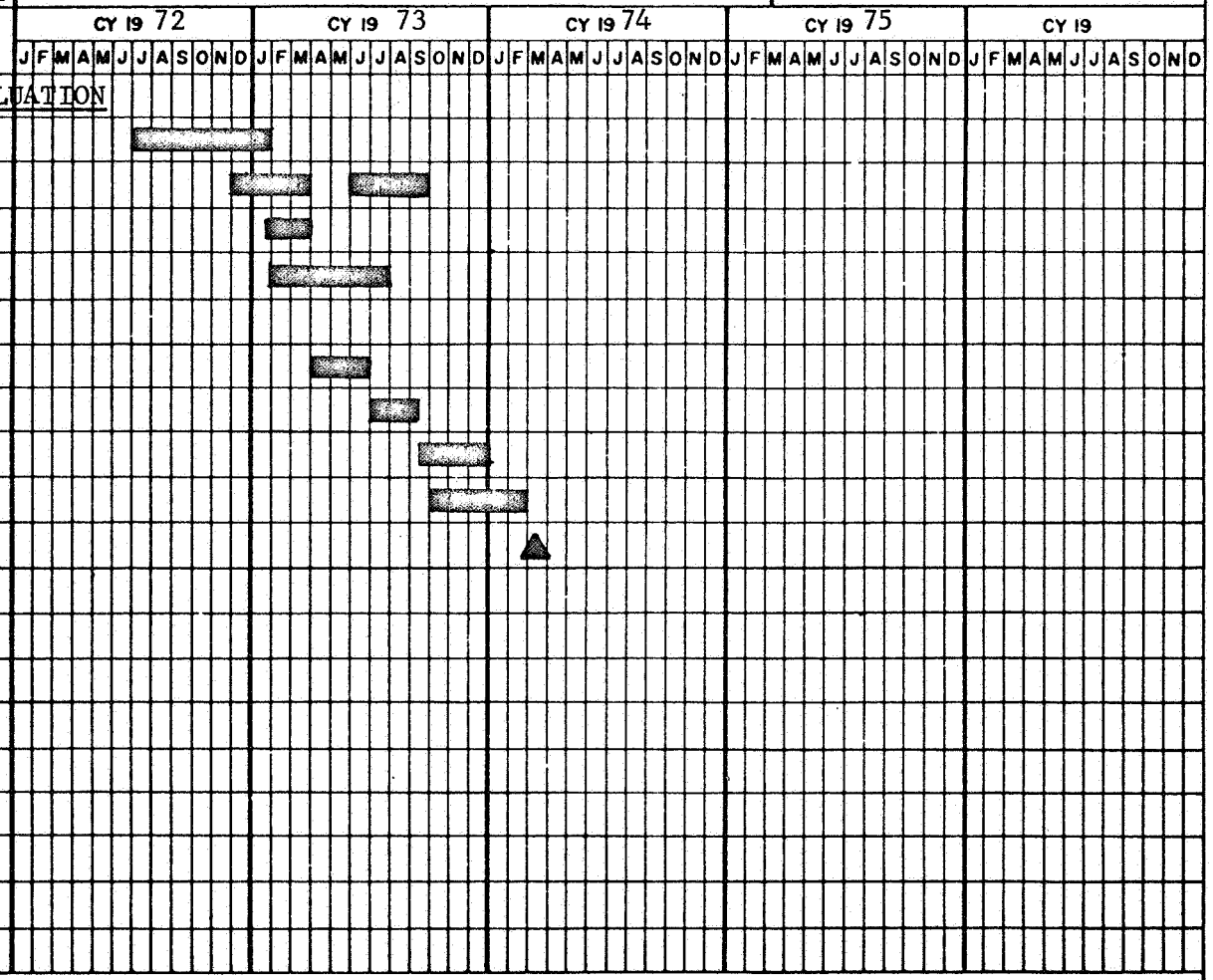
RTOP TITLE SHUTTLE MAIN PROPULSION TECHNOLOGY

5 LEVEL

RTOP NO. 982-52-03 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	POGO DYNAMIC FLOWMETER EVALUATION
2	PROGRAM PLANNING
3	SYSTEM MODELING
4	FACILITY DESIGN
5	FLOWMETER PROCUREMENT
6	SHOP FABRICATION AND
7	INSTALLATION (FACILITY)
8	FACILITY BUILDUP
9	CHECKOUT AND TESTING
10	DATA ANALYSIS
11	FINAL REPORT
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

Completed
Planned

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PT
APPROVAL C. C. Wood
J. Vaniman/D. Price
ACCOMPLISHMENT

MILESTONE SCHEDULE

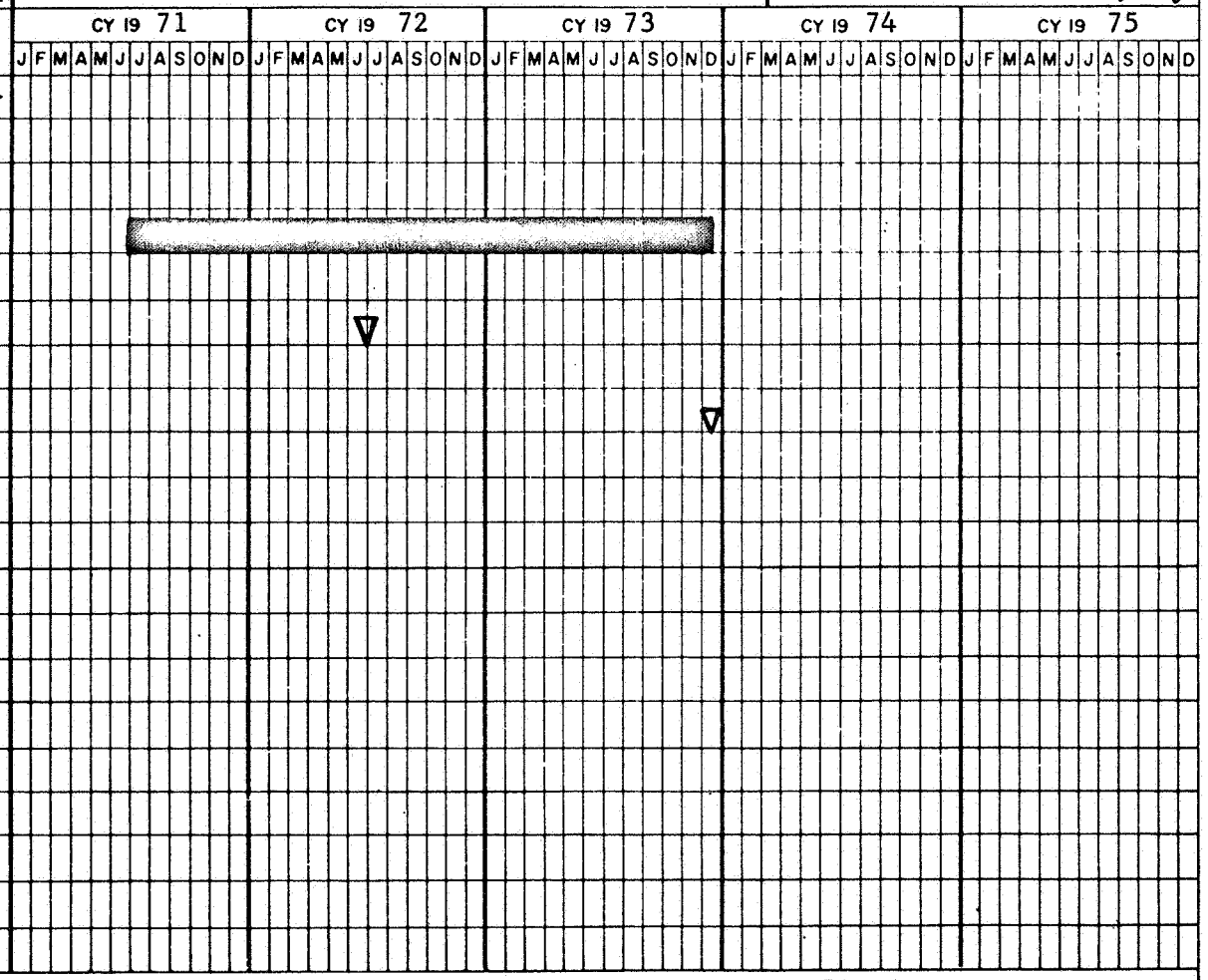
4 LEVEL

RTOP TITLE Space Shuttle Engine and Vehicle TPS Review

RTOP NO. 982-52-61 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL (Date)
LAST SCHED. CHANGE (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	SPACE VEHICLE ENGINE AND
2	HEAT SHIELD REVIEW
3	
4	1. Analysis/Evaluation
5	
6	2. Interim Report
7	
8	3. Final Report
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-I
APPROVAL W. O. FROST
ACCOMPLISHMENT H. S. Harman

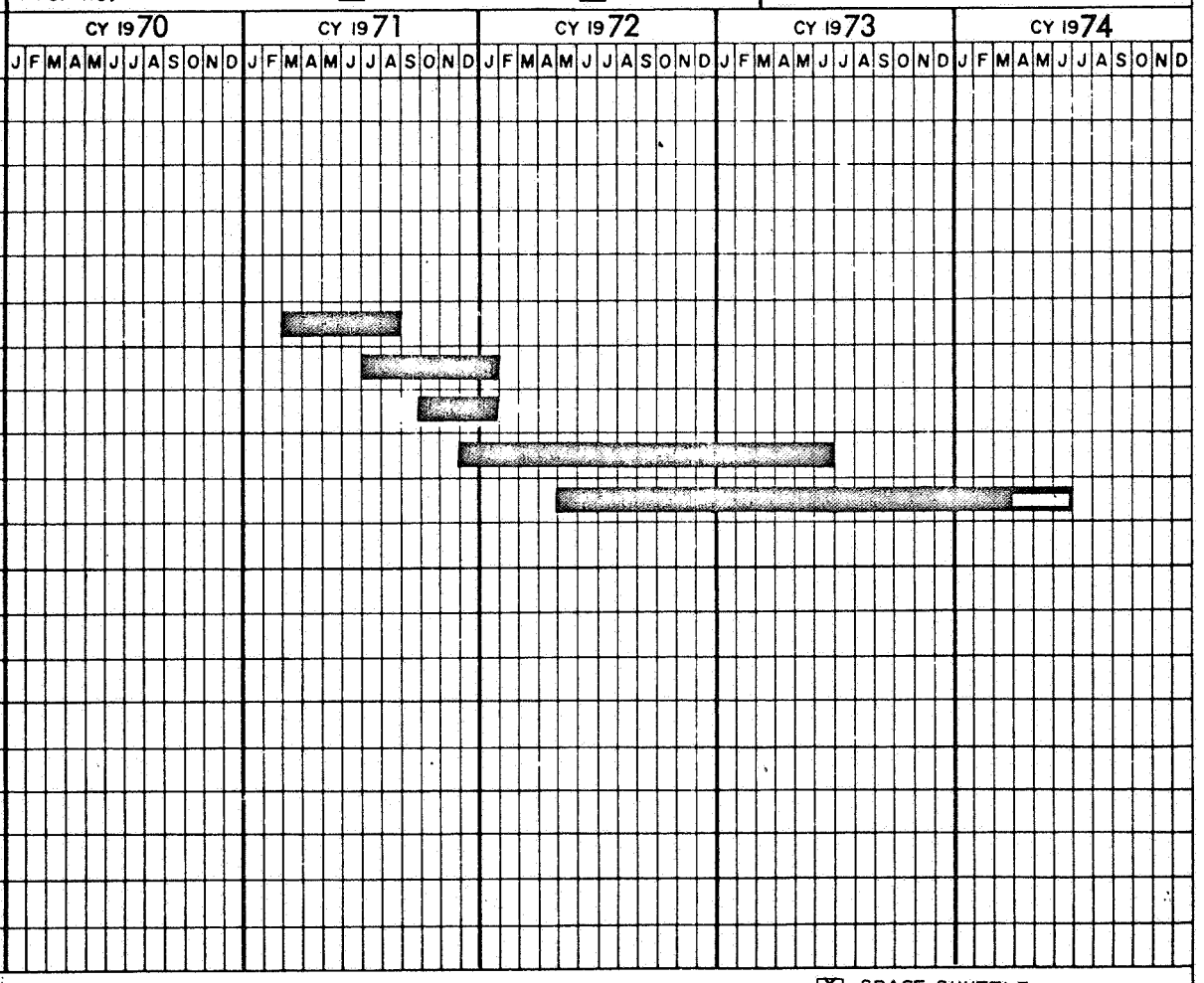
MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Instrumentation for Space Shuttle
RTOP NO. 983-15-21 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date)

	ACTIVITIES
1	Flange-Mounted Preburner ➔
2	Pressure Transducer & Flange-
3	Mounted Cryogenic Pressure
4	Transducer
5	
6	Meas. Technique Dev.
7	Experimental Model
8	Testing
9	Prototype
10	Final Unit Dev.
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-ASTR-1
APPROVAL W. O. FROST
ACCOMPLISHMENT H.S. Harman

MILESTONE SCHEDULE

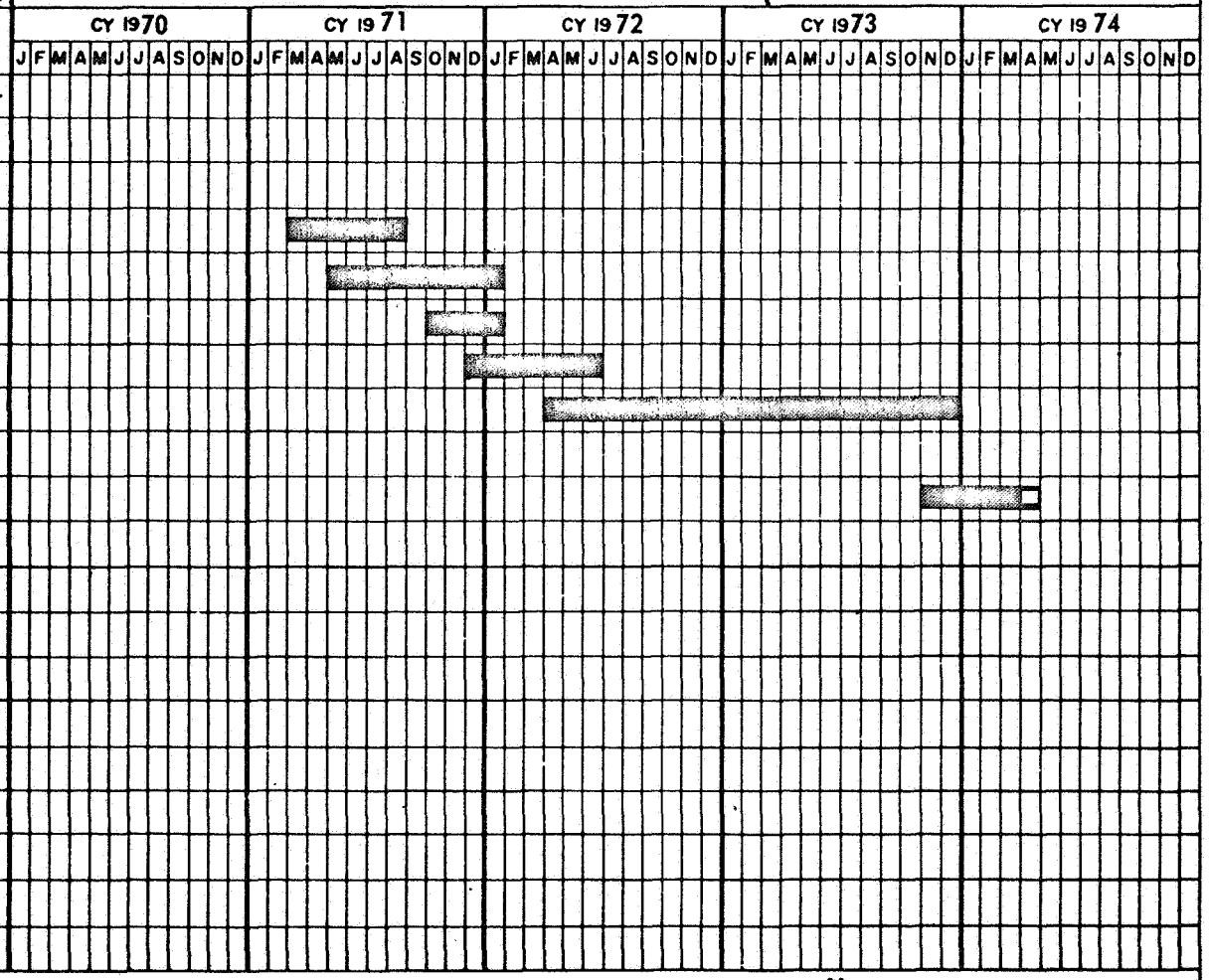
RTOP TITLE Instrumentation for Space Shuttle

4 LEVEL

RTOP NO. 983-15-21 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	Low Differential Pressures ➔
2	in High Line Pressures
3	
4	Meas. Techniques Dev.
5	Experimental Model
6	Testing
7	Prototype
8	Final Unit Dev.
9	
10	Final Report
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

OFFICE OF APPLICATIONS

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTN-PL
APPROVAL G. D. Hopson
ACCOMPLISHMENT R.L. Middleton

MILESTONE SCHEDULE

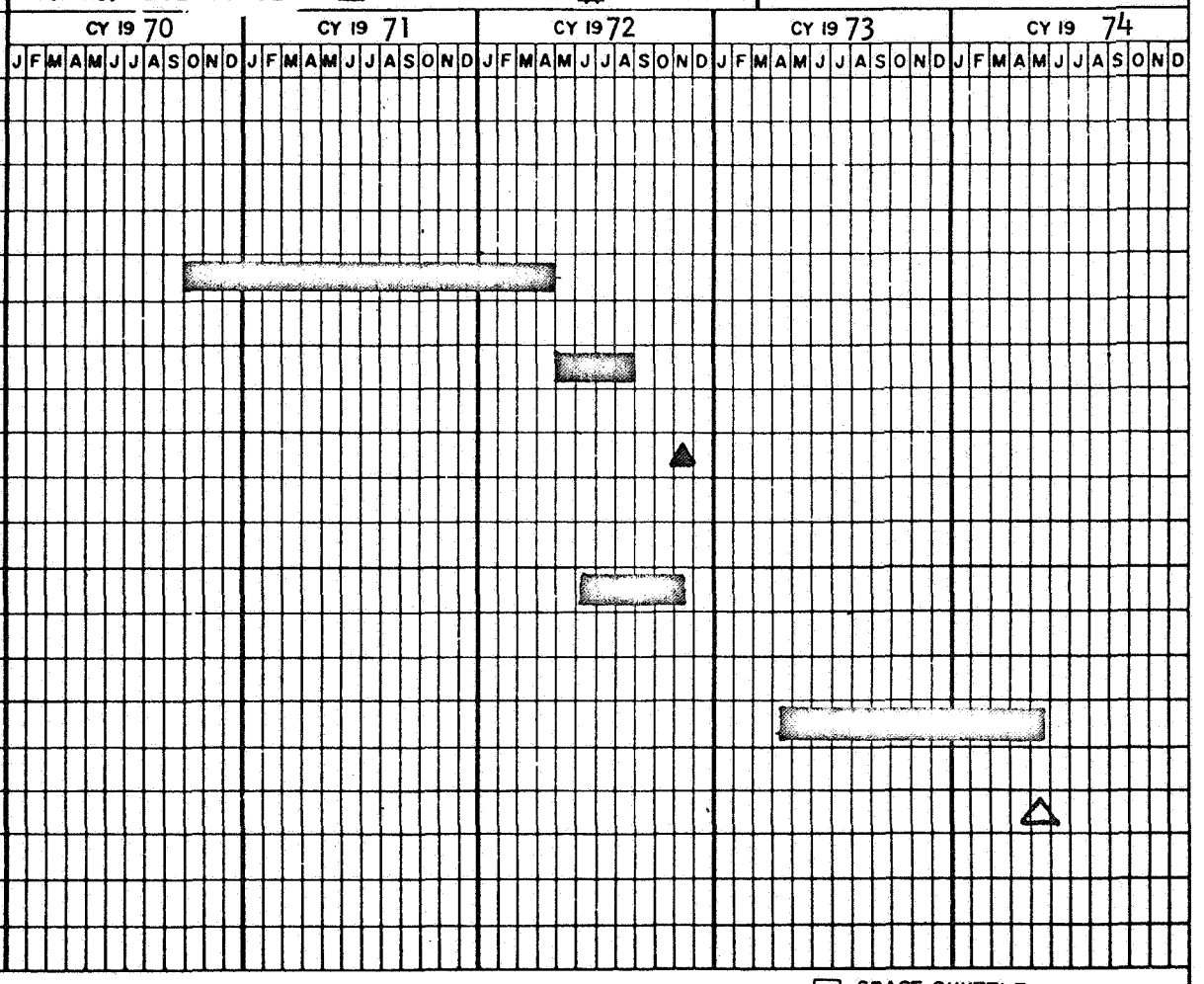
RTOP TITLE Space Station Thermal Control

4 LEVEL

RTOP NO. 161-80-01 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	EVALUATION OF ABSORPTION
2	CYCLES FOR SPACE STATION
3	ENVIRONMENTAL CONTROL
4	
5	SPACE SYSTEMS DEFINITION
6	
7	SYSTEM TEST
8	
9	FINAL REPORT ON SPACE SYS.
10	
11	RESIDENTIAL APPLICATIONS
12	FEASIBILITY STUDY
13	
14	RESIDENTIAL DESIGN
15	ANALYSIS
16	
17	FINAL REPORT ON RESIDENT.
18	APPLICATION
19	
20	



NOTES

WORK COMPLETED
WORK TO BE COMPLETED

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-YT
APPROVAL W. W. Vaughan
ACCOMPLISHMENT S. C. Brown

MILESTONE SCHEDULE

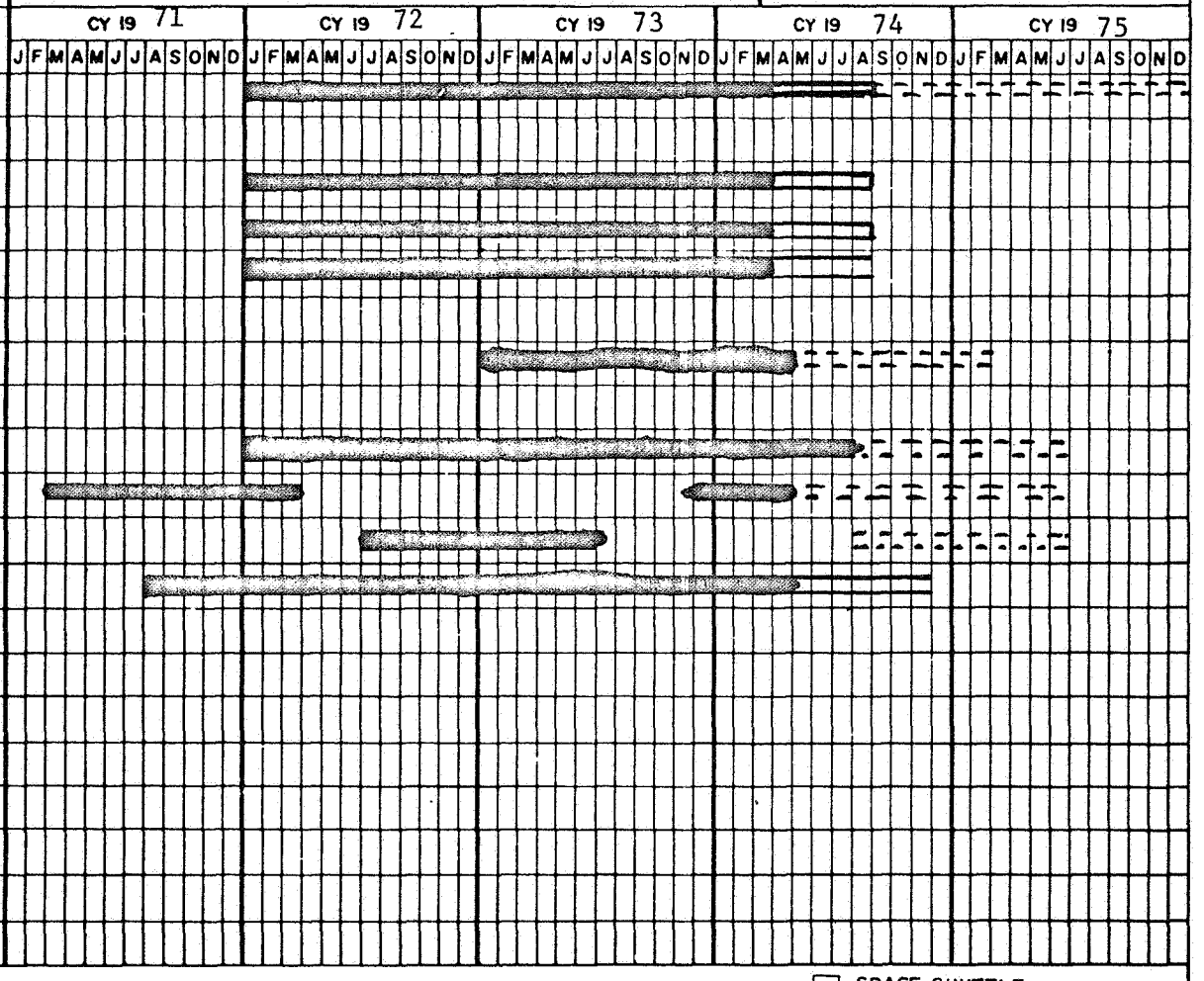
RTOP TITLE World-Wide Cloud Cover Model

4 LEVEL

RTOP NO. 175-21-71 [X] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	World-Wide Cloud Cover Model
	Cloud Type Persistence
	Cloud Type Structure
	Cloud Type Simulation
2	Atmospheric Remote Sensing
3	4-D Atmospheric Model
	Improve 4-D Model
	Compare 4-D Model
	Cloud Cover Program



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[X] Spacelab PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-AERO-Y
APPROVAL William W. Vaughan
ACCOMPLISHMENT R. E. Turner

MILESTONE SCHEDULE

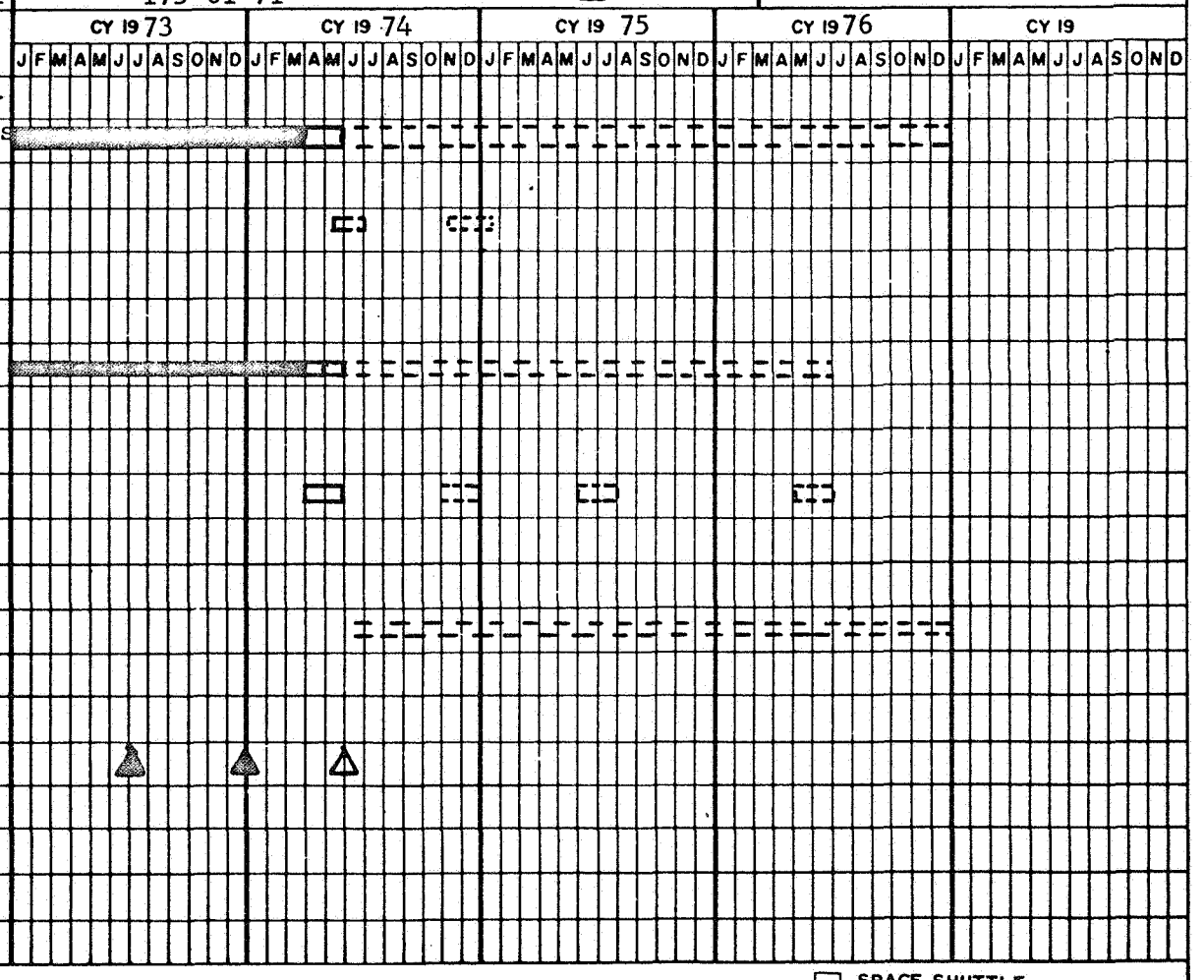
4 LEVEL

RTOP TITLE Interrelationships Between Atmospheric Motions of Different Scales

RTOP NO. 175-61-71 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Interrelationships Between Atmospheric Motions of Different Scales
2	Planned SMS-A and SMS-B Launch
3	Planning for Mesoscale Network Experiment
4	Accomplishment of Experiment
5	Analysis of Correlative Data Results
6	Reports



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ SMS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. W. Vaughan

ACCOMPLISHMENT J. B. Stephens

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Statistical Data Management Methods

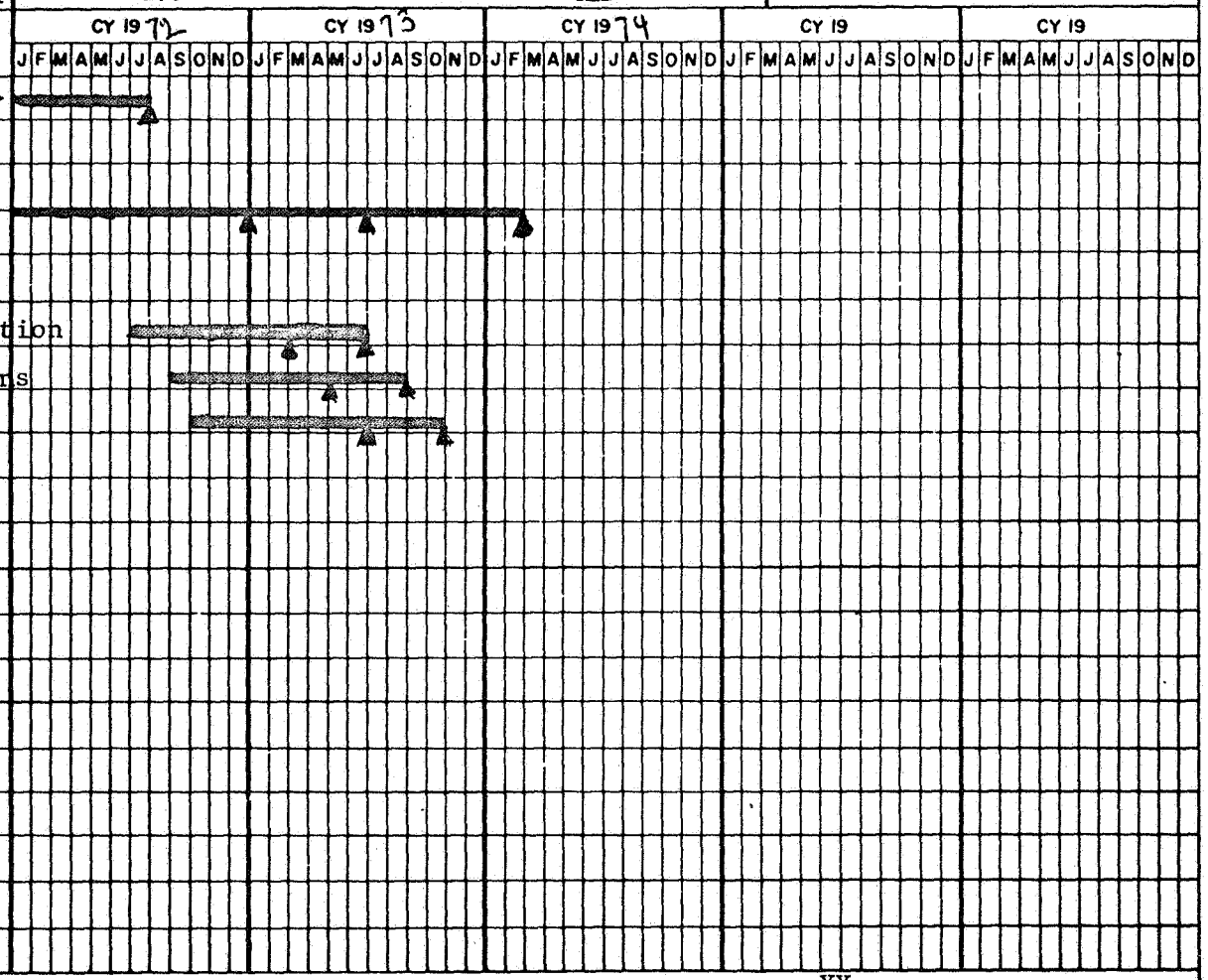
RTOP NO. 175-61-71 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Absorption Cell
2	Modification
3	Theoretical Calculation
4	& Modelling
5	Experimental Measurements
6	1. Temperature Perturbation
7	2. Pressure Perturbations
8	3. Concentration Per-
9	turbations
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Completed Work
Planned Work, Committed - But Not Completed

▲ Completed Milestone
△ Scheduled Milestone

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-YS
APPROVAL William W. Vaughan
ACCOMPLISHMENT R. E. Smith

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Zero-G-Atmospheric Cloud Physics Program

RTOP NO. 175-61-73 [x] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Day) (Mo.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1974	CY 1975	CY 19	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	Tidal & Gravity Wave					
2	Propagation					
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[x] Spacelab PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 2 of 2

CENTER MSFC
RESPONSIBILITY S&E-PE-A
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT I. C. Yates, Jr

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Materials and Process R&D

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19 76	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Solidification of Alloys Exhibiting Solid State Immiscibility (179-11-13-01)					
2						
3	Contract NAS8-28625					
4	Final Report					
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E-PE-A
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT I. C. Yates, Jr.

MILESTONE SCHEDULE

RTOP TITLE Materials and Process R&D

5 LEVEL

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 72	CY 19 73	CY 19 74	CY 19 75	CY 19 76
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Process Development for Immiscible Materials and Alloys (179-11-14-01)					
2						
3	Contract NAS8-28267					
4	Interim Report (Phase I)					
5						
6	Contract NAS8-28267 Mod. 4					
7	(For Phase II effort)					
8	Final Report					
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-A
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT I. C. Yates, Jr.

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Materials and Process R&D

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Immiscible Materials Selection (179-11-14-03)					
2						
3	Contract NAS8-29748					
4	Briefing at MSFC					
5	Final Review Presentation					
6	Final Report					
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-A
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT L. H. Berge

MILESTONE SCHEDULE

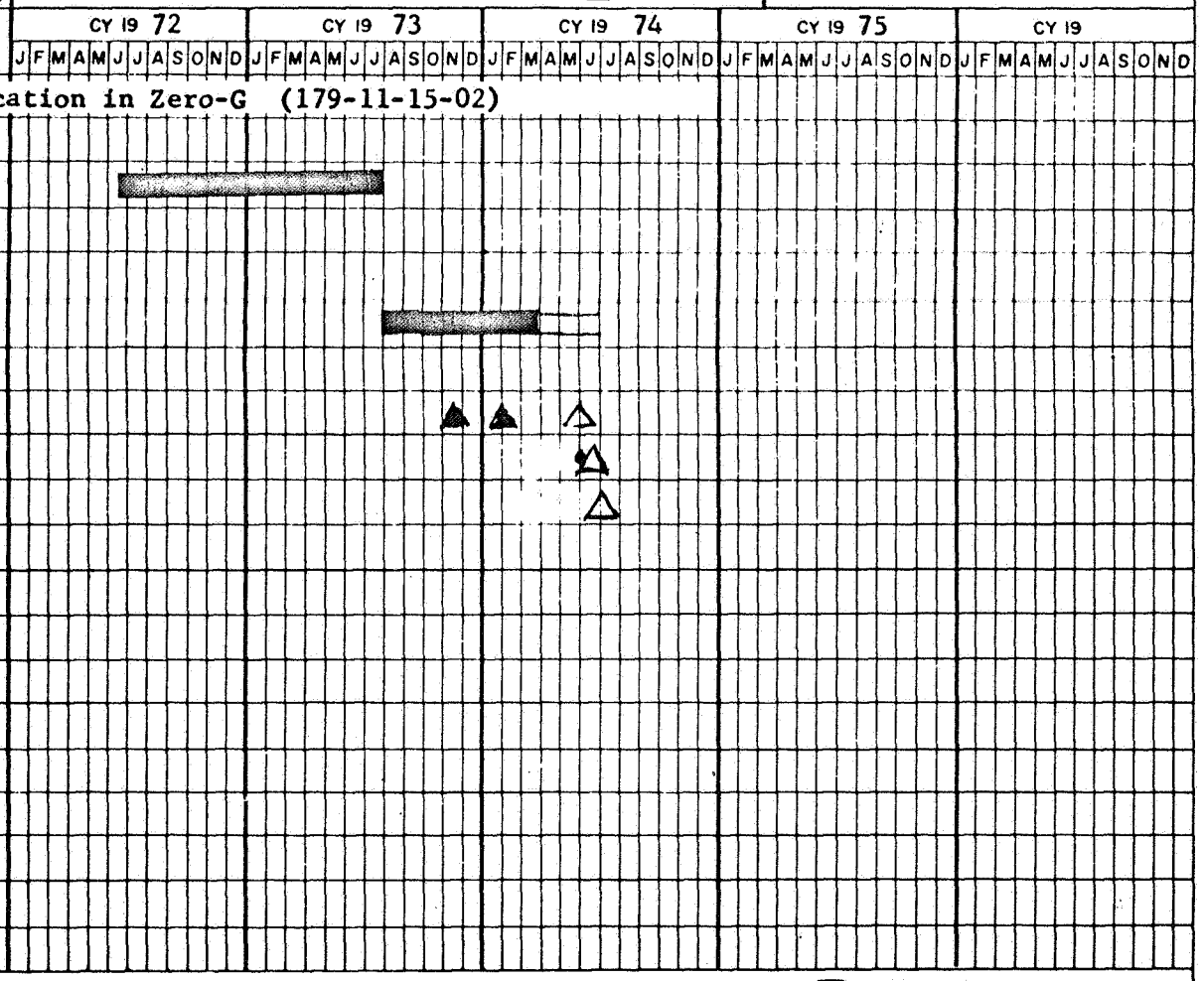
RTOP TITLE **Materials and Process R&D**

5 LEVEL

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (No.) (Initials)
STATUS AS O. 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Metal Drop Solidification in Zero-G (179-11-15-02)
2	
3	Contract NAS8-28604
4	Interim Report (Phase I)
5	
6	Contract NAS8-28604 Mod. 4
7	(For Phase II effort)
8	Drop Tower Tests
9	Final Review Presentation
10	Final Report
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-A
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT I. C. Yates, Jr.

MILESTONE SCHEDULE

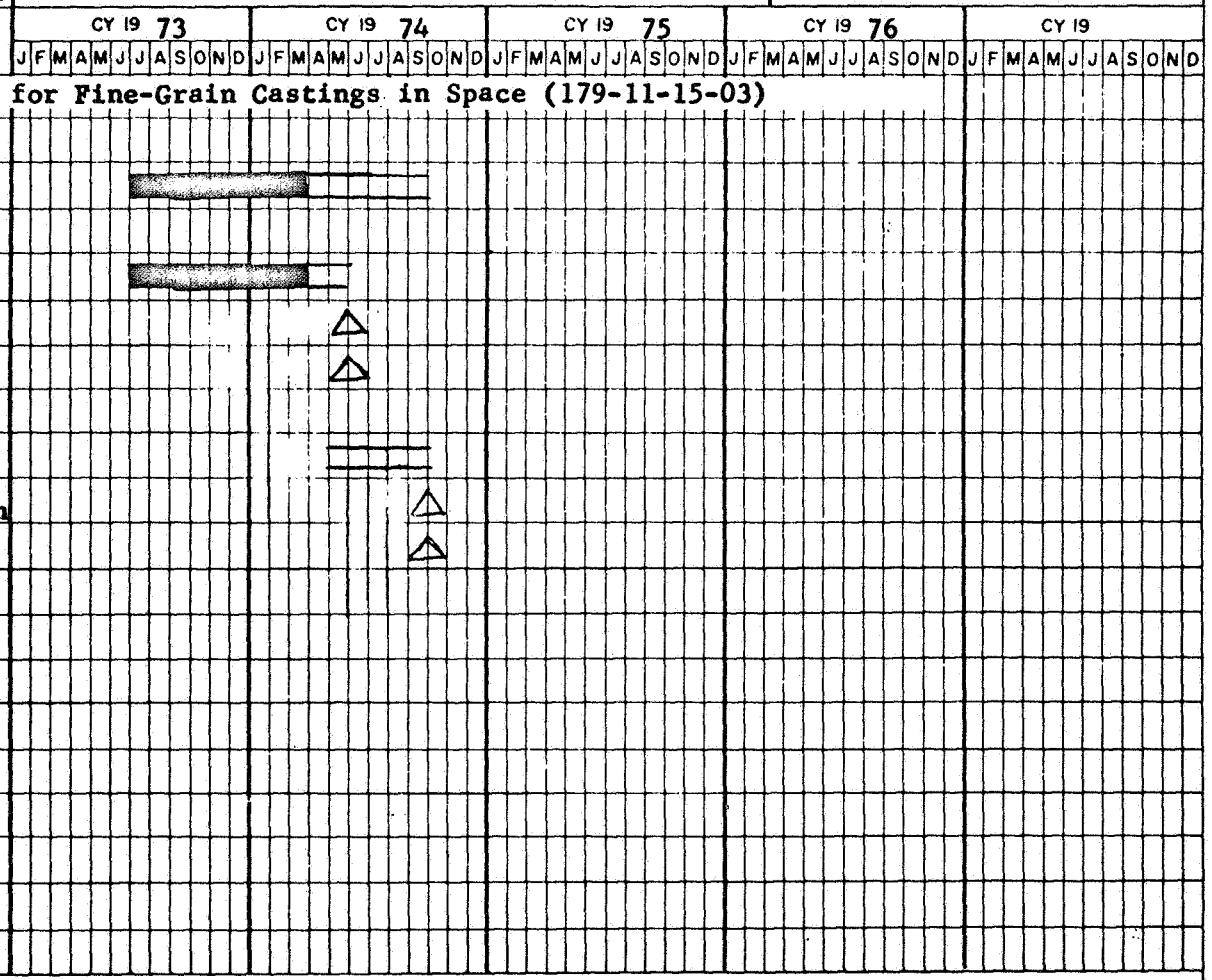
RTOP TITLE Materials and Process R&D

5 LEVEL

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Process Development for Fine-Grain Castings in Space (179-11-15-03)
2	
3	Contract NAS8-29626
4	
5	Phase I
6	Interim Report
7	Review Presentation
8	
9	Phase II
10	Final Review Presentation
11	Final Report
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&R-PB-A

APPROVAL R. F. Huebscher

ACCOMPLISHMENT L. H. Berge

MILESTONE SCHEDULE

5 LEVEL

[illegible]

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Initials)

LAST SCHED CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 74	CY 19 75	CY 19 76	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Containerless Purification of Tungsten (179-11-20-00)					
2						
3	Contract NAS8-29879					
4	Orientation Briefing(MSFC)					
5	Progress Briefing (MSFC)					
6	Final Review (MSFC)					
7	Deliver Final Report					
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-PE-A

APPROVAL H. F. Wuenscher

ACCOMPLISHMENT I.C.Yates, Jr.

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Materials and Process R&D

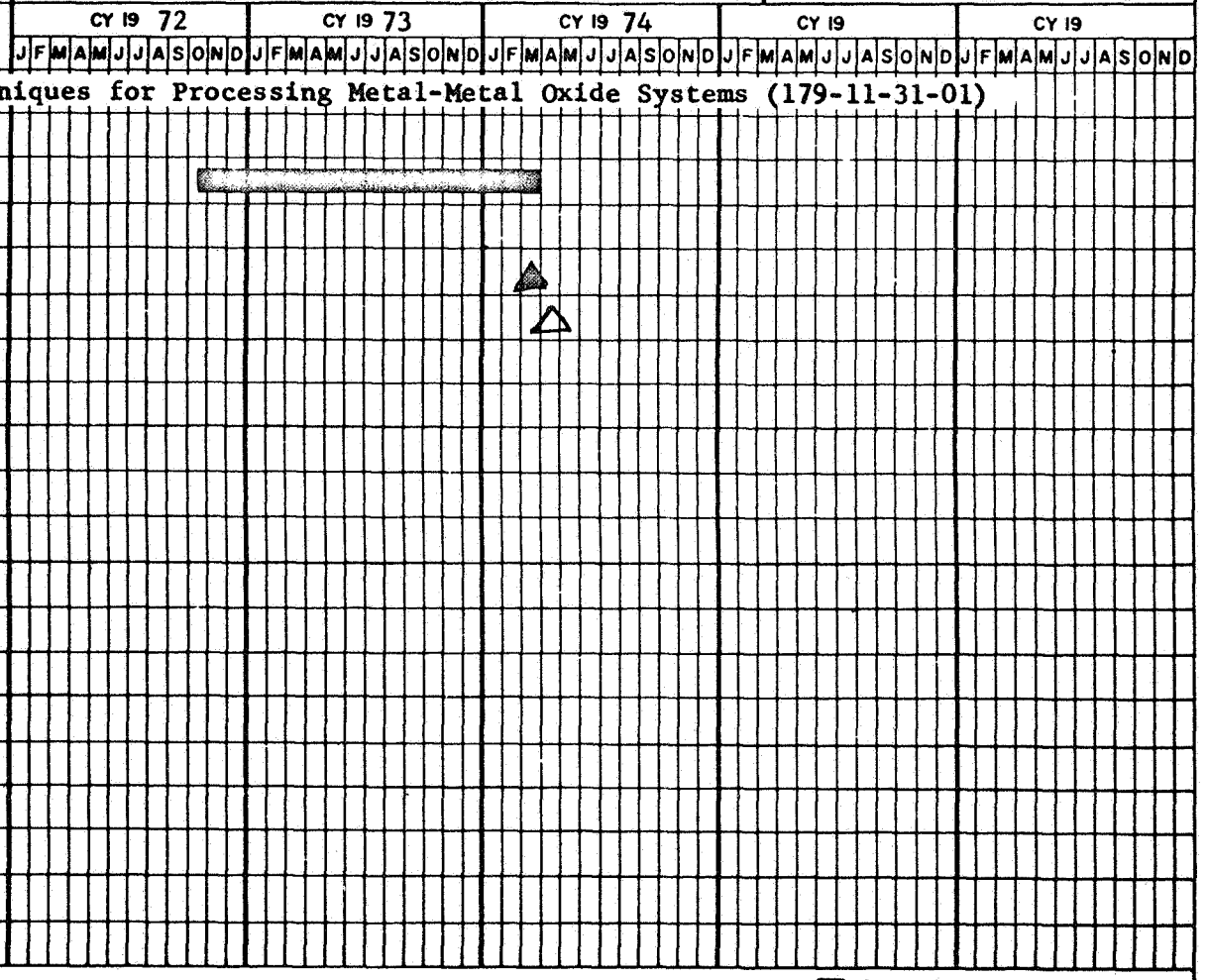
RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Development of Techniques for Processing Metal-Metal Oxide Systems (179-11-31-01)
2	
3	Contract NAS8-29145
4	
5	Final Report Draft
6	Deliver Final Report
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3456 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-A
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT I. C. Yates, Jr.

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Materials and Process R&D

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19 76	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Process Development for Composite Materials Manufacturing in Space (179-11-31-02)					
2						
3	Contract NAS8-29620					
4	Task 1 Technical Report					
5	Task 1 Briefing at MSFC					
6	Final Review Presentation					
7	Final Report					
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MXS
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT R. L. Nichols

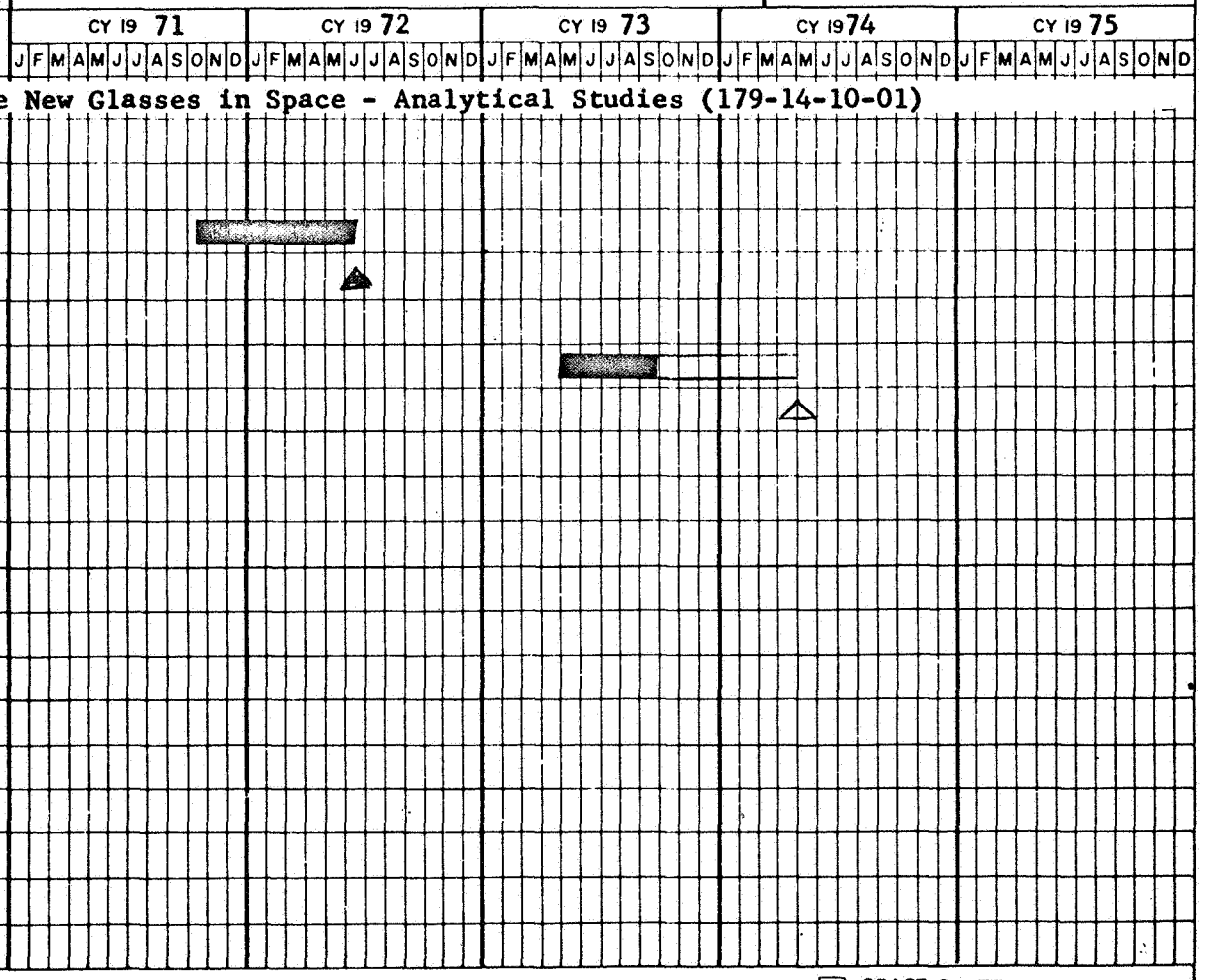
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Glass and Ceramics
(Materials and Process R&D - RTOP 179-10)
RTOP NO. 179-14 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Production of Unique New Glasses in Space - Analytical Studies (179-14-10-01)
2	
3	Prior Contract
4	NAS8-28014
5	Final Report
6	
7	NAS8-28991
8	Final Report
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MXS
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT R. L. Nichols

MILESTONE SCHEDULE

RTOP TITLE Materials and Process R&D

5 LEVEL

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Theoretical Study of Producing Glasses in Space (179-14-10-02)					
2						
3	Contract NAS8-29850					
4						
5	Phase Report					
6						
7	Contract NAS8-29850 Mod.					
8						
9	Final Report					
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MXS
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT R. L. Nichols

MILESTONE SCHEDULE

RTOP TITLE Materials and Process R&D

5 LEVEL

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19 76	CY 19 77
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Study of Diffusion Coefficient of Glasses Under Zero-G (179-14-20-02)					
2						
3	In-House					
4						
5	Contract NAS8-30656					
6	Final Report					
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MXS
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT R. Nichols

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Materials and Process R&D

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 74	CY 19 75	CY 19 76	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Processing of Glass-Ceramics in Space (179-14-20-03)					
2						
3	Proposed Contract					
4	(DCN 1-4-65-48002)					
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-PE-MXS

APPROVAL H. F. Wuenscher

ACCOMPLISHMENT R. L. Nichols

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Materials and Process R&D

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 74	CY 19 75	CY 19 76	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Space Processing of Chalcogenide Glasses (179-14-20-04)					
2						
3	NAS8-30627					
4						
5	Final Report		△			
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MX
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT G. D. Adams

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Materials and Process R&D

RTOP NO. 179-10 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 74	CY 19 75	CY 19 76	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Electrohydrodynamic Space Processes (179-15-10-01)					
2						
3	Contract NAS8-30250					
4						
5	Orientation Briefing(MSFC)					
6						
7	Progress Briefing at MSFC					
8						
9	Final Review Presentation					
10	at MSFC					
11	Deliver Final Report					
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. C. Snoddy

ACCOMPLISHMENT R. C. Ruff

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Study of Liquid-Solid Transition for Materials Processing in Space

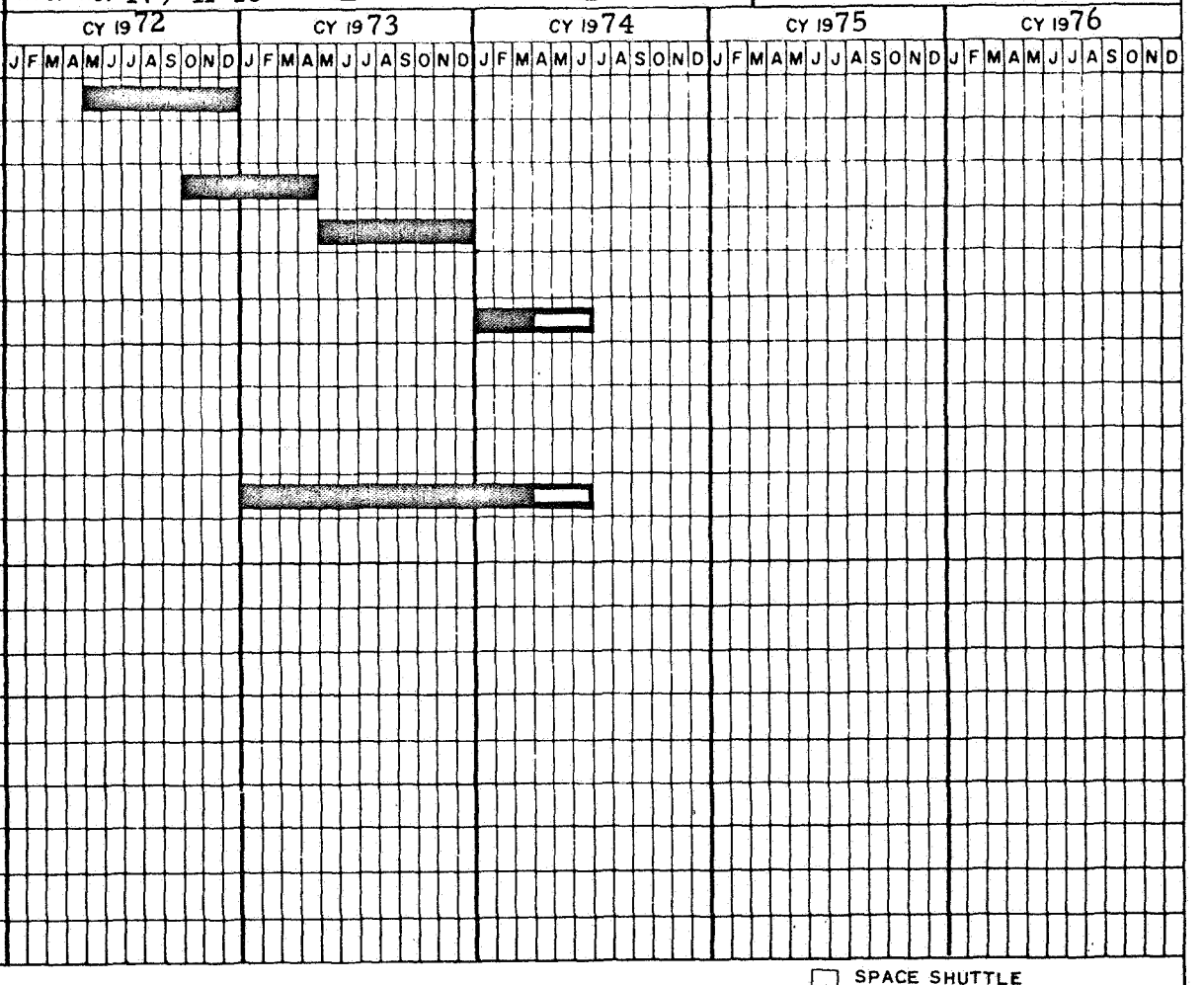
RTOP NO. 179-11-10 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	- Evaluate liquid models
2	- Incorporate time
3	dependant functions
4	- Quantitative analysis
5	- Mathematical analysis
6	of microsegregation
7	- Evaluate similarities &
8	differences between
9	zero-g and magnetic
10	fields
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY
APPROVAL W. C. Snoddy
ACCOMPLISHMENT R. C. Ruff

MILESTONE SCHEDULE

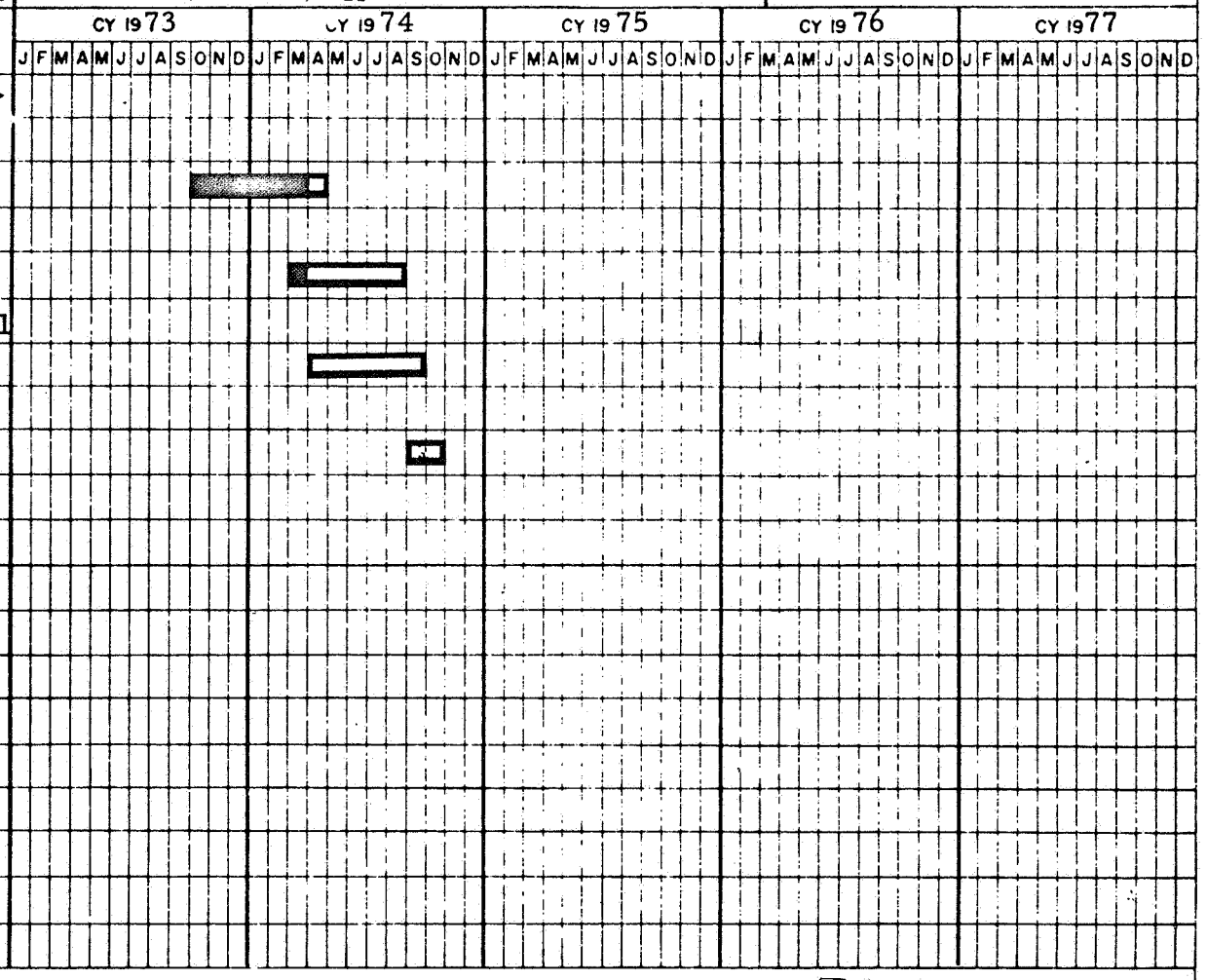
5 LEVEL

RTOP TITLE Single Crystals of Metal Solid Solutions

RTOP NO. 179-11-11 ☒ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	- Effect of Gravitation
2	Orientation on Crystal
3	Structure
4	- Effect of Magnetic Field
5	on Crystal Structure
6	- Analysis of Above Crystal
7	Structure
8	- Flight Experiment
9	Definition
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

CENTER MSFC
RESPONSIBILITY
APPROVAL W. C. Snoddy
ACCOMPLISHMENT R. C. Ruff

MILESTONE SCHEDULE

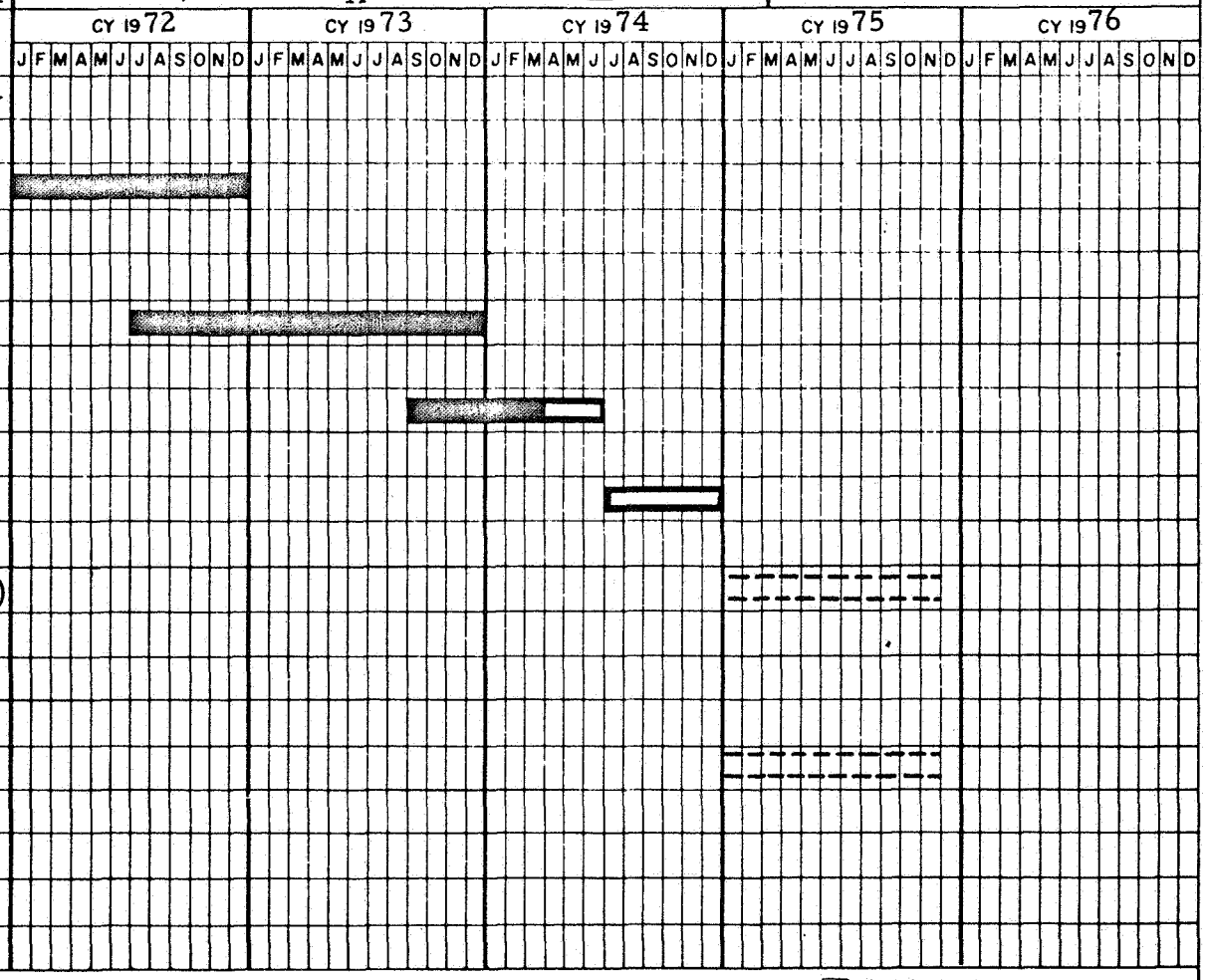
5 LEVEL

RTOP TITLE Segregation Effects During Solidification in Weightless Melts

RTOP NO. 179-11-12 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (No.) (Initials)
STATUS AS C. 31 03 74 (Date) (Initials)

	ACTIVITIES
1	- Develop computer
2	model evaporative
3	segregation
4	- Develop computer model
5	for longitudinal
6	solidification
7	- Incorporate temperature
8	dependant variables
9	- Apply computer model
10	to Skylab results
11	- Apply computer model to
12	ASTP exp. (as requested)
13	- Apply computer model to
14	realistic crystal growth
15	techniques proposed for
16	Spacelab
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY
APPROVAL R. Decher
ACCOMPLISHMENT L. Lacy

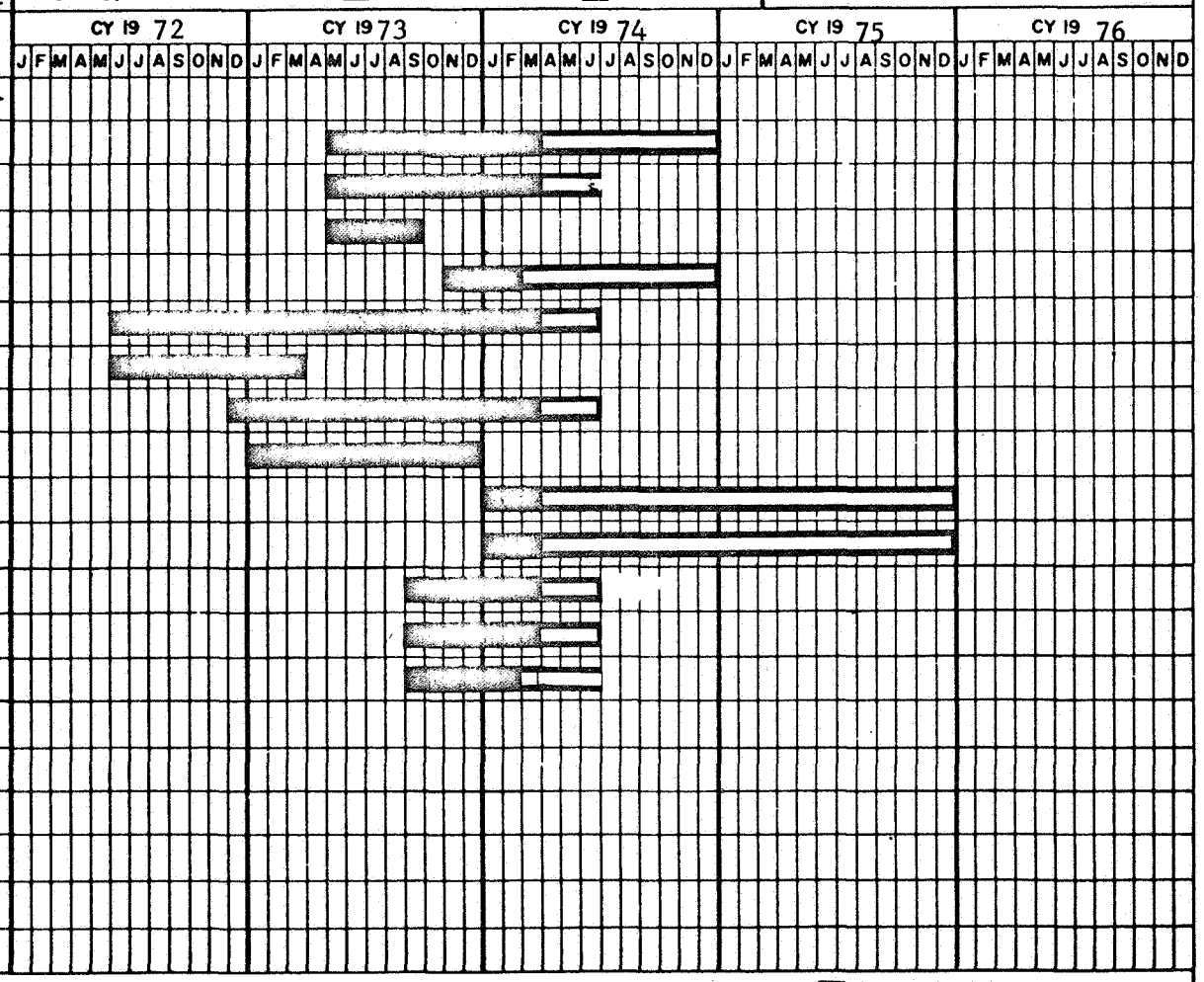
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Immiscible Materails - Ground Based Studies
RTOP NO. 179-11-14-02 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	Physical Properties of
2	Drop Tower Samples
3	GaBi (Electrical)
4	Ga Bi (Supercond.)
5	PbZn & Other
6	Skylab Samples (M566)
7	Acoustical Evaluation
8	Electrical Evaluation
9	Density
10	Lab. Prepared Samples
11	Other Flight Samples
12	Skylab Science Demo.
13	Immiscible Liquids
14	Ice Melting
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY
APPROVAL W. C. Snoddy
ACCOMPLISHMENT M. Davidson

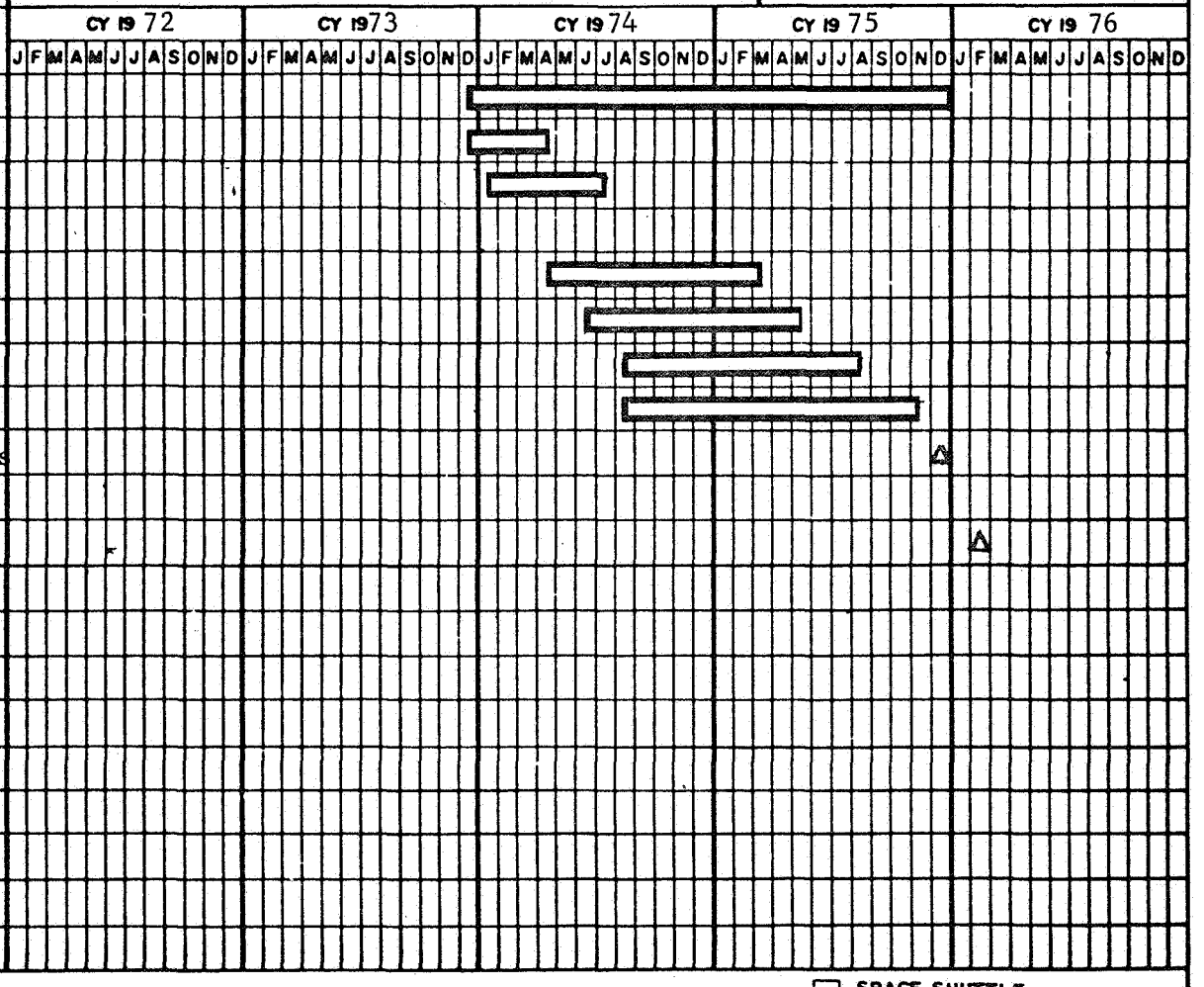
MILESTONE SCHEDULE

TASK:
RTOP TITLE Zone Refining in a Zero Gravity Environment
RTOP NO. 179-11-21-00 [X] ADV. RESEARCH [ ] TECHNOLOGY

5 LEVEL

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Contract
2	Literature survey
3	Materials purchase
4	Analyze floating zones
5	(a) zone diameter
6	(b) surface tension
7	(c) rotational stability
8	Candidate materials study
9	Specify candidate materials
10	Monthly reports
11	Final report
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY
APPROVAL W. C. Snoddy
ACCOMPLISHMENT R. C. Ruff

MILESTONE SCHEDULE

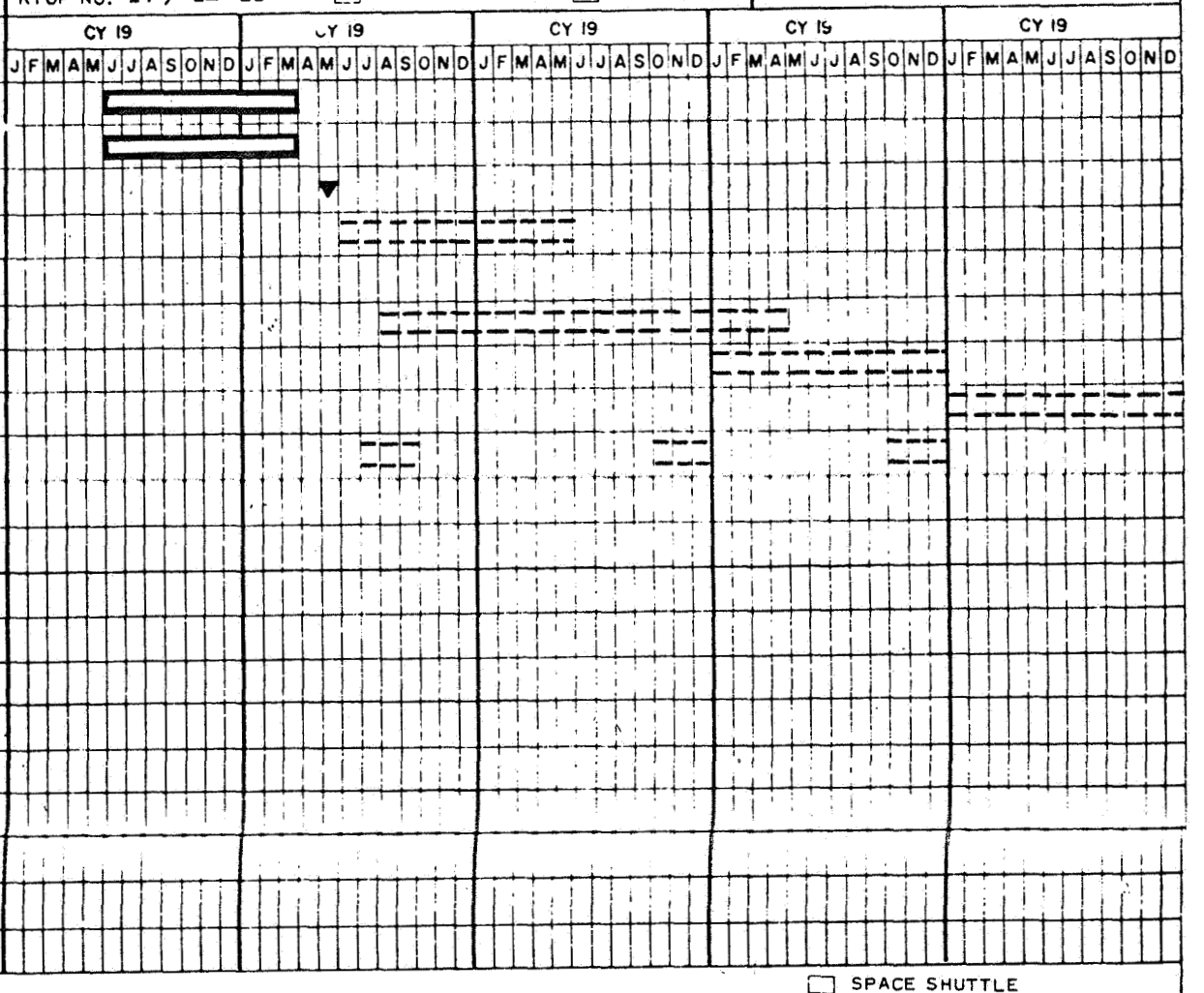
RTOP TITLE Growth of Single Crystal Ribbon in Space

RTOP NO. 179-12-13 ☐ ADV. RESEARCH ☒ TECHNOLOGY

5 LEVEL

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	- RF Shaping Analysis
2	- Other Shaping Analysis
3	- Decision to Continue
4	- Processing Requirements
5	Analysis
6	- Lab Simulation
7	- Prototype
8	- Flight Experiment
9	- Economic Analysis
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. C. Snoddy

ACCOMPLISHMENT T. Bannister

MILESTONE SCHEDULE

Task

RTOP TITLE Analytics of Crystal Growth

5 LEVEL

Start date

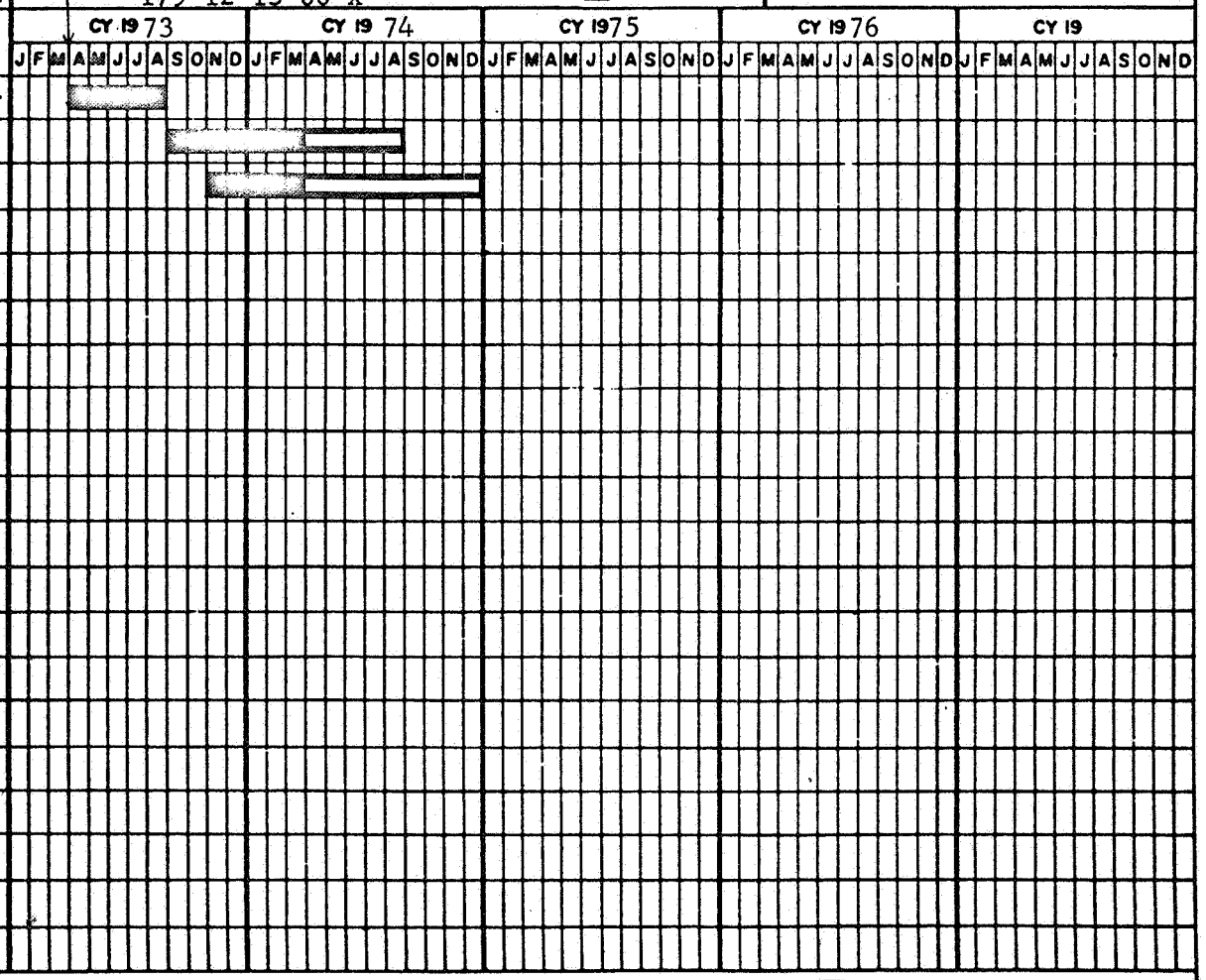
RTOP NO. 179-12-13-06 ☒ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Define Equations
2	Obtain Solutions
3	Perform Lab Studies
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. C. Snoddy

ACCOMPLISHMENT M. Davidson

MILESTONE SCHEDULE

Task ~~RTOP~~ TITLE Space Processing Research on Crystal Growth

5 LEVEL

RTOP NO. 179-12-15-01 ☐ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 (Date) 03 74 (Initials)

	ACTIVITIES	CY 1972	CY 1973	CY 1974	CY 1975	CY 1976
1	Characterization Studies →					
2	M555 Sample Charact.					
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

MILESTONE SCHEDULE

CENTER MSFC
RESPONSIBILITY
APPROVAL W. C. Snoddy
ACCOMPLISHMENT M. Davidson

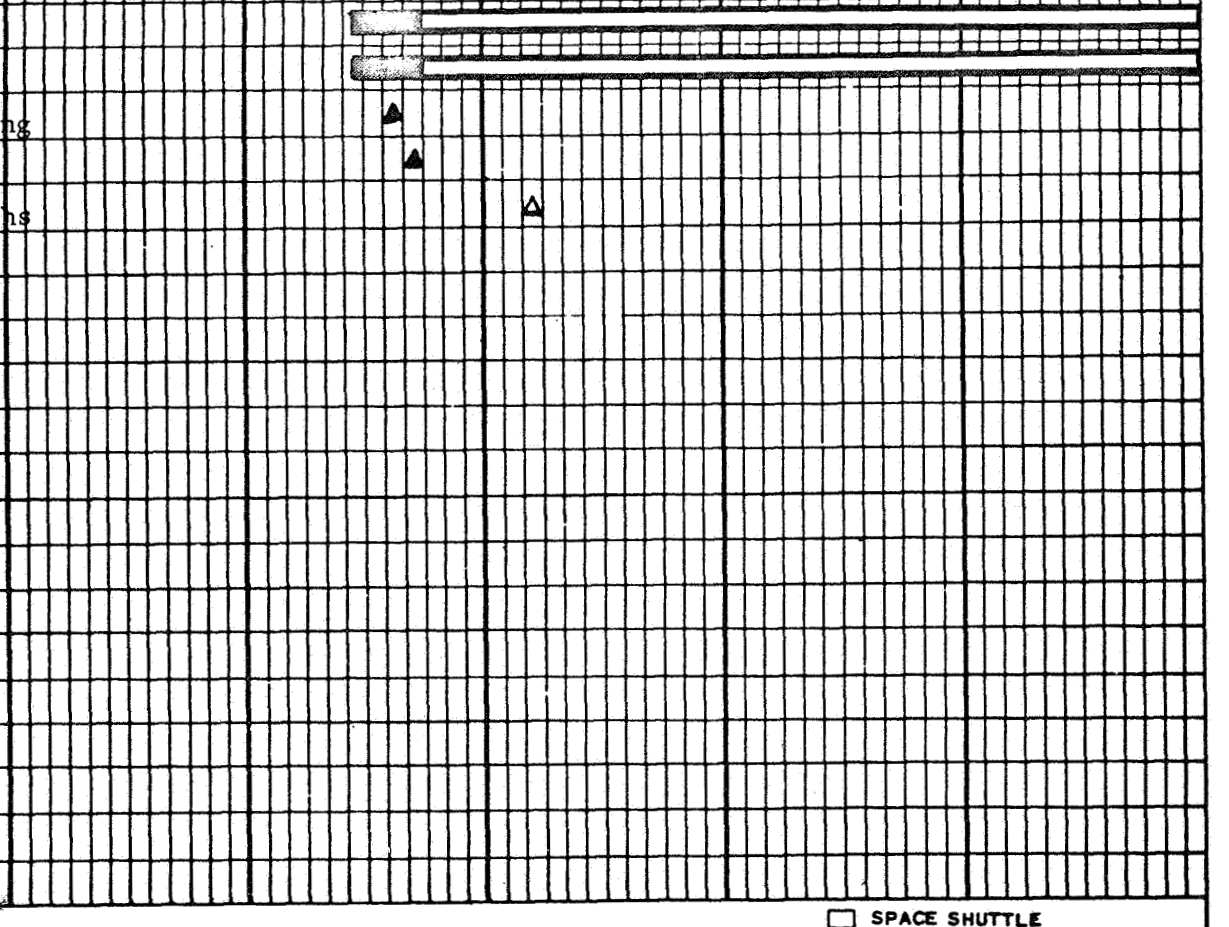
Task TITLE Crystal Growth & Characterization

5 LEVEL

NO. 179-12-15-02 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Crystal growth studies
2	Characterization studies
3	Develop photovoltaic scanning
4	X-ray topography available
5	X-ray transmission topographs
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL

ACCOMPLISHMENT M. C. Davidson

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Gravitational Effects on Process-Induced Dislocation in Silicon

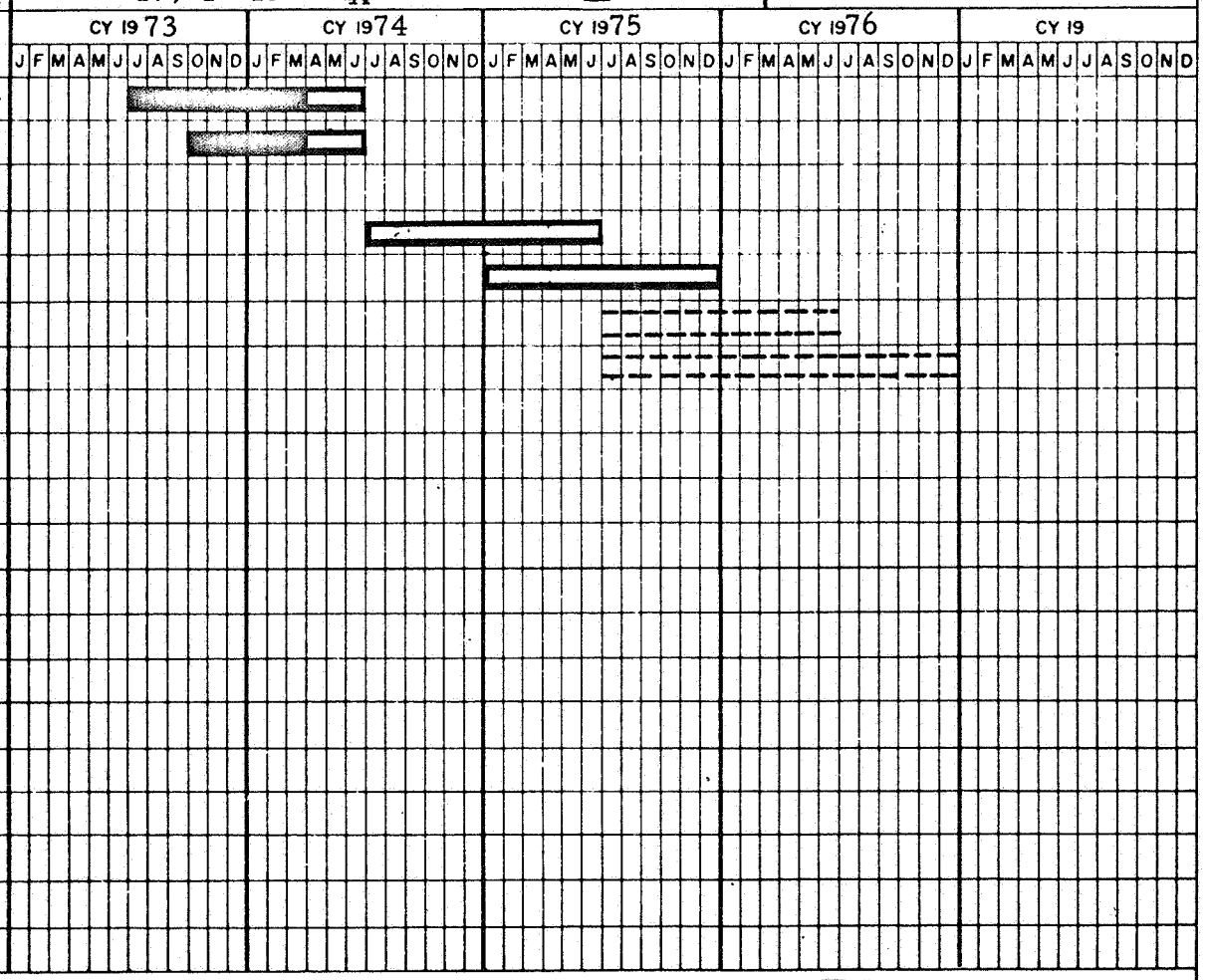
RTOP NO. 179-12-16 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	- Open Tube Testing
2	- Closed Tube Apparatus
3	Acquisition
4	- Closed Tube Testing
5	- Centrifuge Testing
6	- LSI Processing
7	- Flight Experiment
8	Design
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY
APPROVAL
ACCOMPLISHMENT R. C. Ruff

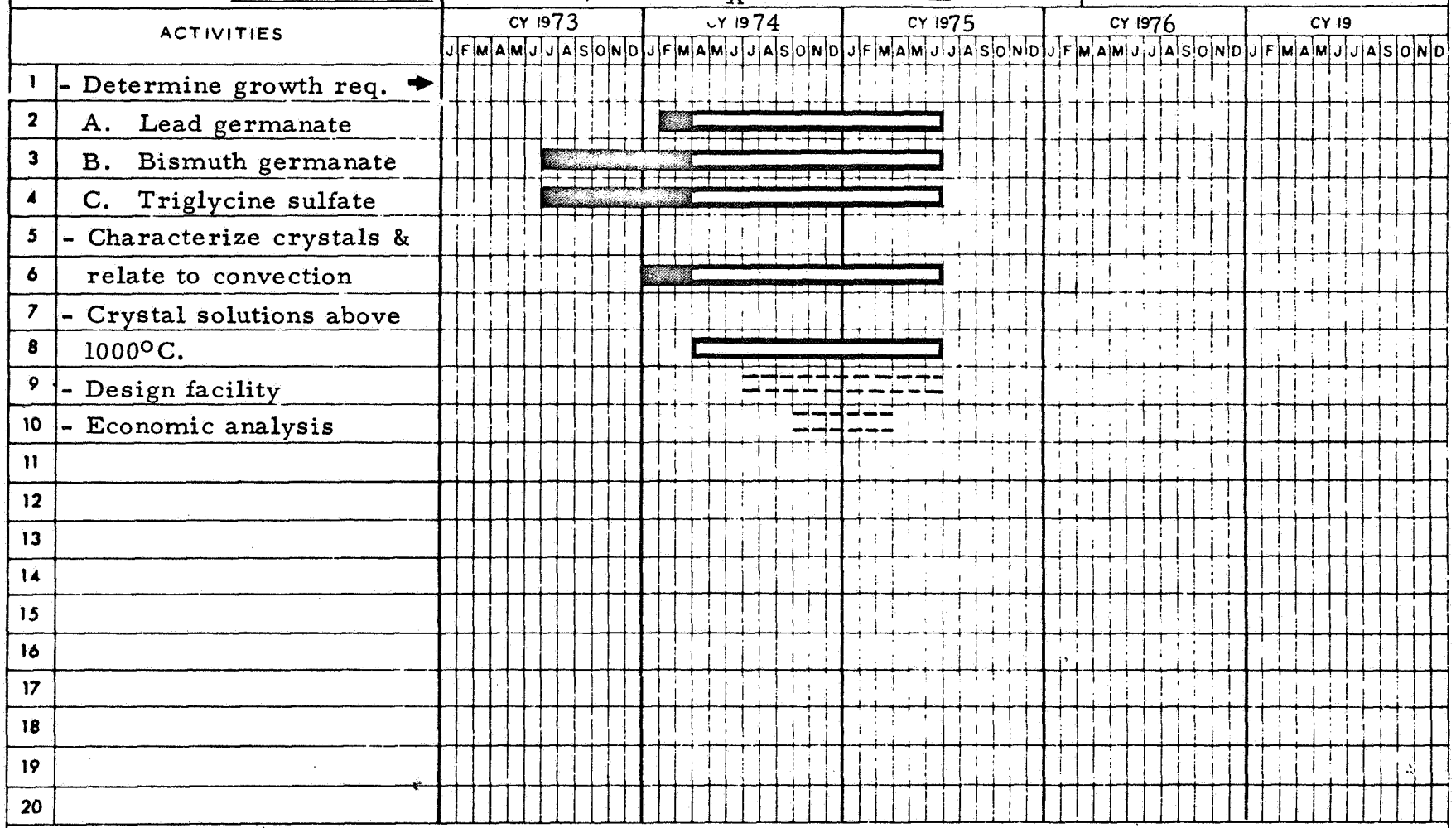
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Crystal Growth in Fused Solvent Systems

RTOP NO. 179-12-23 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) (Initials)



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. C. Snoddy

ACCOMPLISHMENT T. Bannister

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE SOLUTION CRYSTAL GROWTH

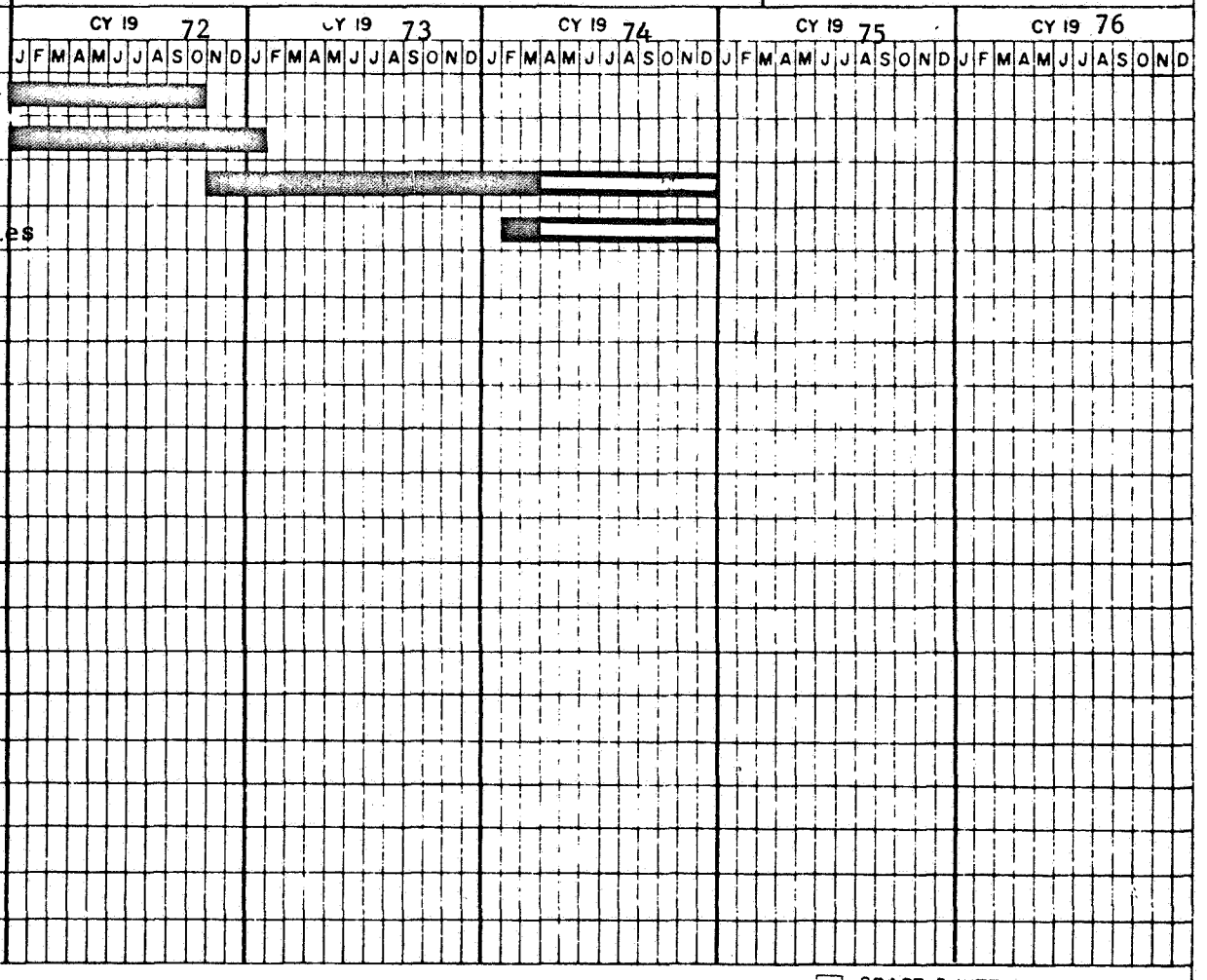
RTOP NO. 179-12-23-02 ☒ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Ferroelectric set-up
2	Growth set-up
3	Convection study
4	Analysis of Skylab IV Samples
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. C. Snoddy

ACCOMPLISHMENT T. Bannister

MILESTONE SCHEDULE

RTOP TITLE CONVECTION ANALYSIS

5 LEVEL

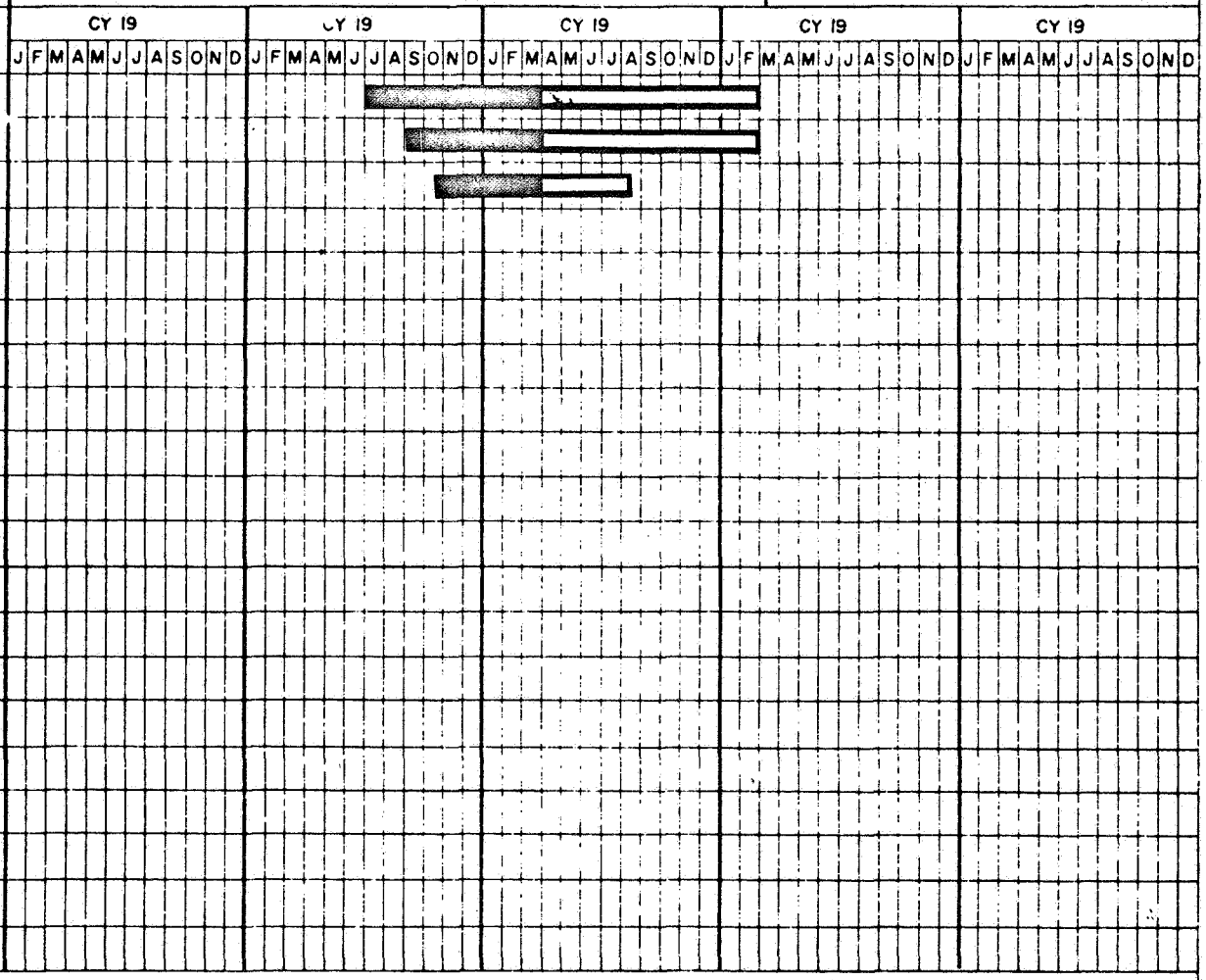
RTOP NO. 179-15-11-02 [ ] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____

STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	Vibrational convection
2	Sounding rocket
3	Skylab IV demo.
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. C. Snoddy

ACCOMPLISHMENT Facemire

MILESTONE SCHEDULE

TASK:

RTOP TITLE Soret Separation in Zero Gravity

5 LEVEL

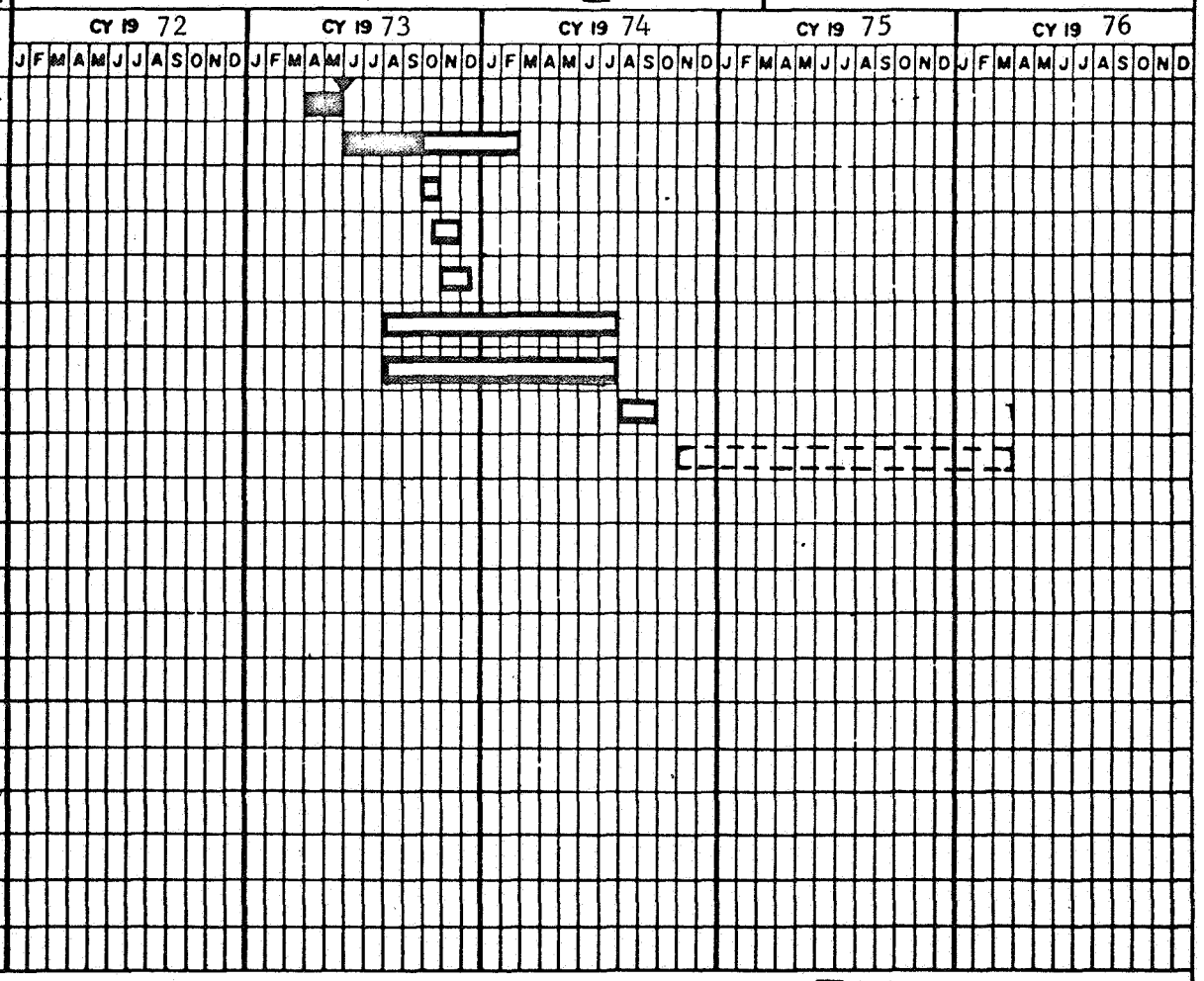
RTOP NO. 179-15-12-01 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (Initials)

STATUS AS OF 3; 03 74 (Date) (Initials)

	ACTIVITIES
1	Contract negotiated & Signed (NAS8-29609)
2	Literature survey
3	Install Soret equipment
4	Perform initial tests and
5	analyze results
6	Perform studies of Convective effects
7	Develop analytical models
8	Final report
9	Develop flight experiment
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. C. Snoddy

ACCOMPLISHMENT C. F. Schafer

MILESTONE SCHEDULE

task ~~RTOP~~ TITLE Diffusion Analysis in Low Gravity

5 LEVEL

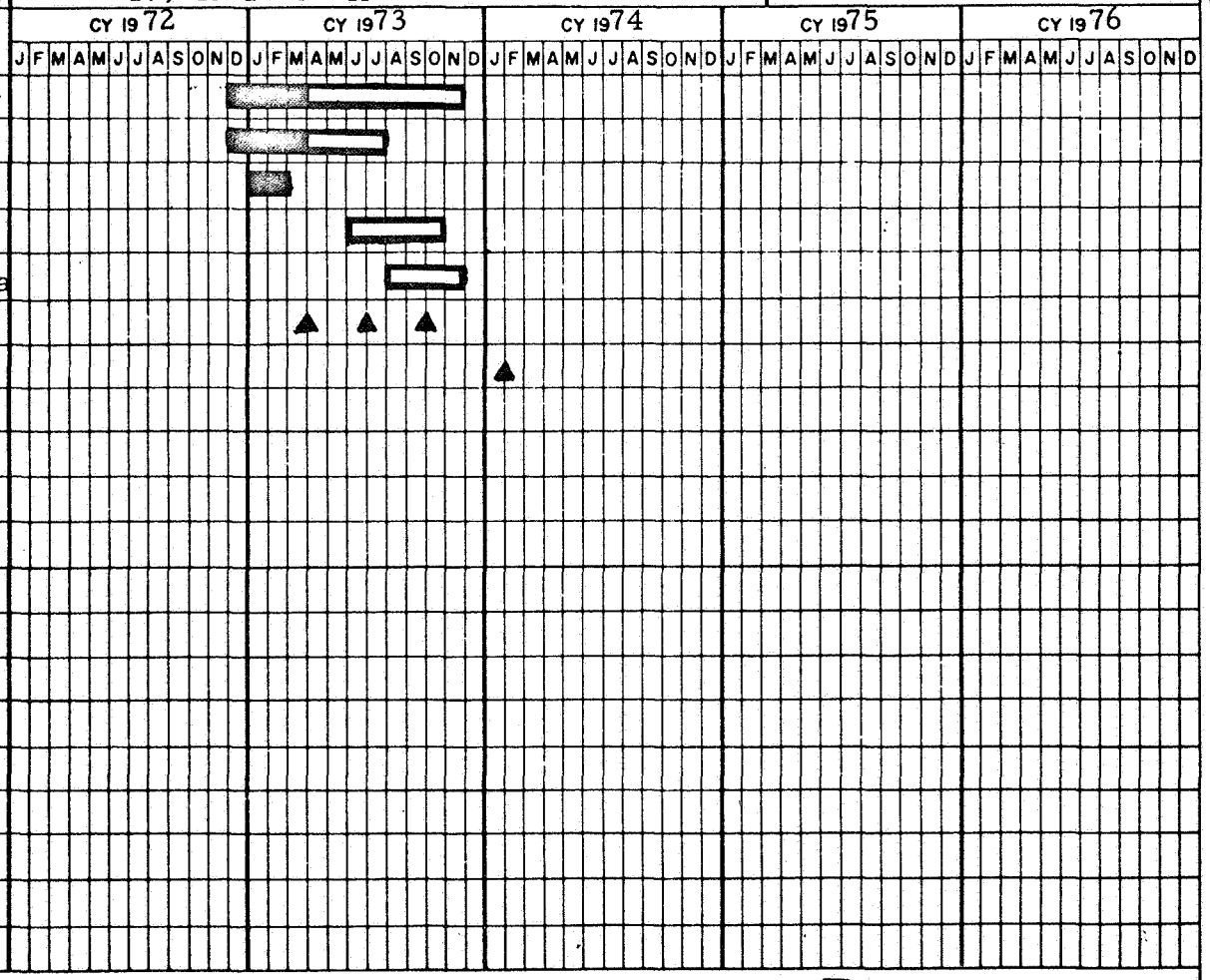
RTOP NO. 179-15-12-02 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	- Contract
2	- Literature Survey
3	- Materials Purchase
4	- Diffusion Measurements
5	- Analysis of Diffusion Data
6	- Quarterly Reports
7	- Final Reports
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-A
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT A. Boese

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Space Processing Equipment Technology

RTOP NO. 179-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: M518 Multipurpose Electric Furnace Modification (179-21-10-00)					
2						
3	NAS8-29769					
4						
5	Deliver Furnace & Hardware		△			
6						
7	Documentation		△			
8						
9	Final Report		△			
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MXX
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT B. R. Aldrich

MILESTONE SCHEDULE

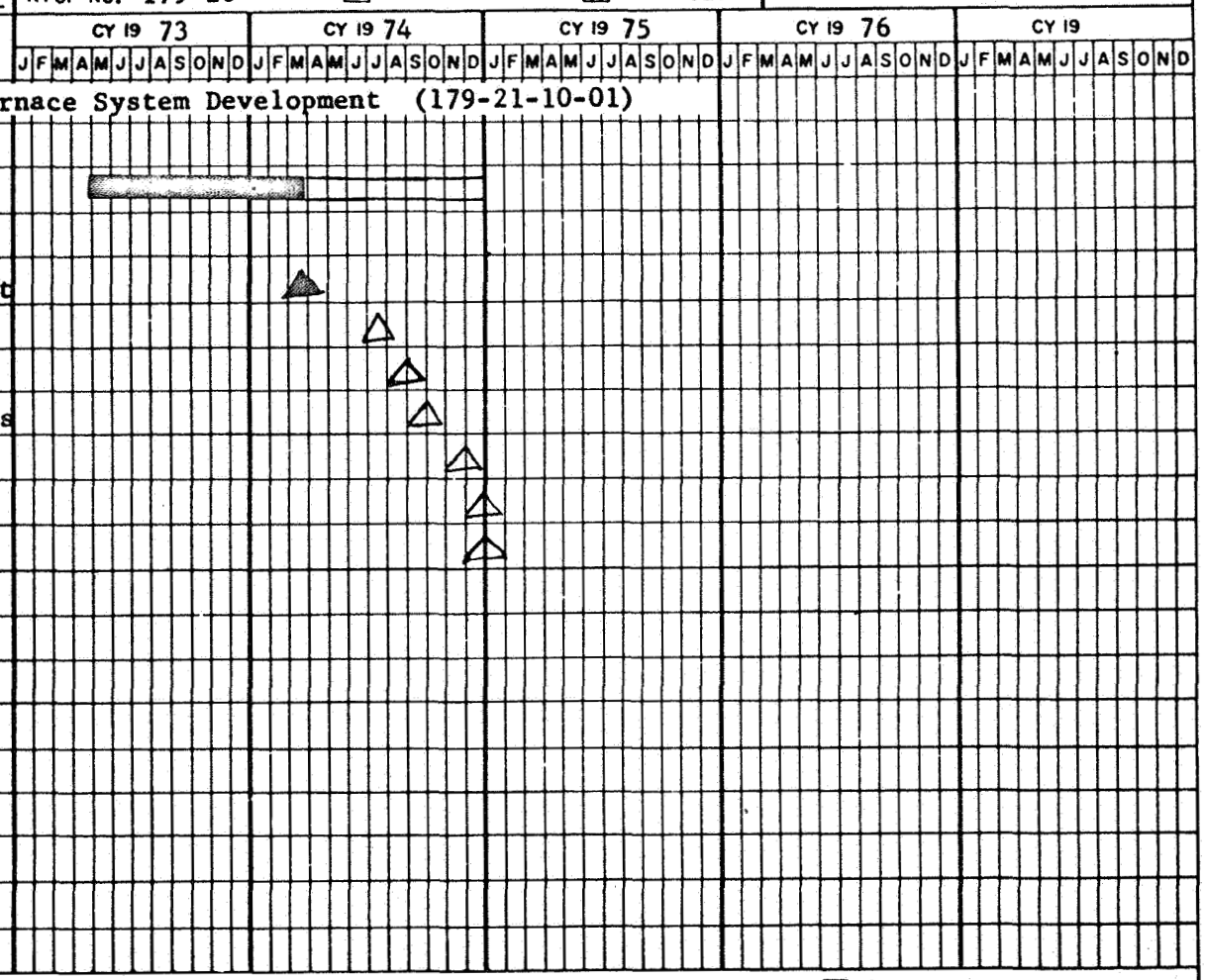
5 LEVEL

RTOP TITLE Space Processing Equipment Technology

RTOP NO. 179-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Space Processing Furnace System Development (179-21-10-01)
2	
3	Contract NAS8-29769
4	
5	A - Identify User Require't
6	B - Analysis of Materials
7	C - Contract Review
8	D - Fab Critical Components
9	E - Provide Heater System
10	F - Performance Testing
11	G - Delivery of Axial
12	Gradient Element
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MXX
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT B. R. Aldrich

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Space Processing Equipment Technology

RTOP NO. 179-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19 76	CY 19 77
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Furnace Systems for Use on Low "G" Test Facilities (179-21-10-03)					
2						
3	In-House					
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASF
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-A
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT L. H. Berge

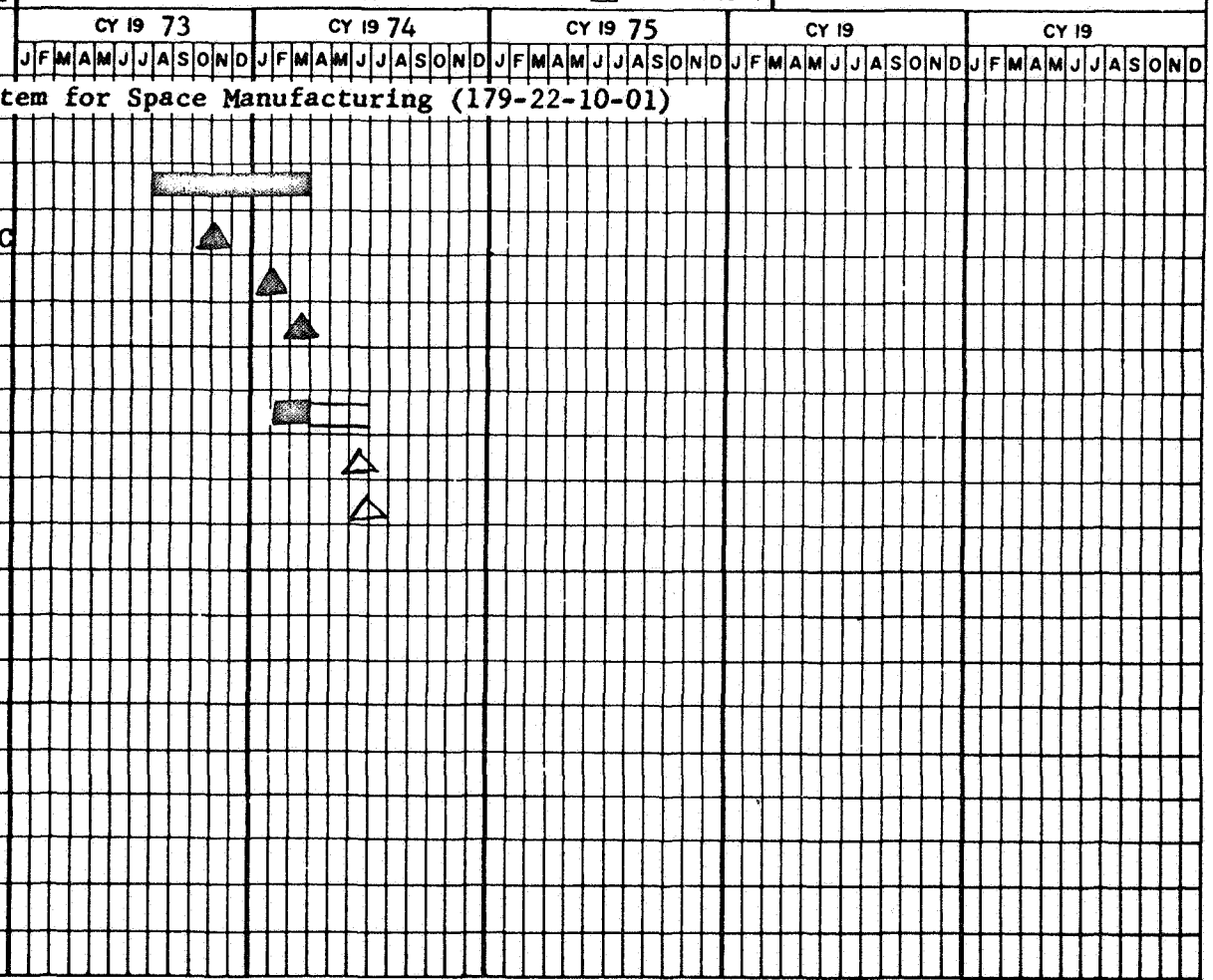
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Space Processing Equipment Technology
RTOP NO. 179-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK: Free Suspension System for Space Manufacturing (179-22-10-01)
2	
3	NAS8-29680 - Basic
4	Technical Briefing at MSFC
5	Review Presentation
6	Report - Basic Contract
7	
8	NAS8-29680 - Modification
9	Final Review Presentation
10	Final Report
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-A
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT Berge, L. H.

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Space Processing Equipment Technology
RTOP NO. 179-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 74	CY 19 75	CY 19 76	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Containerless Processing System (179-22-10-01)					
2						
3	DCN 1-4-65-48019					
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-A
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT L. H. Berge

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Space Processing Equipment Technology
RTOP NO. 179-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Acoustic Positioning System for Space Processing (179-22-20-02)					
2						
3	Contract NAS8-30471					
4	Orientation Briefing(MSFC)					
5	Progress Report (MSFC)					
6	Final Review Briefing(MSFC)					
7	Final Report					
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL

ACCOMPLISHMENT R. C. Ruff

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Solar Energy Concentrator System for Crystal Growth and Zone Refining in Space

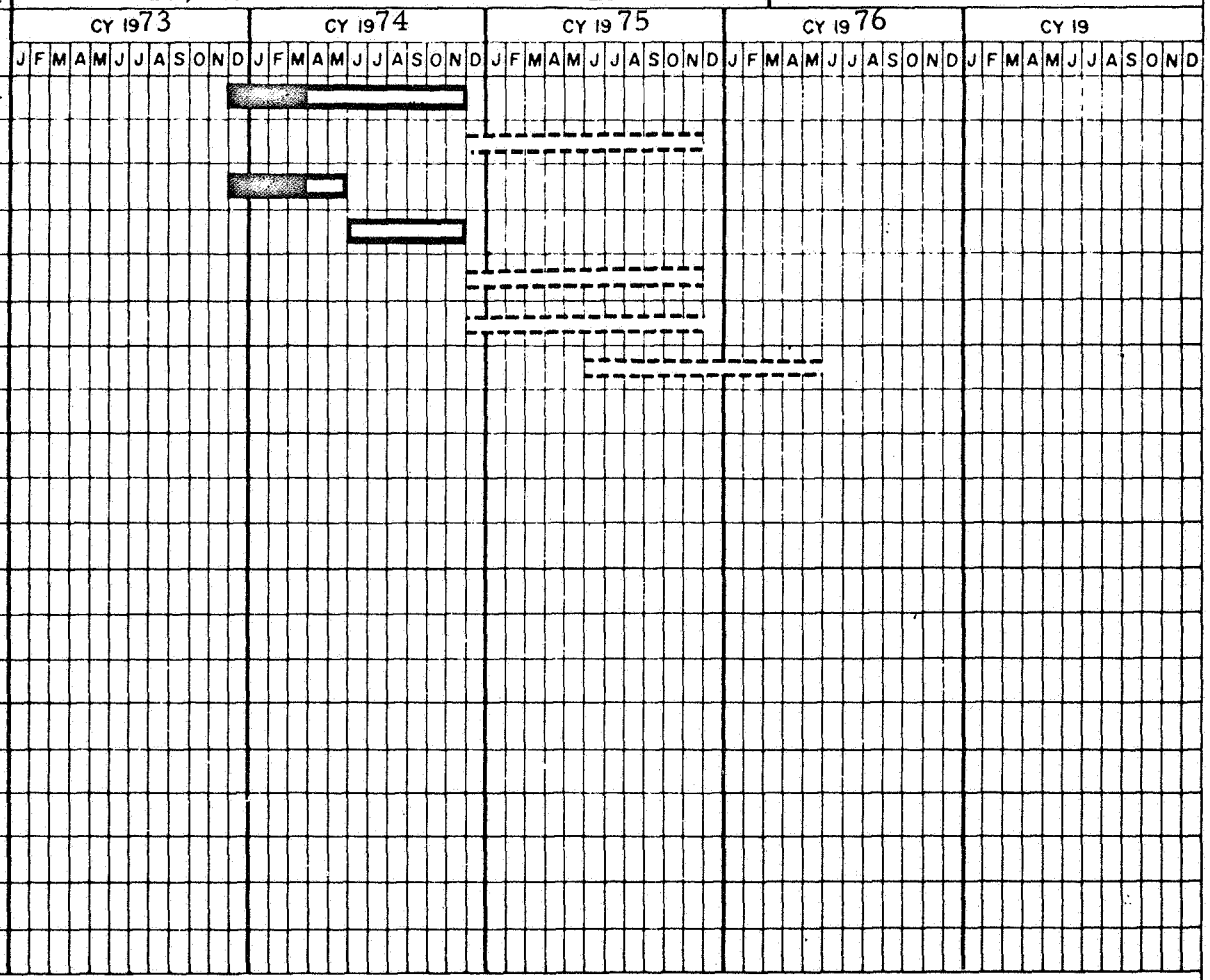
RTOP NO. 179-21-20 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	- System Definition
2	- System Optimization
3	- Materials Analysis
4	- Preliminary Design
5	- Economic Comparison
6	- Spacelab Feasibility
7	- Laboratory Testing
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. C. Snoddy, S&E-SSL-T

ACCOMPLISHMENT M. Davidson

MILESTONE SCHEDULE

5 LEVEL

Task ~~PROJ~~ TITLE Crystal Growth Techniques in Zero Gravity

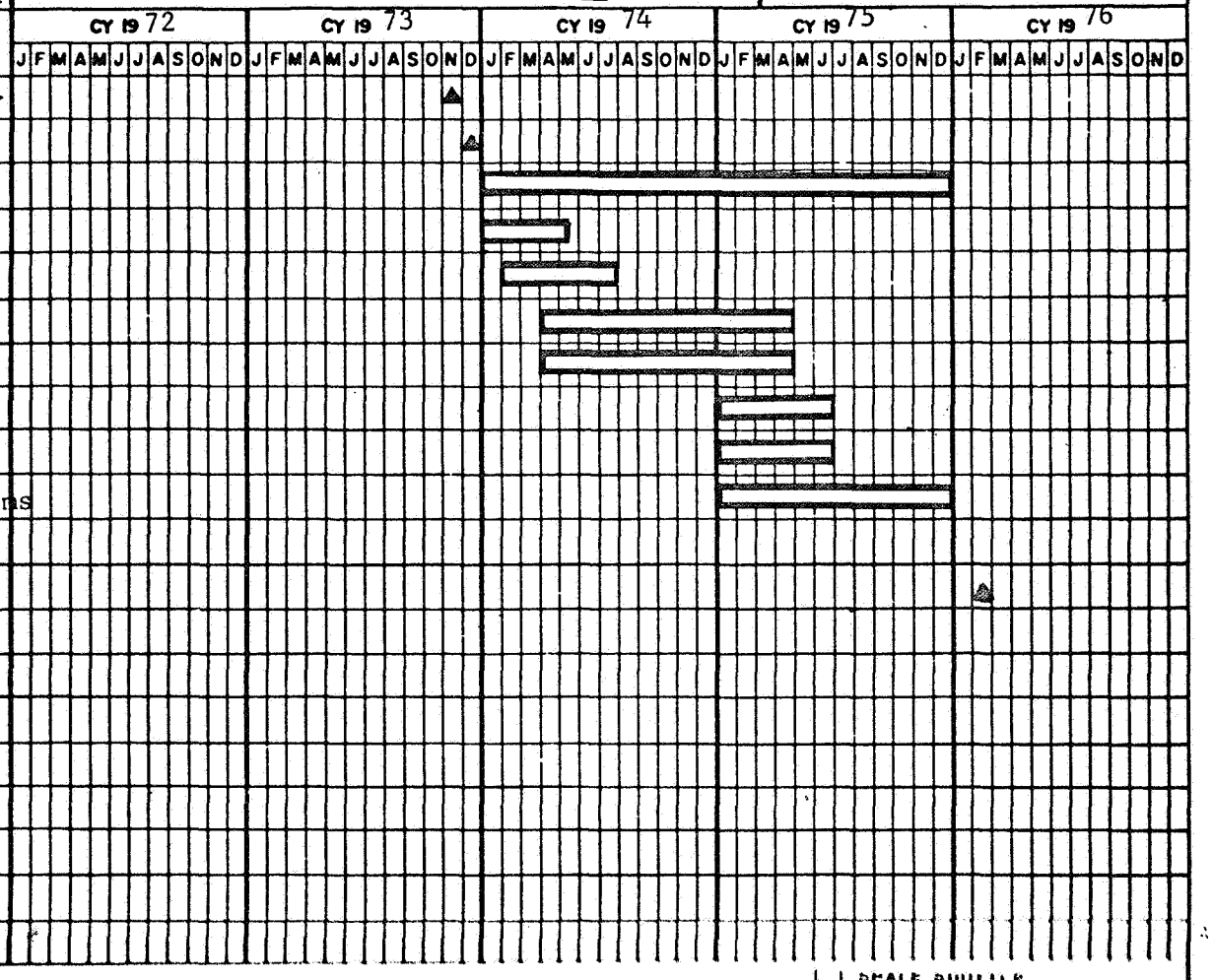
RTOP NO. 179-24-30-01 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	RFQ
2	Quotation
3	Contract
4	Literature Survey
5	Materials purchase
6	Test heat sources
7	Test temperature sensors
8	Analyze heater data
9	Analyze sensor data
10	Design Containerless Systems
11	Monthly reports
12	Final Report
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL R. Decher

ACCOMPLISHMENT L. Lacy

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Acoustic Mixing for Space Processed Materials

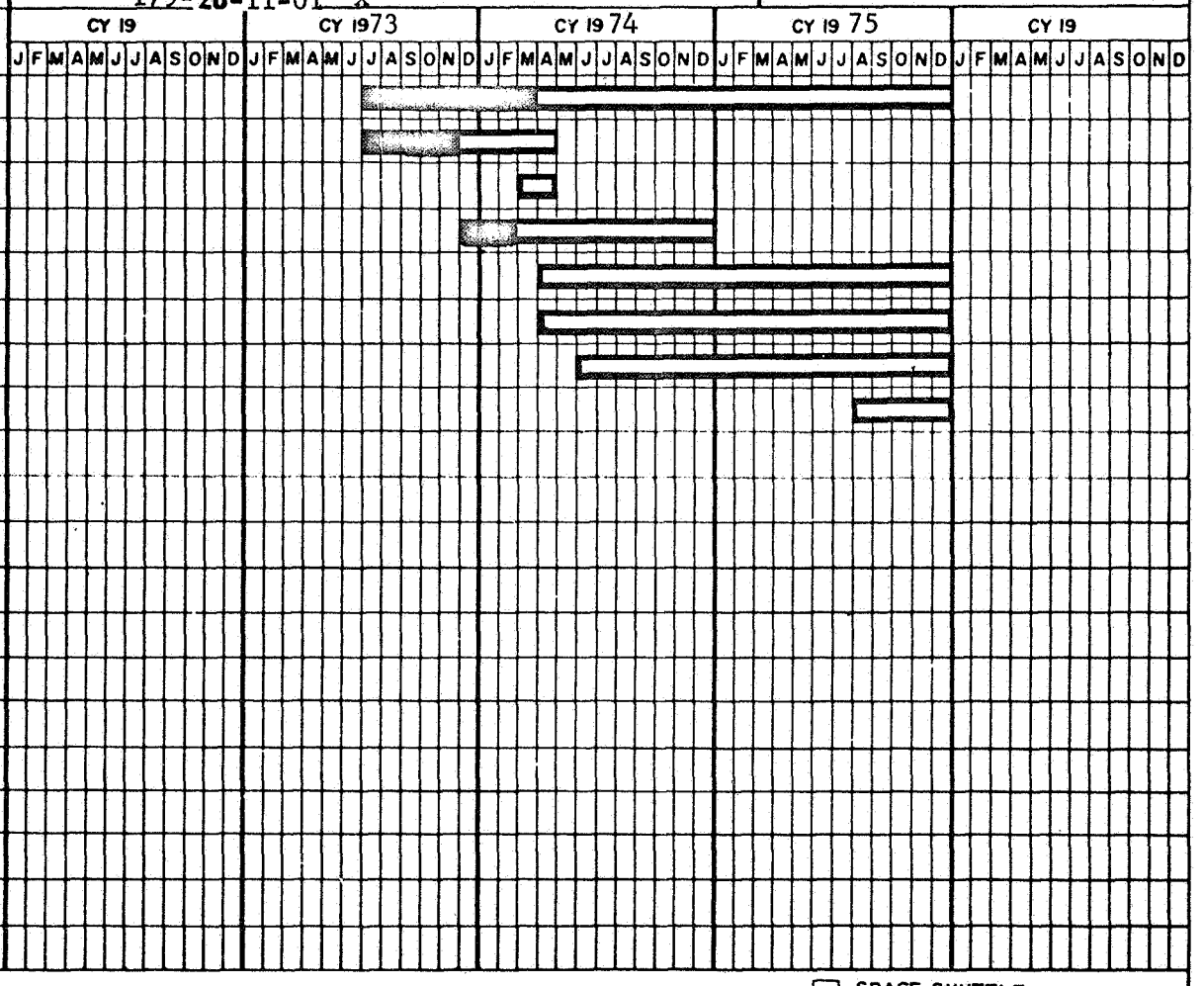
RTOP NO. 179-26-11-01 ☒ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ _____

STATUS AS OF 31 03 74 (Initials) ___

	ACTIVITIES
1	Acoustic Mixing
2	Acoustic Particle Counting
3	Report on 2
4	Theoretical Studies
5	Experimental Simulation
6	Molten Metals
7	Zero-Gravity
8	Demonstrate Feasibility
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MWP
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT V. H. Yost

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Ground Based Space Processing Tests

RTOP NO. 179-30 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19 76	CY 19 77
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Drop Tower Program Support (179-31-99-01)					
2						
3	In-House					
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processing
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-PE-MWP
APPROVAL H. F. Wuenscher
ACCOMPLISHMENT V. H. Yost

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Space Processing Flight Systems

RTOP NO. 179-40 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19 76	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK: Rocket Payload Non-Spin System (179-42-22-01)					
2						
3	In-House					
4						
5	Platform Procurement					
6	NAS8-30528					
7	Deliver Platforms					
8	Deliver Final Report					
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ Space Processes
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-YE
APPROVAL William W. Vaughan
ACCOMPLISHMENT Otha H. Vaughan

MILESTONE SCHEDULE

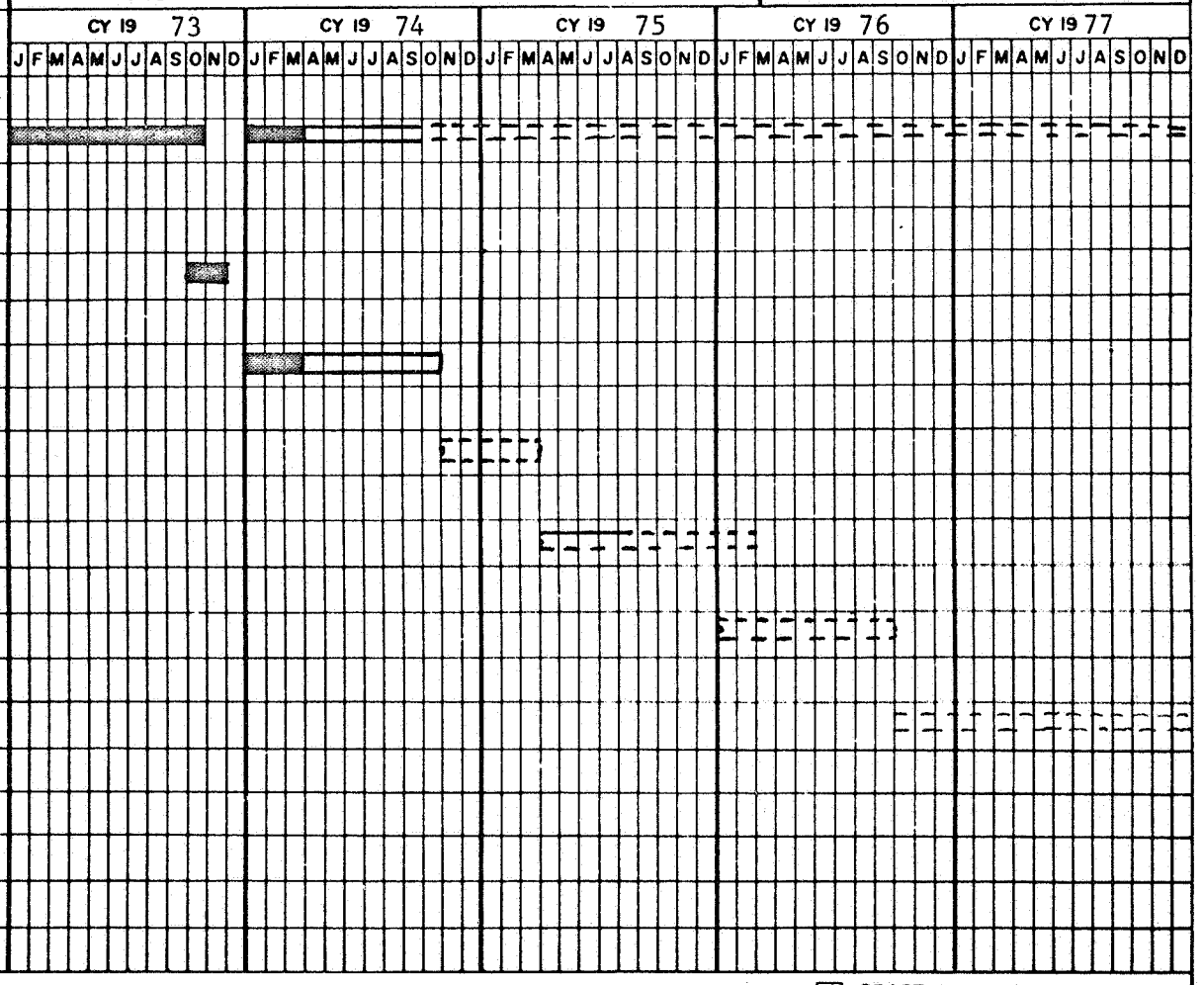
4 LEVEL

RTOP TITLE Zero-G Cloud Physics Experiments

RTOP NO. 645-10-01 [x] ADV. RESEARCH [x] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) _____ (No.) _____ (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
	Science:
1	Science Advisory Board
	Laboratory:
2	Pre ØA Proc Cycle
3	ØA Contract
4	ØB Proc Cycle
5	ØB Contracts
6	ØC/D Pro Cycle
7	ØC/D Contract



NOTES

[xx] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-G

APPROVAL James C. Blair

ACCOMPLISHMENT J.R. Duncan, Jr.

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Terminal Guidance and Navigation for Comet and Asteroid Rendezvous

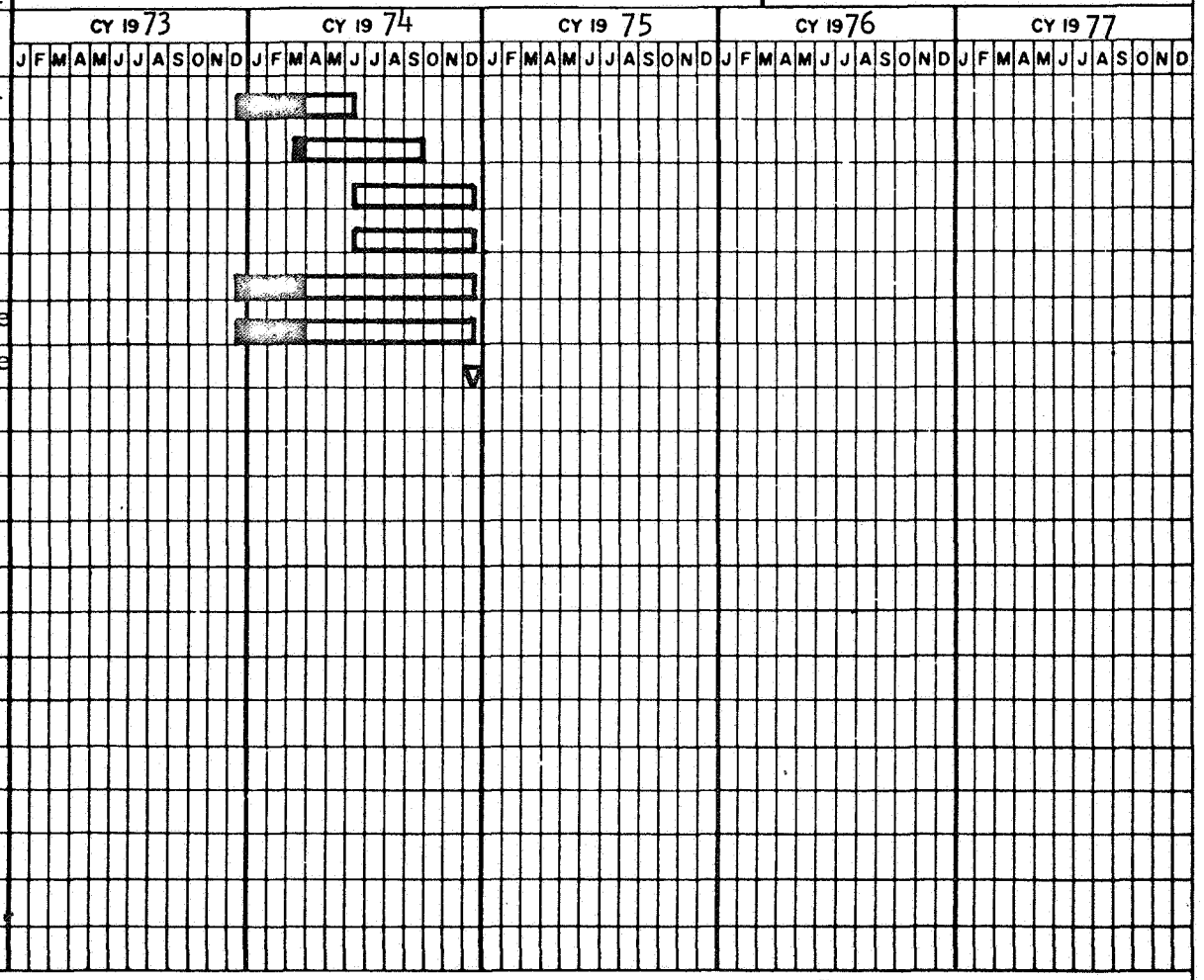
RTOP NO. 684-30-90 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Measurement Types Study
2	Thrust Constraints & Errors
3	End Point Control Studies
4	System Studies
5	Instrument & Computer Requirements
6	Guidance & Navigation Scheme Development & Testing
7	Guidance & Navigation Scheme Delivery
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3456 (April 1970)

Page 3 of 3 pages

OFFICE OF SPACE SCIENCES

CENTER MSFC
RESPONSIBILITY
APPROVAL J. P. Lindberg
ACCOMPLISHMENT Gerald Wittenstein

MILESTONE SCHEDULE

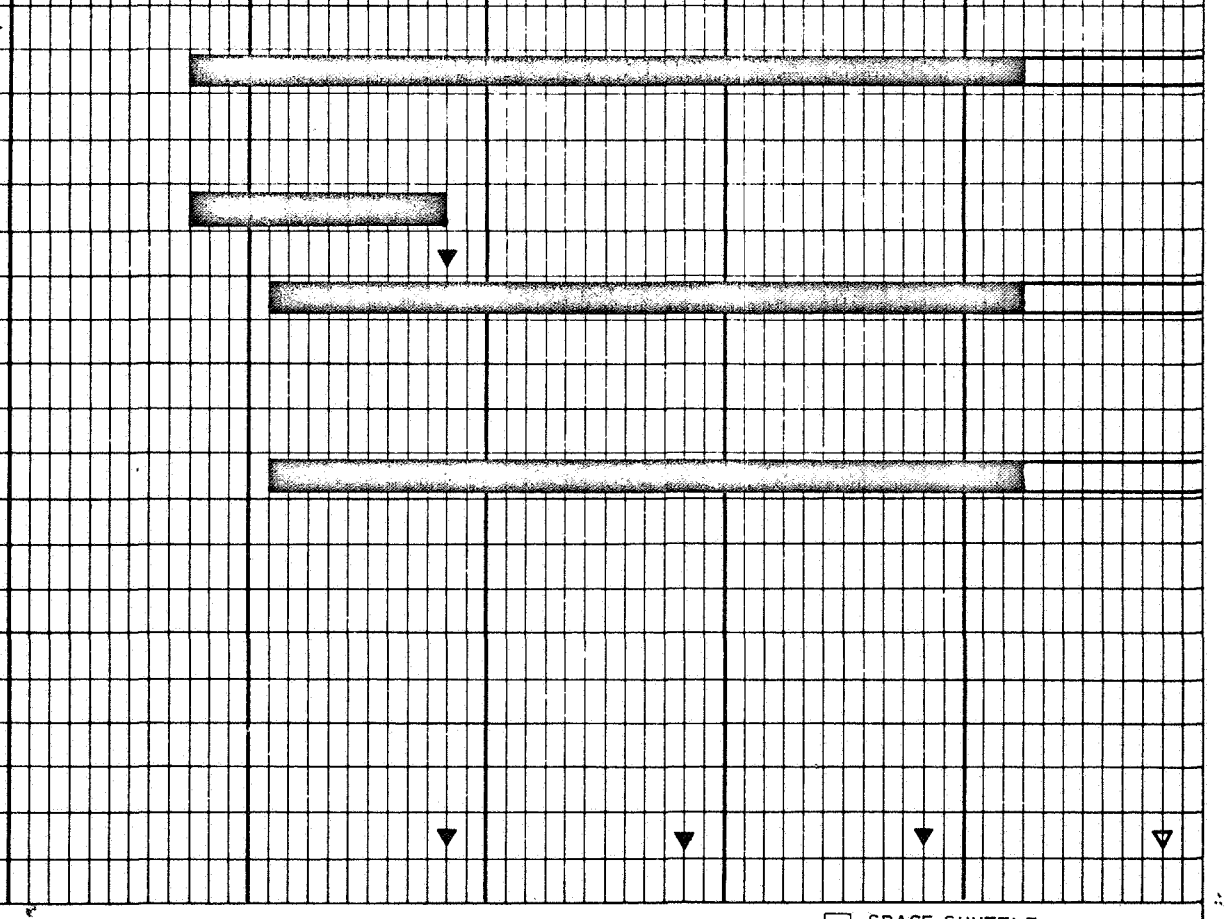
System Performance and Technology (4 LEVEL)

RTOP TITLE
Assessment for Unmanned Missions

RTOP NO. 180-17-50 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	
2	Update Maintain Methods, Computer Program Data
3	Bank
4	
5	Test Methods (HEAO)
6	
7	Investigate Future OSS
8	Missions for Performance
9	Requirements Forecast
10	
11	Investigate Scout for
12	Astrionics Improvement
13	
14	
15	
16	
17	
18	
19	Yearly Summary Reports
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

▼ Completed Milestone
▽ Scheduled Milestone

Completed Work

Planned Work, Committed - But Not Completed

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL Fred Wojtalik
ACCOMPLISHMENT J. R. Parker

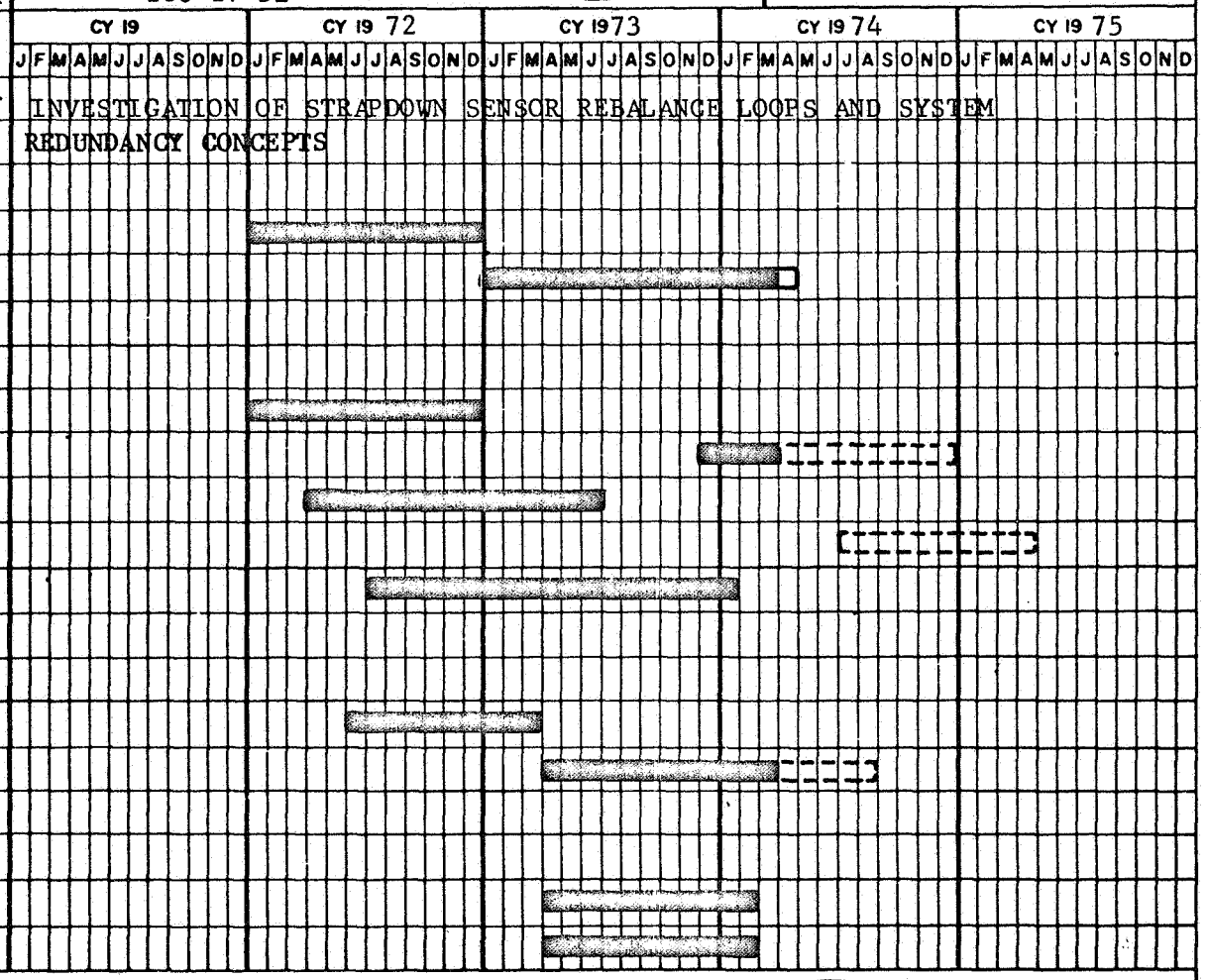
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE
SYSTEM AND TRAJECTORY ANALYSIS
RTOP NO. 180-17-52 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK TITLE
2	
3	Redundancy Concepts
4	*SDF Sensor
5	**TDF Sensor
6	
7	Electronics Loop
8	Analysis - SDF Sensor
9	Analysis - TDF Sensor
10	Design - SDF Sensor
11	Design - TDF Sensor
12	Design Verification SDF
13	Sensor
14	Simulation
15	SDF Sensor
16	TDF Sensor
17	
18	Time Sharing Analysis
19	SDF Sensor
20	TDF Sensor



NOTES
*Single-degree-of-freedom Sensor
**Two-degree-of-freedom Sensor

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL F. S. Wojtalik
ACCOMPLISHMENT B. Gaines

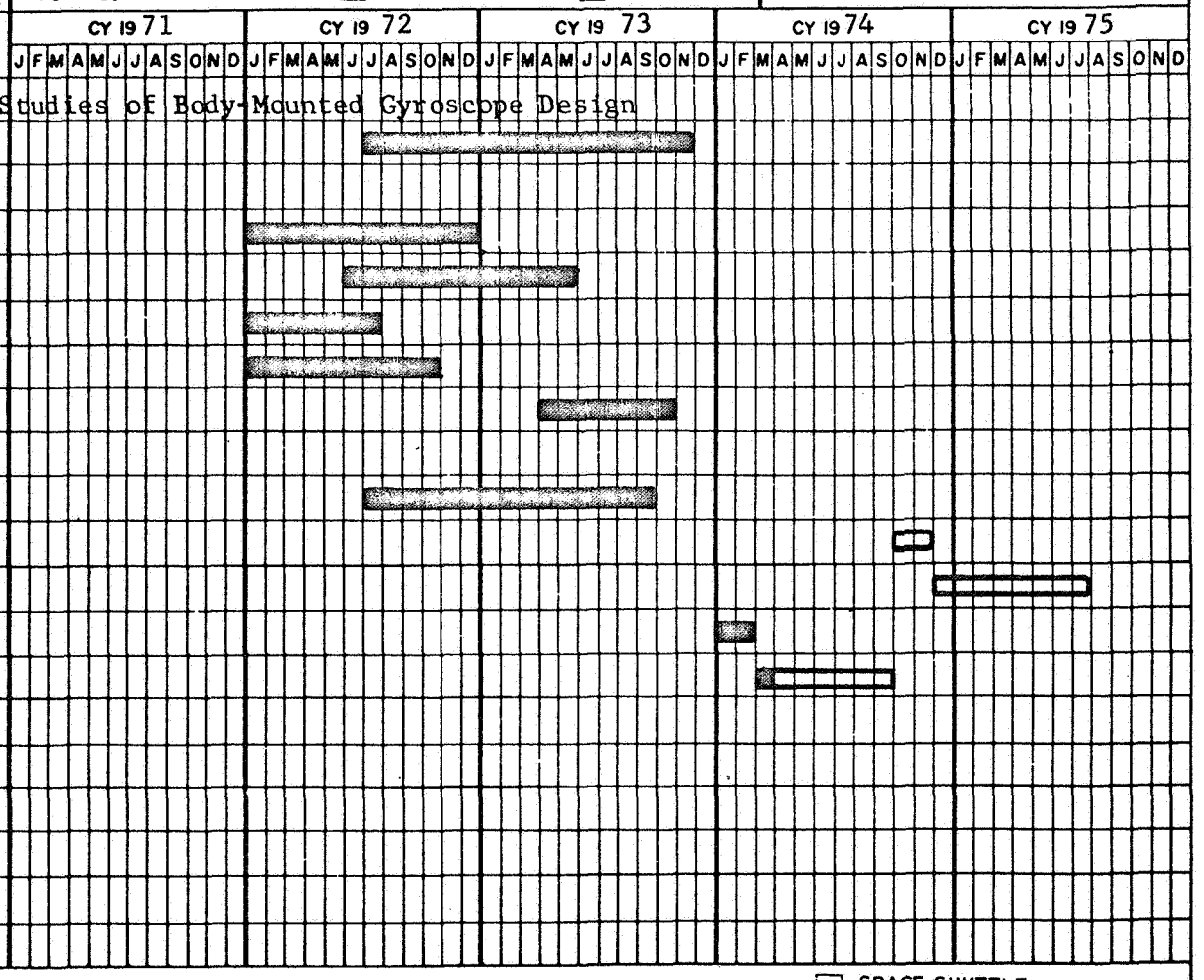
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE System and Trajectory Analysis
RTOP NO. 180-17-52 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	TASK TITLE: Experimental Studies of Body-Mounted Gyroscope Design
2	Loop Evaluation
3	Dynamic Tests
4	MIT-18 IRIG
5	Kearfott 2544
6	Torquer S.F. Modeling
7	Dry Gyro Test Design
8	Dry Gyro Testing
9	Component Modularity
10	Study
11	Laser Gyro Test Design
12	Laser Gyro Testing
13	Accelerometer Test Design
14	Accelerometer Testing
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-GC
APPROVAL F. S. Wojtalik
ACCOMPLISHMENT B. Gaines

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Dynamic Test of Inertial Sensors
RTOP NO. 180-17-53 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 70	CY 19 71	CY 19 72	CY 19 73	CY 19 74
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK TITLE: Procurement and Evaluation of Advanced Gyroscopes for Modular Strapdown System					
2	Developmental Testing at HSSC					
3	Deliver Gyro with Breadboard Electronics					
4	Deliver Fully Integrated Gyro					
5	Final Report Phases 1, 2, and 3					
6	Evaluate Gyro System at MSFC					
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL F. S. Wojtalik
ACCOMPLISHMENT B. Gaines

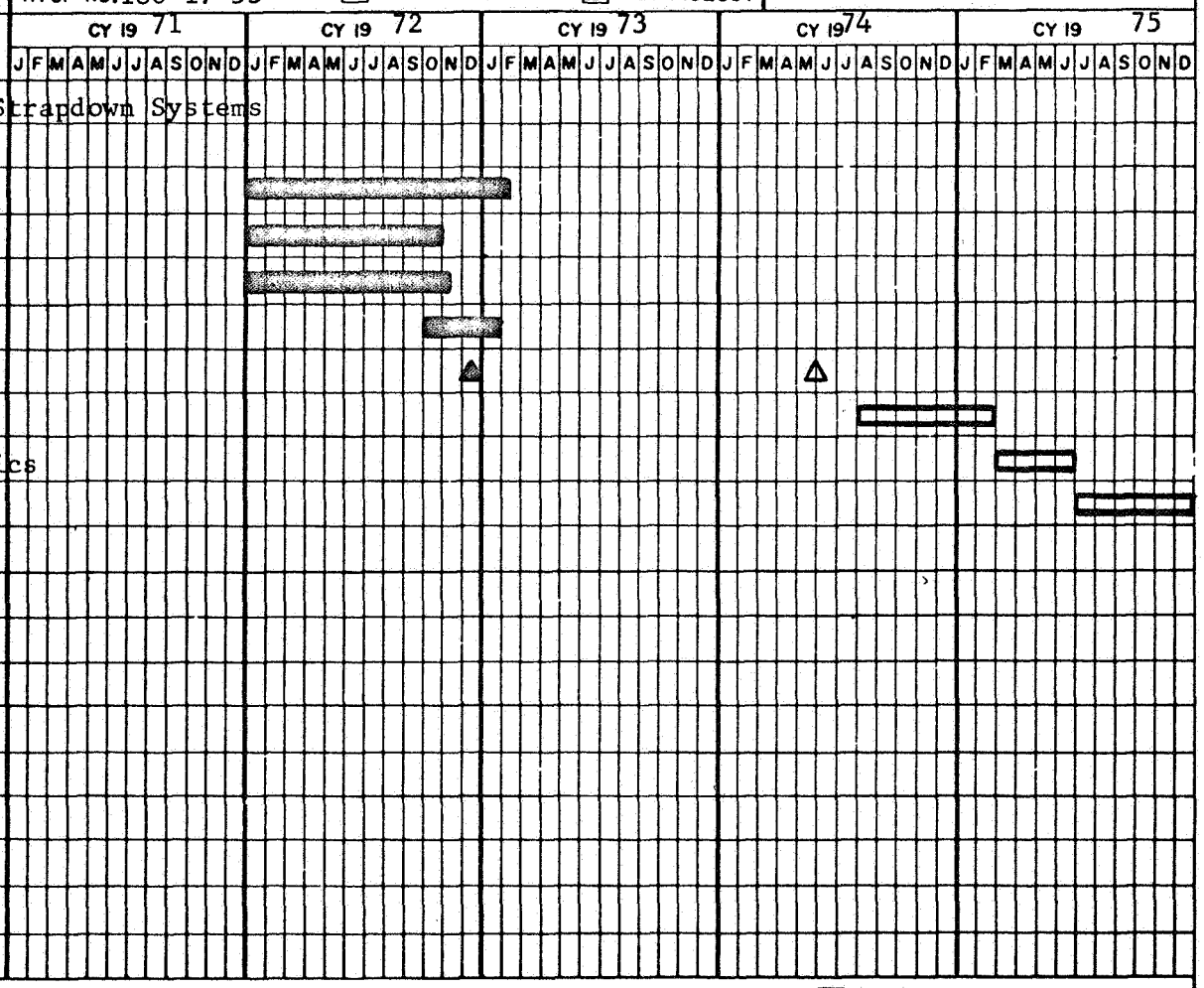
MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Dynamic Tests of Inertial Sensors
RTOP NO. 180-17-53 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (Title) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK TITLE: Dry Gyro for Strapdown Systems
2	Contract
3	Build Gyros
4	Design Tests
5	Test Equipment
6	Perform Tests
7	Reports
8	Modify Tuner Rotor Gyro
9	Interface Digital Electronics
10	Testing
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3456 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL Fred Wojtalik
ACCOMPLISHMENT R. Kissel

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE
DYNAMIC TESTS OF INERTIAL SENSORS

RTOP NO. 180-17-53 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (Nr) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19	CY 19 72	CY 19 73	CY 19 74	CY 19 75
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK TITLE:	STRAPDOWN GYRO AND ACCELEROMETER TEST METHODS				
2						
3	Single-Axis Test Simulation					
4	Computer Program					
5	Strapdown Sensor Test					
6	Support					
7						
8	Report - Finalized					
9						
10	"Vibratuned" Gyro Error					
11	Analysis					
12						
13	Report					
14						
15	Vibratuned Gyro Analytical					
16	Improvement Study					
17	Improvement Recommendations					
18						
19	Vibratuned Gyro All-Digital					
20	Loop Feasibility Study					

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC
RESPONSIBILITY S&E–ASTR–CGG
APPROVAL C. N. SWEARINGEN
ACCOMPLISHMENT DR. J. B. WHITE

MILESTONE SCHEDULE

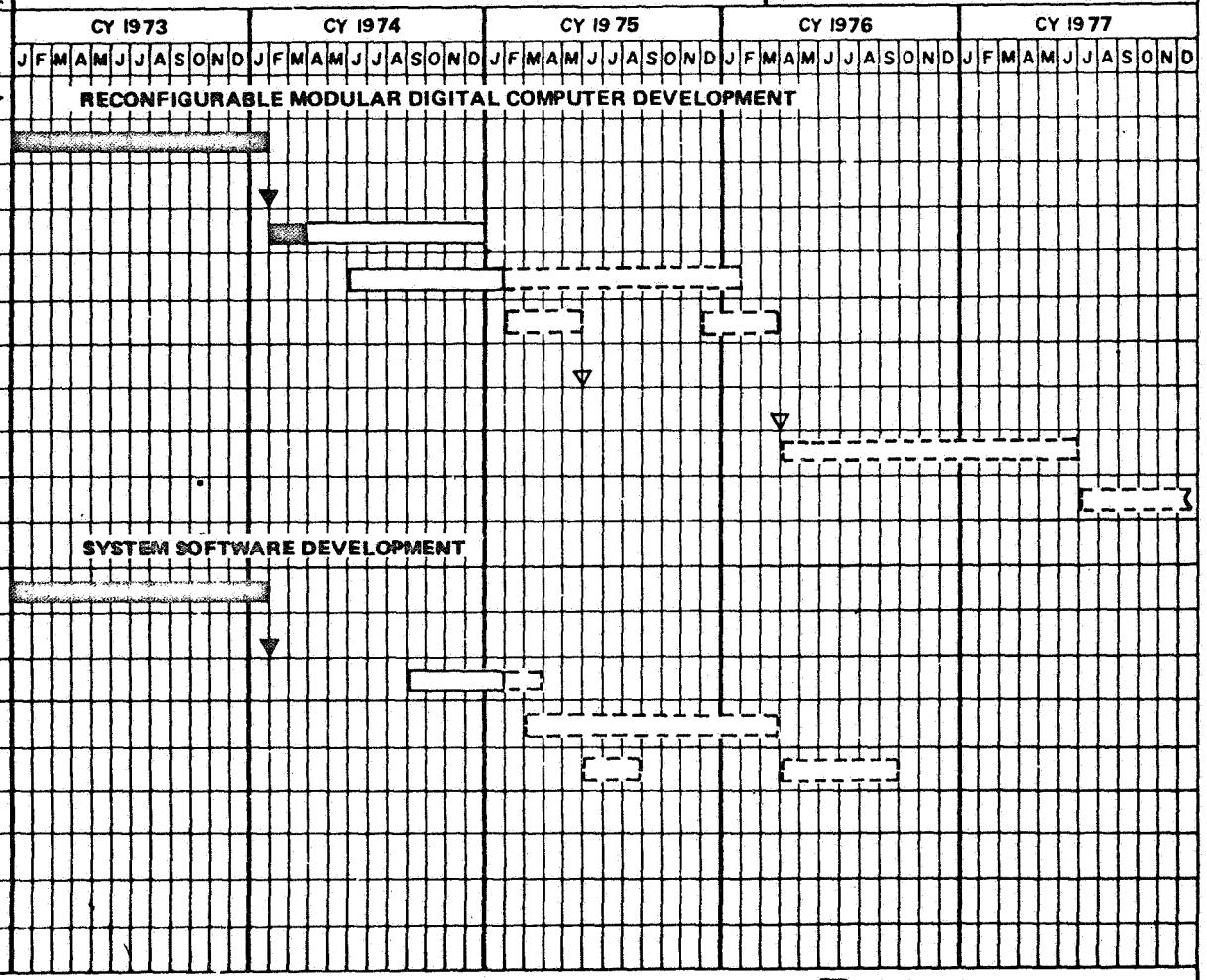
RTOP TITLE GUIDANCE COMPUTER TECHNOLOGY

5 LEVEL

RTOP NO. 180-17-54 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	TASK TITLE
2	ARMMS PHASE I DESIGN
3	ARMMS ARCHITECTURE DEFINED
4	ARMS BREADBOARD DESIGN
5	ARMS B/B FABRICATION
6	ARMS B/B INTEG. & CHECKOUT
7	ARMS B/B SIMPL. SYST. COMPLETE
8	ARMS B/B REPL. SYST. COMPLETE
9	ARMS B/B EVALUATION
10	ARMS PROTOTYPE DEVELOPMENT
11	TASK TITLE
12	ARMMS EXEC. SOFTWARE DESIGN
13	ARMMS EXEC. DEFINED
14	ARMS B/B SOFTWARE DESIGN
15	ARMS B/B SOFTWARE CODE
16	ARMS B/B SOFTWARE CHECKOUT
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-R
APPROVAL J. C. Taylor
ACCOMPLISHMENT S. V. Caruso

MILESTONE SCHEDULE

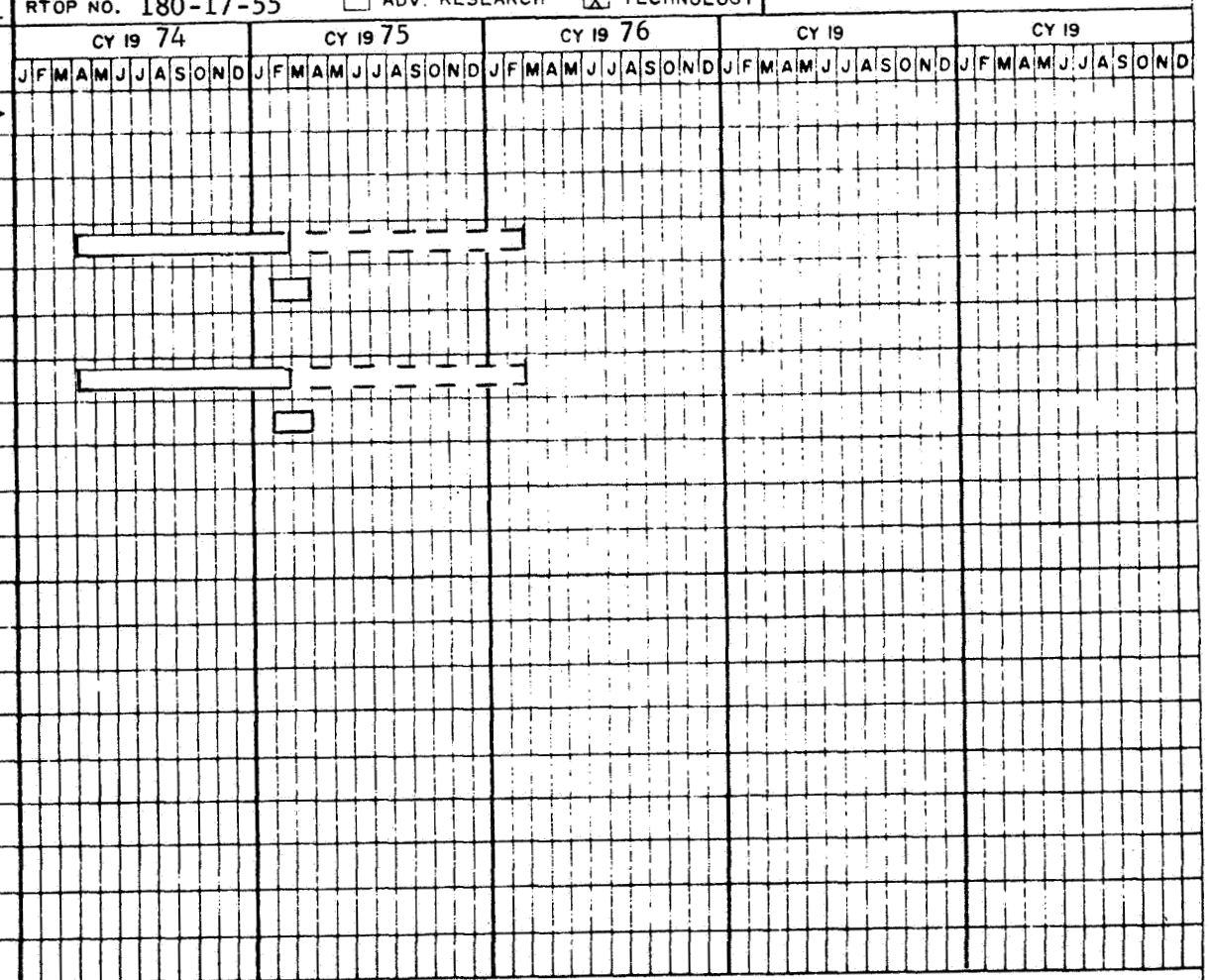
4 LEVEL

RTOP TITLE CONTAMINATION CONTROL IN HYBRID MICROELECTRONIC MODULES

RTOP NO. 180-17-55 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	HYBRID MICROELECTRONICS
2	
3	CONTAMINATION CONTROL
4	STUDY
5	FINAL REPORT
6	ULTRASONIC WIRE BONDING
7	INVESTIGATION
8	FINAL REPORT
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY
APPROVAL C. N. Swearingen
ACCOMPLISHMENT H. Garrett

MILESTONE SCHEDULE

RTOP TITLE Low Cost Computer for SEPS

LEVEL

RTOP NO. 180-17-56 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 74	CY 19 75	CY 19 76	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1						
2	Definition Study					
3						
4	Technology Development					
5						
6	Space Qualify					
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC

RESPONSIBILITY

APPROVAL

APPROVAL

ACCOMPLISHMENT G. Lee

MILESTONE SCHEDULE

5 YEAR

RTOP TITLE Simulation of SEPS Control System

RTOP NO. 180-17-56 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL

LAST SCHED. CHANGE (Date) (No) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19-74	CY 19-75	CY 19-76	CY 19-77	CY 19-78
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	Preliminary Simulation Study					
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1976)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-G

APPROVAL James C. Blair

ACCOMPLISHMENT W. E. Causey

MILESTONE SCHEDULE

RTOP TITLE Solar Electric Propulsion Stage (SEPS) Technology

4 LEVEL

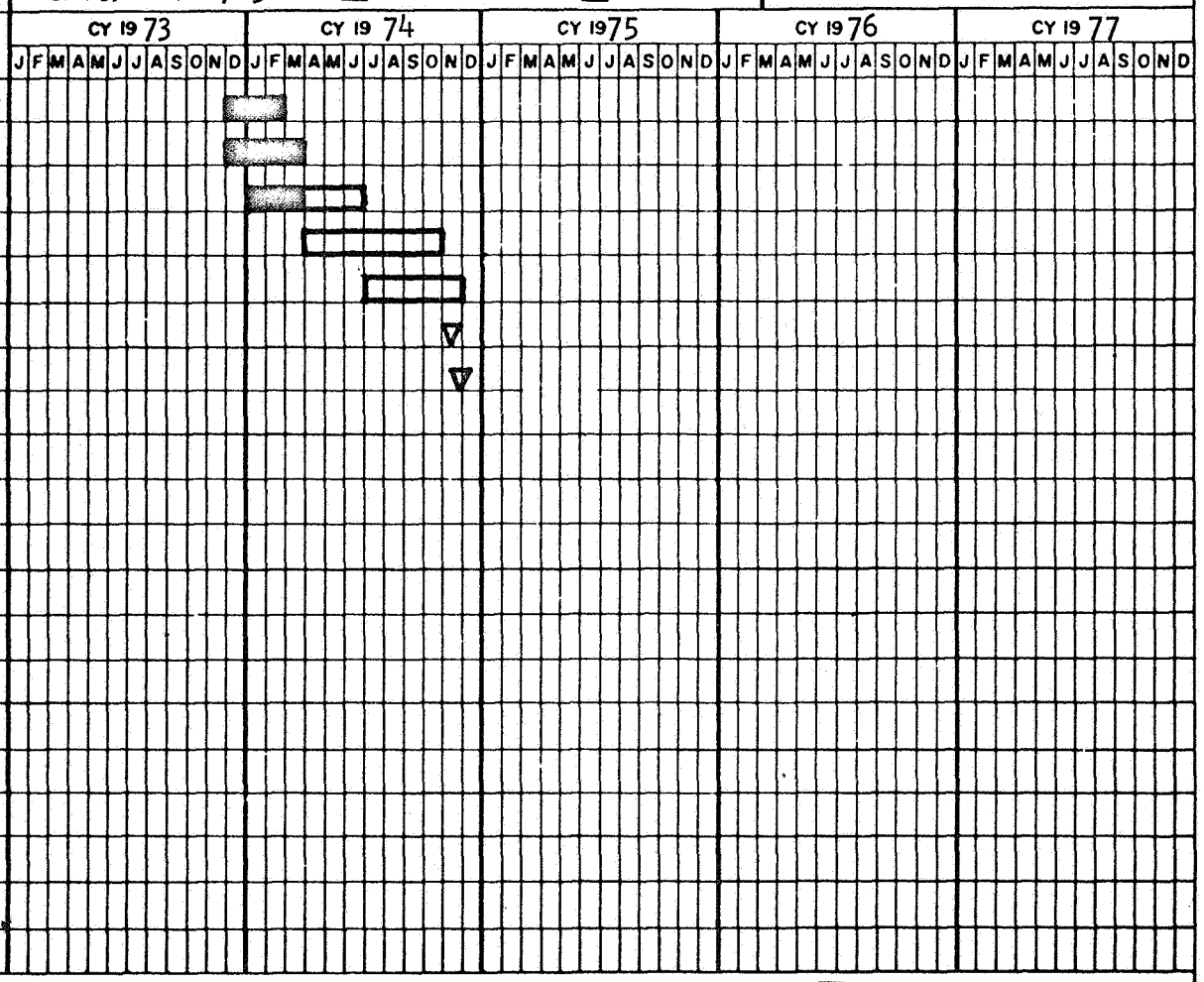
RTOP NO. 180-17-56 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Requirements Definition
2	Computer Program Modification
3	Configuration Analysis and Selection
4	Functional Specifications and Sizing
5	Cost Analysis
6	Cost Summary
7	Configuration and Autonomy Level Selection
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-G

APPROVAL James C. Blair

ACCOMPLISHMENT J.R. Duncan, Jr.

MILESTONE SCHEDULE

RTOP TITLE Solar Electric Propulsion Stage (SEPS) Technology

4 LEVEL

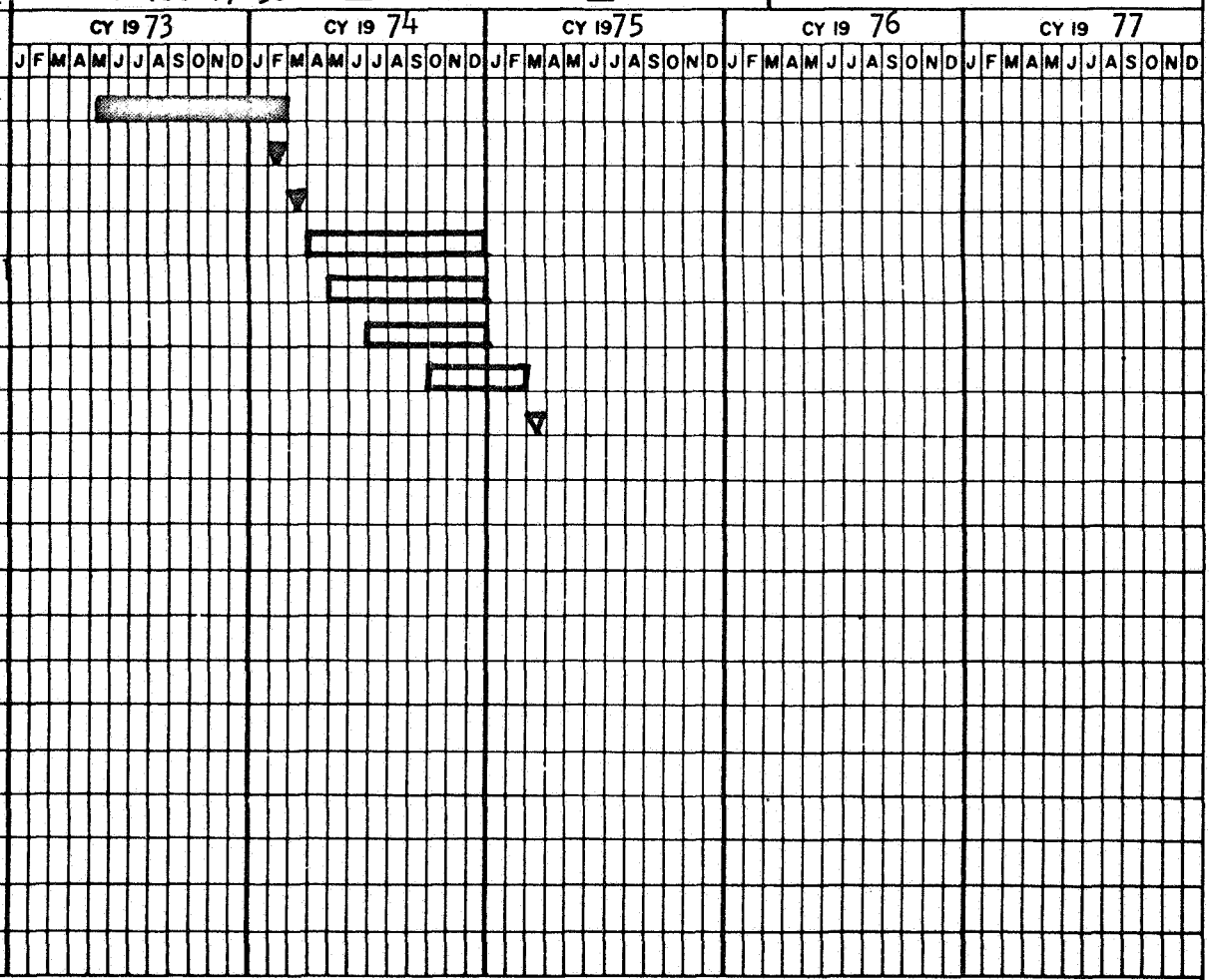
RTOP NO. 180-17-56 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	MAPSEP Program Development
2	Documentation Report-Draft
3	Documentation Report - Distribution
4	MAPSEP Improvements
5	Development of Earth Orbital Oriented Program
6	Test Case and Verification Method Definition
7	Checkout and Test
8	Documentation Report Update and Distribution
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3 pages.

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-AERO-G

APPROVAL James C. Blair

ACCOMPLISHMENT J. R. Duncan, Jr.

MILESTONE SCHEDULE

RTOP TITLE Solar Electric Propulsion Stage (SEPS) Technology

4 LEVEL

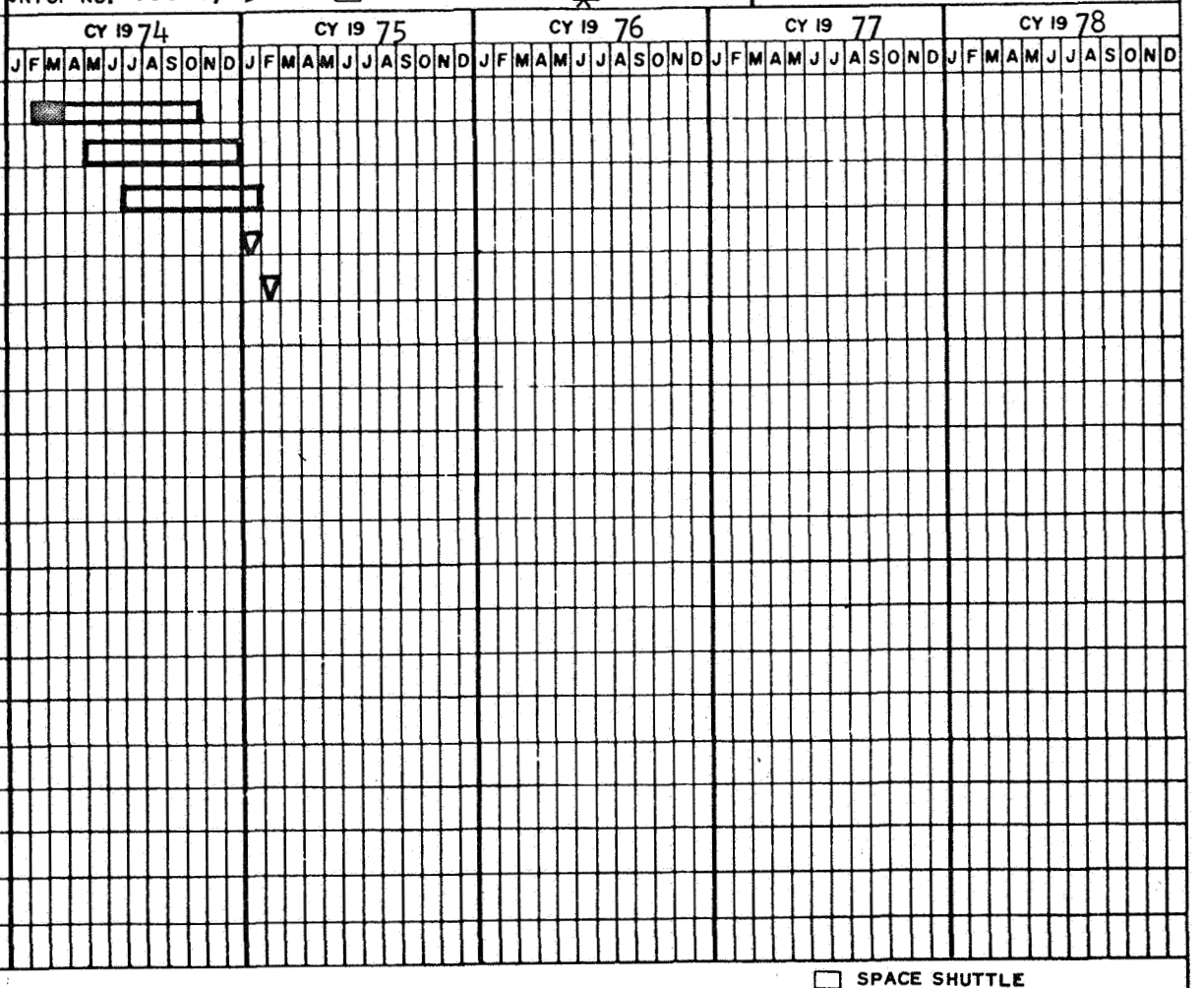
RTOP NO. 180-17-56 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	HILTOP Transfer & Test
2	ASTOP Transfer & Test
3	HILTOP Prog. Modification
4	Manual Updates - Draft
5	Manual Updates - Dist.
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-E
APPROVAL R. M. ADEN
ACCOMPLISHMENT L. E. YOUNG

MILESTONE SCHEDULE

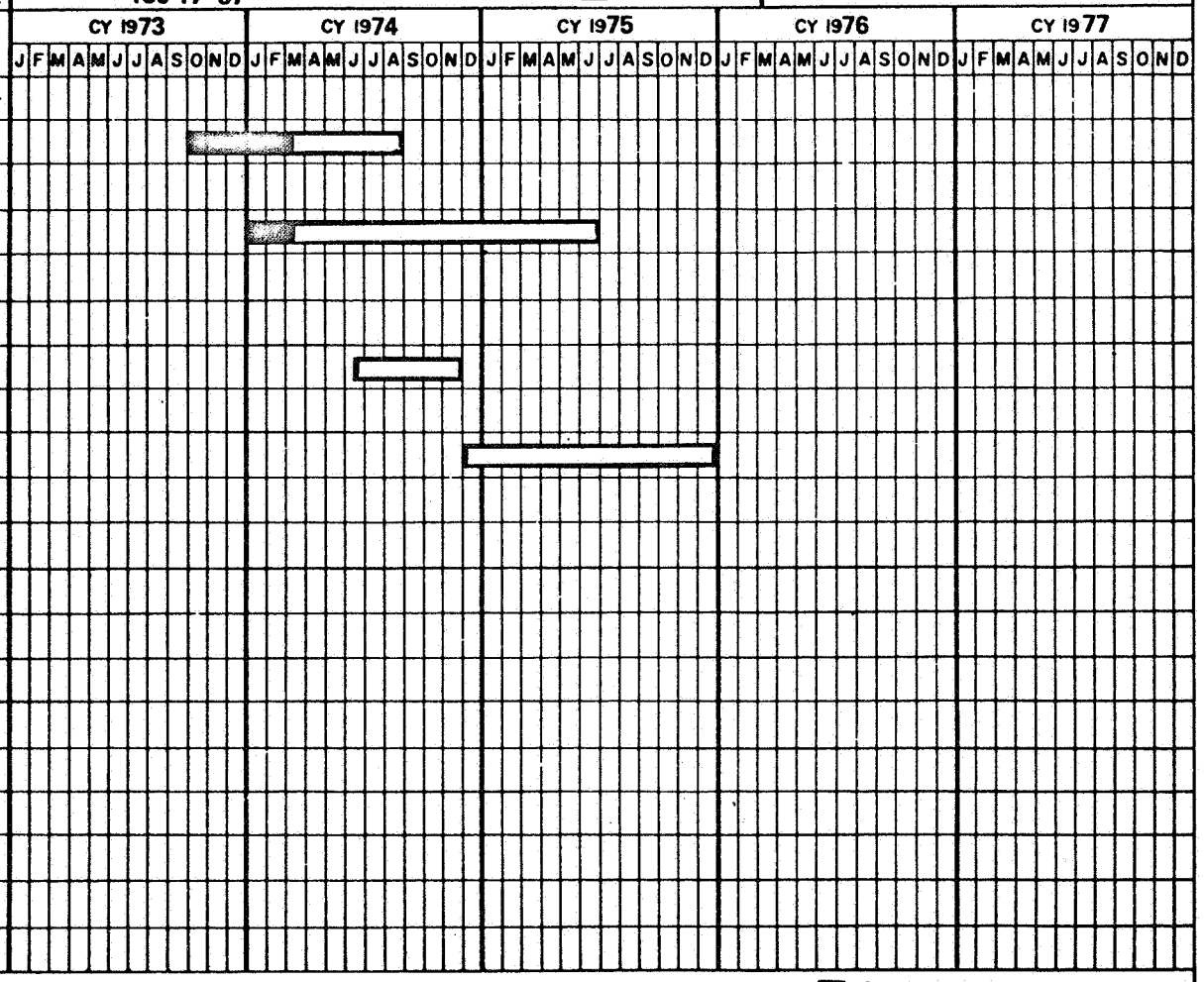
5 LEVEL

RTOP TITLE SEPS SOLAR ARRAY

RTOP NO. 180-17-57 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	SEPS SOLAR ARRAY SRT
2	PERFORM PRELIMINARY DESIGN TO IDENTIFY TECHNOLOGY REQ'T
3	
4	TECHNOLOGY DEVELOPMENT
5	
6	FABRICATE AND TEST FULL-SCALE WING
7	SUBMIT RFP AND SELECT CONTRACTOR
8	
9	FABRICATE AND TEST
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES ADDITIONAL DETAILS ARE FURNISHED IN THE SCHEDULES OF THE RELATED TASKS AND SUB-TASKS.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E–ASTR–E
S&E–ASTR–R

APPROVAL R. M. ADEN
J. C. TAYLOR

ACCOMPLISHMENT G. FILIP

MILESTONE SCHEDULE

RTOP TITLE SEPS SOLAR ARRAY TECHNOLOGY DEVELOPMENT

5 LEVEL

RTOP NO. 180-17-57 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES	CY 1974	CY 1975	CY 1976	CY 1977	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	SOLAR CELL TO SOLAR CELL INTERCONNECT BONDING					
2	IN-HOUSE BONDING EVALUATION					
3	ISSUE RFP AND SELECT-CONTRACTOR					
4	DEVELOP INTERCONNECT BOND (PERFORM CONTRACT)					
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER

RESPONSIBILITY S&E–ASTR–E
S&E–ASTN–M
R. M. ADEN

APPROVAL R. SCHWINGHAMER

ACCOMPLISHMENT F. UPTAGRAFFT

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE SOLAR ARRAY TECHNOLOGY FOR SOLAR ELECTRIC PROPULSIONS STAGE

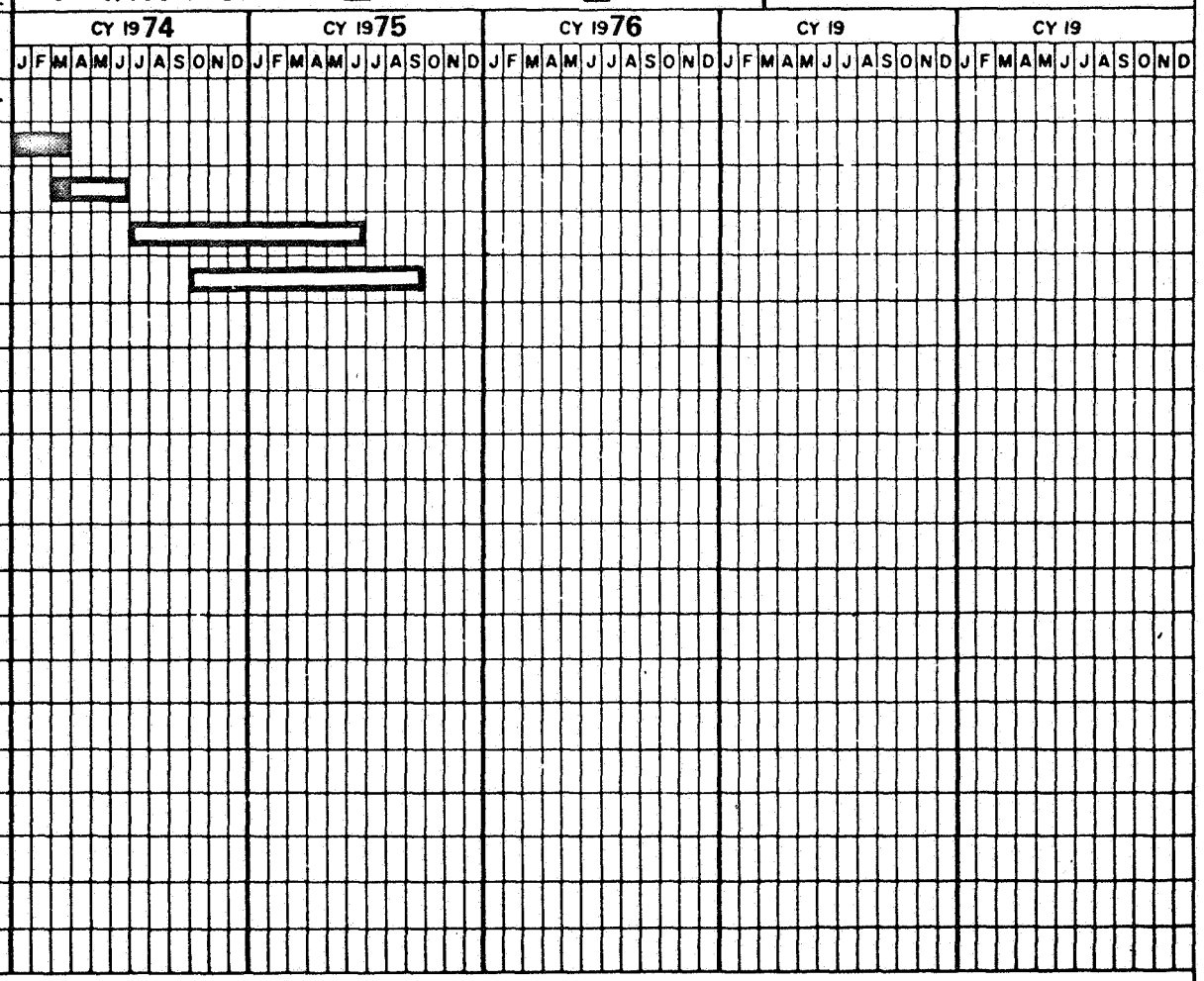
RTOP NO. 180-17-57 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	MATERIALS TESTS AND DEMONSTRATION
2	PREPARE CANDIDATE MATERIALS LIST
3	ISSUE RFP AND SELECT CONTRACTOR
4	PERFORM MATERIALS EVALUATION CONTRACT
5	IN-HOUSE TEST AND EVALUATION
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY S&E-ASTR-E
S&E-QUAL-A

APPROVAL R. M. ADEN
R. M. HENRITZE

ACCOMPLISHMENT K. WOODIS

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE SOLAR ARRAY TECHNOLOGY FOR SOLAR ELECTRIC PROPULSION STAGE

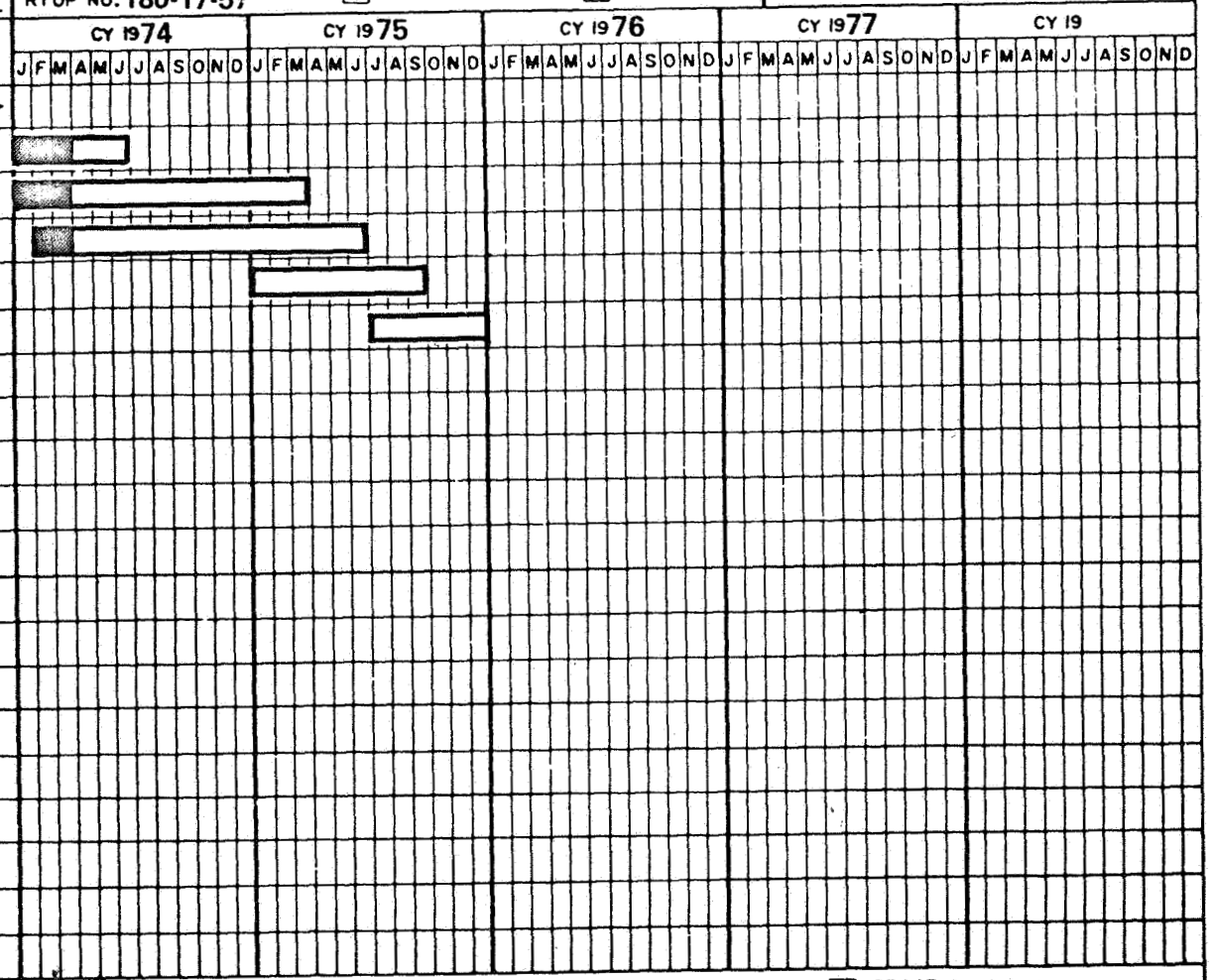
RTOP NO. 180-17-57 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	NON-DESTRUCT INSP AND TEST METHODS FOR SOLAR CELL MODULES
2	DEV OF TECHNIQUES FOR INTERCONNECT INTEGRITY TESTING-PHASE I
3	DEV OF TECHNIQUES FOR MODULE TESTING PHASE II
4	DEVELOP PROTOTYPE TEST HARDWARE-PHASE III
5	TEST ON FULL SCALE MODULES-PHASE IV
6	EVALUATION OF TEST RESULTS-PHASE V
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E–ASTR–E
APPROVAL R. M. ADEN
ACCOMPLISHMENT D. W. ALEXANDER

MILESTONE SCHEDULE

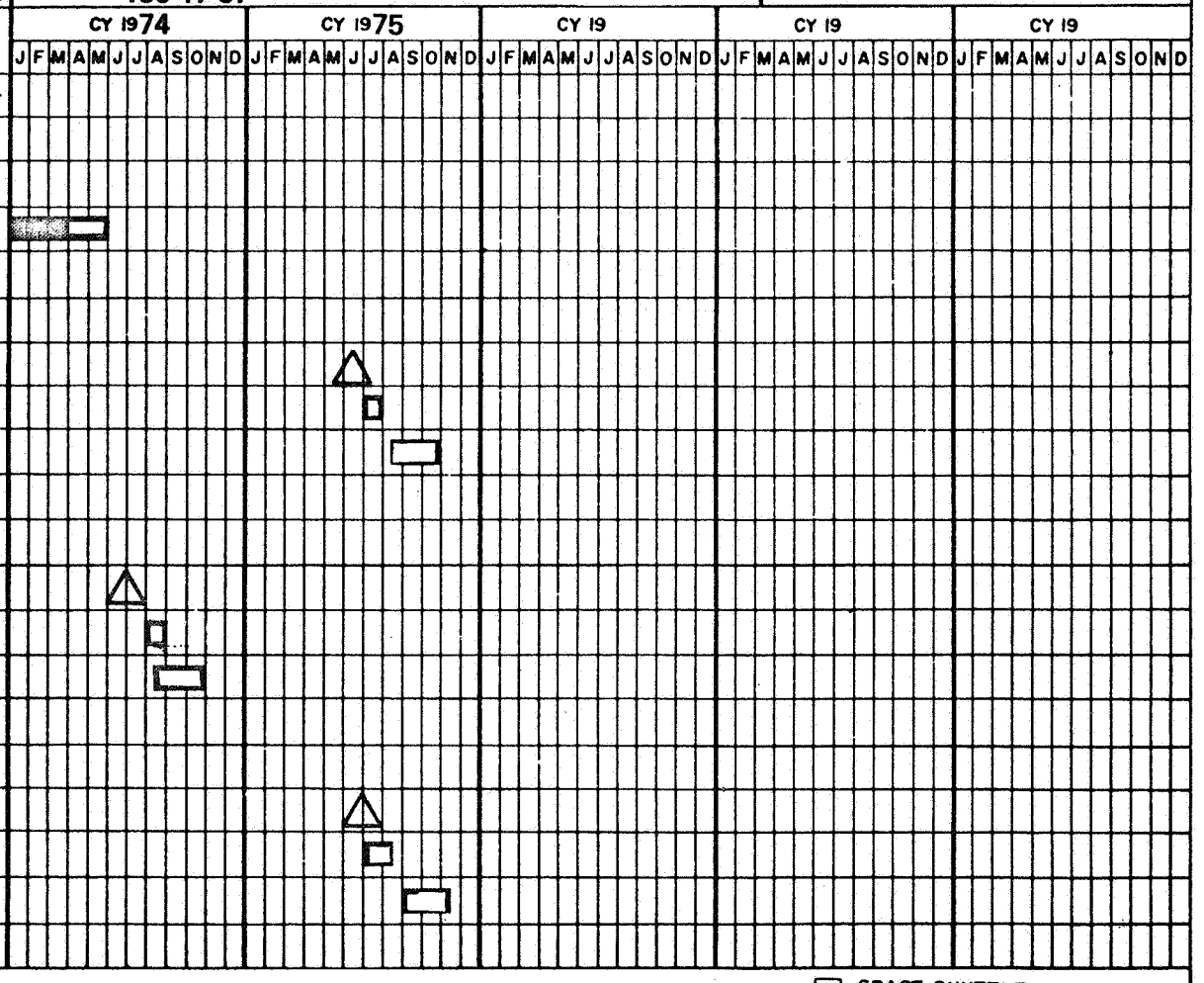
RTOP TITLE SOLAR ARRAY TECHNOLOGY FOR SOLAR ELECTRIC PROPULSION STAGE

5 LEVEL

RTOP NO. 180-17-57 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	ILLUMINATION AND THERMAL-CYCLE TESTING OF SOLAR CELL
2	MODULES
3	
4	JPL SOLAR CELL CALIBRATION
5	
6	
7	MODULES DELIVERED UNDER INTER-CONNECT BONDING EFFORT
8	I–V TESTING
9	THERMAL-CYCLE TESTING
10	
11	
12	MODULES DELIVERED UNDER PRELIMINARY DESIGN EFFORT
13	I–V TESTING
14	THERMAL-CYCLE TESTING
15	
16	
17	MODULES DELIVERED UNDER FULL-SCALE WING DEVELOPMENT EFFORT
18	I–V TESTING
19	THERMAL-CYCLE TESTING
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER MSFC

RESPONSIBILITY S&E–ASTR–E
S&E–PE–M
R. M. ADEN

APPROVAL W. ANGELE

ACCOMPLISHMENT J. M. WILLIS

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE SOLAR ARRAY TECHNOLOGY FOR SOLAR ELECTRICAL PROPULSION STAGE

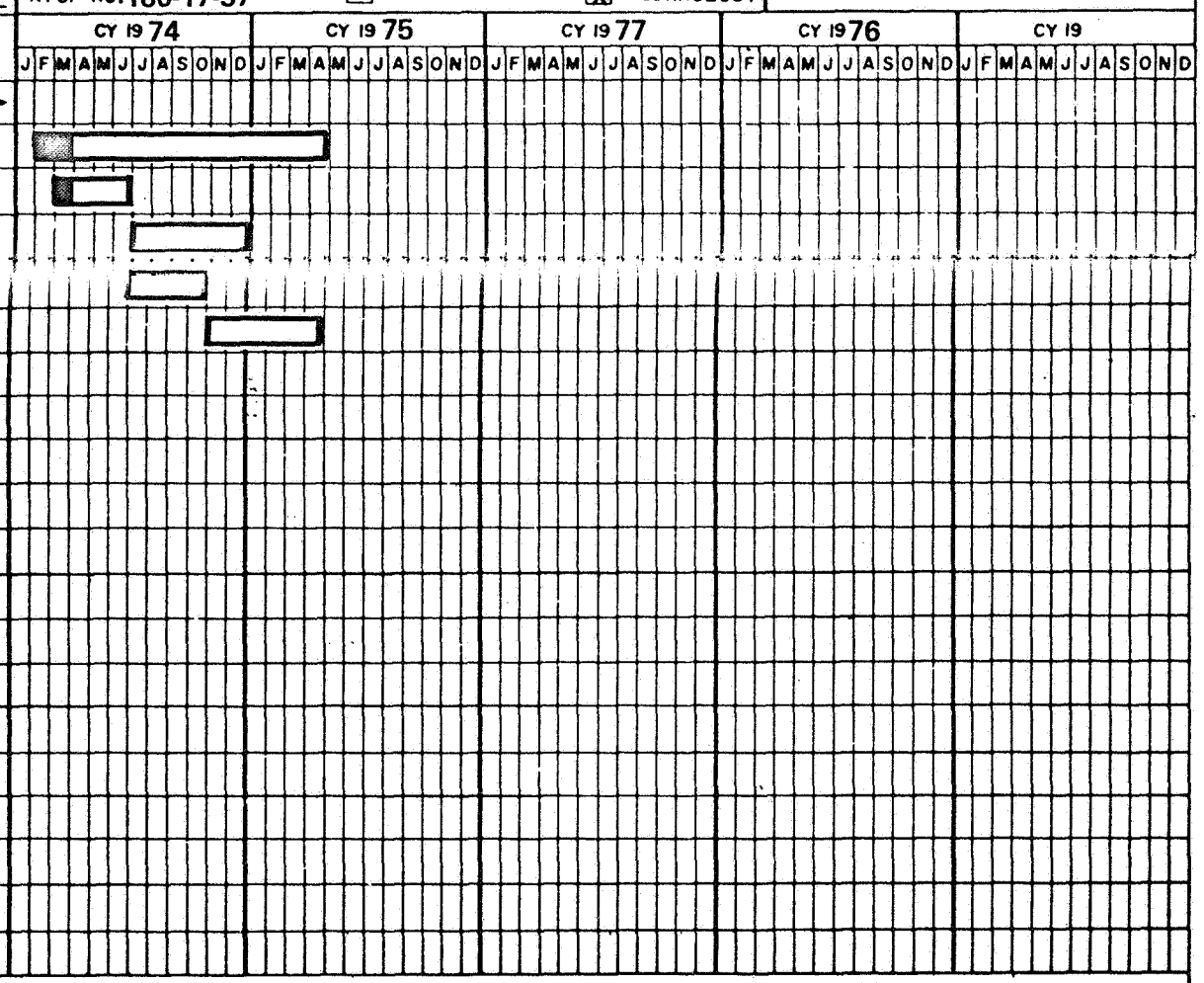
RTOP NO. 180-17-57 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) (No.) (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	FLAT CONDUCTOR CABLE DEVELOPMENT AND CABLE TERMINATION
2	INHOUSE PROTOTYPE DEVELOPMENT, INVESTIGATION, AND TESTS
3	ISSUE RFP, AND SELECT CONTRACTOR FOR TERMINATION DEVELOPMENT
4	PERFORM TERMINATION DEVELOPMENT
5	ISSUE RFP AND SELECT CONTRACTOR FOR LIGHT WEIGHT ALUMINUM FCC
6	PERFORM DEVELOPMENT OF LIGHT WEIGHT FCC
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ SEPS PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3458 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-AERO-YS
APPROVAL William W. Vaughan
ACCOMPLISHMENT G. Swenson

MILESTONE SCHEDULE

RTOP TITLE Magnetospheric-Physics-Particle and Particle/Photon Interactions

4 LEVEL

RTOP NO. 188-36-56 [X] ADV. RESEARCH [X] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Orig.) (No.) (Initials)
STATUS AS OF 31 (Date) 03 74 (Initials)

	ACTIVITIES	CY 1973	CY 1974	CY 1975	CY 19	CY 19
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	Airglow Research →					
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[X] Plasma Physics PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

Page 3 of 3

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL W. C. Snoddy

ACCOMPLISHMENT W. C. Snoddy

MILESTONE SCHEDULE

RTOP TITLE REAL TIME SOLAR MAGNETOGRAPH (RTSM)

5 LEVEL

RTOP NO. 188-38-52 ☐ ADV. RESEARCH ☐ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19 76	CY 1977
1	Real Time Solar Magnetograph					
2	Dev., Integrate, & Check-					
3	out Facility					
4	Software Checkout					
5	Measurements					
6	Reporting					
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

J F M A M J J A S O N D

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY W. C. Snoddy

APPROVAL W. C. Snoddy

ACCOMPLISHMENT E. R. Miller

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE UV and Optical Astronomy

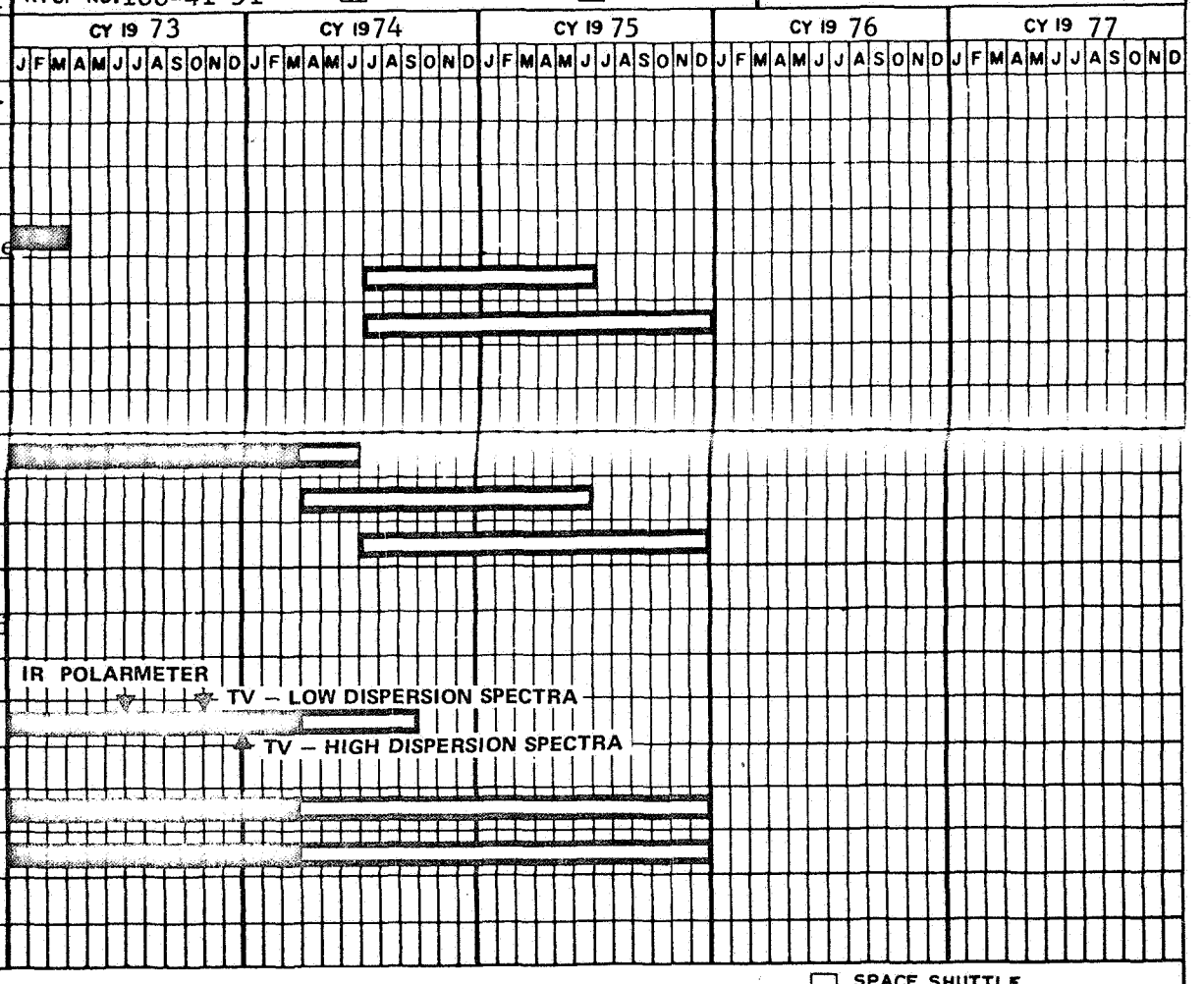
RTOP NO. 188-41-51 [x] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Initials)

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES
1	Visible & IR Photometry of
2	of Variable Stars & Other
	Stellar Objects in Support
3	of MSFC Astronomy Flight
	Projects
4	Instrumentation Complete
5	Observations
6	Publications
7	Photelectric Photometry of
8	Magnetic Variable Stars
9	Instrumentation
10	Observations
11	Publications
12	Relationship of Certain
13	Celestial Optical & Infrared
	Emitting Objects & High
14	Energy Radiation
15	Instrumentation
16	
17	Observations
18	Publications
19	
20	



NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL R. J. Naumann

ACCOMPLISHMENT S. Clifton

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE Meteor Astronomy

RTOP NO. 188-45-52 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____

STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 1972	CY 1973	CY 1974	CY 1975	CY 1976
1	Airborne Observations					
2	Spectral Analysis					
3	Observations					
4	Analysis					
5	Development of Equip.					
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

J F M A M J J A S O N D

NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL R. Decher

ACCOMPLISHMENT T. A. Parnell

MILESTONE SCHEDULE

5 LEVEL

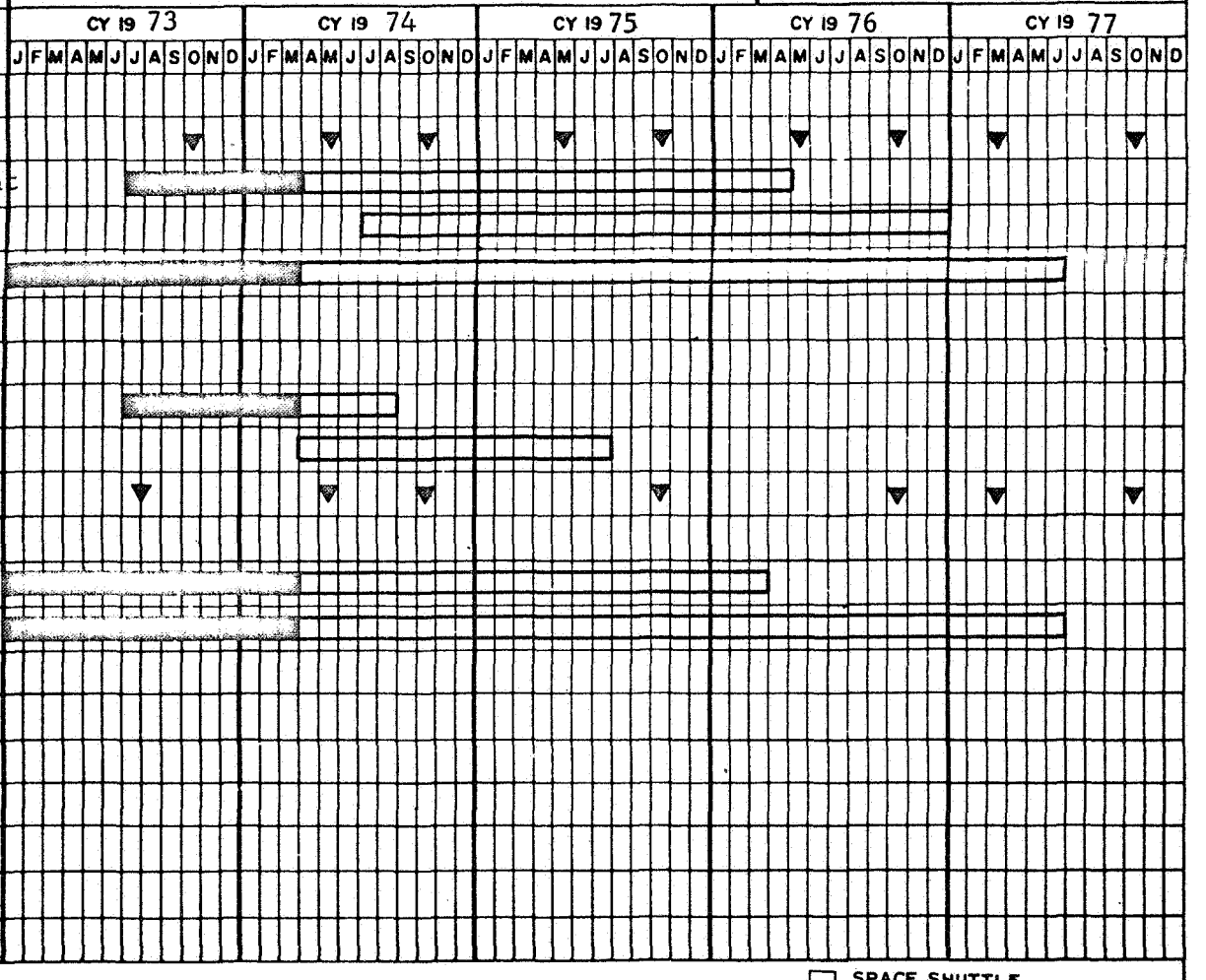
RTOP TITLE COSMIC-RAY & GAMMA-RAY ASTRONOMY INVESTIGATIONS

RTOP NO. 188-46-64 [x] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Initials)

STATUS AS OF 31 03 74 (Date) _____ (Initials)



	ACTIVITIES
1	COSMIC RAY
2	Balloon Flight
3	Large Detector Development
4	Shuttle Instr. Designed
5	Theoretical Calculations
6	
7	GAMMA RAY
8	Small M/C Detector
9	Large M/C Detector
10	Balloon Flight
11	Calculations of Back-
12	ground
13	Theoretical Calculations
14	
15	
16	
17	
18	
19	
20	

NOTES

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[ ] _____ PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC

RESPONSIBILITY

APPROVAL Hans H. Hosenthien

ACCOMPLISHMENT G. S. Nurre

MILESTONE SCHEDULE

4 LEVEL

RTOP TITLE Large Space Telescope

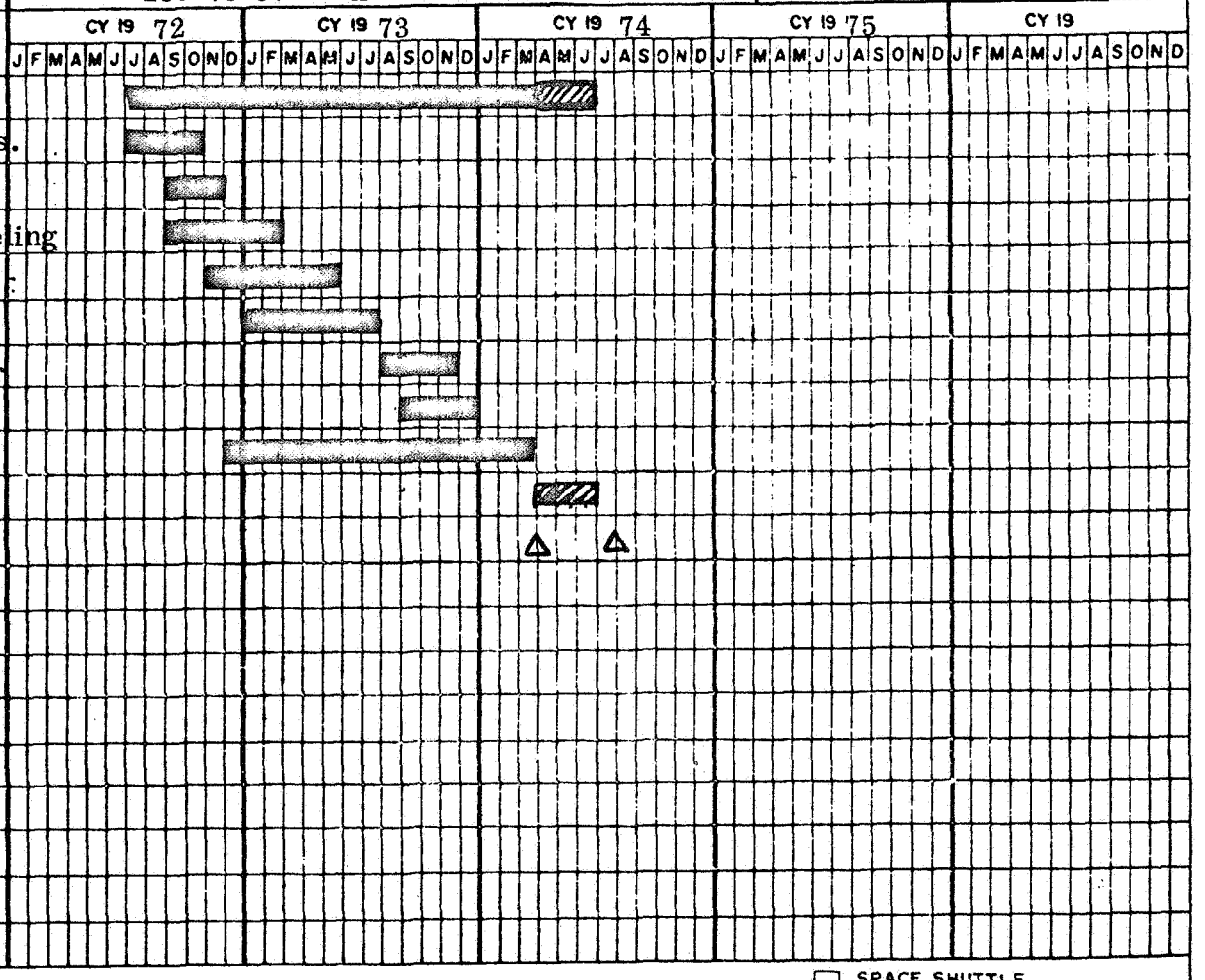
RTOP NO. 188-78-57 [X] ADV. RESEARCH [ ] TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)

LAST SCHED. CHANGE _____ (Date) _____ (No) _____ (Initials)

STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	Fine Pointing Study
2	Stability Analysis-Linear Sys.
3	Structural Modeling
4	CMG & Reaction Wheel Modeling
5	Noise Modeling
6	Body Pointing Simulations
7	Secondary Mirror Controller
8	Secondary Mirror System
9	Simulations
10	Double Gimbal CMG Analysis
11	Final Reports
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

Projected Contract Extension

[ ] SPACE SHUTTLE
[ ] SPACE STATION/BASE
[X] LST PROJECT
[ ] NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

CENTER NASA-MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL F. Wojtalik
ACCOMPLISHMENT P. Golley

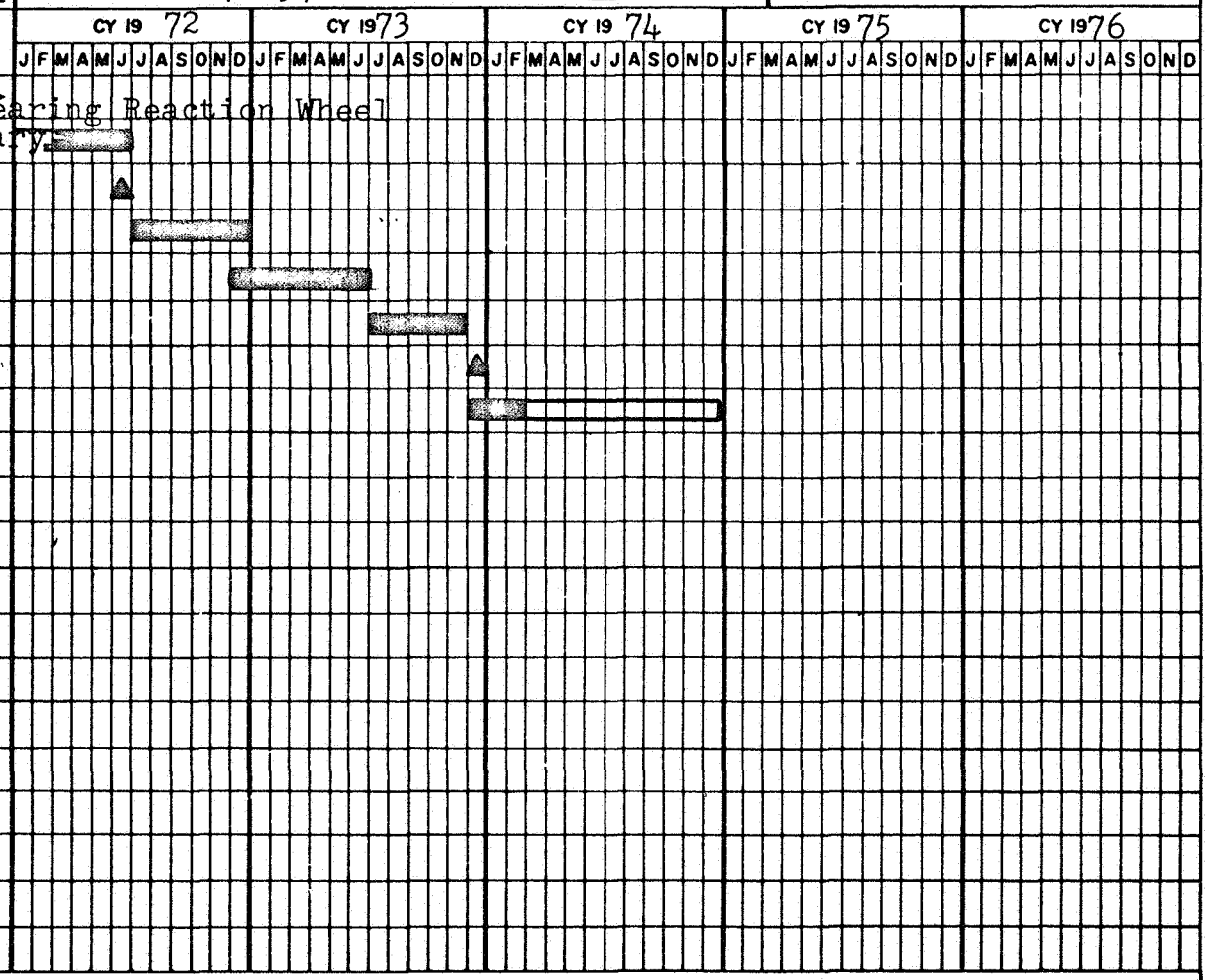
MILESTONE SCHEDULE

RTOP TITLE Large Space Telescope

5 LEVEL

RTOP NO. 188-78-57 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____
STATUS AS OF 31 03 74 (Date) _____ (Initials)



	ACTIVITIES
1	TASK: Dual-Spin Gas Bearing Reaction Wheel
2	Analysis and Preliminary Design
3	Contract Award
4	Design
5	Fabricate & Assemble
6	Test
7	Delivery
8	In-House Evaluation
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

NOTES

Contractor will deliver a final report 30 days after delivery.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ LST PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER NASA-MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL F. S. Wojtalik
ACCOMPLISHMENT P. T. Golley

MILESTONE SCHEDULE

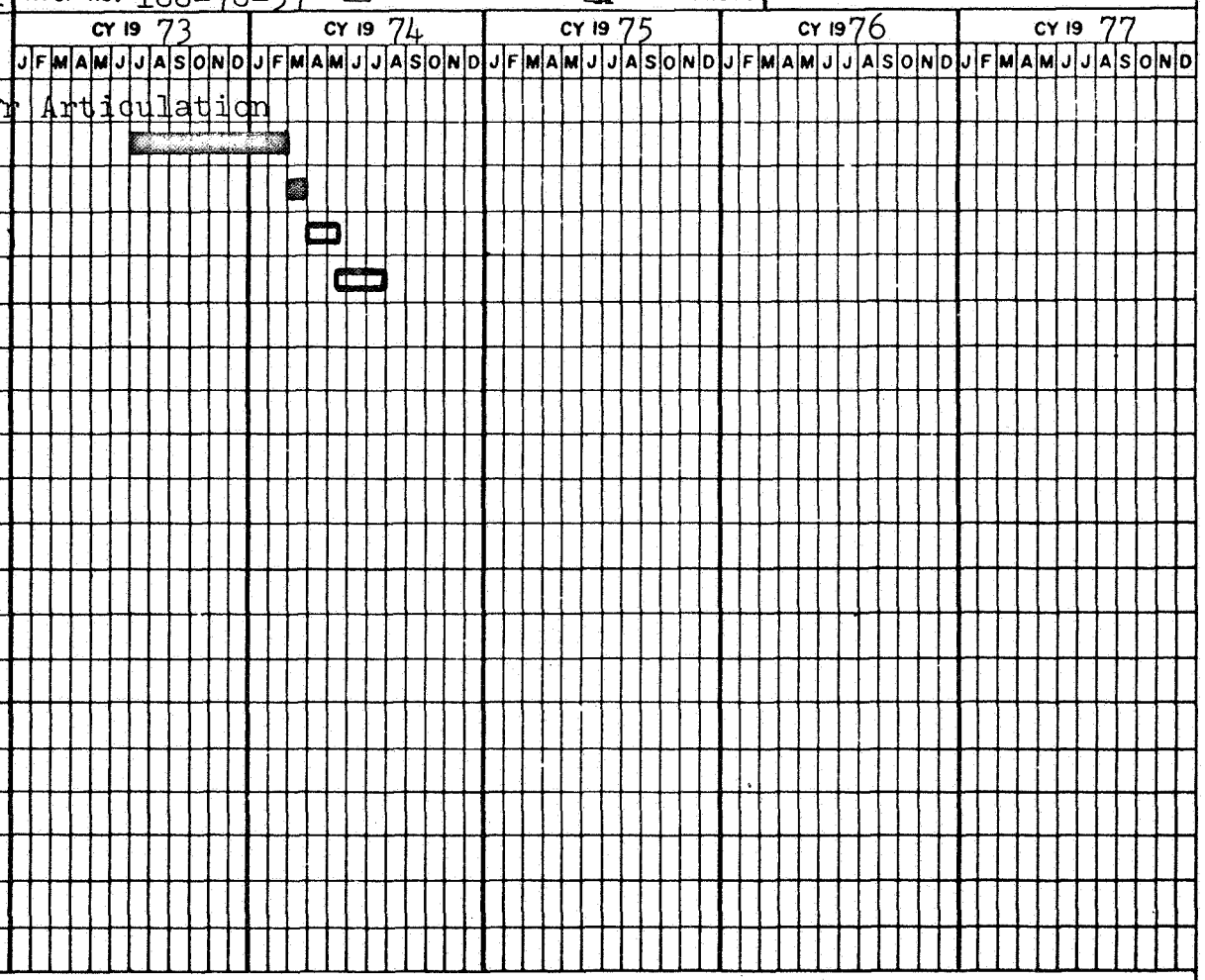
5 LEVEL

RTOP TITLE Large Space Telescope

RTOP NO. 188-78-57 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) _____ (Initials)

	ACTIVITIES
1	TASK: Secondary Mirror Articulation
2	Design & Fabrication
3	Acceptance Testing
4	In-house Testing (MSFC)
5	Testing at Martin/Denver
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	



NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ LST PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

5 YEAR

CENTER MSFC
RESPONSIBILITY S&E-ASTR-G
APPROVAL Fred Wojtalik
ACCOMPLISHMENT J. R. Parker

MILESTONE SCHEDULE

5 LEVEL

RTOP TITLE
Large Space Telescope

RTOP NO. 188-78-57 ☐ ADV. RESEARCH ☒ TECHNOLOGY

ORIGINAL SCHED. APPROVAL _____ (Date)
LAST SCHED. CHANGE _____ (Date) (No.) (Initials)
STATUS AS OF 31 03 74 (Date) (Initials)

	ACTIVITIES	CY 19 73	CY 19 74	CY 19 75	CY 19 76	CY 19 77
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	TASK:	LST FINE GUIDANCE SENSOR				
2						
3	Preliminary Design					
4						
5	Breadboard Design and Test					
6						
7	Procure Electronic Components					
8						
9	Brassboard-Design Verification					
10						
11	Procure Test Equipment					
12						
13						
14						
15						
16						
17						
18						
19						
20						

NOTES

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ LST PROJECT
☐ NON-PROJECT ORIENTED

MSFC - Form 3450 (April 1970)

FINANCIAL STATUS CHARTS

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: LAUNCH VEHICLE PROPULSION TECHNOLOGY

RTOP NO. 113-31-12 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

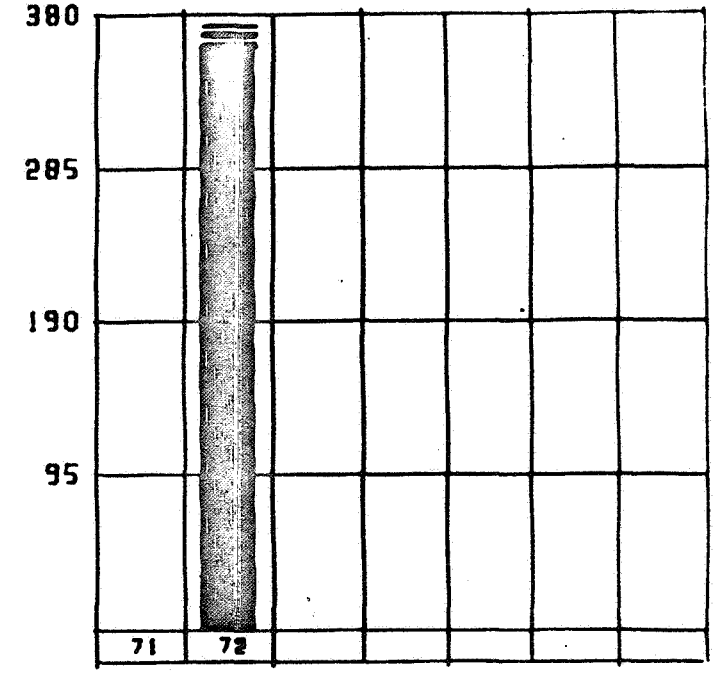
CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.												
COMM. ACT.												
OBLIG PLAN.												
OBLIG ACT.												

DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL



	71	72
PLAN.	0	375
ACT.	0	361

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: SHUTTLE MAIN PROPULSION TECHNOLOGY

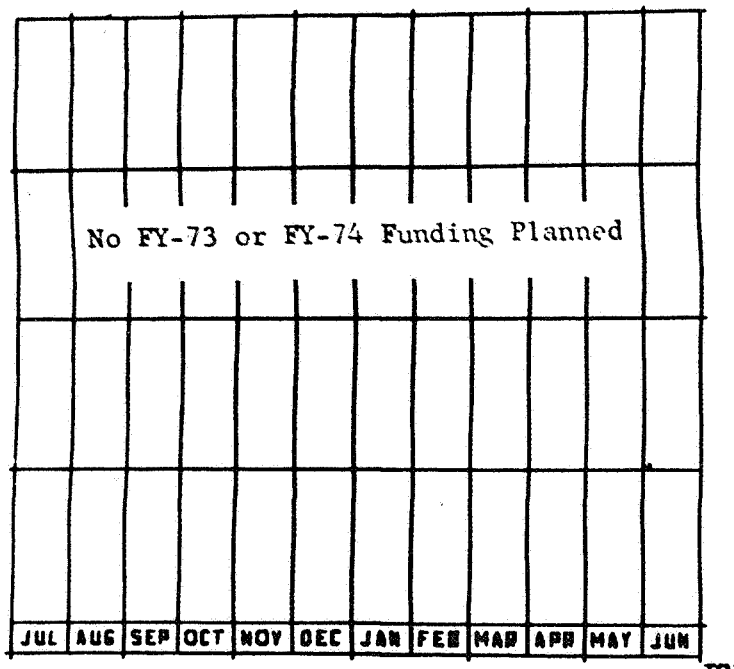
RTOP NO. 113-31-14 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

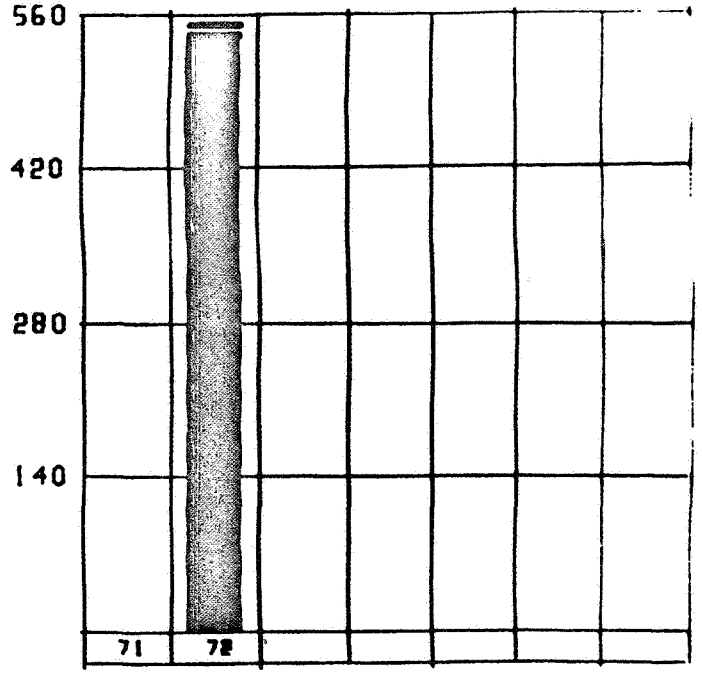
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS — PLANNED / ACTUAL



		TOTAL	71	72
COMM.	PLAN.			
	ACT.			
OBLIG	PLAN.		0	556
	ACT.		0	542

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER MSFC

RESPONSIBILITY APPROVAL

ACCOMPLISHMENT

RTOP TITLE STRUCTURAL COMPOSITE MATERIALS FOR SPACE SHUTTLE

RTOP NO. 114-03-33 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

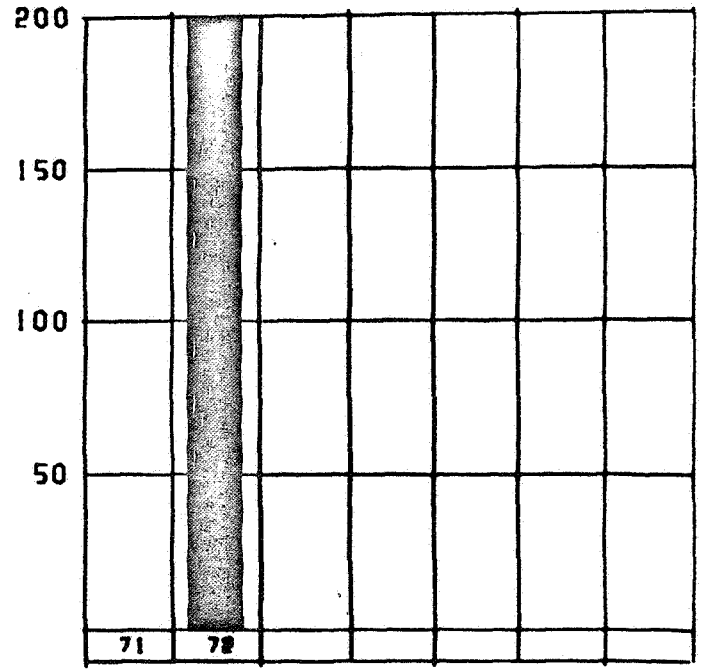
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS

OBLIGATIONS

PLANNED

ACTUAL



	71	72
PLAN.	0	200
ACT.	0	200

----- PLANNED COMM.

—— ACTUAL COMM.

..... PLANNED OBLIG.

—— ACTUAL OBLIG.

☒ SPACE SHUTTLE

☐ SPACE STATION/BASE

☐ _____ PROJECT

☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

WTOP TITLE: SPACE SHUTTLE COMPOSITES FOR PRIMARY STRUCTURE

WTOP NO. 114-08-04 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN

DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL

940
705
470
235

	71	72
PLAN.	0	939
ACT.	0	890

													TOTAL
COMM.	PLAN.												
	ACT.												
OBLIG	PLAN.												
	ACT.												

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
—— ACTUAL OBLIG.

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

4 LEVEL

CENTER RESPONSIBILITY APPROVAL MSFC

ACCOMPLISHMENT

RTOP TITLE SHUTTLE GUIDANCE

RTOP NO. 115-17-04 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

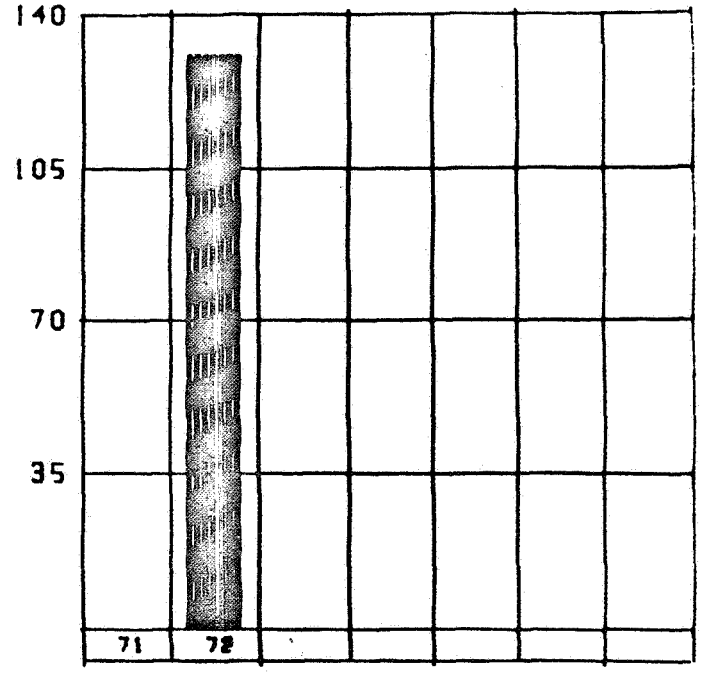
CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN													
COMM. ACT.													
OBLIG PLAN													
OBLIG ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL



	71	72
PLAN	0	131
ACT.	0	131

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

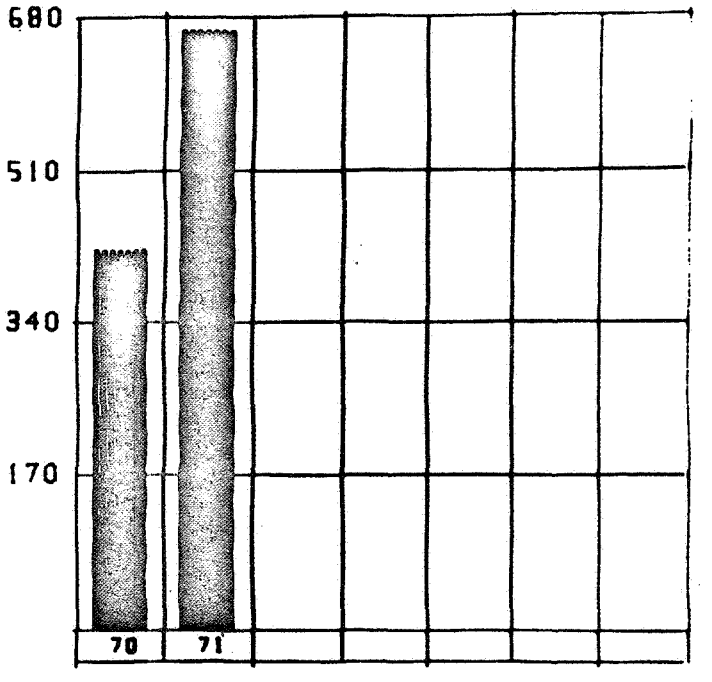
CENTER RESPONSIBILITY APPROVAL	FINANCIAL STATUS (LEVEL 4)	ORIG. SCHED. APPROVAL
MSFC	RTOP TITLE SPACE SHUTTLE ADVANCED COMPOSITES FOR PRIMARY STRUCTURES	LAST SCHED. CHANGE
ACCOMPLISHMENT	RTOP NO. 124-08-37 ☐ ADV. RES. ☐ TECHNOLOGY	STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-72, FY-73, FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS



PLANNED
ACTUAL

	70	71
PLAN.	423	667
ACT.	423	667

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
——— ACTUAL OBLIG.

[X] SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: ATMOSPHERIC PARAMETERS

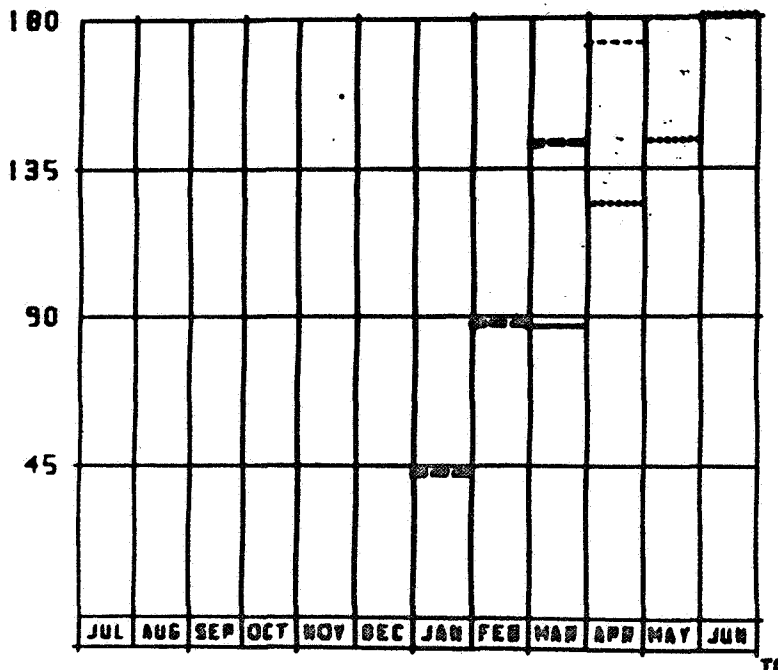
RTOP NO. 501-08-10 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

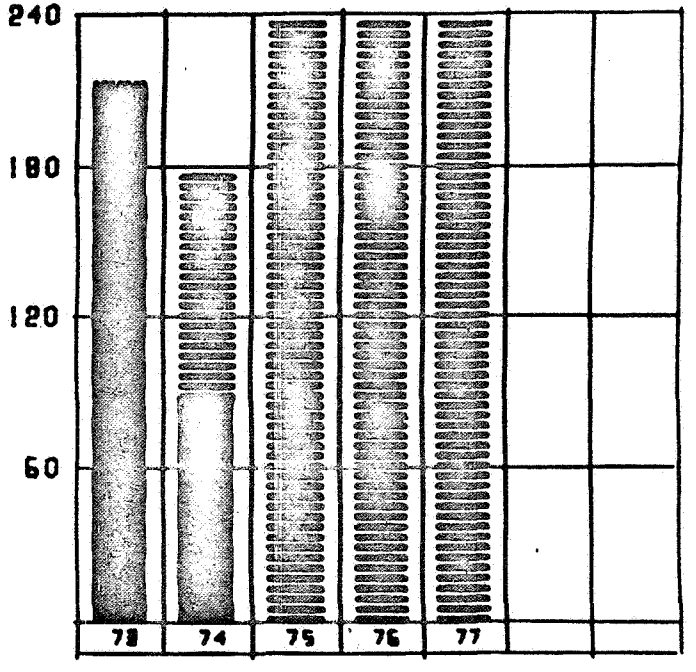


		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										30	7	0	37
	ACT.	0	0	0	0	0	0	43	45	55				143
OBLIG	PLAN.										36	19	37	92
	ACT.	0	0	0	0	0	0	0	0	88				88

----- PLANNED COMM.
▬▬ ACTUAL COMM.
------ PLANNED OBLIG.
—— ACTUAL OBLIG.

DOLLARS IN THOUSANDS — OBLIGATIONS

▤ PLANNED
▩ ACTUAL



	73	74	75	76	77		
PLAN.	214	180	240	240	240		
ACT.	214	88					

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: HAZARD AVOIDANCE AND ELIMINATION

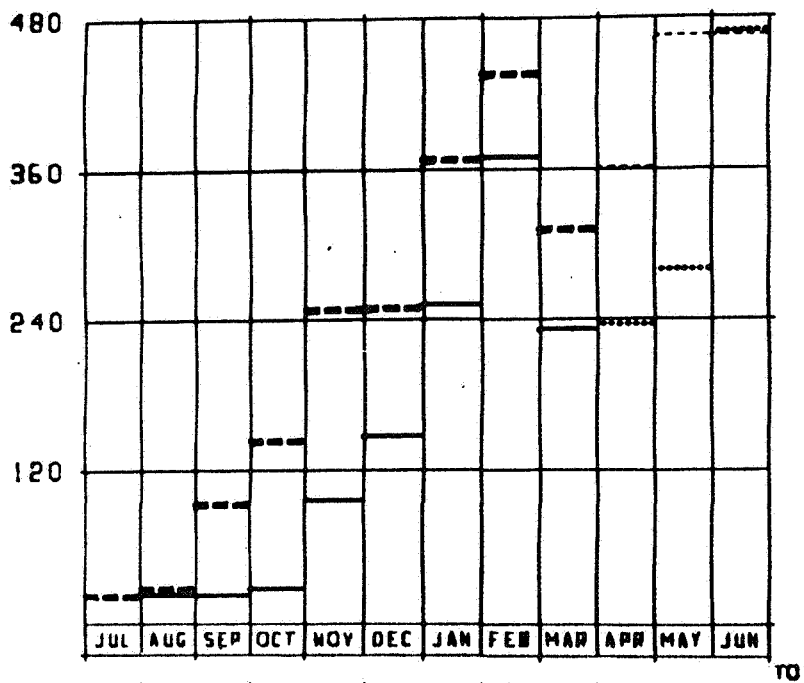
RTOP NO. 501-38-13 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

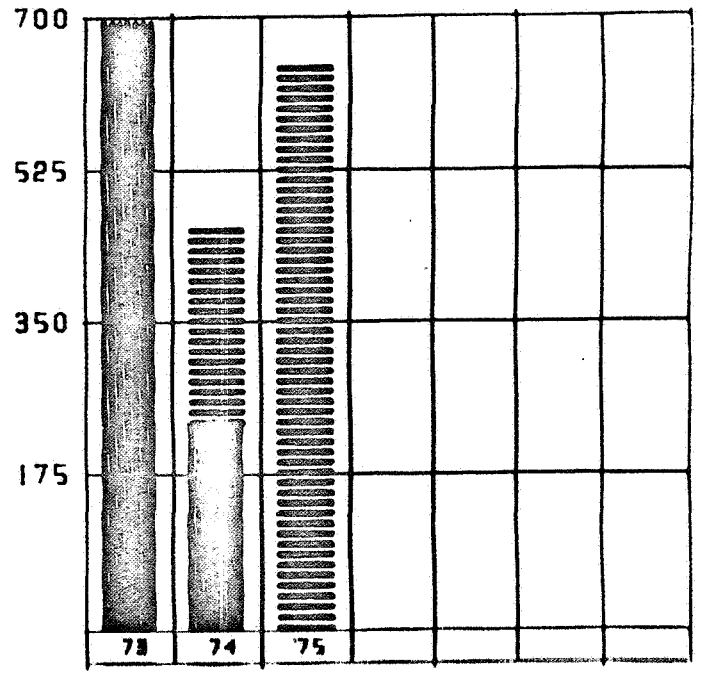
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										50	104	0	154
	ACT.	21	6	66	50	105	1	119	68	-124				313
OBLIG	PLAN.										0	44	189	233
	ACT.	0	24	0	5	69	51	105	118	-138				234

	73	74	75
PLAN.	696	467	650
ACT.	696	234	

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: PROPERTIES OF MATERIALS FOR ELECTRONIC APPLICATIONS

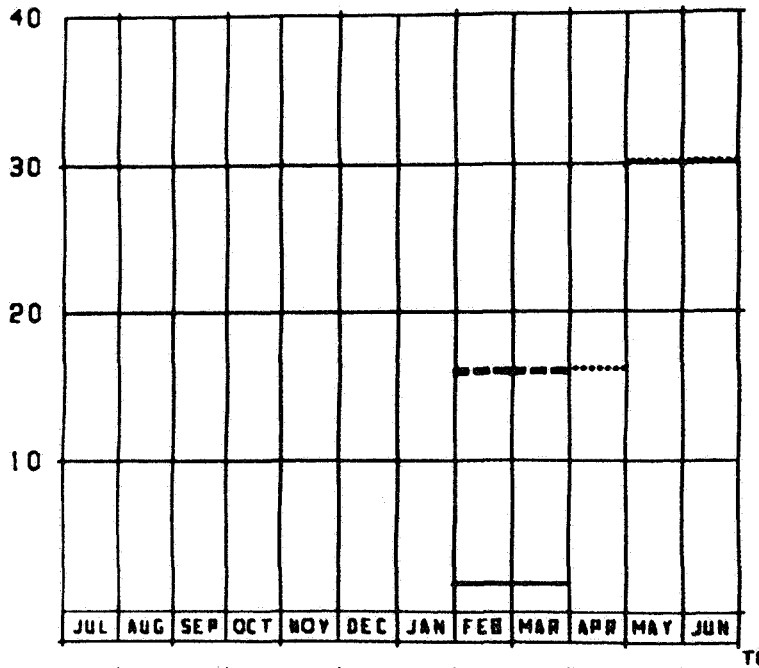
RTOP NO. 502-01-03 ☐ ADV. DES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

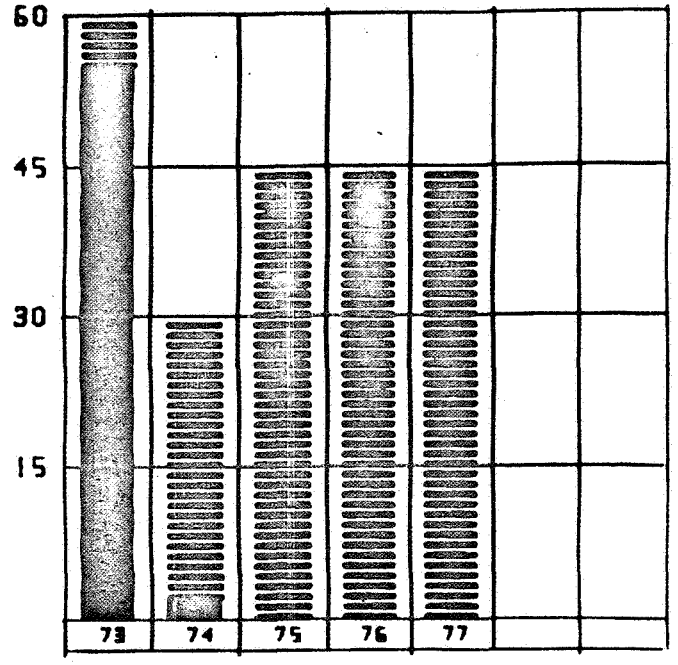
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN										14	0	0	14
	ACT.	0	0	0	0	0	0	0	16	0				16
OBLIG	PLAN										14	14	0	28
	ACT.	0	0	0	0	0	0	0	2	0				2

	73	74	75	76	77		
PLAN	60	30	45	45	45		
ACT.	55	2					

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER MSFC

RESPONSIBILITY APPROVAL

ACCOMPLISHMENT

RTOP TITLE THERMAL CONTROL

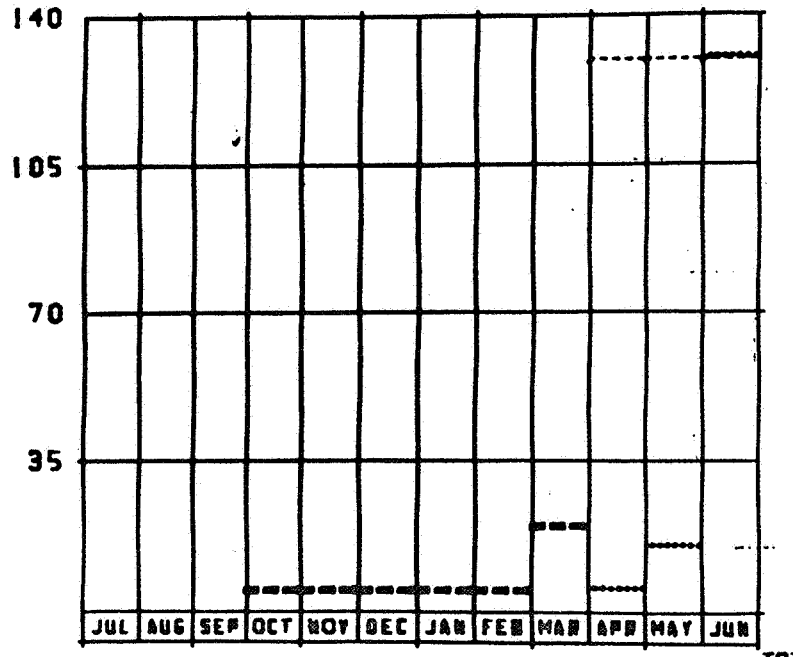
RTOP NO. 502-21-27 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

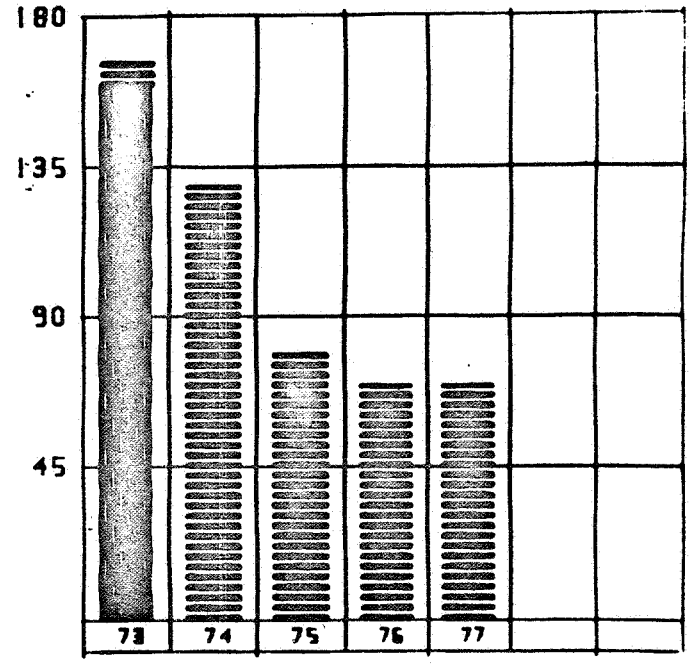
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										110	0	0	110
	ACT.	0	0	0	5	0	0	0	0	15				20
OBLIG	PLAN.										5	10	115	130
	ACT.	0	0	0	0	0	0	0	0	0				0

	73	74	75	76	77		
PLAN.	169	130	80	70	70		
ACT.	160	0					

----- PLANNED COMM.
— — — ACTUAL COMM.
------ PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: OPTICAL CONTAMINATION OF SPACECRAFT

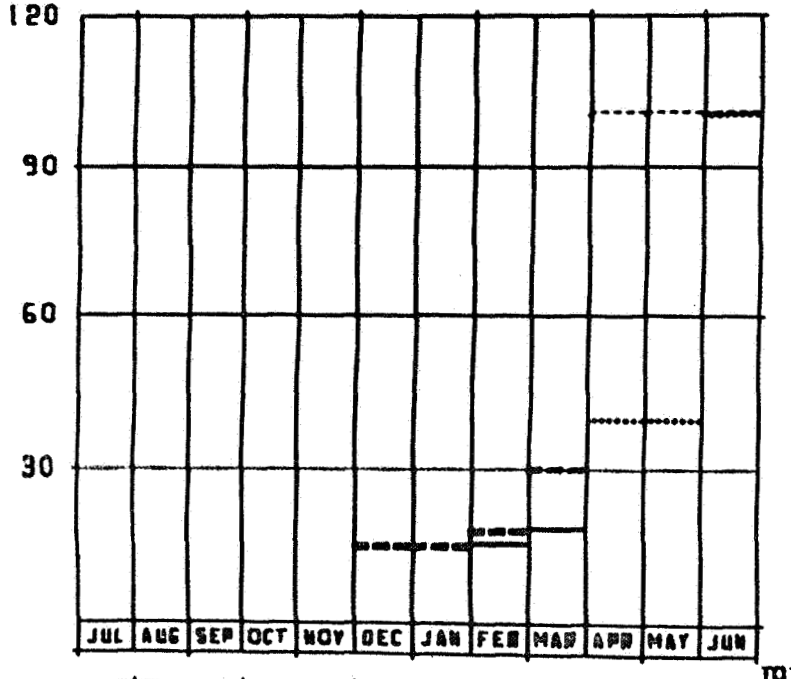
RTOP NO. 502-21-28 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

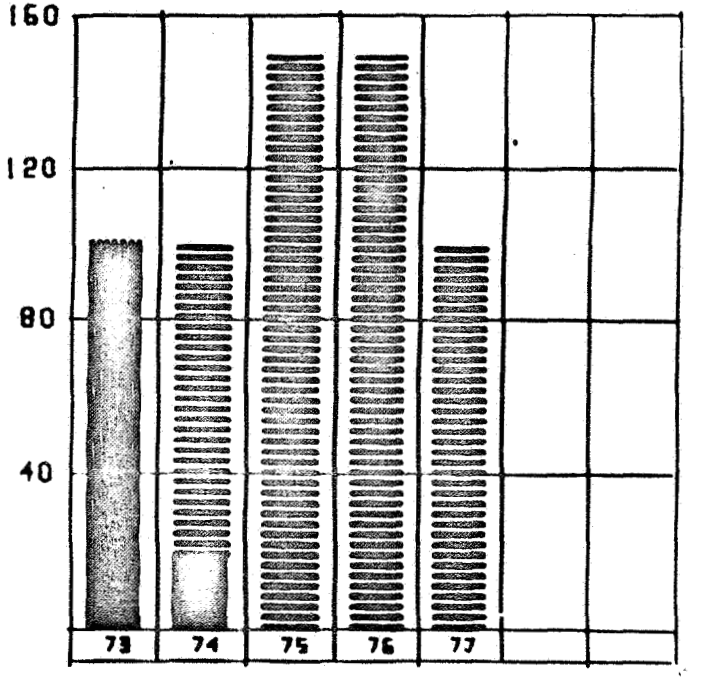
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS — PLANNED / ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										71	0	0	71
	ACT.	0	0	0	0	0	15	0	3	12				29
OBLIG	PLAN.										20	0	61	81
	ACT.	0	0	0	0	0	0	0	16	3				19

	73	74	75	76	77		
PLAN.	101	100	150	150	100		
ACT.	101	19					

----- PLANNED COMM.
— — ACTUAL COMM.
------ PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: ENVIRONMENTAL DESIGN CRITERIA

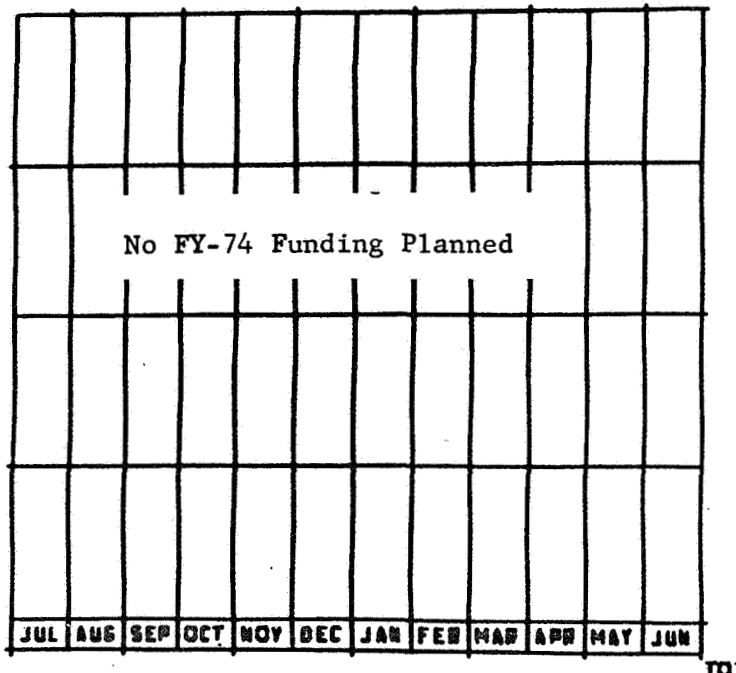
RTOP NO. 502-21-30 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

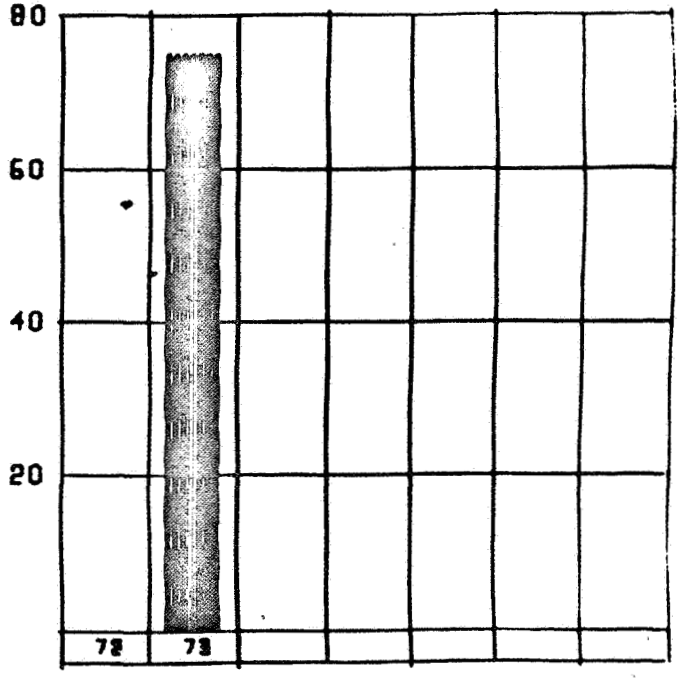
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS



PLANNED
ACTUAL

														TOTAL
COMM.	PLAN.													
	ACT.													
OBLIG	PLAN.													
	ACT.													

	72	73					
PLAN.	0	75					
ACT.	0	75					

----- PLANNED COMM.
—— ACTUAL COMM.
..... PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS - 4 LEVEL

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: SPACE VEHICLE DYNAMICS

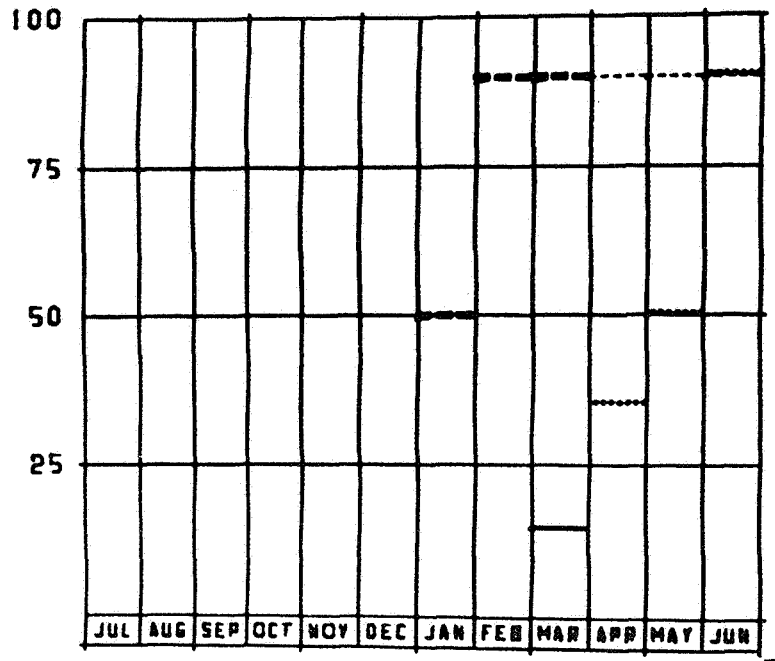
RTOP NO. 502-22-11 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

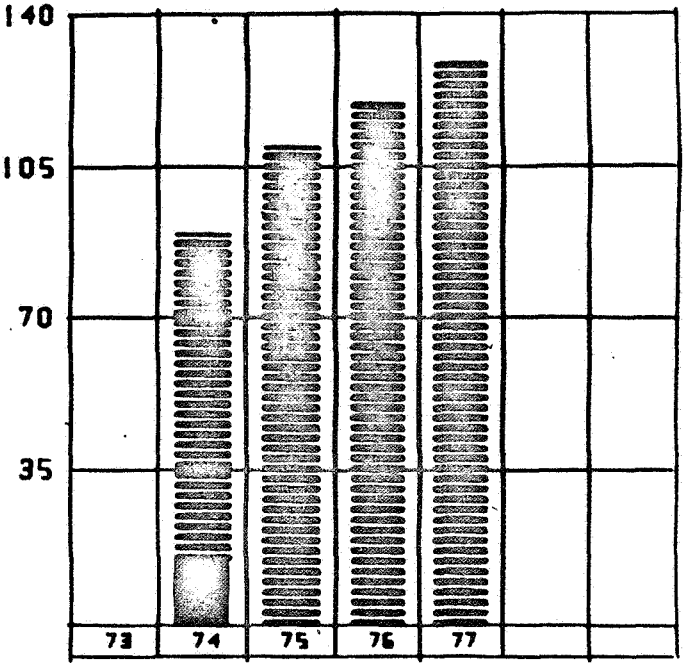
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS — PLANNED / ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										0	0	0	0
	ACT.	0	0	0	0	0	0	50	40	0				90
OBLIG	PLAN.										20	15	40	75
	ACT.	0	0	0	0	0	0	0	0	15				15

	73	74	75	76	77		
PLAN.	0	90	110	120	130		
ACT.	0	15					

----- PLANNED COMM.
—— ACTUAL COMM.
..... PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: LARGE TELESCOPE TECHNOLOGY

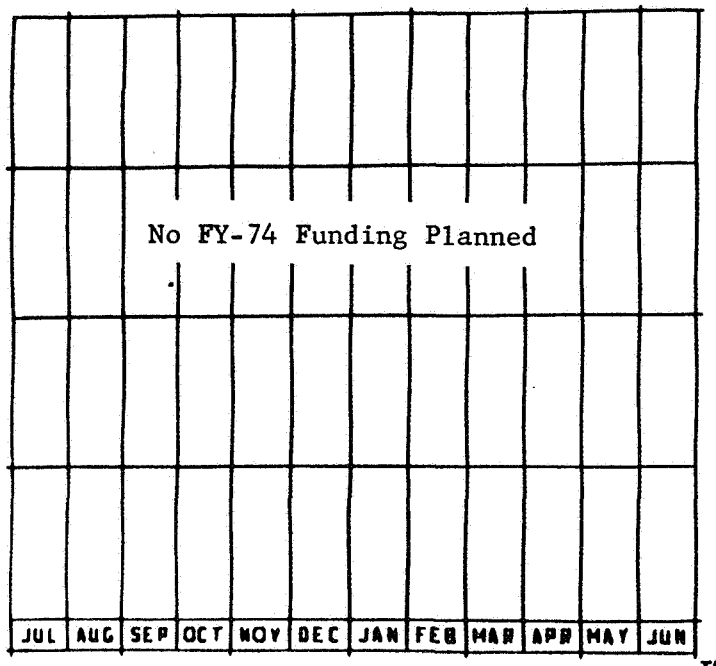
RTOP NO. 502-23-21 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

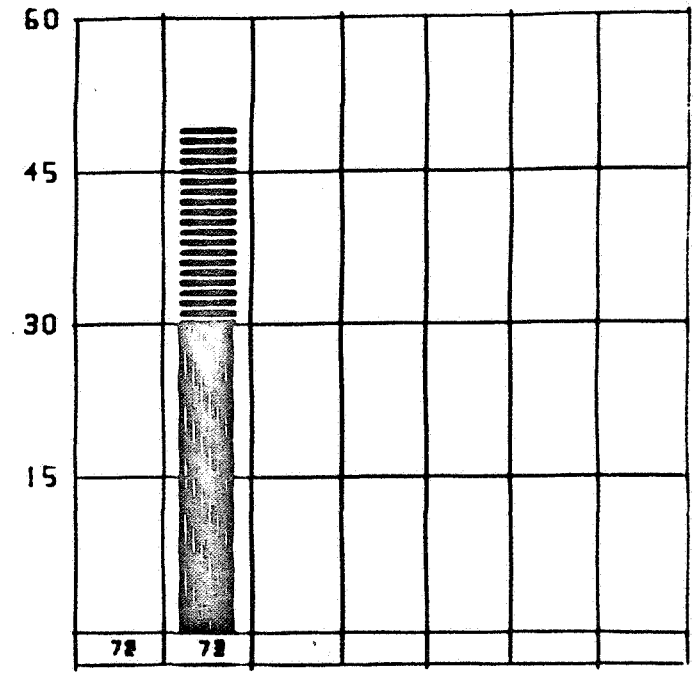
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS — PLANNED / ACTUAL



		TOTAL
COMM. PLAN.		
COMM. ACT.		
OBLIG PLAN.		
OBLIG ACT.		

	72	73
PLAN.	0	50
ACT.	0	30

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ ——— PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

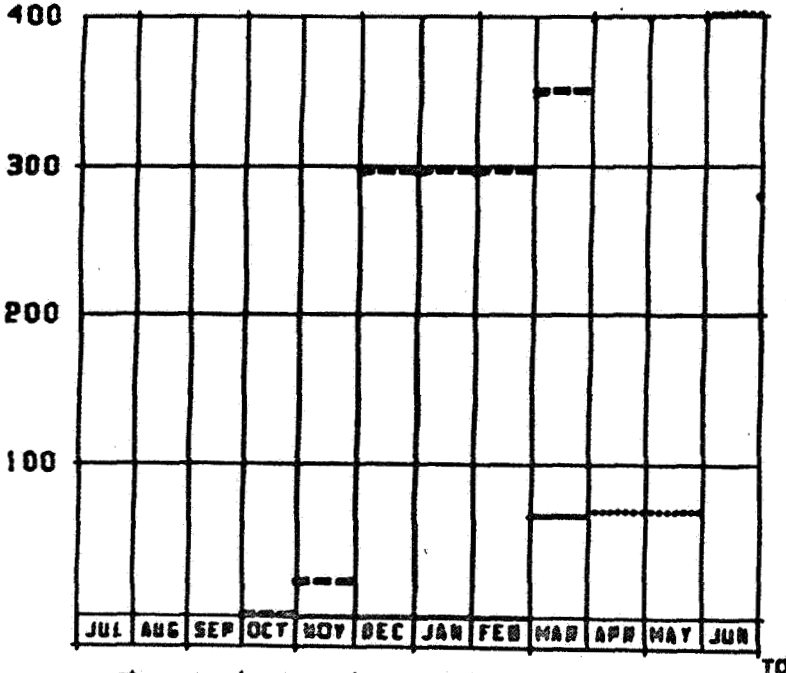
RTOP TITLE: OPTICAL MASS MEMORY

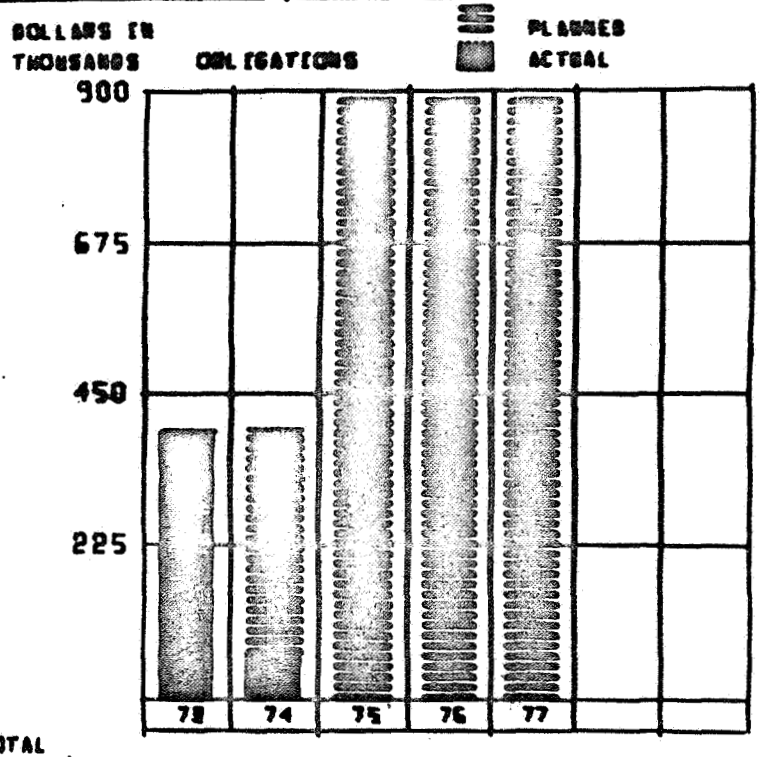
RTOP NO. 502-23-31 ☐ ADV. DES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74





		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN										49	0	0	49
	ACT.	0	0	0	1	22	275	0	0	53				351
OBLIG	PLAN										0	0	332	332
	ACT.	0	0	0	0	1	0	0	0	67				68

	73	74	75	76	77		
PLAN	400	400	900	900	900		
ACT.	395	68					

----- PLANNED COMM.
— — ACTUAL COMM.
..... PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: INERTIAL COMPONENTS

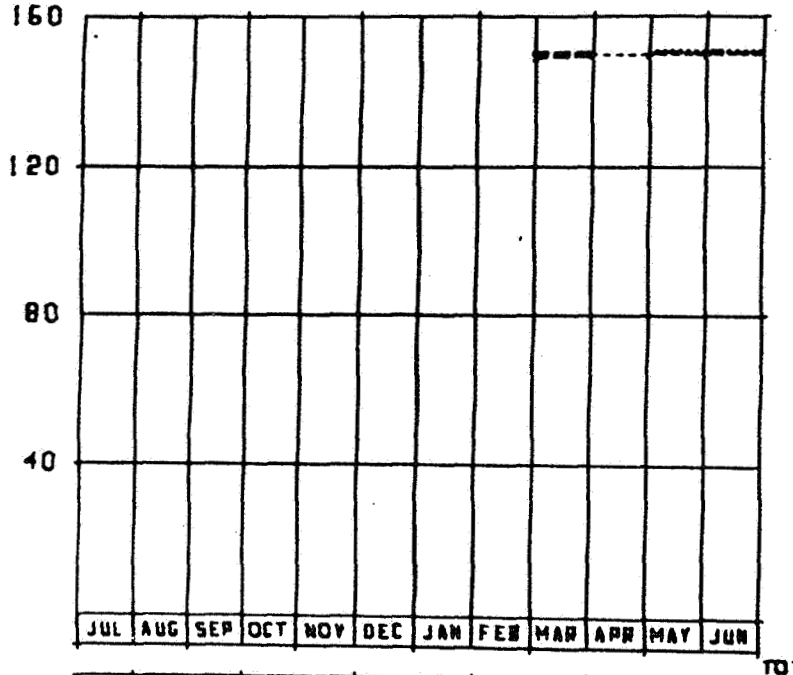
RTOP NO. 502-23-42 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

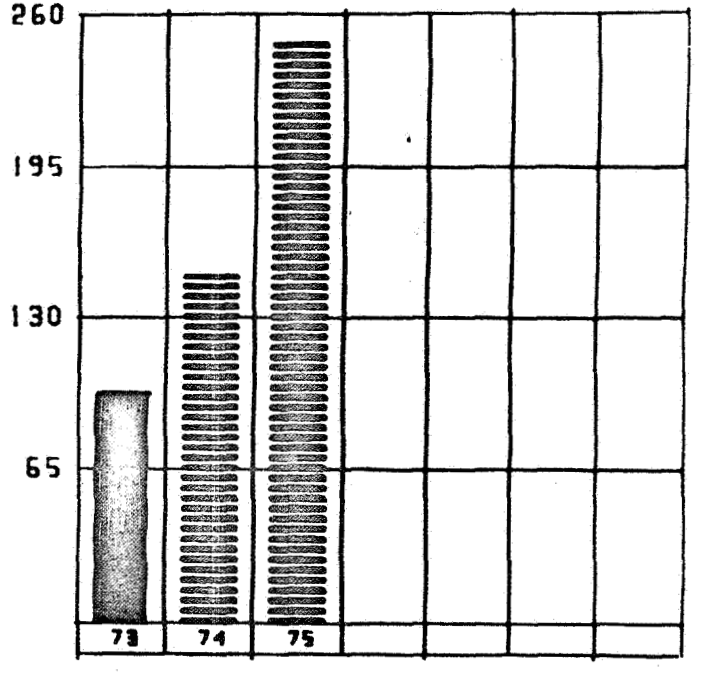
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										0	0	0	0
	ACT.	0	0	0	0	0	0	0	0	150				150
OBLIG	PLAN.										0	150	0	150
	ACT.	0	0	0	0	0	0	0	0	0				0

	73	74	75
PLAN.	100	150	250
ACT.	97	0	

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

4 LEVEL

CENTER: MSFC

RESPONSIBILITY APPROVAL

ACCOMPLISHMENT

RTOP TITLE: DESIGN, PROCESSING, AND TESTING OF LSI ARRAYS

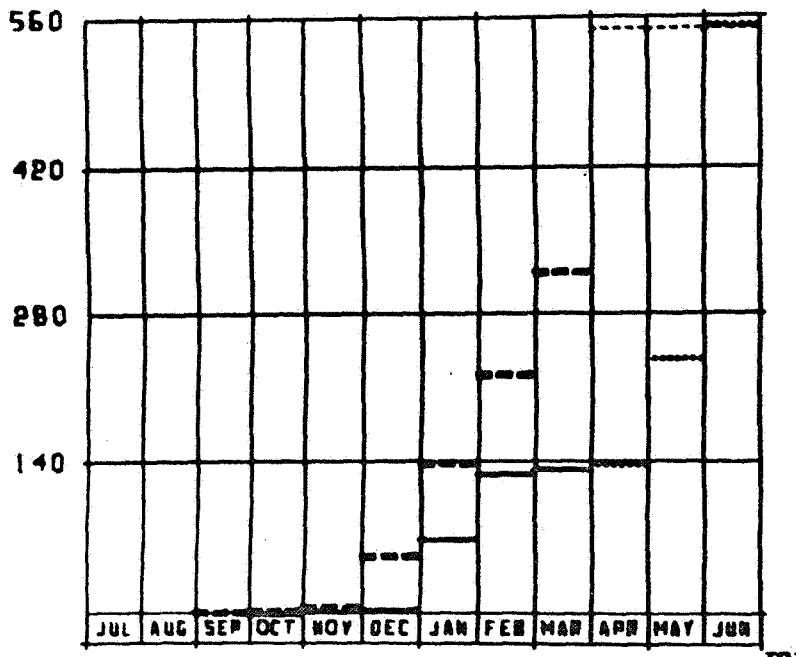
RTOP NO. 502-23-51 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

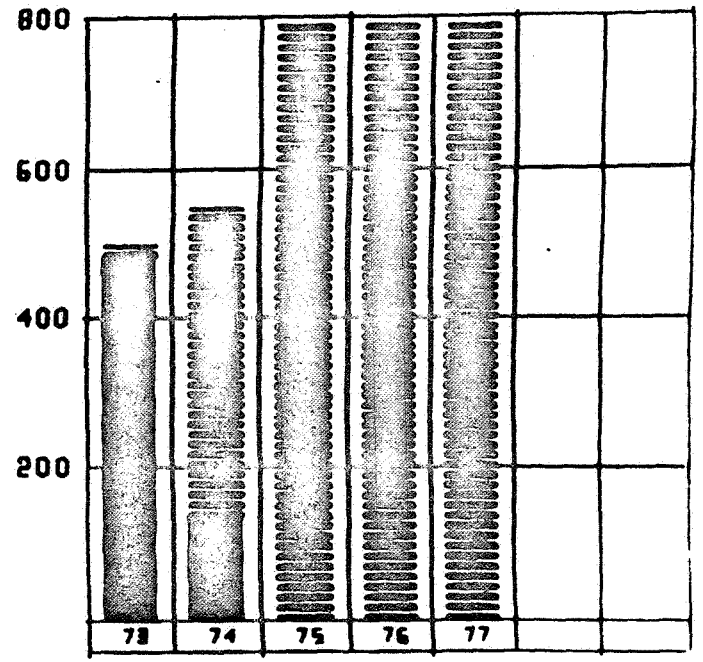
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										230	0	0	230
	ACT.	0	0	1	1	3	47	86	84	98				320
OBLIG	PLAN.										0	100	315	415
	ACT.	0	0	0	1	2	2	64	61	5				135

	73	74	75	76	77		
PLAN.	500	550	800	800	800		
ACT.	485	135					

PLANNED COMM. — PLANNED OBLIG.

ACTUAL COMM. — ACTUAL OBLIG.

☐ SPACE SHUTTLE

☐ SPACE STATION/BASE

☐ _____ PROJECT

☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

4 LEVEL

CENTER MSFC

RESPONSIBILITY APPROVAL

ACCOMPLISHMENT

RTOP TITLE SCREENING AND RELIABILITY TESTING OF MICROCIRCUITS AND ELECTRONIC DEVICES

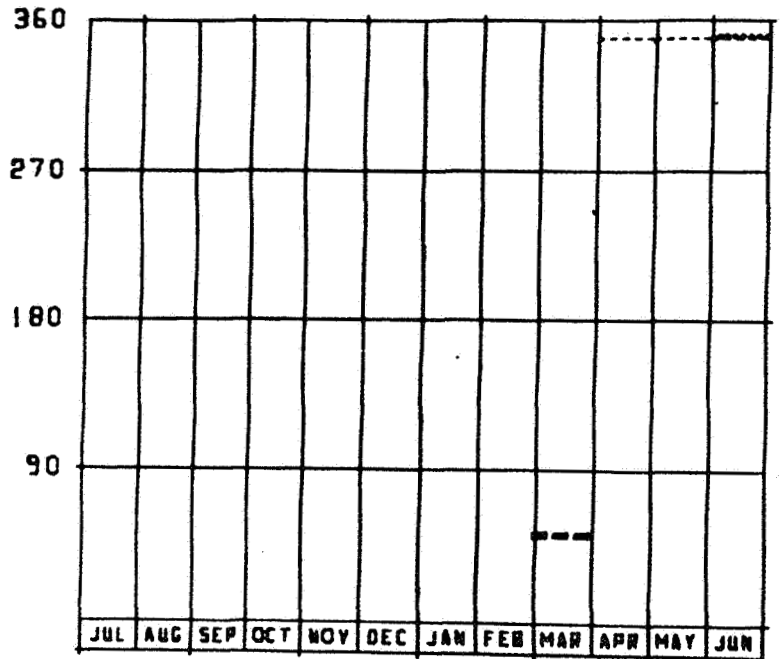
RTOP NO. 502-23-52 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

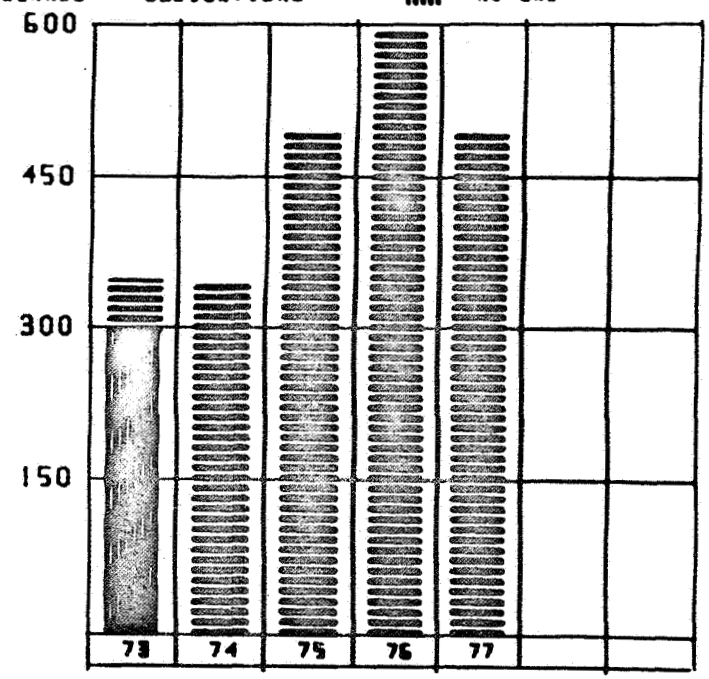
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										298	0	0	298
	ACT.	0	0	0	0	0	0	0	0	52				52
OBLIG	PLAN.										0	0	350	350
	ACT.	0	0	0	0	0	0	0	0	0				0

	73	74	75	76	77		
PLAN	350	350	500	600	500		
ACT.	298	0					

----- PLANNED COMM.
— — — ACTUAL COMM.
····· PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

4 LEVEL

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: SOLAR ARRAY TECHNOLOGY FOR SOLAR ELECTRIC PROPULSION STAGE

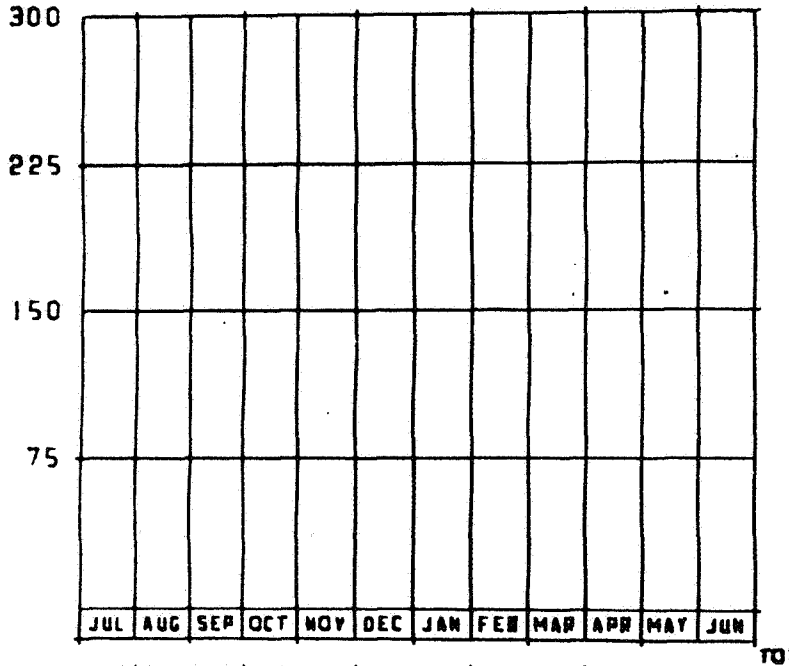
RTOP NO. 502-24-17 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

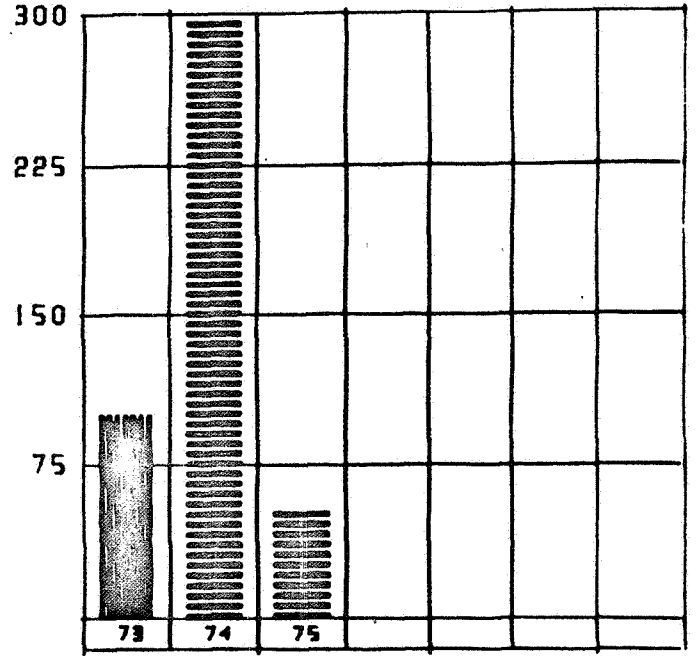
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED
ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										0	0	300	300
	ACT.	0	0	0	0	0	0	0	0	0				0
OBLIG	PLAN.										0	0	0	0
	ACT.	0	0	0	0	0	0	0	0	0				0

	73	74	75				
PLAN.	100	300	55				
ACT.	100	0					

PLANNED COMM. ..... PLANNED OBLIG.

ACTUAL COMM. ——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: LAUNCH VEHICLE PROPULSION TECHNOLOGY

502-24-21

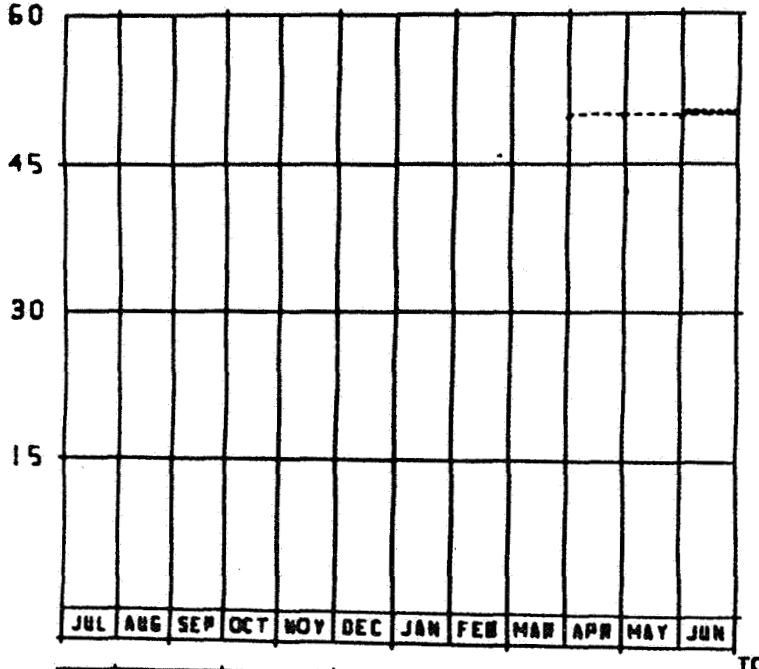
RTOP NO. 502-04-21 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

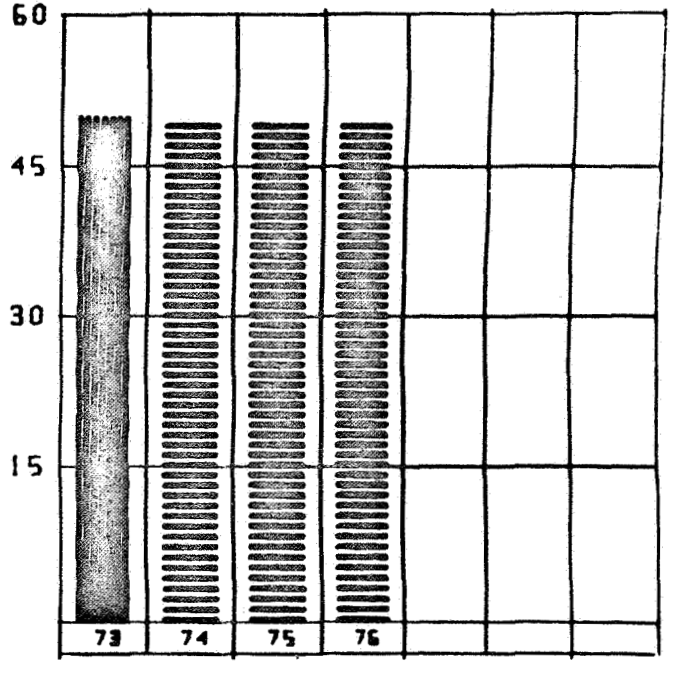
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										50	0	0	50
	ACT.	0	0	0	0	0	0	0	0	0				0
OBLIG	PLAN.										0	0	50	50
	ACT.	0	0	0	0	0	0	0	0	0				0

	73	74	75	76			
PLAN.	50	50	50	50			
ACT.	50	0					

----- PLANNED COMM.
— — — ACTUAL COMM.
····· PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: MULTI-KW DC DISTRIBUTION SYSTEM TECHNOLOGY

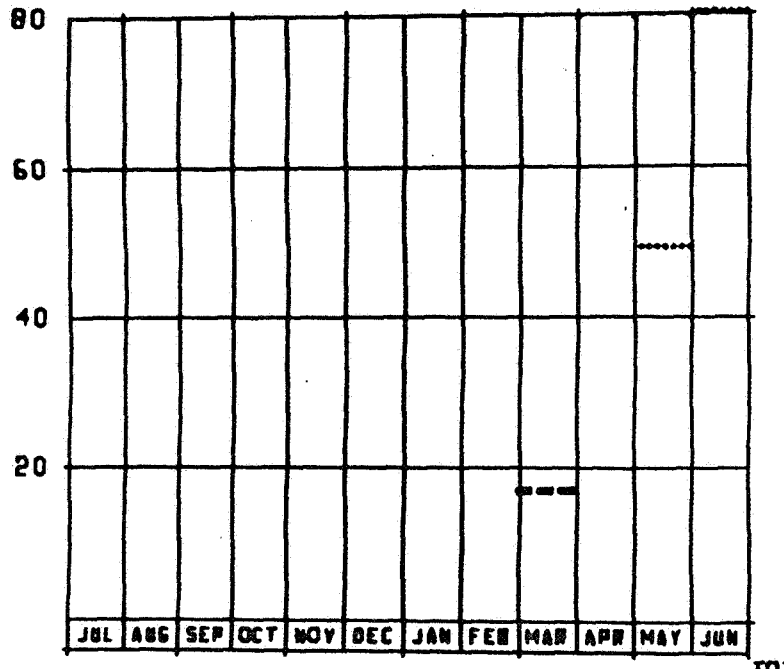
RTOP NO. 502-25-73 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

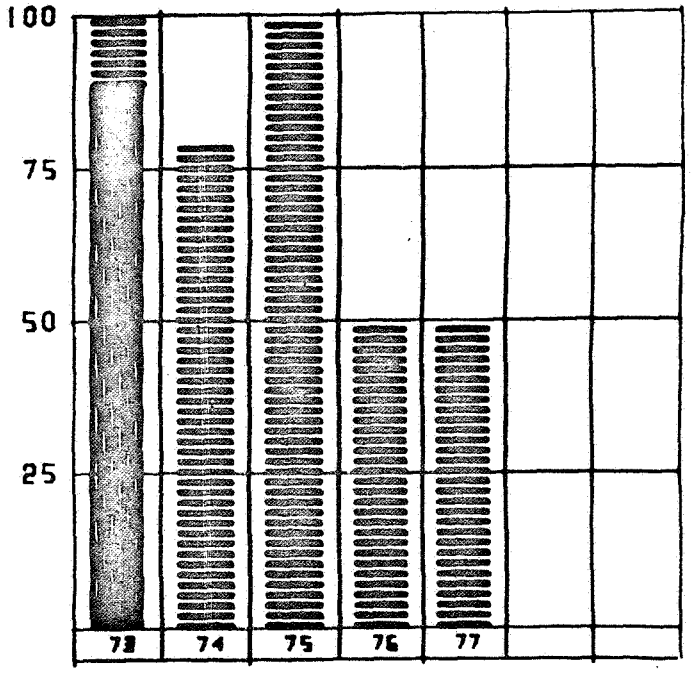
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										63	0	0	63
	ACT.	0	0	0	0	0	0	0	0	17				17
OBLIG	PLAN.										0	49	31	80
	ACT.	0	0	0	0	0	0	0	0	0				0

	73	74	75	76	77		
PLAN.	100	80	100	50	50		
ACT.	89	0					

----- PLANNED COMM.
▬▬ ACTUAL COMM.
------ PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: SENSOR AND INSTRUMENTATION RESEARCH

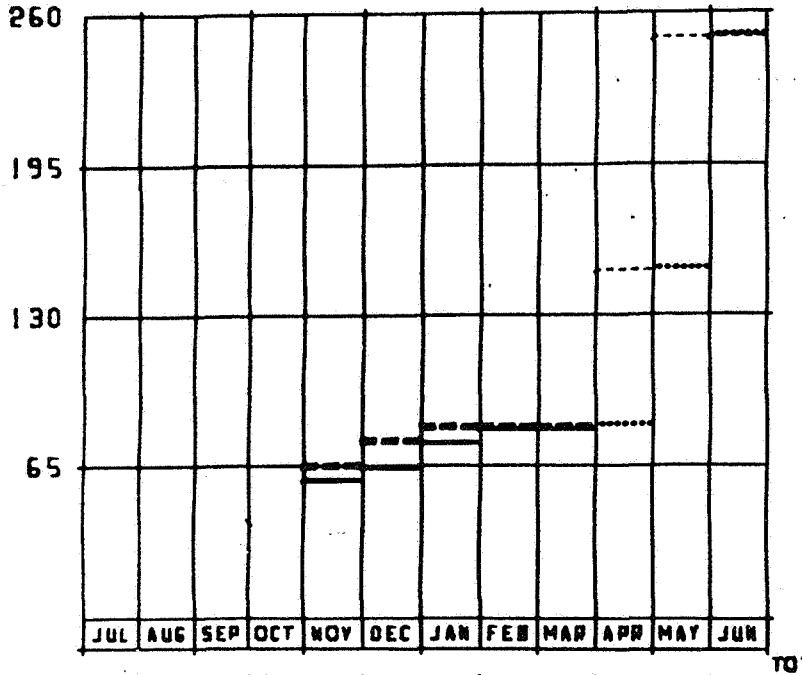
RTOP NO. 502-33-53 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

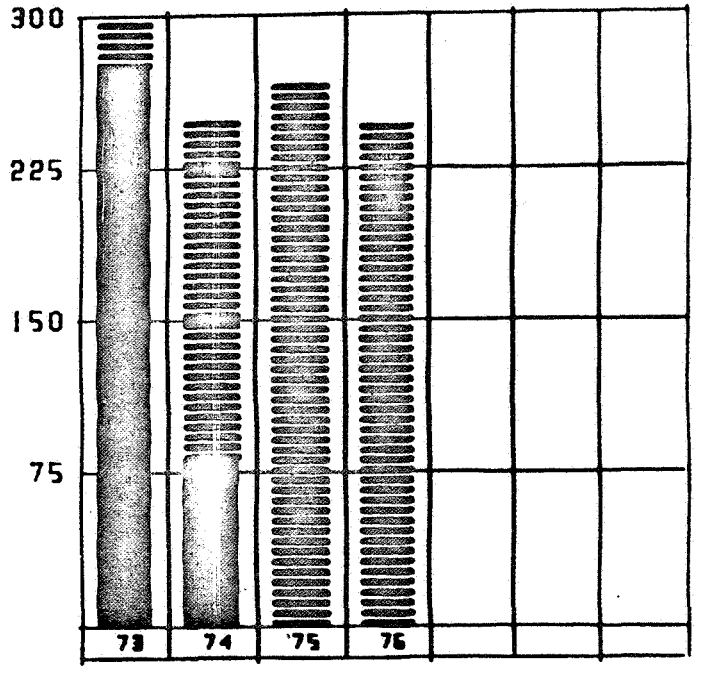
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										68	100	0	168
	ACT.	0	0	0	0	65	11	6	0	0				82
OBLIG	PLAN.										0	68	100	168
	ACT.	0	0	0	0	60	5	11	6	0				82

	73	74	'75	76			
PLAN.	300	250	270	250			
ACT.	276	82					

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER MSFC

RESPONSIBILITY

APPROVAL

ACCOMPLISHMENT

RTOP TITLE NUCLEAR STAGE TECHNOLOGY

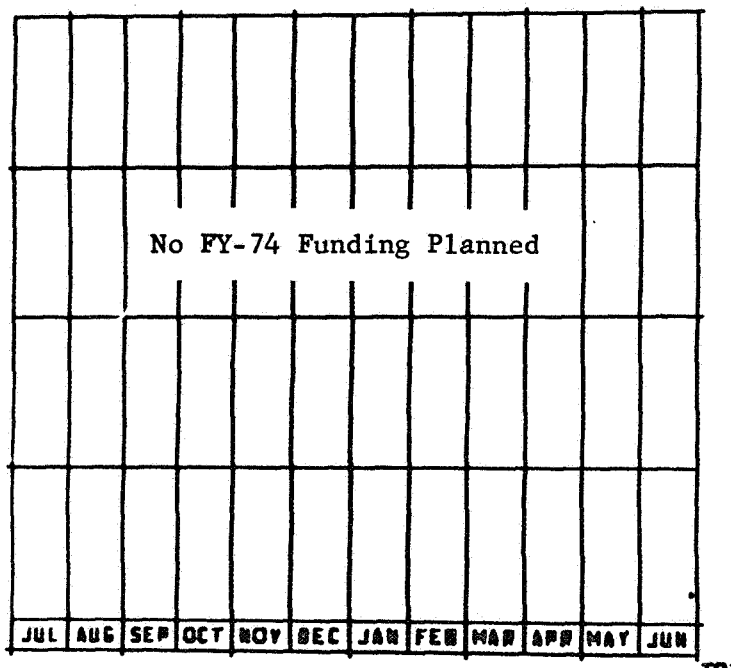
RTOP NO. 503-24-06 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

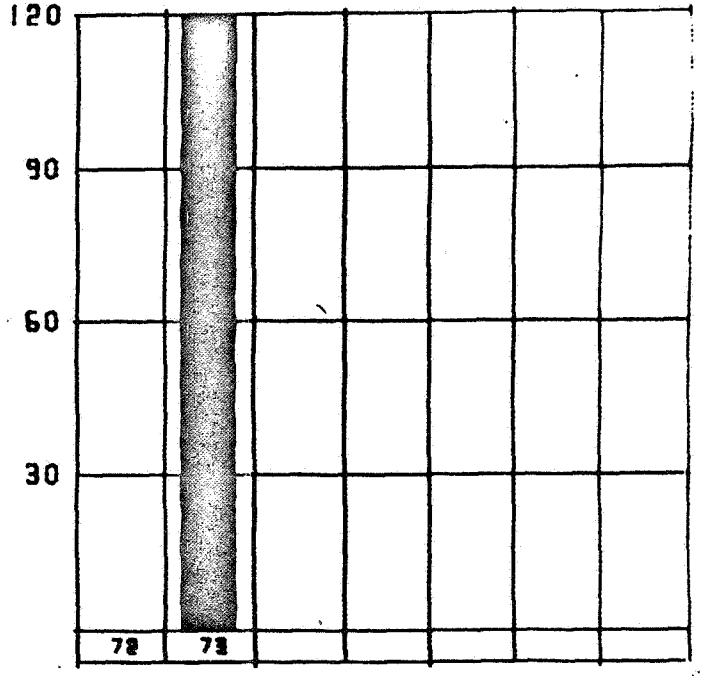
CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED

ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.													
	ACT.													
OBLIG	PLAN.													
	ACT.													

	72	73
PLAN.	0	120
ACT.	0	120

----- PLANNED COMM.

—— ACTUAL COMM.

..... PLANNED OBLIG.

—— ACTUAL OBLIG.

☐ SPACE SHUTTLE

☐ SPACE STATION/BASE

☐ _____ PROJECT

☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER MSFC

RESPONSIBILITY APPROVAL

ACCOMPLISHMENT

RTOP TITLE ELECTRICAL POWER - SPACE STATION

RTOP NO. 908-51-05 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

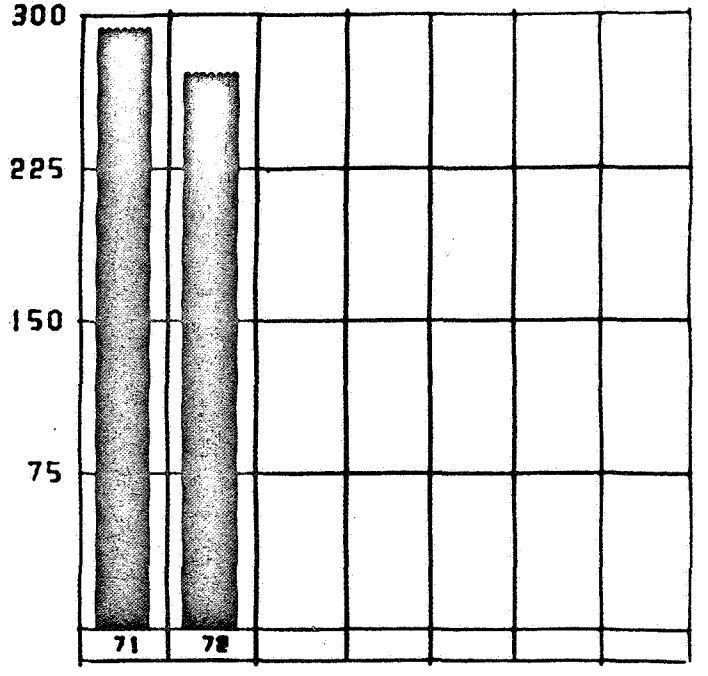
CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.													
	ACT.													
OBLIG	PLAN.													
	ACT.													

DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



	71	72
PLAN.	294	272
ACT.	294	272

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY MSFC

ACCOMPLISHMENT

RTOP TITLE STABILIZATION AND CONTROL

RTOP NO. 908-51-08 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

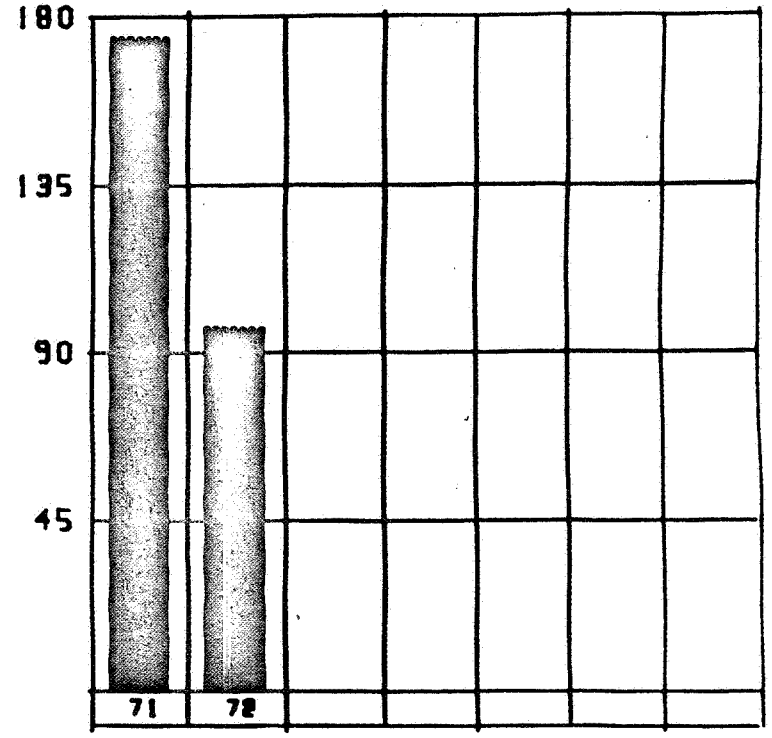
CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL



	71	72
PLAN.	175	97
ACT.	175	97

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

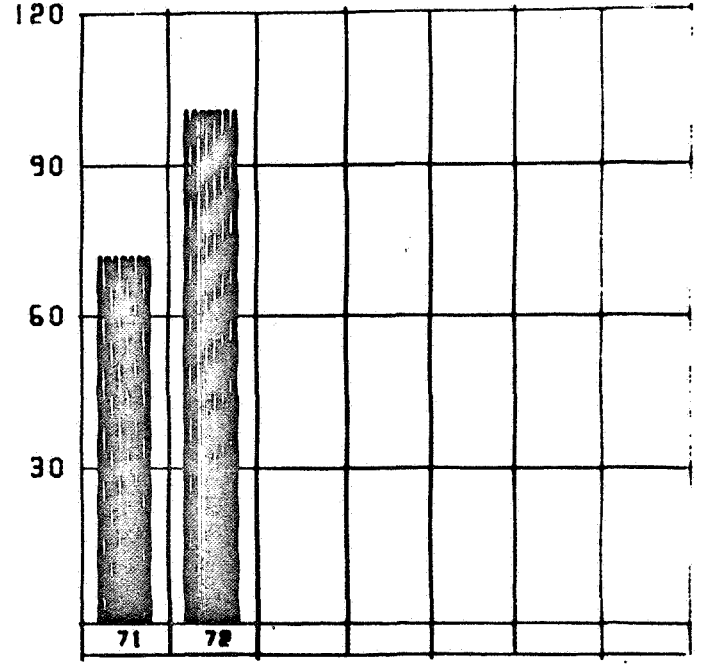
CENTER RESPONSIBILITY APPROVAL	FINANCIAL STATUS (LEVEL 4)	ORIG. SCHED. APPROVAL
MSFC	RTOP TITLE MANUFACTURING AND INSPECTION	LAST SCHED. CHANGE
ACCOMPLISHMENT	RTOP NO. 908-51-21 ☐ ADV. RES. ☐ TECHNOLOGY	STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS



	71	72
PLAN.	72	101
ACT.	72	101

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: CONTROL SYSTEM TECHNOLOGY FOR SHUTTLE VEHICLES

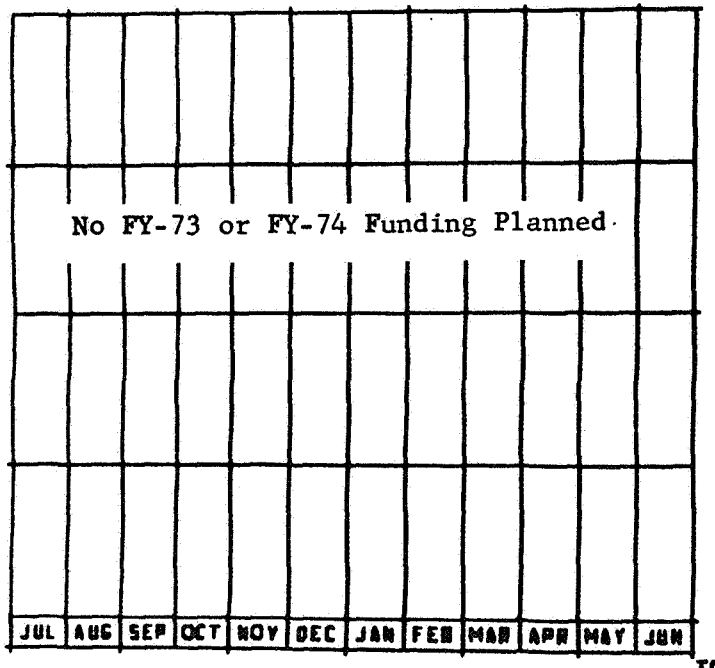
RTOP NO. 908-52-08 ☐ ADV. DES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

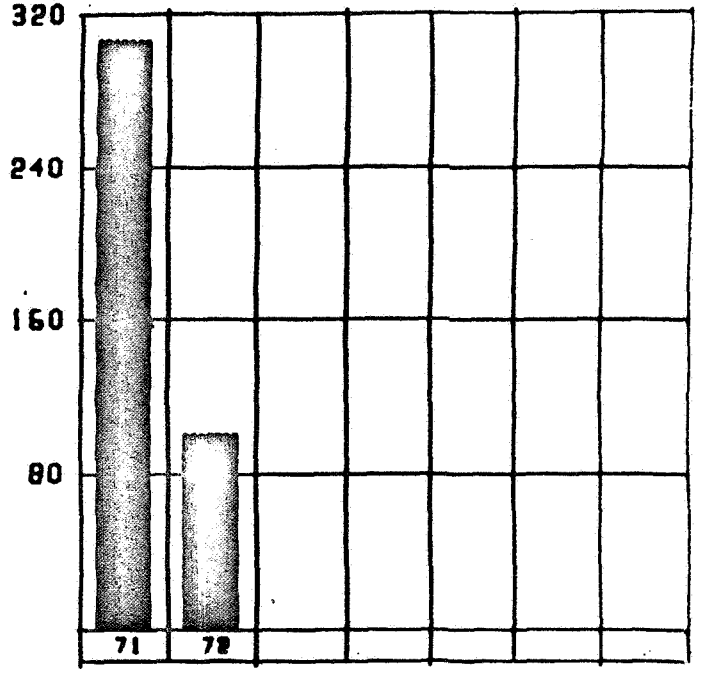
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED
ACTUAL



													TOTAL
COMM.	PLAN.												
	ACT.												
OBLIG	PLAN.												
	ACT.												

	71	72
PLAN.	307	101
ACT.	307	101

----- PLANNED COMM.
—·—·— ACTUAL COMM.
····· PLANNED OBLIG.
——— ACTUAL OBLIG.

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: GUIDANCE AND NAVIGATION

RTOP NO. 908-52-10 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

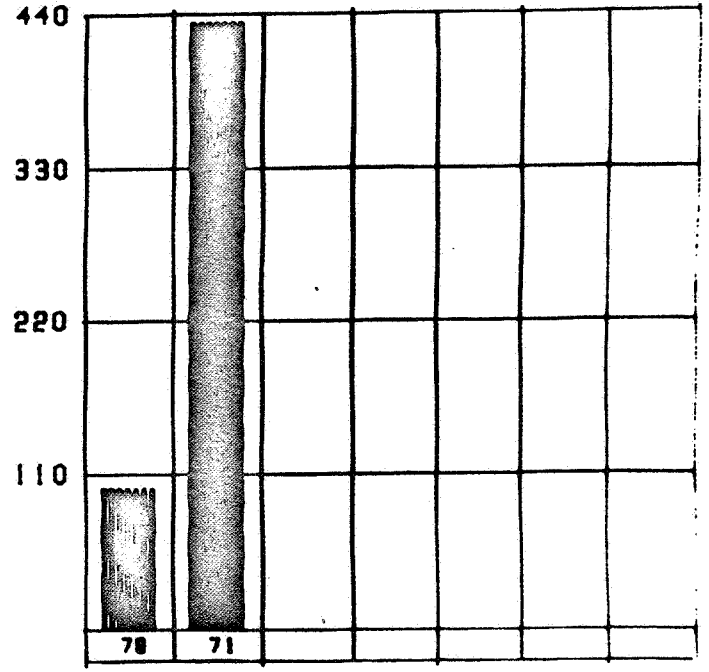
CURRENT FISCAL YEAR - 1974

No FY-72, FY-73, FY-74 Funding Planned

		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.													
	ACT.													
OBLIG	PLAN.													
	ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL



	70	71					
PLAN.	100	435					
ACT.	100	435					

----- PLANNED COMM. ..... PLANNED OBLIG.

— — — ACTUAL COMM. ——— ACTUAL OBLIG.

☒ SPACE SHUTTLE

☐ SPACE STATION/BASE

☐ PROJECT

☐ NON PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER MSFC

RESPONSIBILITY APPROVAL

ACCOMPLISHMENT

RTOP TITLE SPACE SHUTTLE CRYOGENIC TECHNOLOGY

RTOP NO. 908-52-37 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

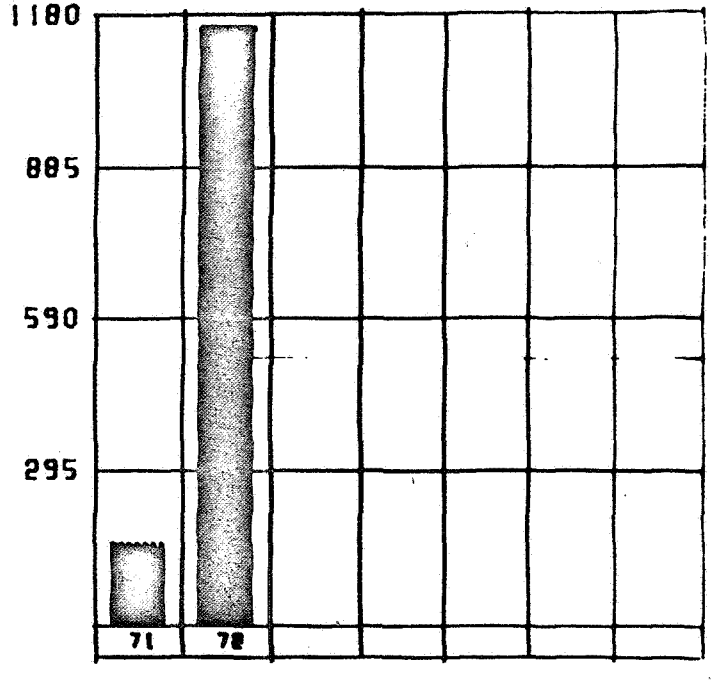
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS

OBLIGATIONS

PLANNED

ACTUAL



	71	72
PLAN.	159	1175
ACT.	159	1154

----- PLANNED COMM.

—— ACTUAL COMM.

------ PLANNED OBLIG.

—— ACTUAL OBLIG.

☒ SPACE SHUTTLE

☐ SPACE STATION/BASE

☐ _____ PROJECT

☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: SPACE SHUTTLE AEROTHERMODYNAMICS

RTOP NO. 908-52-39 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

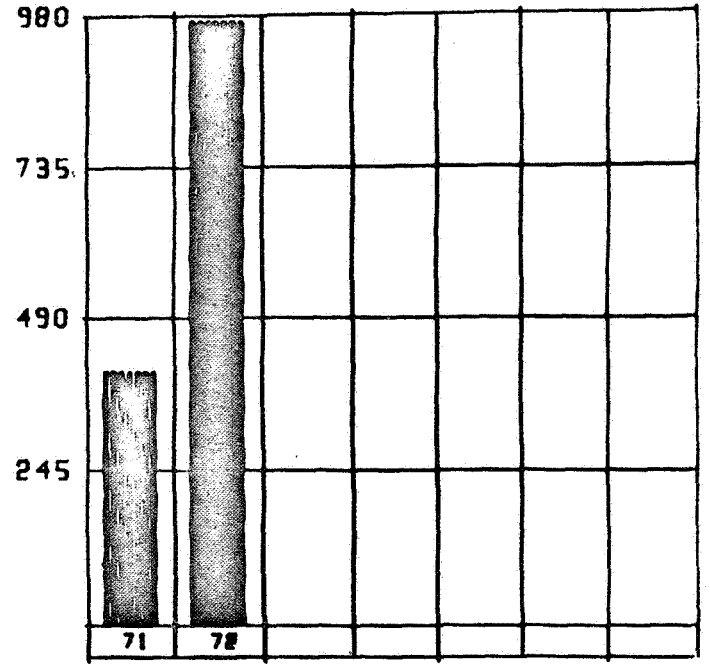
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS



PLANNED
ACTUAL

	71	72
PLAN.	405	974
ACT.	405	973

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER MSFC

RESPONSIBILITY APPROVAL

ACCOMPLISHMENT

RTOP TITLE ELECTRICAL POWER

RTOP NO. 908-54-05 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

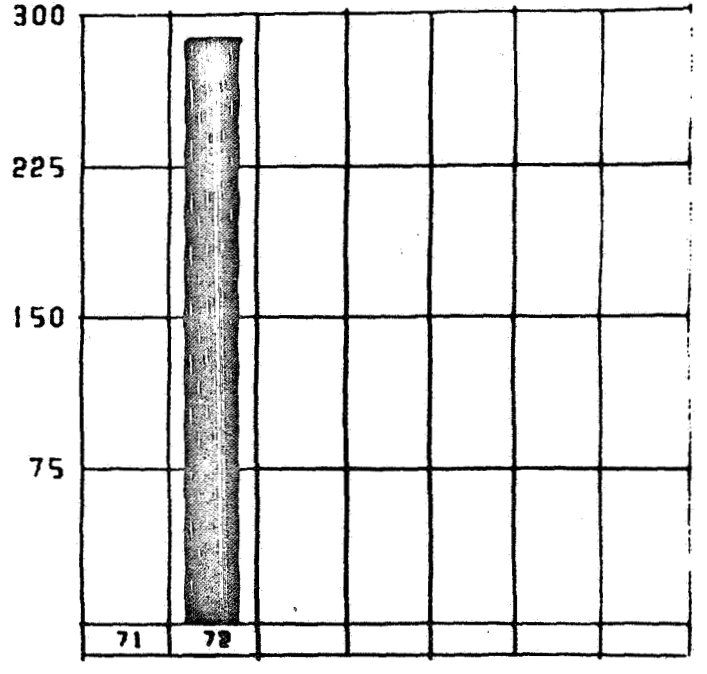
No FY-73 or FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED

ACTUAL



	71	72
PLAN.	0	292
ACT.	0	288

----- PLANNED COMM.

—— ACTUAL COMM.

..... PLANNED OBLIG.

—— ACTUAL OBLIG.

☐ SPACE SHUTTLE

☐ SPACE STATION/BASE

☒ _____ PROJECT

☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

4 LEVEL

CENTER MSFC

RESPONSIBILITY APPROVAL

ACCOMPLISHMENT

RTOP TITLE STABILIZATION AND CONTROL

RTOP NO. 908-54-08 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

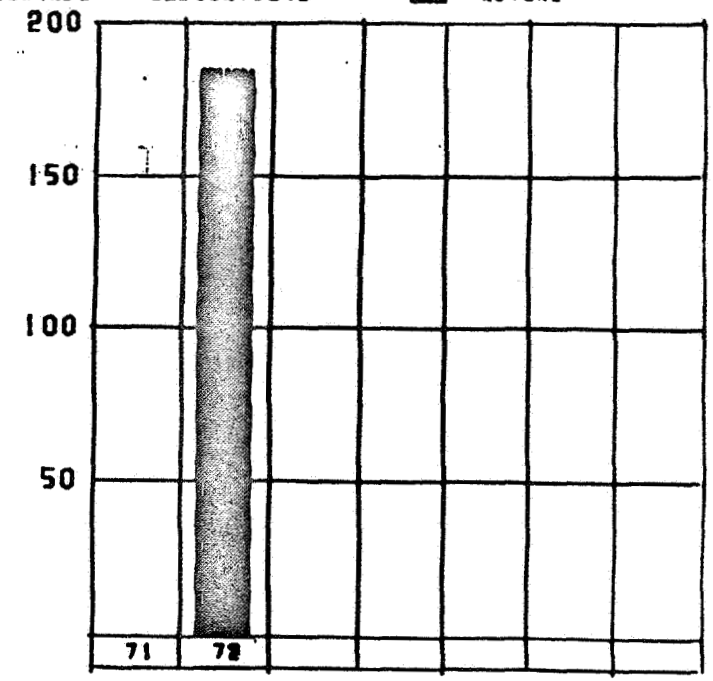
CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



	71	72
PLAN.	0	185
ACT.	0	185

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: THERMAL CONTROL

RTOP NO. 909-51-02 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

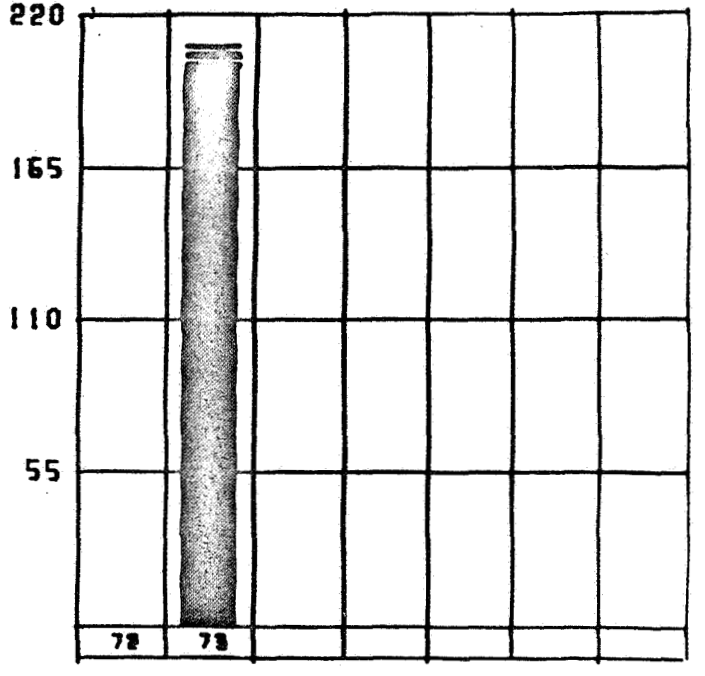
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS



	72	73
PLAN.	0	210
ACT.	0	202

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: EARTH ORBITAL SYSTEMS ELECTRIC POWER TECHNOLOGY

RTOP NO. 909-51-05 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

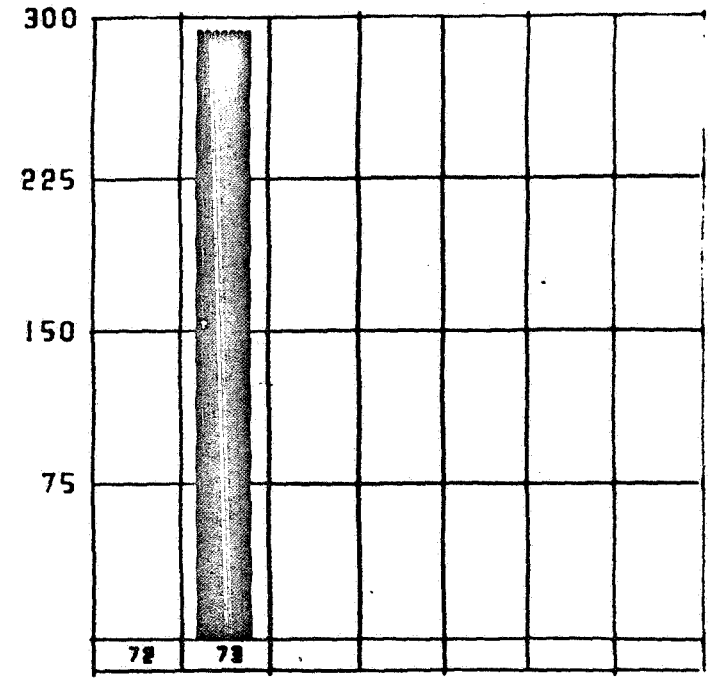
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS



	72	73
PLAN.	0	294
ACT.	0	294

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: COMMUNICATIONS

RTOP NO. 909-51-07 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

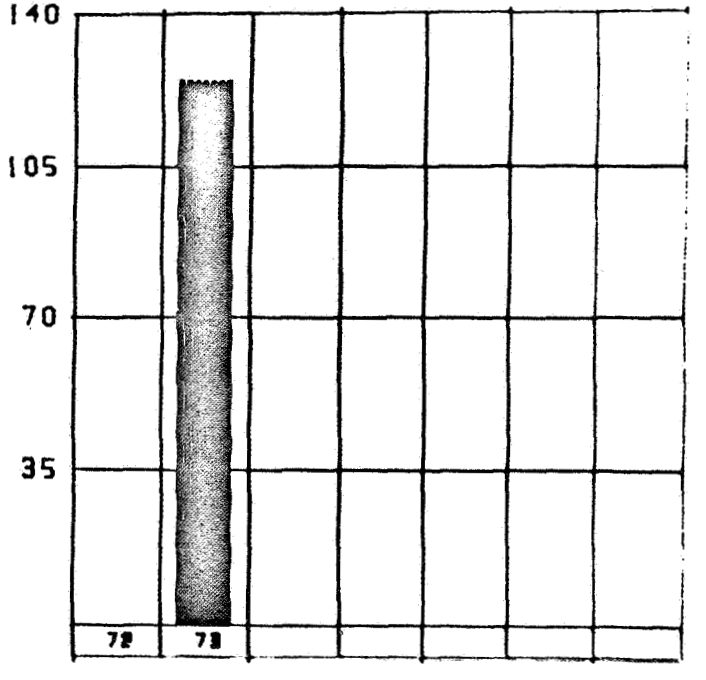
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-74 Funding Planned

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN

DOLLARS IN THOUSANDS — OBLIGATIONS — PLANNED / ACTUAL



		TOTAL	72	73
OBLIG	PLAN.		0	125
	ACT.		0	125

----- PLANNED COMM.
— — ACTUAL COMM.
------ PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☒ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL MSFC

ACCOMPLISHMENT

RTOP TITLE AEROTHERMODYNAMICS

RTOP NO. 909-52-39 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

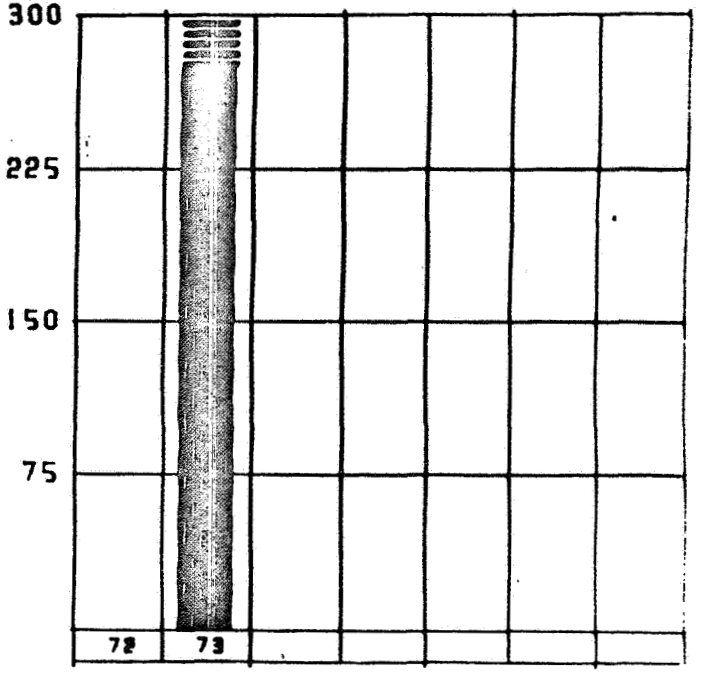
CURRENT FISCAL YEAR - 1974

No FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



	72	73
PLAN.	0	300
ACT.	0	276

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ ——— ——— PROJECT
☐ NON PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: PHYSICAL STANDARDS

RTOP NO. 909-52-46 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL

60 / 45 / 30 / 15

	78	79
PLAN.	0	55
ACT.	0	55

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
——— ACTUAL OBLIG.

☒ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: OPERATIONS MAINTENANCE & SAFETY-EXHAUST EFFECTS

RTOP NO. 909-52-47 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

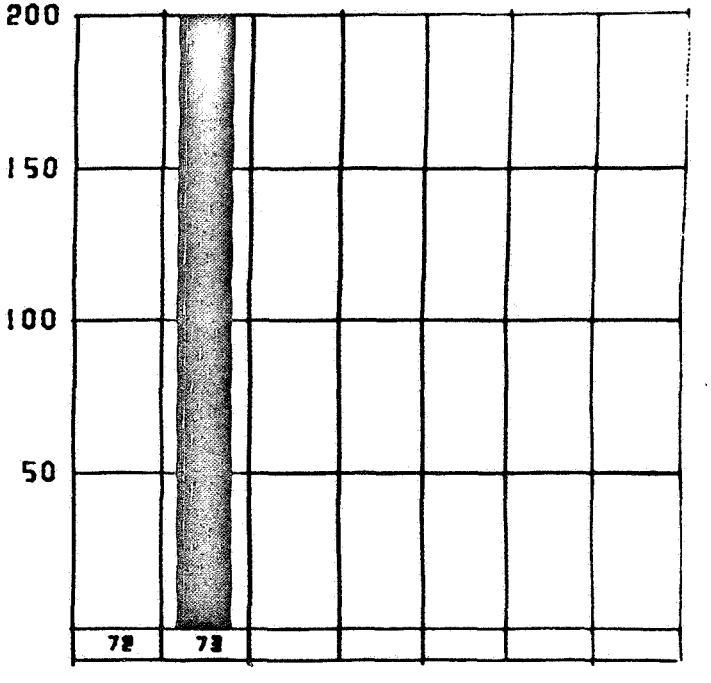
CURRENT FISCAL YEAR - 1974

No FY-74 Funding Planned

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.												
COMM. ACT.												
OBLIG PLAN.												
OBLIG ACT.												

DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL



	72	73
PLAN.	0	200
ACT.	0	200

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
—— ACTUAL OBLIG.

[x] SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: ELECTRICAL POWER

RTOP NO. 909-54-05 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL

120
90
60
30

	72	73
PLAN.	0	104
ACT.	0	104

----- PLANNED COMM.
—— ACTUAL COMM.
..... PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER MSFC

RESPONSIBILITY APPROVAL

ACCOMPLISHMENT

RTOP TITLE COMMUNICATIONS

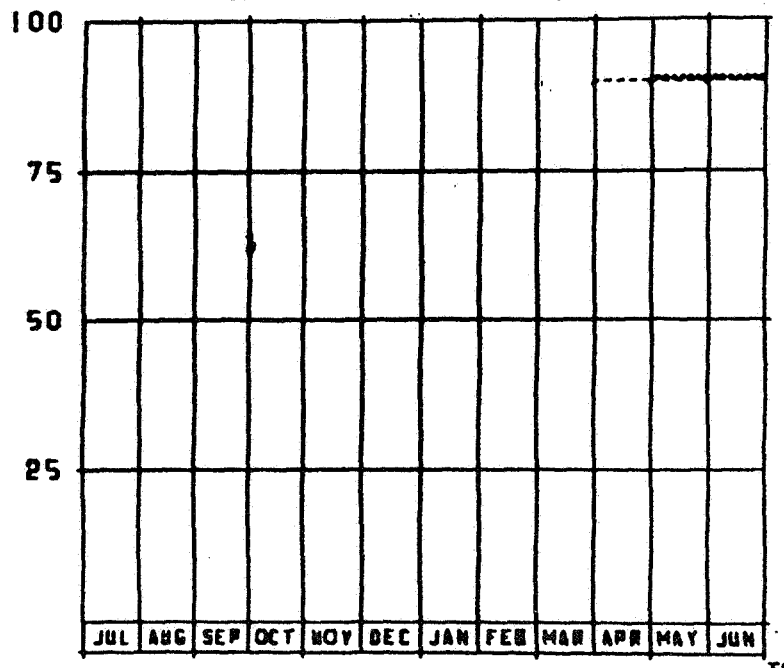
RTOP NO. 909-54-07 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

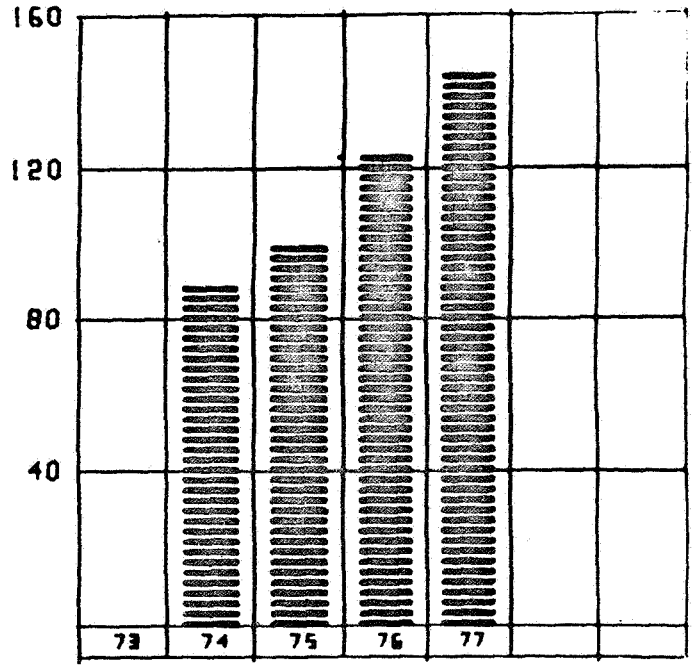
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										90	0	0	90
	ACT.	0	0	0	0	0	0	0	0	0				0
OBLIG	PLAN.										0	90	0	90
	ACT.	0	0	0	0	0	0	0	0	0				0

	73	74	75	76	77		
PLAN	0	90	100	125	145		
ACT.	0	0					

----- PLANNED COMM.
— — — ACTUAL COMM.
-·-·- PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: MANUFACTURING AND INSPECTION

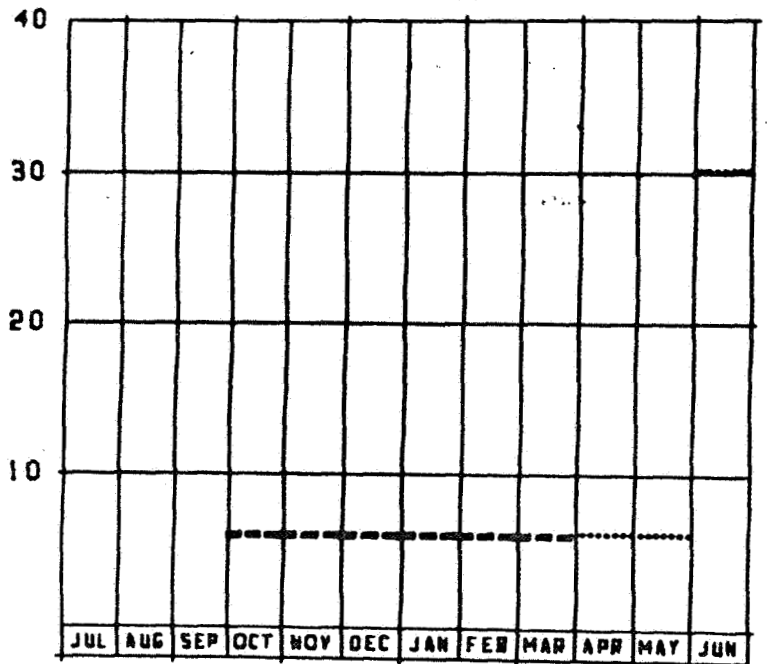
RTOP NO. 909-54-21 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

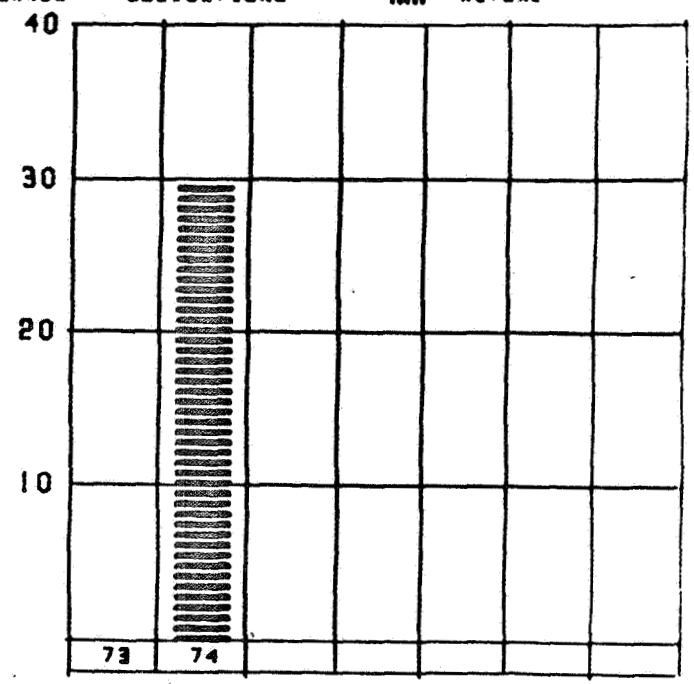
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										24	0	0	24
	ACT.	0	0	0	6	0	0	0	0	0				6
OBLIG	PLAN.										6	0	24	30
	ACT.	0	0	0	0	0	0	0	0	0				0

	73	74
PLAN.	0	30
ACT.	0	0

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CEN MSFC
RESPN. LETT

ACCOMPLISHMENT

RTOP TITLE AMOOS

RTOP NO. 909-54-22 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

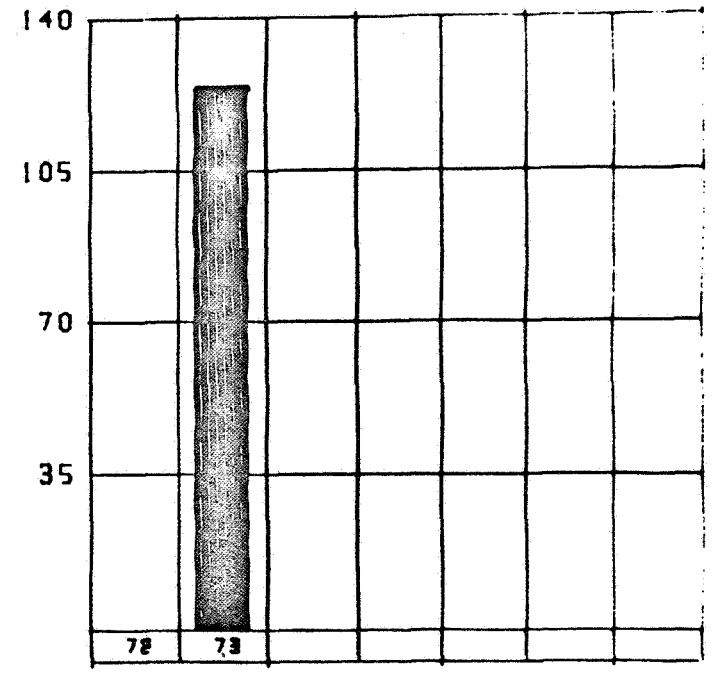
CURRENT FISCAL YEAR - 1974

No FY-74 Funding Planned

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN

DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



				TOTAL
COMM.	PLAN.			
	ACT.			
OBLIG	PLAN.			
	ACT.			

	72	73
PLAN.	0	125
ACT.	0	124

----- PLANNED COMM.
—— ACTUAL COMM.
..... PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ PROJECT
☐ NON PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: INFORMATION MANAGEMENT SYSTEM (SUMC AND TUG)

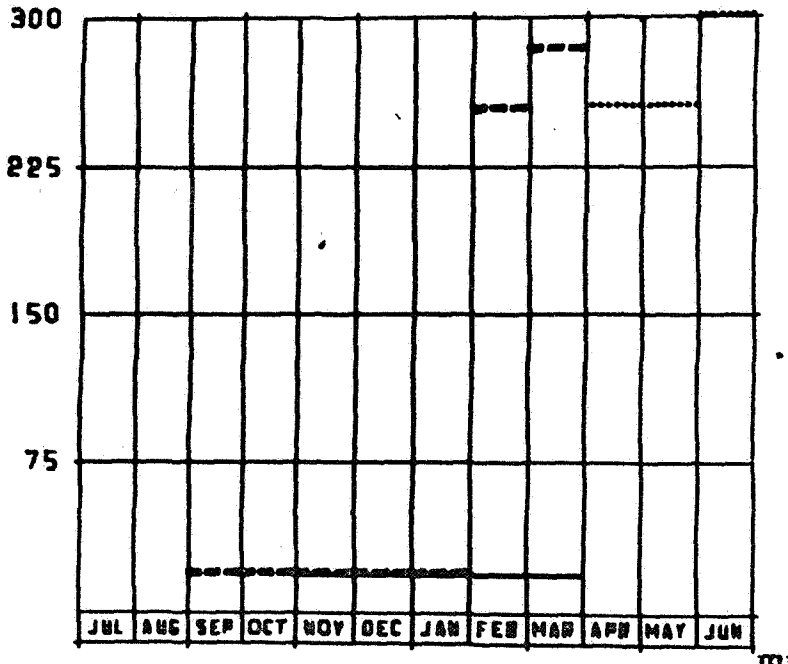
RTOP NO. 909-54-33 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

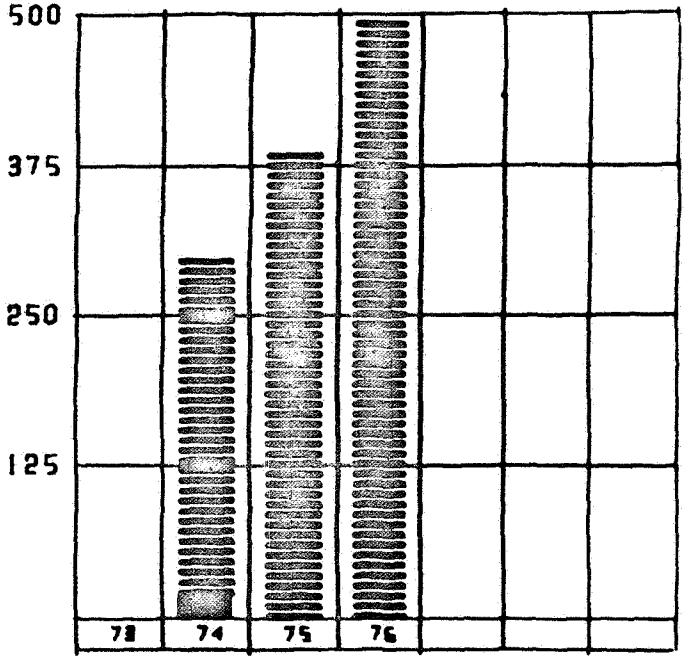
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS



PLANNED
ACTUAL

		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										15	0	0	15
	ACT.	0	0	20	0	0	0	0	235	30				285
OBLIG	PLAN.										235	0	45	280
	ACT.	0	0	0	0	20	0	0	0	0				20

	73	74	75	76			
PLAN.	0	300	390	500			
ACT.	0	20					

----- PLANNED COMM.
--- ACTUAL COMM.
..... PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: STRUCTURAL

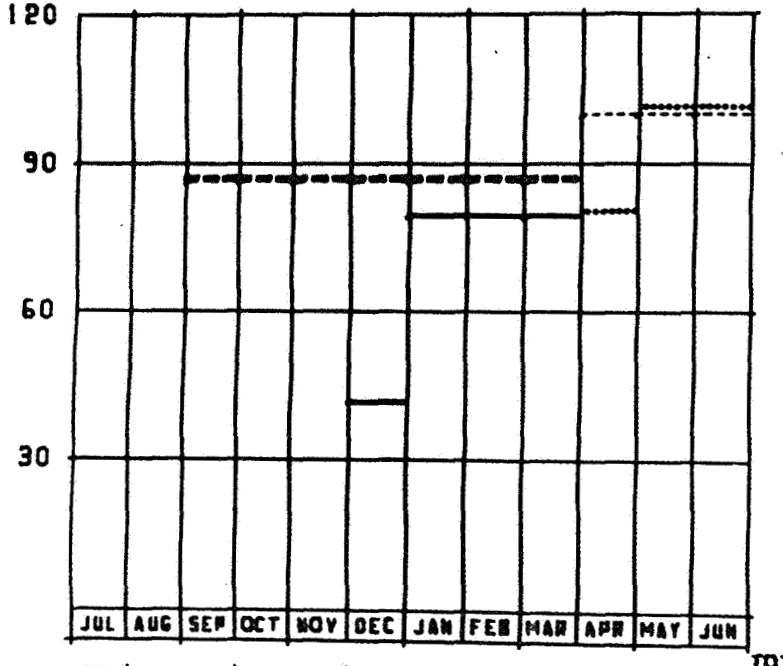
RTOP NO. 909-55-01 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

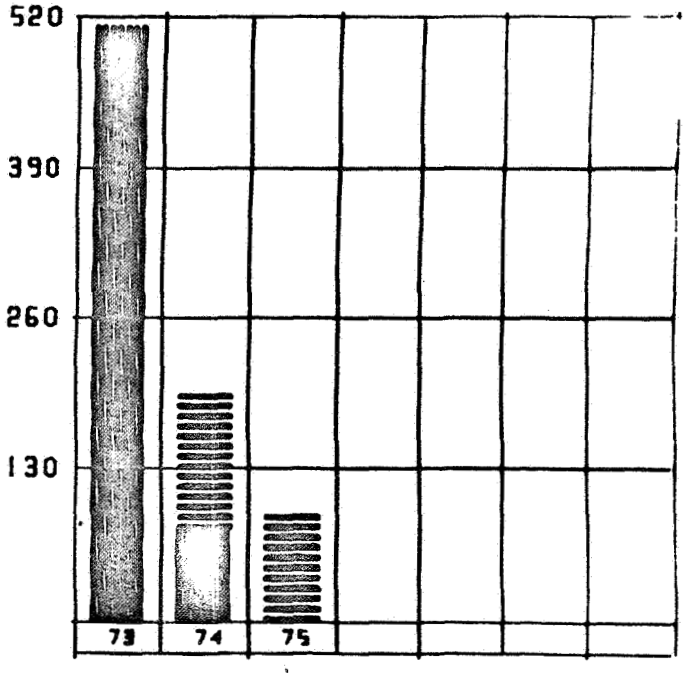
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS



PLANNED
ACTUAL

		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										13	0	0	13
	ACT.	0	0	87	0	0	0	0	0	0				87
OBLIG	PLAN.										0	21	0	21
	ACT.	0	0	0	0	0	42	38	0	0				79

	73	74	75				
PLAN.	513	200	90				
ACT.	513	79					

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: THERMAL CONTROL

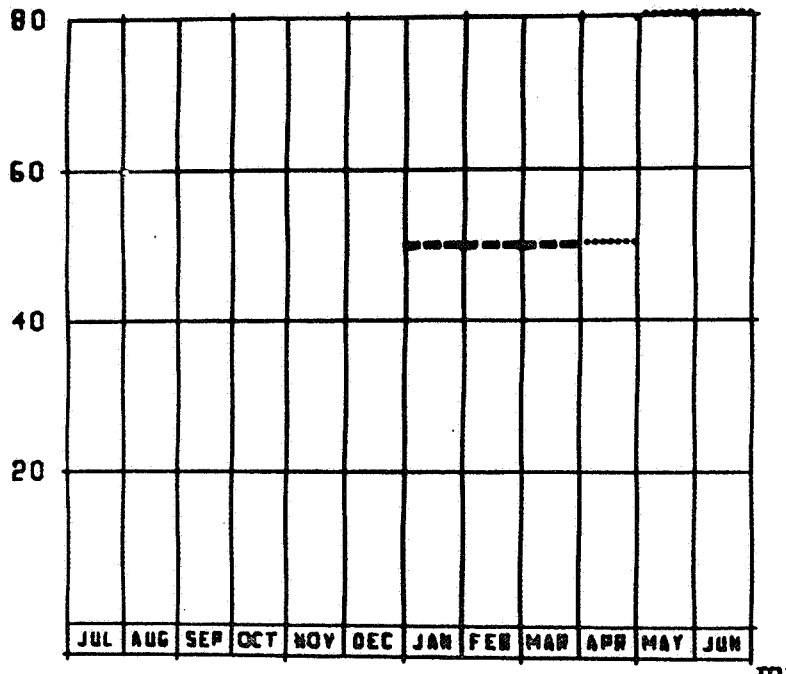
RTOP NO. 909-55-02 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

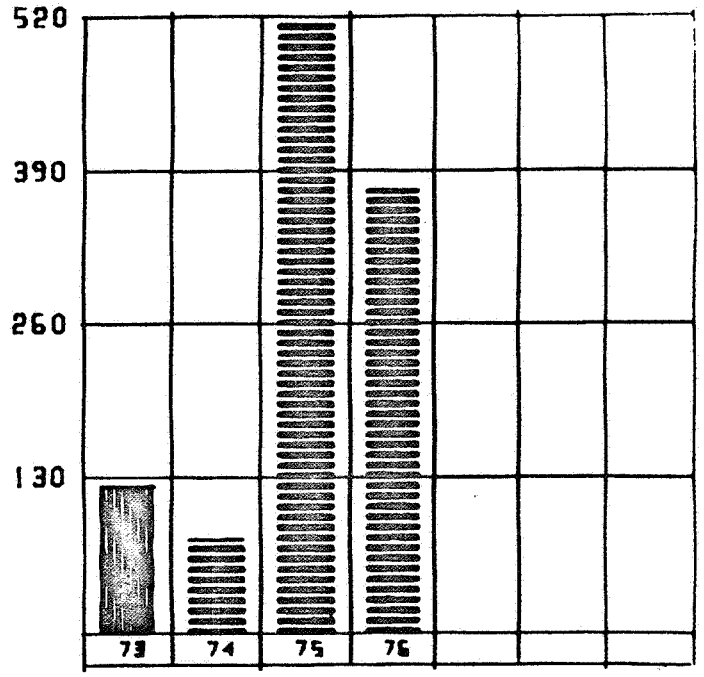
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										30	0	0	30
	ACT.	0	0	0	0	0	0	50	0	0				50
OBLIG	PLAN.										50	30	0	80
	ACT.	0	0	0	0	0	0	0	0	0				0

	73	74	75	76			
PLAN.	125	80	520	375			
ACT.	123	0					

----- PLANNED COMM.
▬▬ ACTUAL COMM.
····· PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: PROPULSION

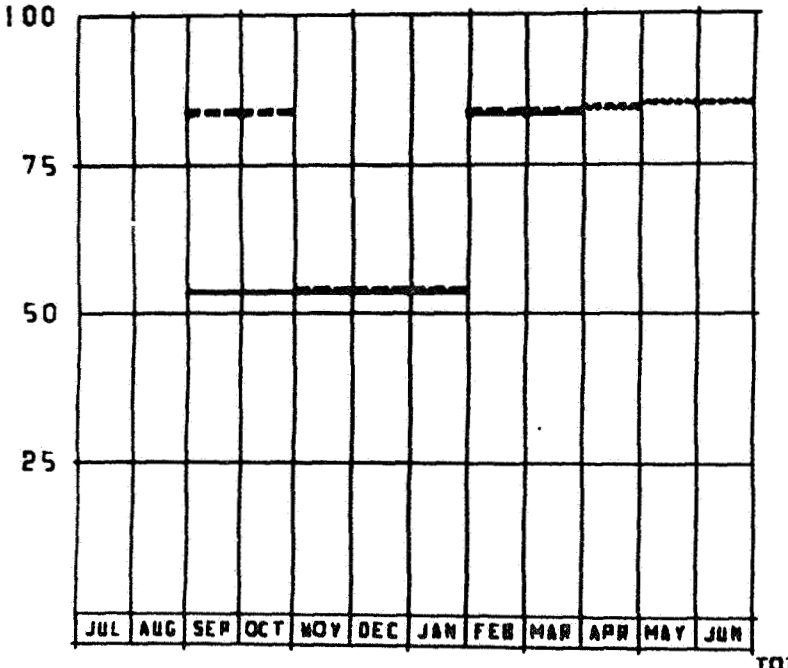
RTOP NO. 909-55-03 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

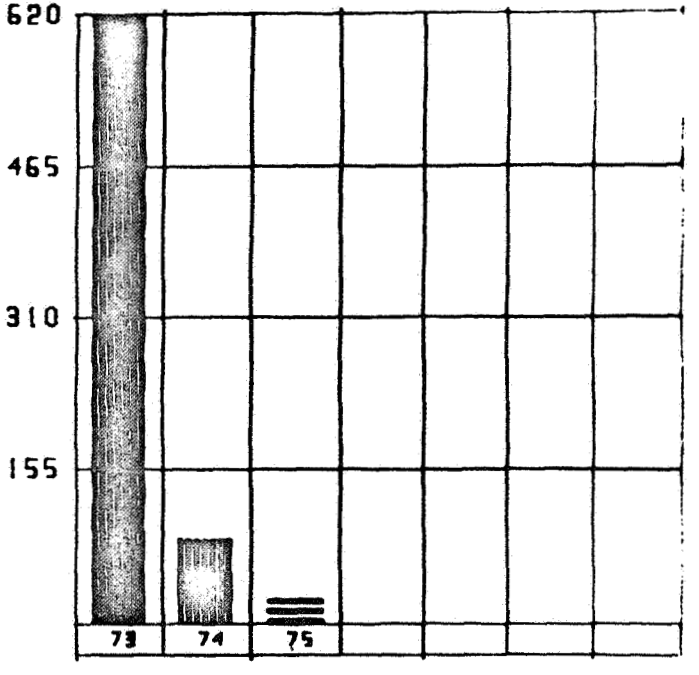
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										1	0	0	1
	ACT.	0	0	84	0	-30	0	0	30	0				84
OBLIG	PLAN.										0	1	0	1
	ACT.	0	0	54	0	0	0	0	30	0				84

	73	74	75
PLAN.	620	85	30
ACT.	620	84	

----- PLANNED COMM.
— — — ACTUAL COMM.
------ PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: ELECTRICAL POWER

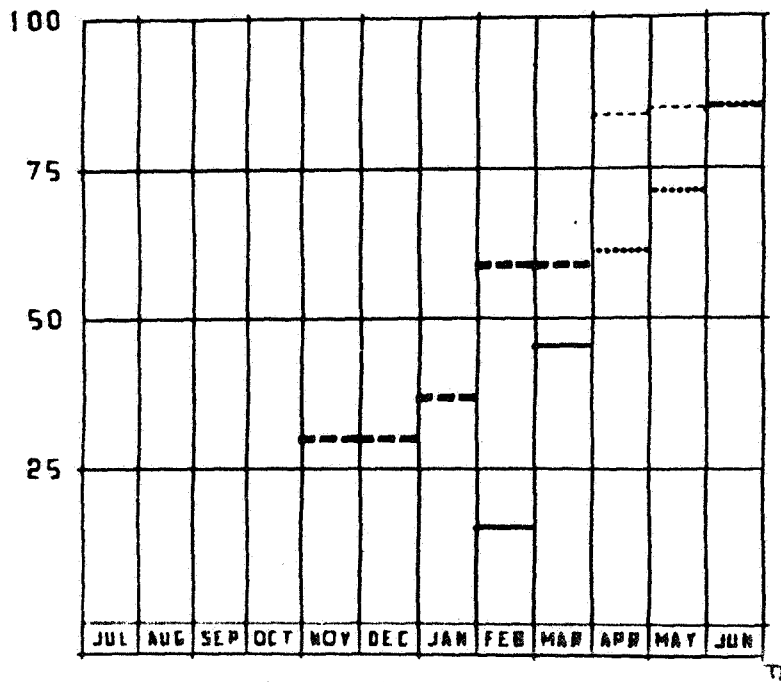
RTOP NO. 909-55-05 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

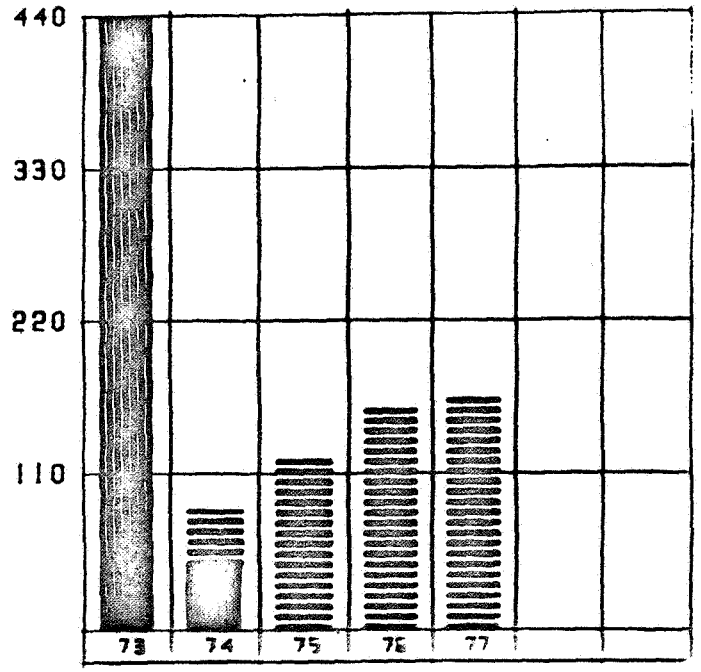
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS — PLANNED / ACTUAL



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN										25	1	0	26
	ACT.	0	0	0	0	30	0	7	22	0				59
OBLIG	PLAN										15	10	14	39
	ACT.	0	0	0	0	0	0	0	16	30				46

	73	74	75	76	77		
PLAN	440	85	125	160	165		
ACT.	440	46					

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: GUIDANCE AND NAVIGATION

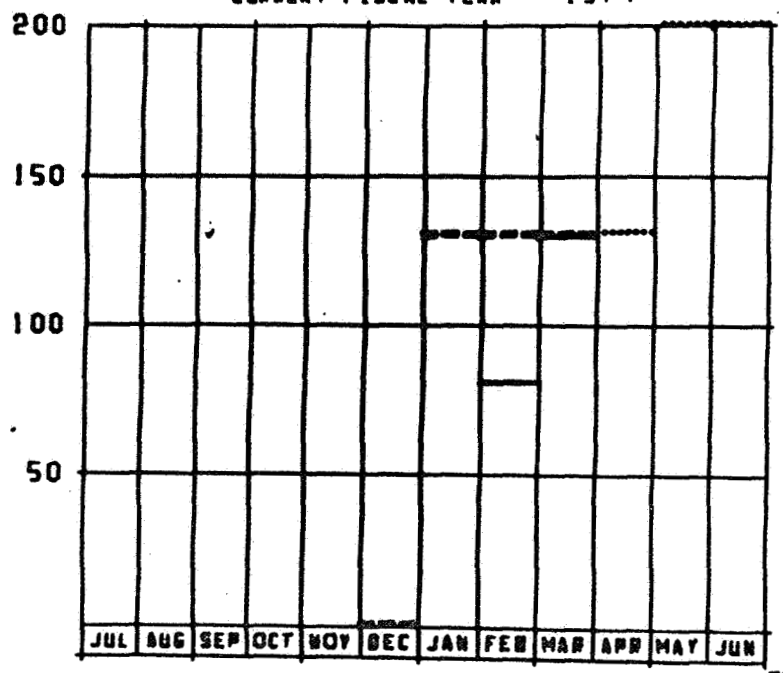
RTOP NO. 909-55-10 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

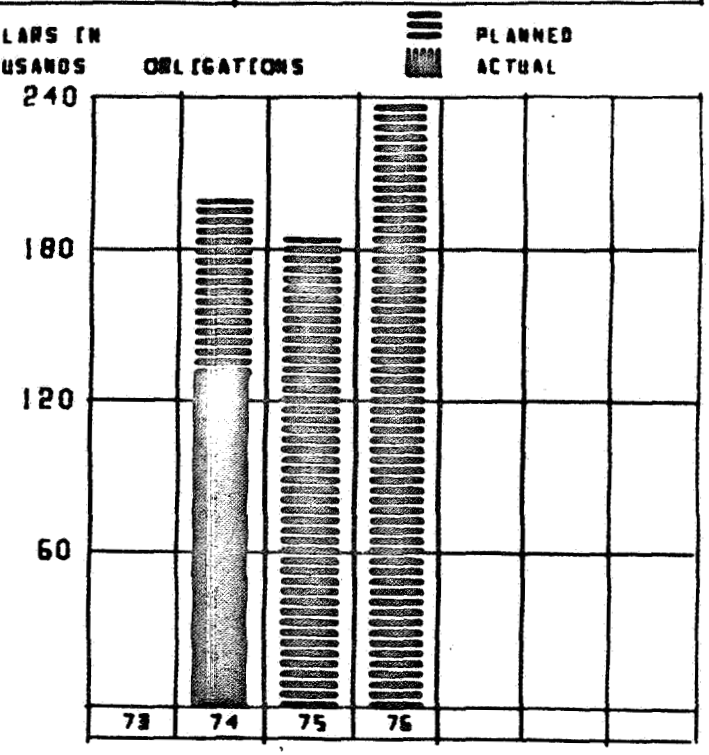
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN										69	0	0	69
	ACT.	0	0	0	0	0	1	130	0	0				131
OBLIG	PLAN										0	69	0	69
	ACT.	0	0	0	0	0	0	0	82	49				131

	73	74	75	76			
PLAN	0	200	185	240			
ACT.	0	131					

----- PLANNED COMM.
— — ACTUAL COMM.
····· PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

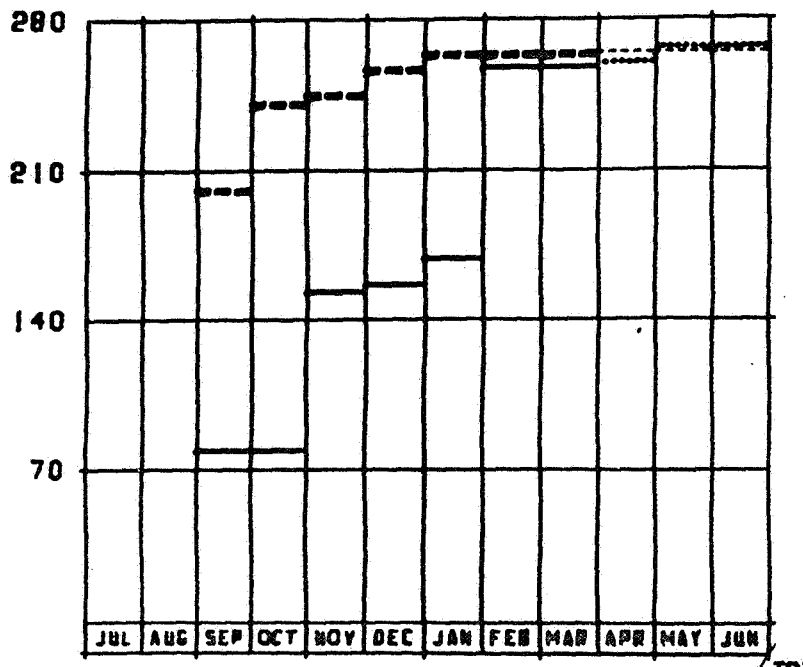
RTOP TITLE: CRYOGENICS

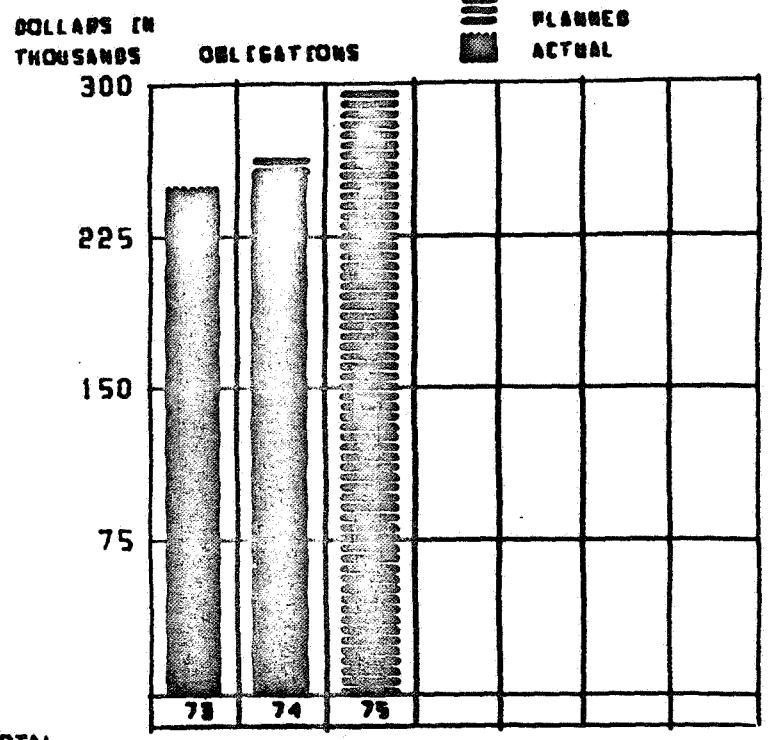
RTOP NO. 909-55-37 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74





														TOTAL
COMM.	PLAN.										1	0	0	1
	ACT.	0	0	201	40	4	12	7	0	0				264
OBLIG	PLAN.										0	7	0	7
	ACT.	0	0	80	0	74	4	12	89	0				259

	73	74	75				
PLAN.	250	265	300				
ACT.	250	258					

----- PLANNED COMM.
— — — ACTUAL COMM.
..... PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ ——— PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: AERODYNAMICS (DYNAMICS)

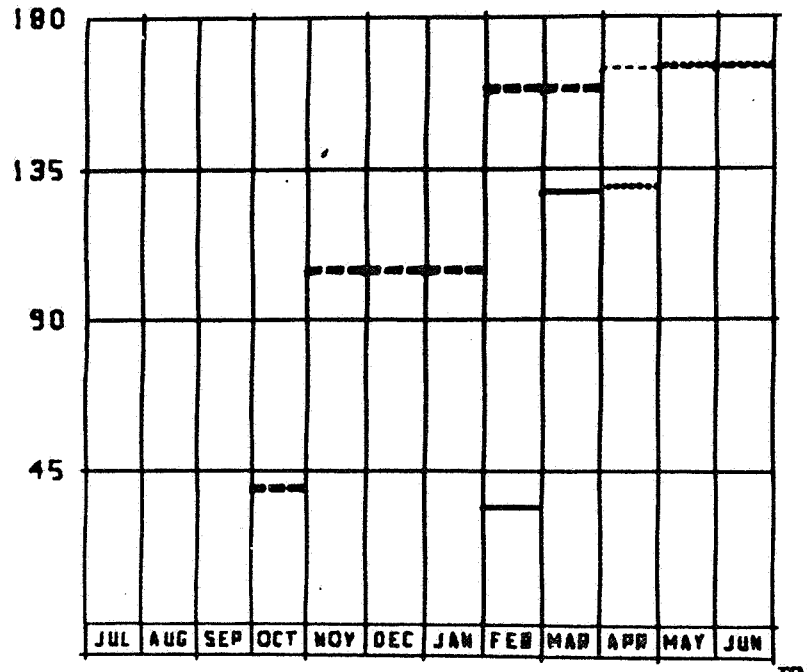
RTOP NO. 909-55-40 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

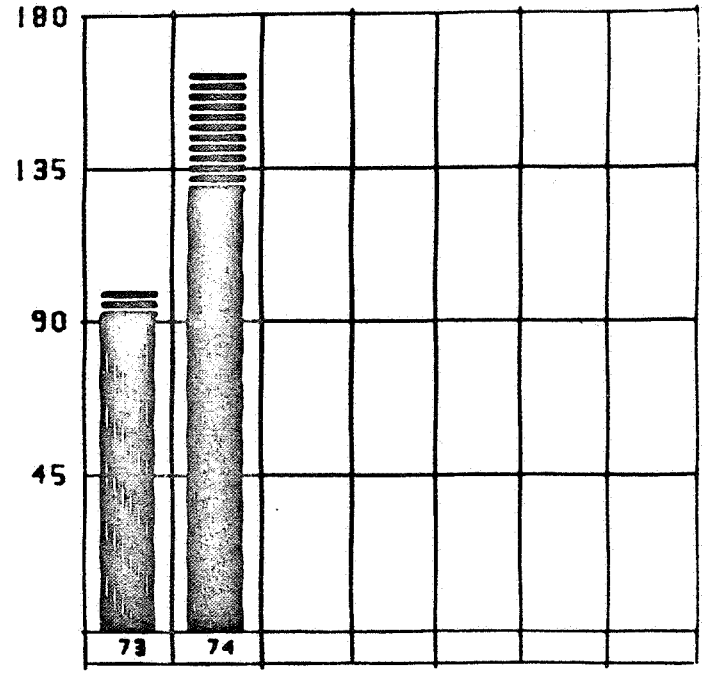
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										6	0	0	6
	ACT.	0	0	0	40	65	0	0	54	0				159
OBLIG	PLAN.										0	36	0	36
	ACT.	0	0	0	0	0	0	0	35	94				129

	73	74
PLAN.	100	165
ACT.	92	129

----- PLANNED COMM.
— — ACTUAL COMM.
..... PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: NATURAL ENVIRONMENT

RTOP NO. 909-55-47 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-74 Funding Planned

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM. PLAN.													
COMM. ACT.													
OBLIG PLAN.													
OBLIG ACT.													

DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL

100
75
50
25

	72	73					
PLAN.	0	99					
ACT.	0	99					

----- PLANNED COMM.
—— ACTUAL COMM.
..... PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: FOOD. ATMOSPHERE. WATER AND WASTE MANAGEMENT

RTOP NO. 970-62-20 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

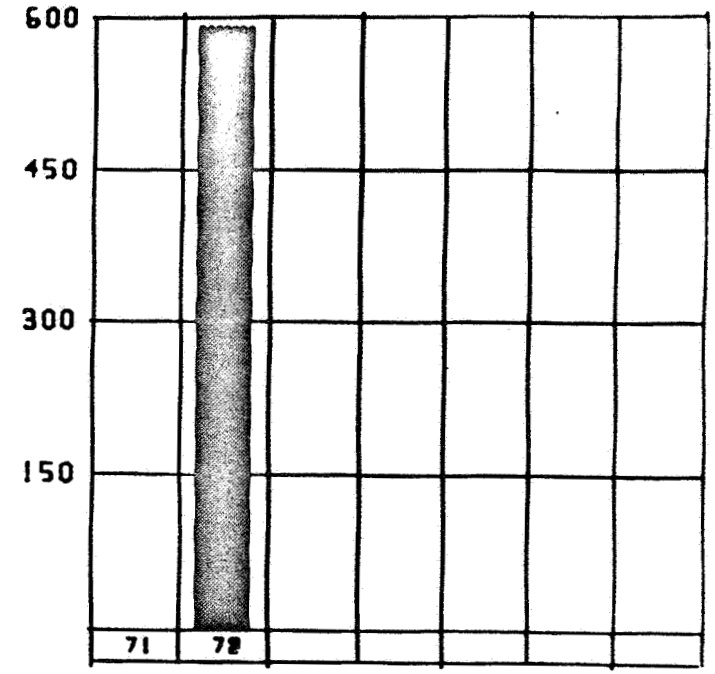
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

No FY-73 or FY-74 Funding Planned

JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN

DOLLARS IN THOUSANDS — OBLIGATIONS — PLANNED / ACTUAL



													TOTAL
COMM.	PLAN.												
	ACT.												
OBLIG	PLAN.												
	ACT.												

	71	72
PLAN.	0	592
ACT.	0	592

----- PLANNED COMM.
—— ACTUAL COMM.
------ PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: WATER AND WASTE MANAGEMENT

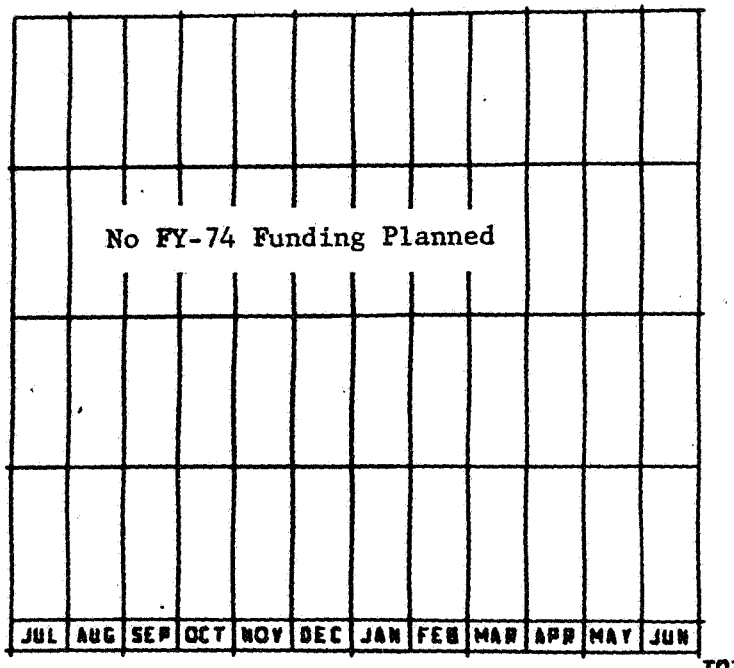
RTOP NO. 970-62-23 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

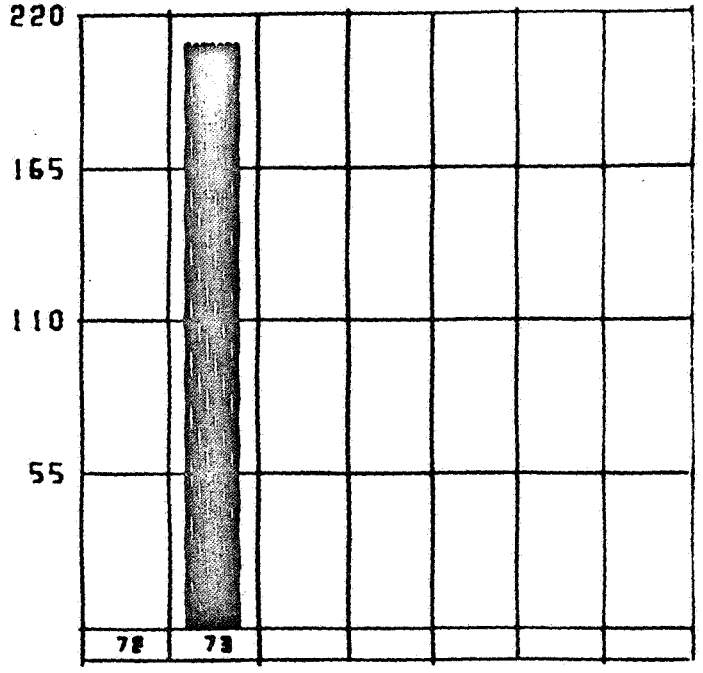
STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS

PLANNED / ACTUAL



													TOTAL
COMM.	PLAN.												
	ACT.												
OBLIG	PLAN.												
	ACT.												

	72	73					
PLAN.	0	210					
ACT.	0	210					

----- PLANNED COMM.
—— ACTUAL COMM.
..... PLANNED OBLIG.
—— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☒ _____ PROJECT
☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER MSFC

RESPONSIBILITY APPROVAL

ACCOMPLISHMENT

RTOP TITLE CVT EC/LSS SUPPORT PROGRAM

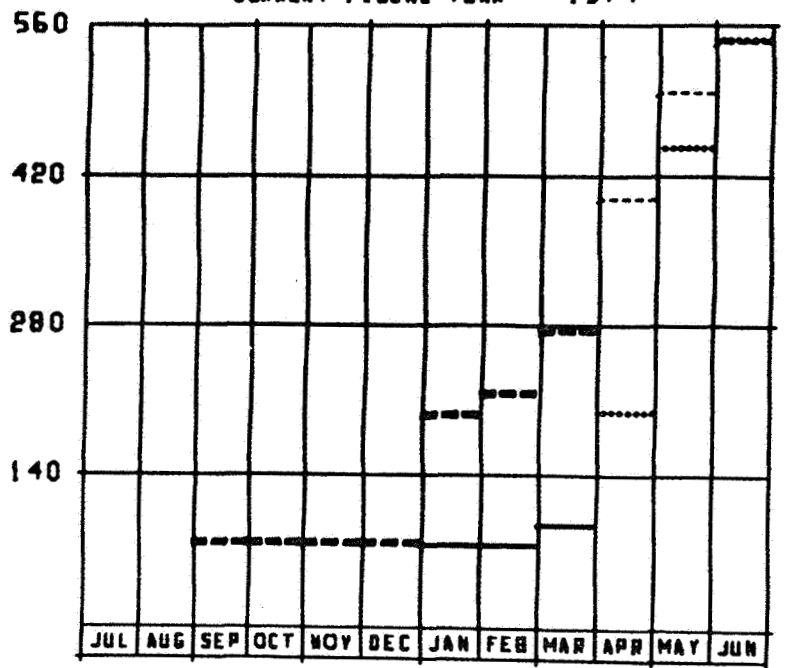
RTOP NO. 970-62-40 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974

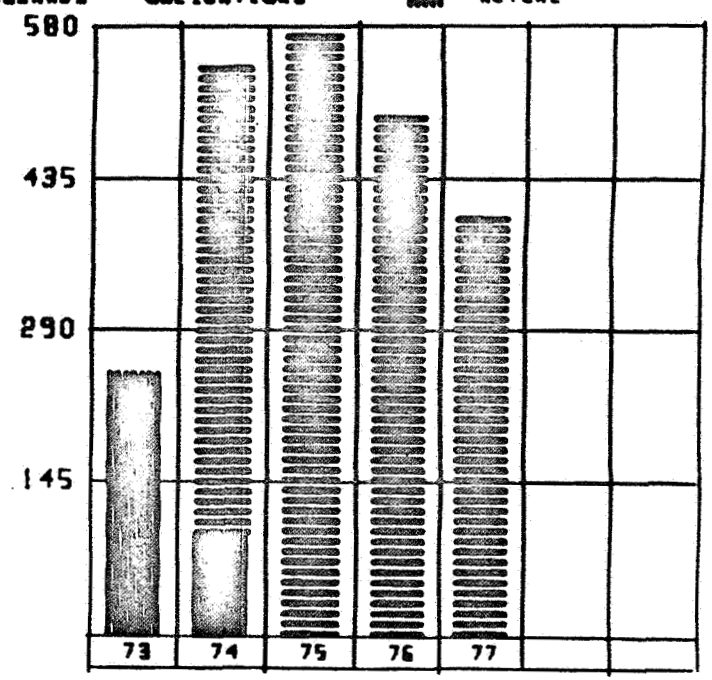


		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										123	100	46	269
	ACT.	0	0	77	0	0	0	120	19	60				276
OBLIG	PLAN.										100	249	100	449
	ACT.	0	0	0	0	0	0	77	0	19				96

----- PLANNED COMM.
— — — ACTUAL COMM.
····· PLANNED OBLIG.
——— ACTUAL OBLIG.

DOLLARS IN THOUSANDS OBLIGATIONS

PLANNED
ACTUAL



	73	74	75	76	77		
PLAN.	250	545	575	500	400		
ACT.	249	96					

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ _____ PROJECT
☒ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: REQUIREMENT FOR PAYLOAD WORKSTATION DESIGN

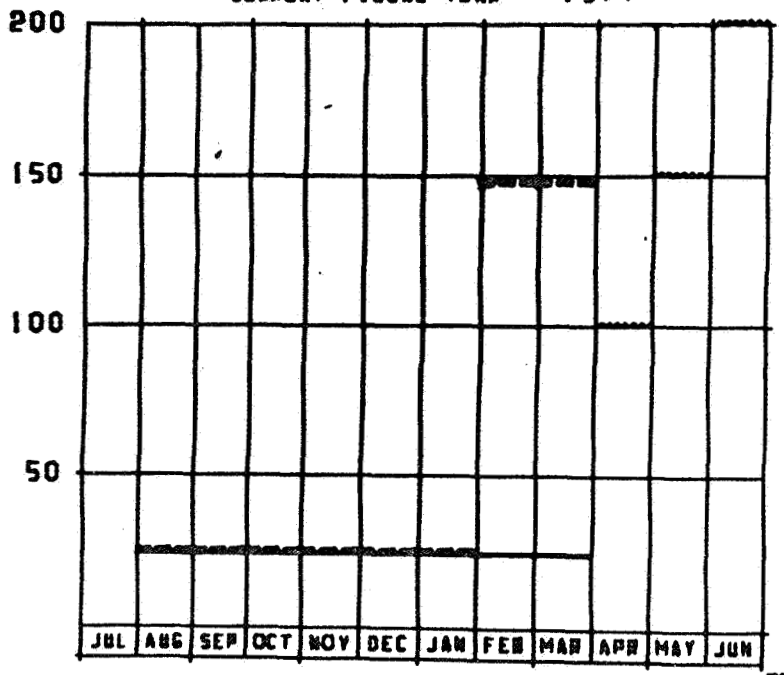
RTOP NO. 970-63-10 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

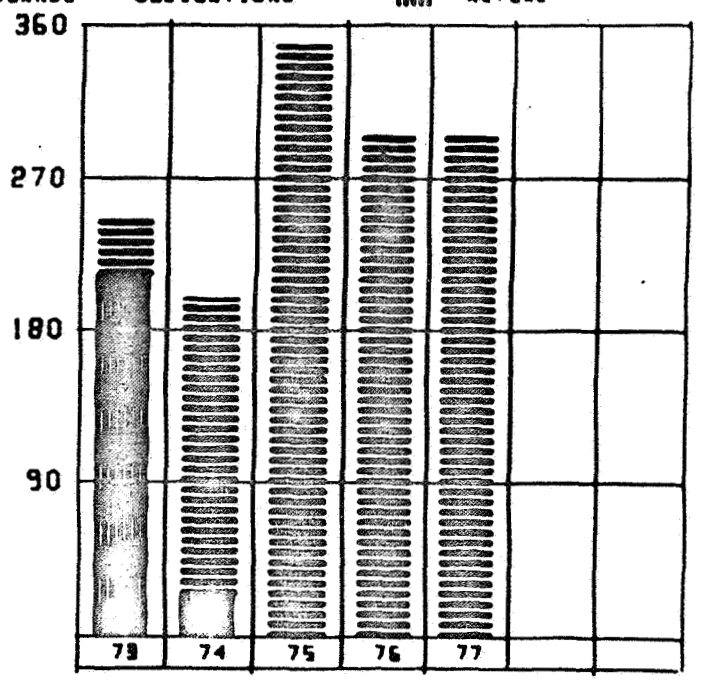
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS — OBLIGATIONS



PLANNED

ACTUAL

		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										52	0	0	52
	ACT.	0	25	0	0	0	0	0	123	0				148
OBLIG	PLAN.										75	50	50	175
	ACT.	0	25	0	0	0	0	0	0	0				25

	73	74	75	76	77		
PLAN.	250	200	350	300	300		
ACT.	214	25					

----- PLANNED COMM.

▬▬ ACTUAL COMM.

------ PLANNED OBLIG.

—— ACTUAL OBLIG.

☐ SPACE SHUTTLE

☐ SPACE STATION/BASE

☒ _____ PROJECT

☐ NON-PROJECT ORIENTED

FINANCIAL STATUS

LEVEL 4

CENTER RESPONSIBILITY APPROVAL: MSFC

ACCOMPLISHMENT

RTOP TITLE: TELEOPERATOR CONTROL AND MANIPULATION

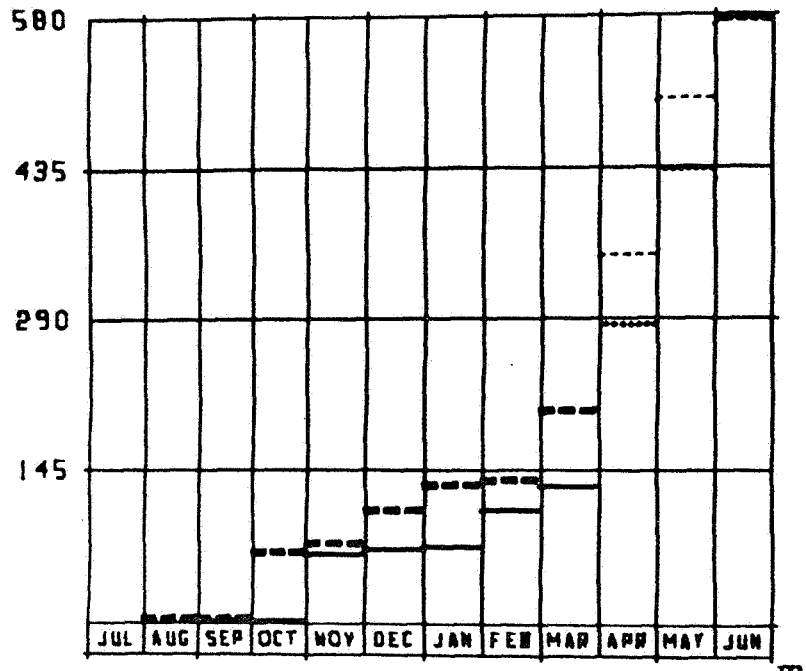
RTOP NO. 970-63-20 ☐ ADV. RES. ☐ TECHNOLOGY

ORIG. SCHED. APPROVAL

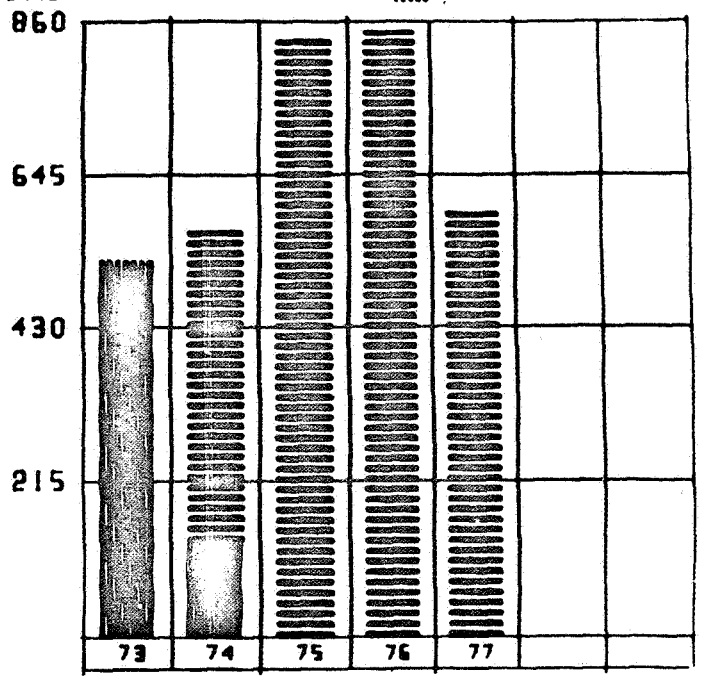
LAST SCHED. CHANGE

STATUS AS OF 31 03 74

CURRENT FISCAL YEAR - 1974



DOLLARS IN THOUSANDS OBLIGATIONS



		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COMM.	PLAN.										150	150	73	373
	ACT.	0	6	0	61	8	32	24	5	66				202
OBLIG	PLAN.										150	150	142	442
	ACT.	0	0	6	0	61	5	2	35	23				133

	73	74	75	76	77		
PLAN.	525	575	845	850	600		
ACT.	525	133					

----- PLANNED COMM.
— — — ACTUAL COMM.
------ PLANNED OBLIG.
——— ACTUAL OBLIG.

☐ SPACE SHUTTLE
☐ SPACE STATION/BASE
☐ PROJECT
☒ NON-PROJECT ORIENTED

DISTRIBUTION

NASA Headquarters
MFC/Mr. William E. Miller, Jr.
MH/Mr. Norman G. Peil
MTG/Mr. Melvyn Savage
MHE/Mr. William A. Summerfelt
MM/Dr. Walton L. Jones (3)
MME/Dr. Stanley Deutsch
MRO/Mr. Albert F. Kershaw
R/Gen. Bruce K. Holloway
RD-T/Mr. Robert E. Smylie
RP/Mr. William H. Woodward
RE/Mr. Peter R. Kurzhals
RMP/Mr. Roy L. Daisey
RF/Mr. R. D. Ginter
RF/Mr. H. Kurt Strass
RW/Mr. George Deutsch
S/Dr. John E. Naugle
SG/Dr. Alois W. Schardt
SG/Mr. Herbert B. Chrisholm
SG/Mr. M. J. Aucremanne
SG/Dr. Erwin R. Schmerling
SG/Mr. Richard E. Halpern
SV/Mr. Joseph E. McGolrick
SV/Mr. Joseph W. Haughey
T/Mr. Gerald M. Truszynski
ERM/Mr. William Spreen (2)
ES/Dr. James H. Bredt
ERR/Dr. Martin W. Molloy
ET/Dr. John S. Patton
RS/Mr. William C. Hayes, Jr.
MMV/Mr. Joseph N. Pecoraro

KSC
DD-SED-4/Mr. A. Carraway
SAB/Mr. R. Cerrato

LaRC
188/Dr. Robert W. Leonard

LeRC
9500/Mr. Howard Douglas/MS 500-25

JSC
AT/Mr. Joseph P. Loftus, Jr.
EC/Mr. J. V. Correale
EE/Mr. R. Sawyer
MA/Mr. M. A. Silveira
EM/Mr. J. Tomberlin
EP/Mr. Joseph Thibodaux, Jr.
EX/Mr. Bruce G. Jackson

MSFC
DEP/Dr. William R. Lucas
AD-S/Dr. Ernst Stuhlinger
A&PS-TU/Mr. James W. Wiggins
A&PS-MS-IL/Miss Lois M. Robertson
PD-PP/Mr. C. Gray
PD-PS-DIR/Mr. J. C. Goodrum
PD-LST/Dr. D. L. Teuber
PD-TUG-E/Mr. E. F. Stluka
S&E-DIR/Mr. Richard G. Smith
S&E-DIR/Dr. Walter Haeussermann
S&E-AERO-DIR/ Dr. Judson A. Lovingood
S&E-AERO-A/Mr. Werner K. Dahm
S&E-AERO-A/Mr. Oscar Holderer
S&E-AERO-D/Mr. John Windham
S&E-AERO-T/Mr. W. D. Murphree
S&E-AERO-G/Mr. James C. Blair
S&E-AERO-G/Mr. Larry Lechner
S&E-AERO-M/Mr. James Lindberg
S&E-AERO-M/Mr. Clarence Fulmer
S&E-AERO-P/Mr. John Sims

MSFC
S&E-AERO-R/Mr. Ralph Butler
S&E-AERO-Y/Mr. William Vaughan (2)
S&E-AERO-Y/Mr. Julian F. Nelson
S&E-AERO-Y/Mr. Robert Turner
S&E-ASTN-DIR/Dr. R. R. Head
S&E-ASTN-AA/Mr. J. H. Furman
S&E-ASTN-MR/Mr. J. W. Welzyn
S&E-ASTN-P/Mr. Charles C. Wood
S&E-ASTN-P/Mr. A. L. Worlund
S&E-ASTN-PL/Mr. J. L. Moses
S&E-ASTN-PP/Mr. R. J. Richmond
S&E-ASTN-R/Mr. L. Smith
S&E-ASTN-PPA/Mr. Lee W. Jones
S&E-ASTR-DIR/Mr. J. T. Powell
S&E-ASTR-A/Dr. S. M. Seltzer
S&E-ASTR-C/Mr. J. H. Lucas
S&E-ASTR-E/Mr. Bob M. Aden
S&E-ASTR-ES/Mr. J. B. Shearer
S&E-ASTR-G/Mr. F. S. Wojtalik
S&E-ASTR-I/Mr. W. O. Frost
S&E-ASTR-ZI/Mr. K. Bennett
S&E-COMP-T/Mr. A. E. Anderson
S&E-ASTN-P/Mr. J. P. McCarty
S&E-PR-DIR/Mr. G. Daniels
S&E-PE-MX/Mr. J. G. Holland (2)
S&E-PE-RC/Mr. W. K. Vardaman
S&E-QUAL-E/Mr. Paul Davis (6)
S&E-R-DIR/Mr. John B. E. Chase
S&E-R-P/Mr. David A. Arnold
S&E-R-DIR/Mr. David H. Hoppers
S&E-R-DIR/Mr. C. Gentry Miles
S&E-R-DIR/Mr. H. E. Attaya, Jr.
S&E-SSL-TR/Mr. Gary Arnett
SP-PC/Mr. T. J. McCullough
S&E-SSL-C/Mr. Billy Bass (2)

☆U.S. GOVERNMENT PRINTING OFFICE: 1974 — 748-297 / 147 REGION NO. 4