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MSCG, 14 May 1965, per document marking; SAMSO ltr dtd 28 Feb 1972

Authorized By: D D 254 MSCG Date 5-14-65

Reclassified By: Richard J. Cook Dept. 1301 Date 1-3-65

ATLAS PLAN VII

(147 650)

(11) AUG 54

(12) 76p.

Classification Changed To:

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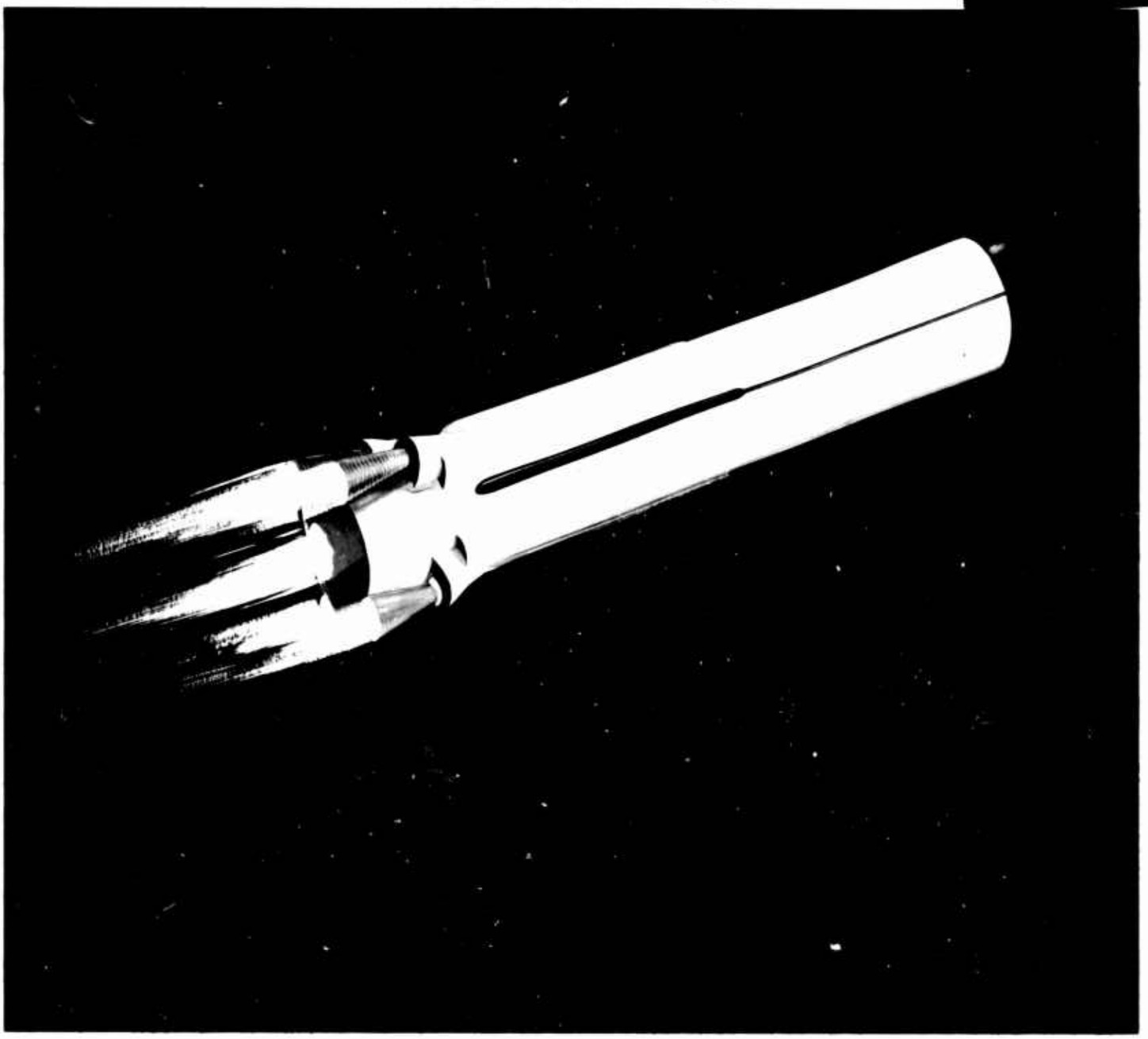
See GD/Convair, San Diego, Calif 147650



[redacted]

THE ATLAS TASK

The series of charts ~~bound here~~ summarizes a detail program plan which has been proposed ~~by Convair~~ for the accelerated Atlas Program.

The technical approaches which are the bases for the program planned, are the outgrowth of a series of conversations between Convair and the technical staff of the USAF Western Development Center, under General Schriever; as well as conversations with WADC, ARDC, AMC and Pentagon officers concerned with the Atlas Program prior to the establishment of the Los Angeles Center.

Included are some background, ~~Convair's~~ recommendations concerning management of the program, a description of the missile configuration which is the basis of this plan, schedules, facility requirements, and cost estimates. Finally, estimated decision dates and required contract changes and amendments are shown.

THE FOLLOWING PROGRAM DOES NOT INCLUDE COST ESTIMATES FOR ENGINE FACILITIES OR OTHER SUBSYSTEM FACILITIES; FOR FUELS; NOR FOR AIR FORCE ADMINISTRATIVE OPERATIONS SUCH AS THE WESTERN DEVELOPMENT CENTER.

As a consequence of the presentation of the program plan to General Schriever and his staff on August 10, certain revised estimates and different budgetary approaches, are in work.

THE COSTS AND SCHEDULES HEREIN CONTAINED ARE THEREFORE NOT THOSE TO BE CARRIED THROUGH THE SYSTEM BY GENERAL SCHRIEVER IN HIS PRESENTATIONS TO DAYTON AND THE PENTAGON LATER THIS MONTH.

[redacted]

[redacted]

THE ATLAS TASK

TO DESIGN AND DEVELOP A STRATEGIC WEAPON SYSTEM CONSISTING OF.....

1. AN INTERCONTINENTAL BALLISTIC MISSILE HAVING:
   - RANGE.....5500 NAUTICAL MILES
   - ACCURACY.....2-3 MILE CEP
   - WARHEAD.....1500-3000 #

2. THE GROUND SUPPORT SYSTEM NECESSARY FOR ITS OPERATIONAL USE.

[redacted]

JULY 1954

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THE TIMING

The chart opposite indicates the magnitude of the acceleration which has been proposed for the Atlas Weapon System. The time span proposed for the development of this missile is considerably less than has been required for the development of weapons systems of less complexity or for conventional airplane strategic bombing systems.

Extraordinary measures must and are therefore being taken as to management (both in Air Force and industry), as to funding, and as to design approaches in order to accomplish this schedule.

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THE TIMING

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April 1958

XB-65 FIRST FLIGHT

February 1957

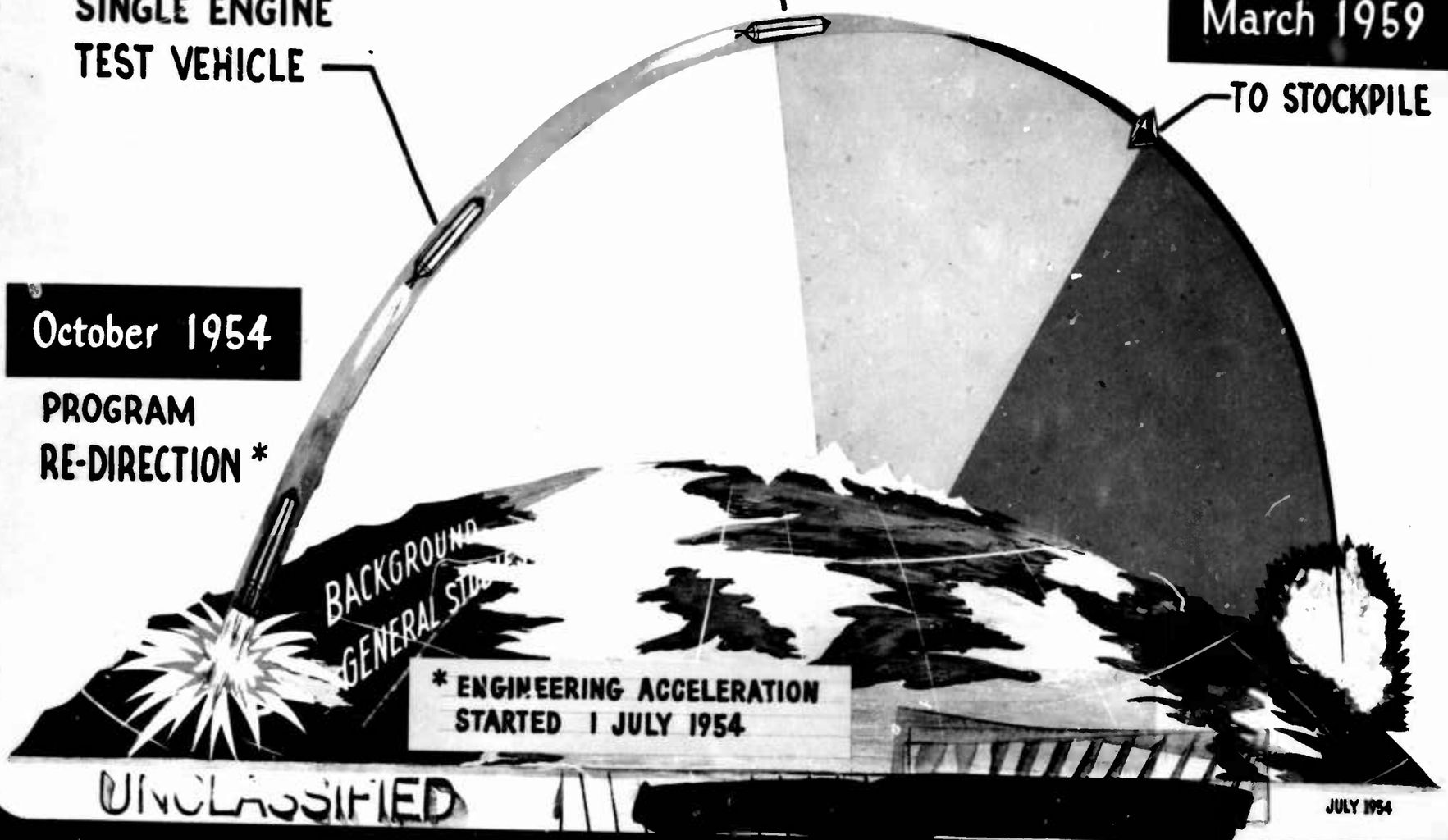
SINGLE ENGINE TEST VEHICLE

March 1959

TO STOCKPILE

October 1954

PROGRAM RE-DIRECTION *



* ENGINEERING ACCELERATION STARTED 1 JULY 1954

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JULY 1954

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[redacted]

ATLAS REQUIREMENTS

During the summer of 1953 a review of the intercontinental missile programs of the United States Air Force was begun. A committee of scientists was appointed by the Air Force to study and recommend possible changes in these programs.

The requirements which had been stated until this time and which were the basis of the contract under which Convair is developing the Atlas missile is shown on the left opposite.

As a result of the increased effectiveness of the warheads and the growing belief that an early intercontinental ballistic missile capability was necessary in the national interest, revisions to these requirements were discussed at considerable length. Such discussions are still continuing, but it appears that requirements essentially like those on the right opposite will be the basis for development of the accelerated Atlas Weapon System.

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ATLAS REQUIREMENTS

[redacted]

PRESENT CONTRACT		ACCELERATED PROGRAM	
RANGE	5500 N.MI.	RANGE	5500 N.MI.
CEP	1500 FT.	CEP	2-3 N.MI. *5 N.MI. ACCEPTABLE FOR EARLY CAPABILITY*
M_I	6.0	M_I	NEAR SONIC
PAYLOAD	3000 LBS.	PAYLOAD	1500-3000 LBS.
YIELD	.5 MT.	YIELD	1.0+ MT.

[redacted]

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JULY 1954

DESIGN PHILOSOPHY

While economy is listed last in order under the new design philosophy, it is understood by all concerned that economy, even under a crash program, must be a watchword. As a matter of fact, Items 1, 2 and 3, the contractor believes may well lend themselves to optimum economy--if appropriately prosecuted.

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DESIGN PHILOSOPHY

PRESENT CONTRACT

1. ECONOMY
2. RELIABILITY *(SIMPLICITY)*
3. LOGISTICS
4. EARLIEST AVAILABILITY *(MINIMUM DEVELOPMENT TIME)*
5. INVULNERABILITY

ACCELERATED PROGRAM

1. EARLIEST AVAILABILITY *(MINIMUM DEVELOPMENT TIME)*
2. RELIABILITY *(SIMPLICITY)*
3. INVULNERABILITY *(MOBILITY)*
4. LOGISTICS
5. ECONOMY

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JULY 1954

[redacted]

GROUND RULES

In a discussion with General Schriever and his technical staff on July 2, 1954, ground rules for the development of a detail program plan were agreed on and are shown opposite.

The basis of this program is one of immediate acceleration of those elements of the Atlas Weapon System which all parties agree are essential to the final program.

Emphasis is placed on acceleration of large rocket development; the design and fabrication of a test vehicle to fly this rocket; and nose cone and guidance research and development.

For the purpose of this plan Convair assumed that the management approach would be one of a Weapon System Contractor.

[redacted]

GROUND RULES

RANGE: 5,500 N. MI. PAYLOAD: 1,500-3,000 LBS	FIVE MAIN ENGINES TWO VERNIER ENGINES 1 ½ - STAGE CONFIGURATION PARALLEL STAGE POWERED NOSE CONE
CEP: 5 N. MI. INITIALLY 2-3 N MI. OBJECTIVE	ALL-INERTIAL GUIDANCE RADIO-INERTIAL GUIDANCE SHORT BASE LINE TRACKER LONG BASE LINE TRACKER
IMPACT MACH NO: NEAR SONIC	FOUR ALTERNATE NOSE CONES (DEVELOP FOR TESTING AND SELECTION OF OPTIMUM)
RELIABILITY	TEST PROGRAM, TEST EQUIPMENT & FACILITIES
DUAL SOURCES	PRIMARY & VERNIER ROCKET ENGINES INERTIAL ELEMENTS OF RADIO-INERTIAL GUIDANCE SYSTEMS
MANAGEMENT	WEAPON SYSTEM CONTRACTOR
SCHEDULE	EARLY AVAILABILITY. FIRST FLIGHT {TEST VEHICLE - FEB. '57 XB-65 - APR. '58

JULY 1954

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UNITED STATES GOVERNMENT ELEMENTS CONCERNED WITH ATLAS

As a background for discussion of Convair's recommendation for the method of management of the program, our understanding of the organization within the Government which has been established for this purpose is shown opposite.

Hereinafter, where the Western Development Center is shown at the top of a chart, it is assumed as the focal point--for industry--for ARDC, AMC, and all other higher echelons of Air Force and Science concerned with the Atlas acceleration.

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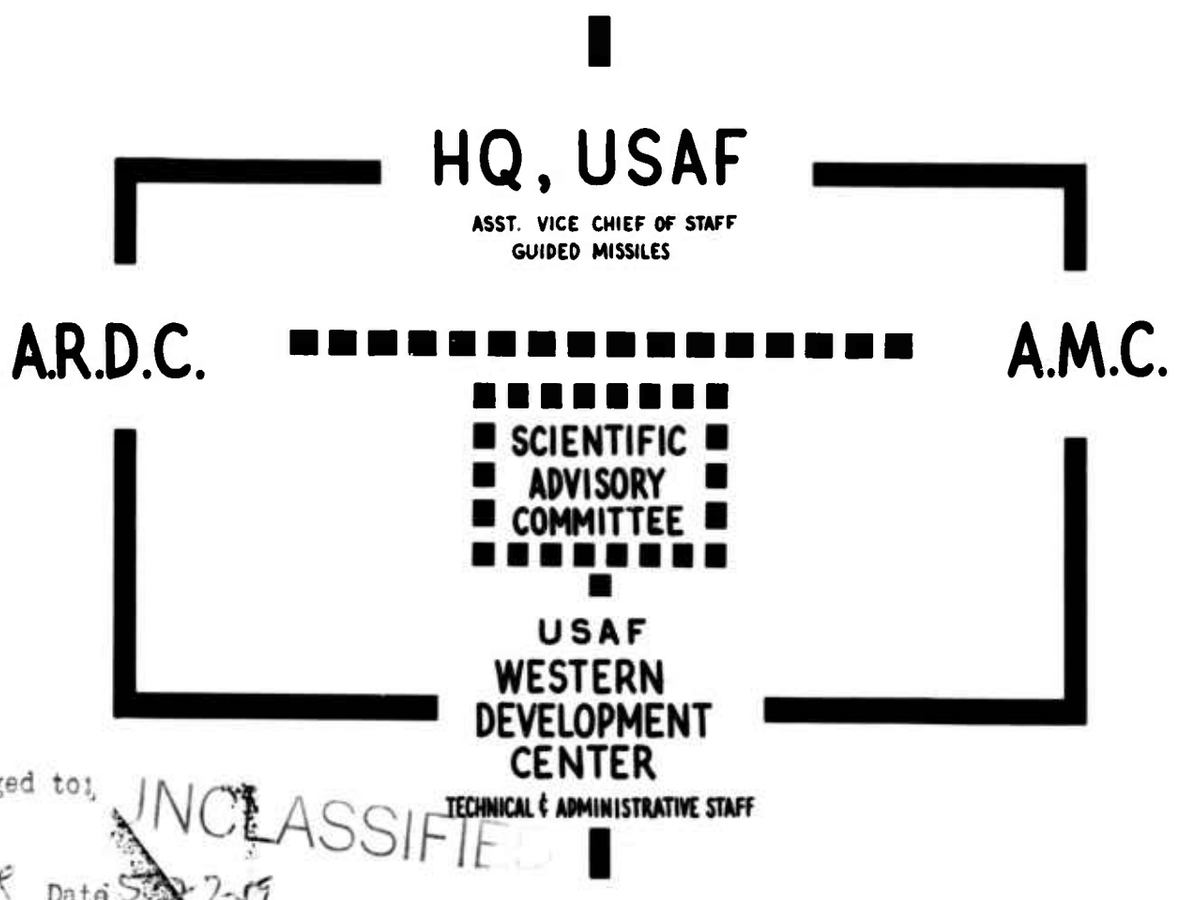
U.S. GOVT. ELEMENTS CONCERNED WITH ATLAS



SEQUENCE OF WEAPON SYSTEM DEVELOPMENT

This chart shows the sequence of events which take place during the course of a Weapon System development.

Each of these steps take time to varying degrees, and require administrative organizational treatment, in many instances, of a highly detailed degree.

A fundamental problem involved in the management of a Weapon System development is the administration of engineering changes which normally occur in all sub-systems and the adjustment which must then be made to other sub-systems because of their close inter-relationships. Because of its magnitude this area of management must receive close attention in comparing different management approaches.

SEQUENCE OF WEAPON SYSTEM DEVELOPMENT

- AIR FORCE REQUIREMENT
  - State of the art
  - Existing developments
  - Weapon concept
- FUNCTIONAL DESIGN
- DETAILED PROGRAM ESTIMATE
- CONTRACTOR EVALUATION
- CONTRACTOR SELECTION
- PROCUREMENT SPECS
- ADMINISTRATION OF SUBSYSTEMS AS TO
  - Schedule
  - Design
  - Operational Utility
- INTEGRATION OF SUBSYSTEMS INTO WEAPON SYSTEM
  - Performance testing
  - Environment testing
  - Flight testing
- PRODUCTION
- OPERATIONAL ARTICLE

ADMINISTRATION OF ENGINEERING CHANGES (arrow spanning Contractor Selection through Production)

TOP SECRET SECRET

ATLAS DEVELOPMENT USING ASSOCIATE CONTRACTORS

Classification Changed to:

Authorized by: AFRC Date 5-22-54

Reclassified by: W.E. Brown Dept 130 Date 6-18-54

There are two basic management approaches which can be taken within the present Air Force organizational structure. The first of these is one using associate contractors for the several sub-systems of the Weapon System which has been the traditional approach in aircraft development.

The chart here shows how the functions listed on the preceding page would be divided between the Air Force, several sub-system contractors and one contractor, presumably the airframe contractor, who would be responsible for assembling the several sub-systems and the complete missile.

Characteristic of this approach is the requirement that the Air Force provide the large and well organized technical groups which are capable of the detailed engineering change administration and correlation between the several sub-systems. This in addition to the Air Force's major function of policy direction and decisions concerning the overall program—these directions and decisions being the major time savers (or time losers if they are delayed) in a program such as this.

The Atlas acceleration program under consideration proposes the development to operational readiness of an extraordinarily complex weapon system IN SOME FIVE TO SIX YEARS. A comparison of the actual schedules of development to operational readiness of such weapons systems as the B-47 and the B-52 through the associate contractor approach would seem to argue strongly in favor of an unusual organization of the industry by the Air Force if the Atlas is to be in operation in the record time considered.

The Air Force has taken an initial step in the organization of its Western Development Center. It is Convair's belief that the Air Force has the best chance of making the extraordinary schedule considered for the Atlas by similarly organizing the industry under a System Contractor responsible to that Center for the development and production of the Atlas system.

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Classification Changed to: UNCLASSIFIED

Authorized by: AFIR Date 5-27-59

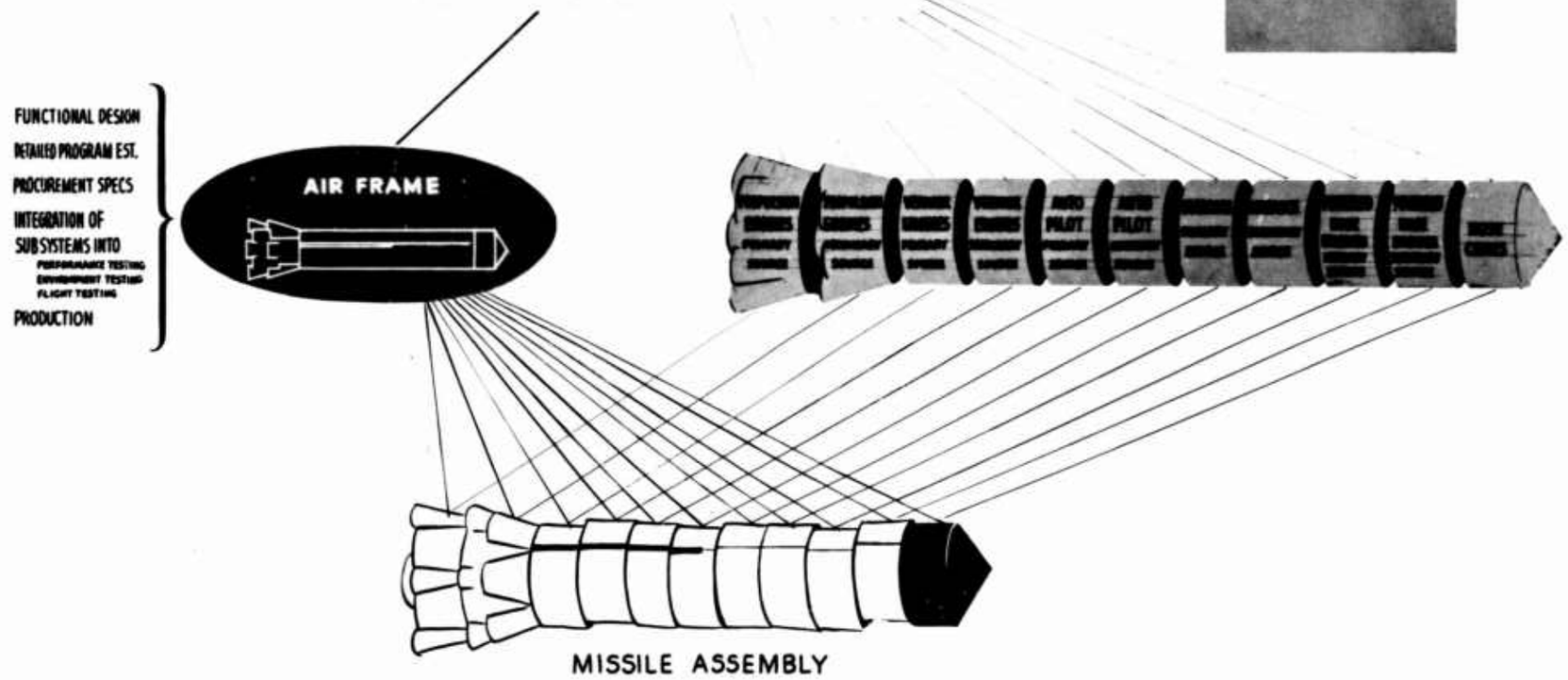
Reclassified by: W.E. Bowman Dept. 73 Date 6-18-59

ATLAS DEVELOPMENT USING ASSOCIATE CONTRACTORS

USAF WESTERN DEVELOPMENT CENTER

- FUNCTIONAL DESIGN
- DETAILED PROGRAM ESTIMATE
- CONTRACTOR EVALUATION
- CONTRACTOR SELECTION
- PROCUREMENT SPECS
- ADMINISTRATION OF SUB SYSTEMS
  - *SCHEDULE . . . DESIGN & OPERATING UNITY
- DEVELOPMENT SURVEILLANCE

- FUNCTIONAL DESIGN
- PROCUREMENT SPECS
- DETAILED PROGRAM ESTIMATE
- PRODUCTION



DEVELOPMENT START — OPERATIONAL MISSILE

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An alternative approach is one in which a prime contractor is selected who assumes for the Air Force the detail administration of engineering changes between sub-systems. Under this system the prime contractor performs a considerable amount of leg work involved in assembling information necessary for making decisions and provides this to the Air Force with recommendations as a basis for the decisions which must be made within the Air Force.

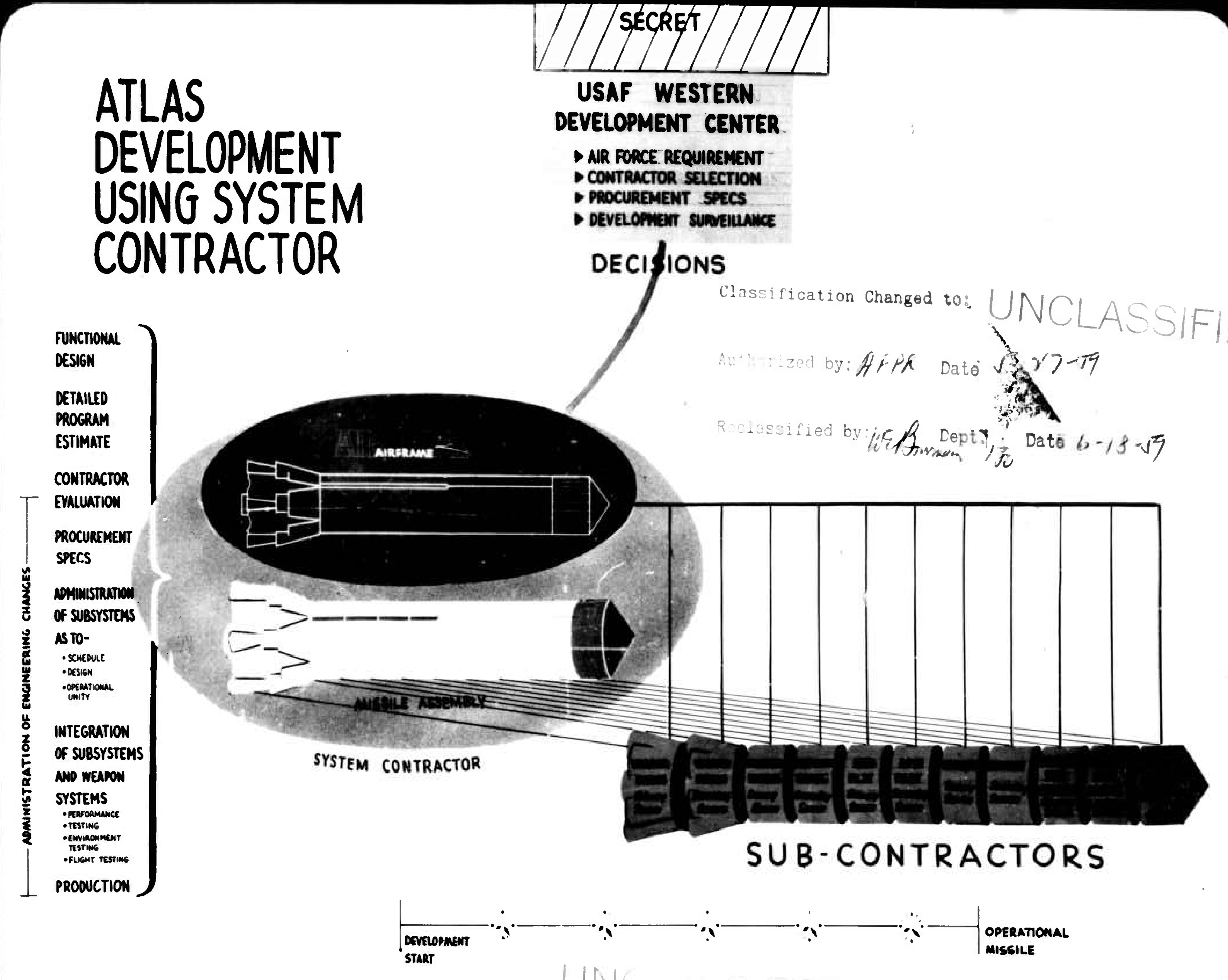
It is Convair's belief that either management approach will succeed in developing a successful Atlas weapon.

However, where time is of primary importance, Convair strongly believes that the system contractor approach will provide a usable Weapon System in the shortest possible time.

This because (a) the system contractor already has a considerable organization base from which to expand the engineering, the contracting and the administration of the many industrial elements of Atlas development to the great degree and yet in the short time period required by the acceleration program; (b) by integrating the engineering development of all sub-systems from start of development to production, the system contractor affords a guard against duplication of effort, weight growth, unnecessary retrofit and the numerous other time-consuming matters which the Air Force would, in the associate contractor approach, have to build an administrative and technical staff to control; (c) leaves the Air Force free to monitor, to inspect and review, and to make decisions.

Convair believes its more than two years' experience as a Systems Contractor on the B-58 Weapon System has definite application to the Atlas program.

While the B-58 System is considerably different from a technical standpoint than the Atlas, and while the industrial management responsibility may also be different (particularly in light of the establishment of the Western Development Center), nevertheless Convair believes that both the mistakes and accomplishments it has engendered in the administration of the B-58 Weapon System to date has given Convair valuable experience for the systems administration of the Atlas Program.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ATLAS DEVELOPMENT USING SYSTEM CONTRACTOR
USAF WESTERN DEVELOPMENT CENTER
▶ AIR FORCE REQUIREMENT
▶ CONTRACTOR SELECTION
▶ PROCUREMENT SPECS
▶ DEVELOPMENT SURVEILLANCE
DECISIONS
FUNCTIONAL DESIGN
DETAILED PROGRAM ESTIMATE
CONTRACTOR EVALUATION
PROCUREMENT SPECS
ADMINISTRATION OF SUBSYSTEMS AS TO-
• SCHEDULE
• DESIGN
• OPERATIONAL UNITY
INTEGRATION OF SUBSYSTEMS AND WEAPON SYSTEMS
• PERFORMANCE
• TESTING
• ENVIRONMENT TESTING
• FLIGHT TESTING
PRODUCTION
ADMINISTRATION OF ENGINEERING CHANGES
AIRFRAME
MISSILE ASSEMBLY
SYSTEM CONTRACTOR
SUB-CONTRACTORS
DEVELOPMENT START
OPERATIONAL MISSILE

Classification Changed to: UNCLASSIFIED
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Reclassified by: W.E. Brennan Dept. 170 Date 6-13-59

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PROCEDURE FOR SELECTION OF SUB-SYSTEM SUB-CONTRACTORS

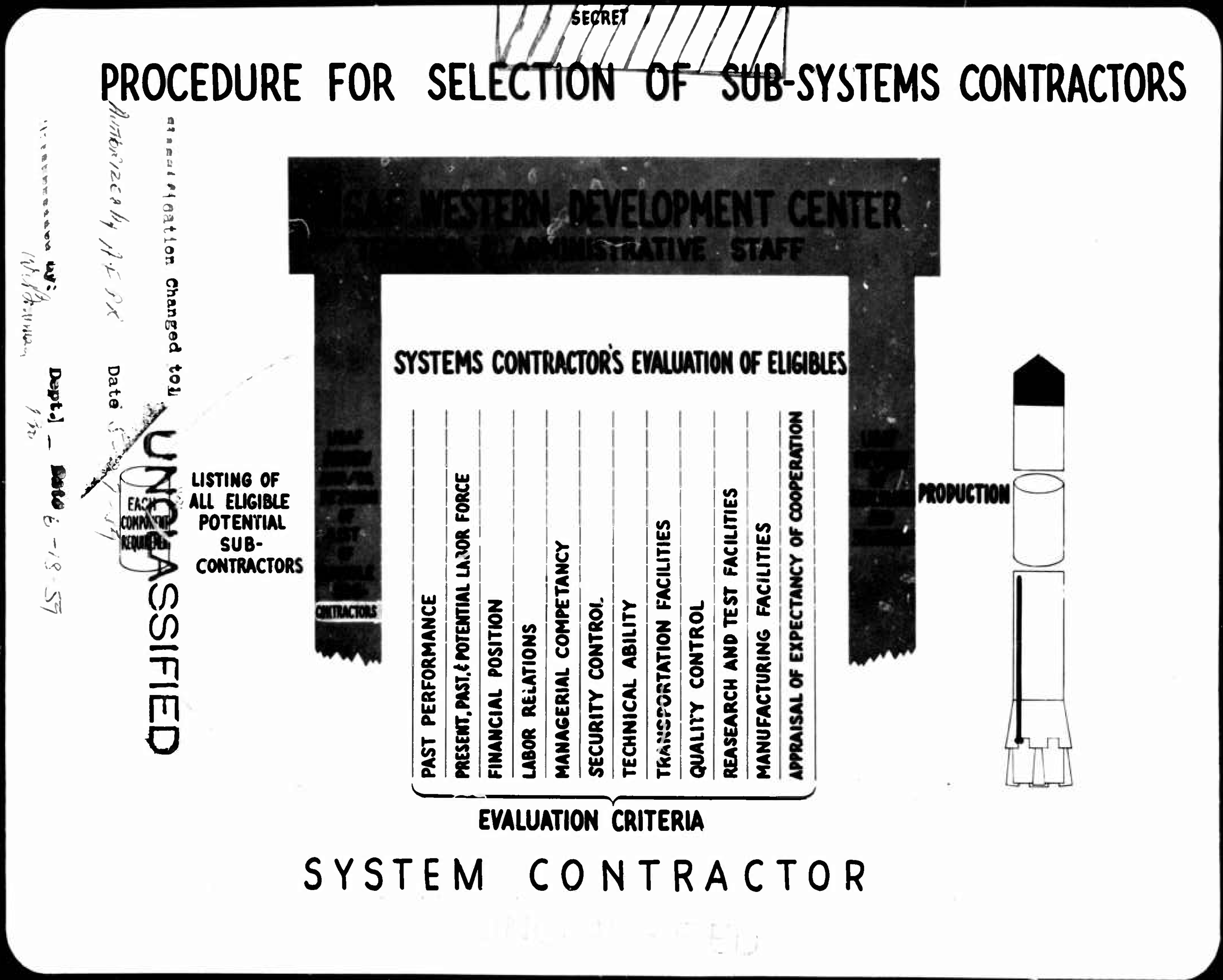
This chart shows the procedure by which the Air Force would assure itself that the maximum, most effective industrial participation is brought to bear in the Weapon System development.

The contractor proposes to the Air Force a listing of all eligible potential sub-contractors for a certain component. The Air Force reviews, and adds or subtracts from the list, and returns it to the System Contractor. The System Contractor then offers invitations to bid to the approved list.

Concurrently a System Contractor team surveys all sub-contractors listed on the basis of the evaluation criteria cited on the chart. The same team evaluates all prospective sub-contractors concerned with the particular component. Upon completion of the evaluation process, the System Contractor affords the Air Force its listing and evaluations of the prospective sub-contractors.

The Air Force reviews the listing and makes the selection.

The System Contractor then proceeds to contract for the development and production of the component.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PROCEDURE FOR SELECTION OF SUB-SYSTEMS CONTRACTORS
WESTERN DEVELOPMENT CENTER
ADMINISTRATIVE STAFF
SYSTEMS CONTRACTOR'S EVALUATION OF ELIGIBLES
PAST PERFORMANCE
PRESENT, PAST, & POTENTIAL LABOR FORCE
FINANCIAL POSITION
LABOR RELATIONS
MANAGERIAL COMPETANCY
SECURITY CONTROL
TECHNICAL ABILITY
TRANSPORTATION FACILITIES
QUALITY CONTROL
REASEARCH AND TEST FACILITIES
MANUFACTURING FACILITIES
APPRAISAL OF EXPECTANCY OF COOPERATION
EVALUATION CRITERIA
LISTING OF ALL ELIGIBLE POTENTIAL SUB-CONTRACTORS
CONTRACTORS
PRODUCTION
SYSTEM CONTRACTOR

HOW USAF MONITORS PROJECT FOR COMPLIANCE WITH REQUIREMENTS

Throughout the life of the project the Air Force would monitor the operations of the system contractor and the sub-contractors with appropriate information being provided by the industrial elements so that the Air Force can make decisions as required by the over-all program schedule.

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HOW USAF MONITORS PROJECT for COMPLIANCE WITH REQUIREMENTS

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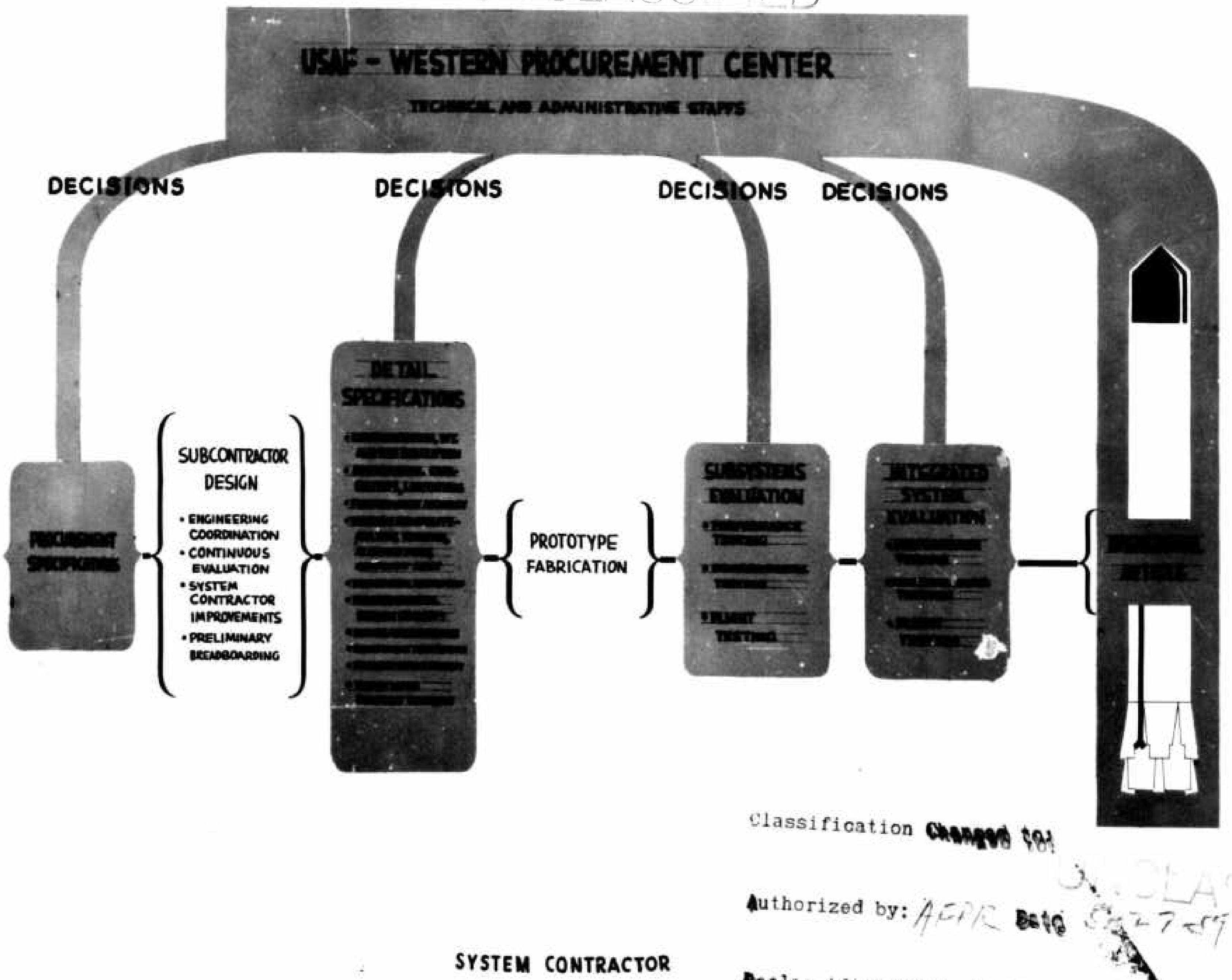

Classification Changed to: UNCLASSIFIED

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Declassified by: H.E. Bowman Dept. 132 Date 6-15-59

CURRENT AND PAST SUB-CONTRACTORS

The present Atlas contract held by Convair has been proceeding at a low level, but a considerable amount of sub-contracting has been done.

This list of current and past sub-contractors indicates the considerable amount of experience which Convair has already accumulated on this contract in providing for participation of sub-contractors in the over-all sub-systems development.

This and the subsequent chart listing suppliers also gives an indication of the industrial complex already established in the Atlas area of effort, affording the Air Force a ready-made and time-saving base for contract expansion and engineering integration in the accelerated program.

CURRENT & PAST SUBCONTRACTORS

SUBCONTRACTOR	TASK
1. INTERNATIONAL BUSINESS MACHINES	MACHINE COMPUTATIONS
2. NAVAL ORDNANCE TEST STATION	AERODYNAMIC HEATING RESEARCH
3. AERO-JET GENERAL CORP.	H_2O_2 WIND TUNNEL
4. MASSACHUSETTS INSTITUTE OF TECHNOLOGY	ALL-INERTIAL GUIDANCE SYSTEM
5. MAGNAVOX CO.	SPECIAL PURPOSE COMPUTOR
6. BENDIX-PACIFIC DIVISION	TELEMETERING
7. SPERRY-GYROSCOPE CO.	GUIDANCE STATION TEST EQUIPMENT
8. ROHR AIRCRAFT CORP.	TANK ASSEMBLIES
9. SOLAR AIRCRAFT CORP.	TANK & BODY ASSEMBLY
10. M.H. GOLDEN CO.	POINT LOMA TEST FACILITY
11. THE NOBLE CO.	UPPER PORTION OF LAUNCHING TOWER
12. UNION STEEL CO.	PRESSURIZATION TRAILER
13. THE NOBLE CO.	HANDLING TRAILER
14. NORTH AMERICAN AVIATION	ROCKET ENGINE DEVELOPMENT

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LIST OF SUPPLIERS

As a further indication of the amount of industrial participation in the current project, this list of suppliers are those already involved in the Atlas Project.

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LIST OF SUPPLIERS

NAME	TYPE OF ITEM
GOODYEAR AIRCRAFT CORP.	*COMMUTATOR ASSEMBLY.*
BENDIX WEST COAST BENDIX AVIATION CORP.	*INVERTER.*
BROWN INSTRUMENT- *DIVISION MINNEAPOLIS-HONEYWELL REG. CO.*	*ELECTRICAL CONTROLS & EQUIPMENT.*
LINDE AIR PRODUCTS.	*OXYGEN TUBES & RACK.*
HEWLETT PACKARD CO.	*ELECTRICAL INSTRU.*
SANBORN CO.	*RECORDING & SOUND EQUIP.*
LEEDS & NORTHRUP CO.	*ELECTRICAL INSTRUMENTS. & EQUIPMENT.*
GENERAL RADIO CORP.	*ELECTRONIC TEST EQUIP.*
C.E.C. INSTRUMENTS *DIVISION OF CONS. ENGINEERING.*	*PRESSURE PICK-UPS.*
JACK & HEINTZ CO.	*INVERTER.*
KOLLSMAN INSTRUMENT CORP.	*PERMANENT MAGNET GENERATORS.*
M-B MANUFACTURING CO.	*VIBRATION EXCITERS POWER SUPPLIES & CONTROL PANELS.*
RUCKER CO.	*HYDRAULIC PUMP*
STATHAM LABORATORIES.	*PRESSURE PICK-UP WITH TEMPERATURE COMPENSATION & PRESSURE PROTECTION.*

NAME	TYPE OF ITEM
ALLEN BRADLEY CO.	*RESISTORS, CAPACITORS, ELECTRONIC PARTS.*
AMPLEX MFG. CORP. *SUB-DIVISION OF CHRYSLER CORP.*	*OILITE PLATES, CORES, BARS, OIL BEARINGS & FRICTION UNITS.*
CORNING GLASS WORKS	*GLASS CAPACITORS, DIELECTRIC ELECTRONIC PARTS (GLASS).*
GENERAL ELECTRIC CO.	*ELECTRONIC PARTS.*
NATIONAL SUPPLY CO.	*STEEL CASTINGS.*
NORTON CO.	*REFRACTORY RODS, ABRASIVES, GRINDING WHEELS.*
SCINTILLA, DIV. BENDIX AVIATION CORP.	*ELECTRONIC PARTS.*
SPERRY GYROSCOPE CO. *DIVISION OF SPERRY CORP.*	*ELECTRONIC PARTS.*
TURBO PRODUCTS CO.	*POROUS METAL SAMPLES.*
SURPRENANT MFG. CO.	*ELECTRIC WIRE, 18 & 22 GA. WIRE.*
THE TORRINGTON CO.	*NEEDLE BEARINGS.*
U.S. STEEL SUPPLY *DIVISION U.S. STEEL CORP.*	*STEEL BEAM & STEEL PLATE.*

APPROX. 45 ADDITIONAL SUPPLIERS FOR A.N. STANDARD PARTS, RAW STOCK, MISC. ELECTRONIC SMALL PARTS ETC.

CURRENT ATLAS ORGANIZATION

In order to afford maximum effort to the Atlas Program, extraordinary organizational steps have already been taken within Convair for the Atlas Project.

The status of the organization as of July 1954 is shown on the opposite page.

Within the General Office a "Vice President for Atlas" has been established who is responsible for all Convair activities on Atlas, both inside and outside the plant. It is a primary responsibility of this Vice President to afford the Atlas Program priority within Convair in all areas such as management, personnel, engineering, plant facilities and production.

Within the operating division, a Program Director has been established in the Division Manager's office to provide maximum priority within the division. In each department, separate Atlas organizations are being established and those which are currently operating are shown.

CONVAIR SAN DIEGO

CURRENT ATLAS ORGANIZATION

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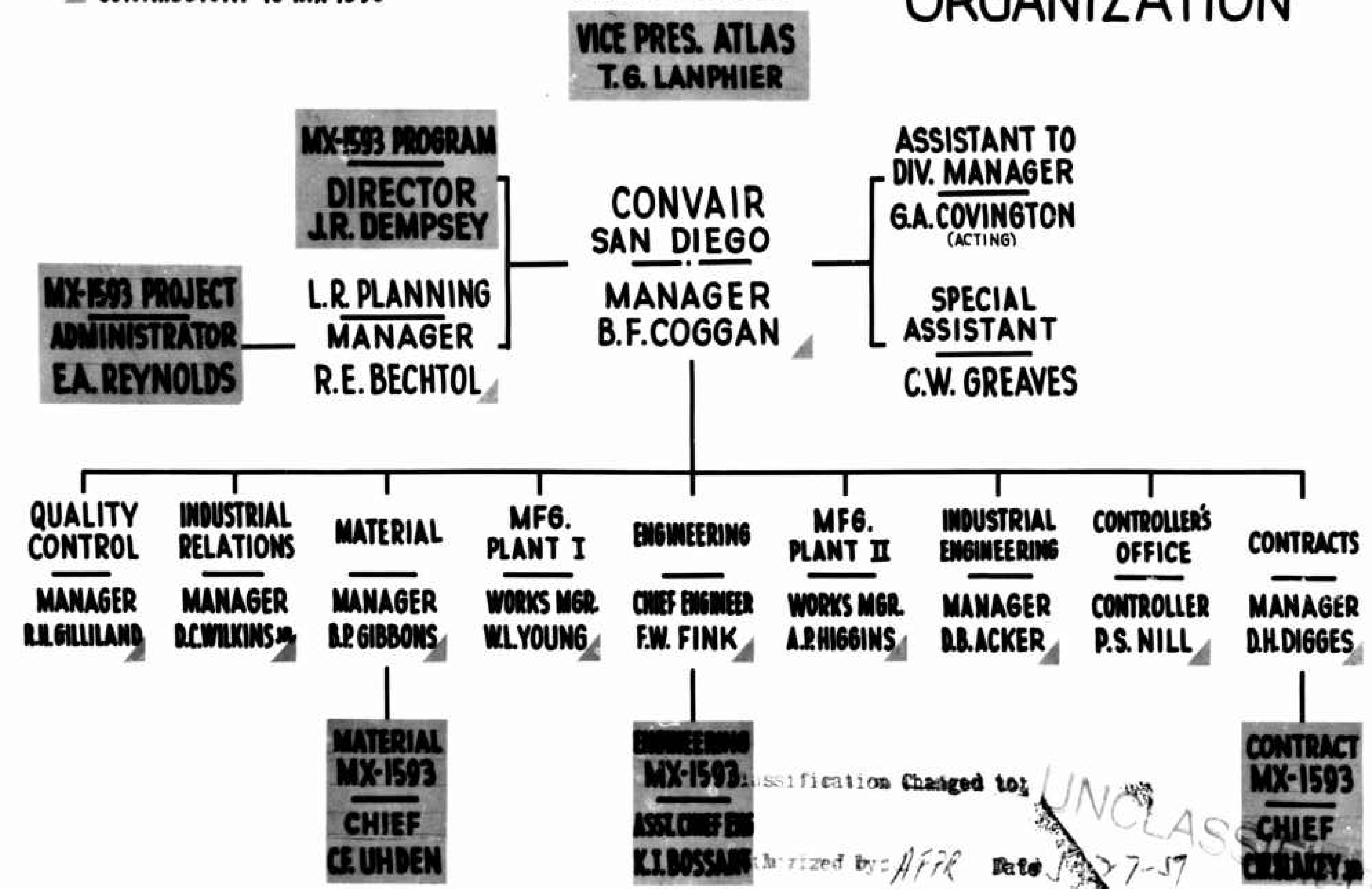
- MX-1593 OPERATION (shaded box)
- CONTRIBUTORY TO MX-1593 (triangle mark)



CONVAIR
GENERAL OFFICE
VICE PRES. ATLAS
T.G. LANPHIER
MX-1593 PROGRAM
DIRECTOR
J.R. DEMPSEY
MX-1593 PROJECT
ADMINISTRATOR
E.A. REYNOLDS
L.R. PLANNING
MANAGER
R.E. BECHTOL
CONVAIR
SAN DIEGO
MANAGER
B.F. COGGAN
ASSISTANT TO
DIV. MANAGER
G.A. COVINGTON
(ACTING)
SPECIAL
ASSISTANT
C.W. GREAVES
QUALITY
CONTROL
MANAGER
R.H. GILLILAND
INDUSTRIAL
RELATIONS
MANAGER
D.C. WILKINS JR.
MATERIAL
MANAGER
B.P. GIBBONS
MFG.
PLANT I
WORKS MGR.
W.L. YOUNG
ENGINEERING
CHIEF ENGINEER
F.W. FINK
MFG.
PLANT II
WORKS MGR.
A.P. HIGGINS
INDUSTRIAL
ENGINEERING
MANAGER
D.B. ACKER
CONTROLLER'S
OFFICE
CONTROLLER
P.S. NILL
CONTRACTS
MANAGER
D.H. DIGGES
MATERIAL
MX-1593
CHIEF
C.E. UHDEN
ENGINEERING
MX-1593
ASST. CHIEF ENG
K.J. BOSSART
CONTRACT
MX-1593
CHIEF

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NEXT STAGE OF CONVAIR ATLAS ORGANIZATION

The organization as shown on the preceding page is the present status of organizational progression to a "Division within a Division" as shown here. This organization can then be established as a separate Division whenever it becomes appropriate.

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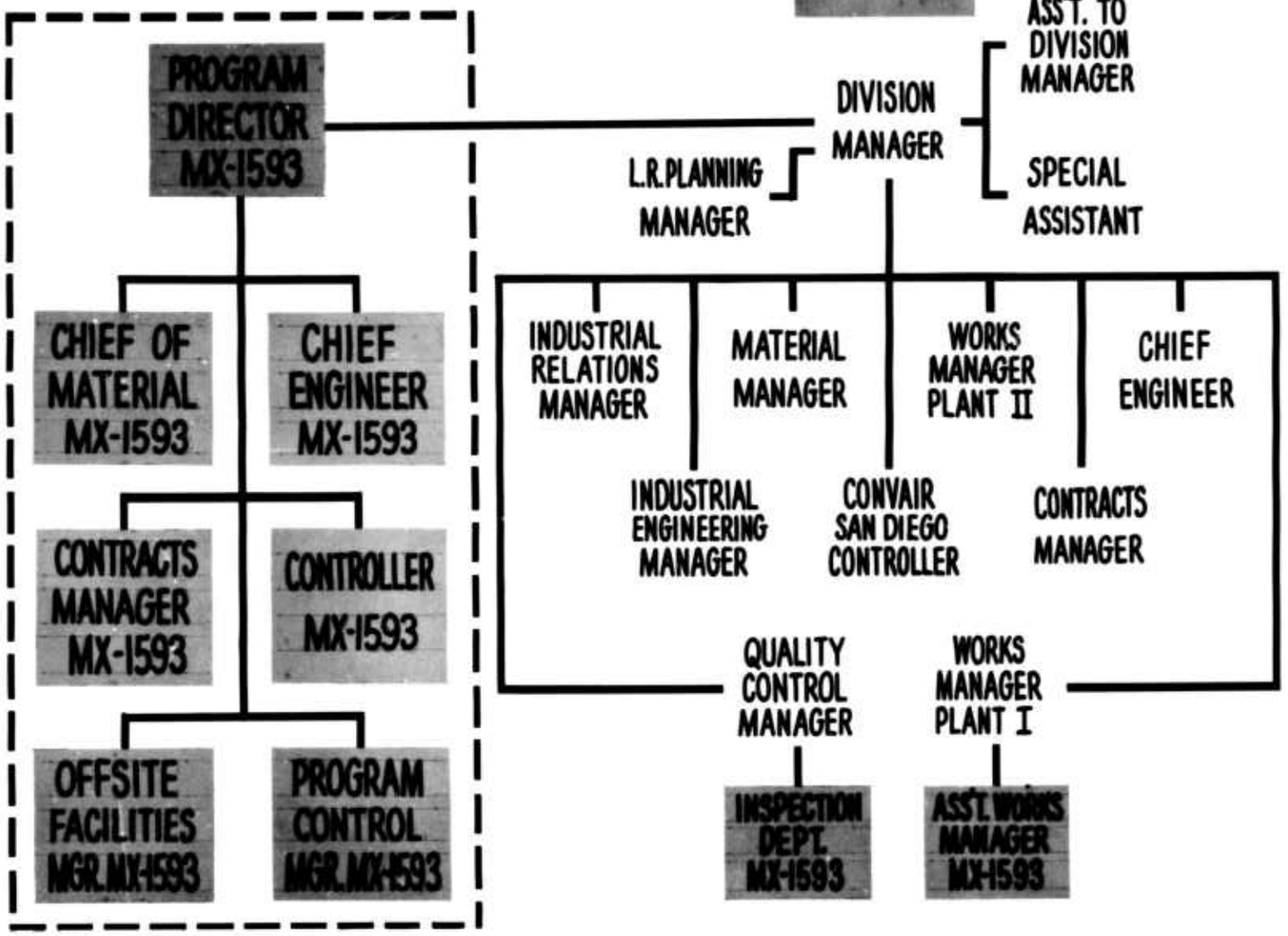
NEXT STAGE OF CONVAIR ATLAS ORGANIZATION



CURRENT AND PAST CONSULTANTS

This chart lists those consultants who have participated in the Atlas Program since its beginning and lists areas in which their advice has been sought.

It is included in this presentation as an indication of the sort of talent which has contributed to Convair's developments in the Atlas area since the inception of the program. It is intended as at least a partial answer to the criticism, sometimes heard, that Convair's approach to the Atlas has not had the advantage of the advice and thought to be afforded by higher levels of science not officially associated with the airframe manufacturing business.

CURRENT & PAST CONSULTANTS

CONSULTANTS	SUBJECT
*DR. V. C. HARRIS UNIVERSITY OF CALIFORNIA	THEORETICAL MATHEMATICS MATHEMATICAL ANALYSIS
*DR. S. A. SCHAAF *DR. H. NAGAMATSU *PROF. K. D. WOOD	GENERAL AERODYNAMICS
LEE ARNOLD ASSOCIATES	AERODYNAMIC NOISE
PROF. M. J. ZUCROW LANGLEY FIELD	AERO-THERMODYNAMICS
PROF. POL DUWEZ MR. M. ROSEN LEWIS LABORATORY	AERODYNAMIC HEAT PROTECTION
ARMOUR RESEARCH FOUNDATION BATTELLE MEMORIAL INSTITUTE	HEAT ABSORBANT CERAMICS
PURDUE RESEARCH FOUNDATION	FILM COOLING
*PROF. LESTER LEES	BOUNDARY LAYER THEORY
PROF. CARLO FERRARI AMES LABORATORY	BOUNDARY LAYER & FLOW

CONSULTANTS	SUBJECT
PROF. F. L. WHIPPLE	AEROBALLISTICS & OPTICS
PROF. C. E. SMITH	OPTICS
*DR. R. S. DUNHOLTER	STRUCTURAL ANALYSIS
PAUL E. HUMPHREY	AUTOMATIC PILOT THEORY
*BAIRD ASSOCIATES, INC.	ALL-INERTIAL GUIDANCE
PROF. PAUL HERGET *DR. D. A. WELLS	CELESTIAL MECHANICS OF GUIDANCE
*DR. J. VON NEUMANN	GUIDANCE RESEARCH & DESIGN
MR. J. A. CULLEN	COMPUTER THEORY
*DR. H. W. BODE *DR. DARLINGTON *DR. ALEXANDER DR. R. THORENSEN DR. B. F. AMBROSIO	COMPUTER RESEARCH & DESIGN
AERO-JET-GENERAL CORP.	ROCKET ENGINE RESEARCH & DESIGN
NORTH AMERICAN AVIATION	PROPULSION SYSTEMS

*INDICATES PAST CONSULTANTS

JULY 1954

CURRENT ENGINEERING PERSONNEL
PROJECT ATLAS

As an indication of the current level of activity which may not be generally known, the names of all Atlas Engineering personnel are shown on the opposite page. Four hundred and six names are shown, three hundred and six of which are utilized full time on Atlas work.

CURRENT ENGINEERING PERSONNEL - PROJECT ATLAS

UNCLASSIFIED

PROJECT OFFICE

NAME	COLLEGE	EXPERIENCE
John L. Blair	Ph.D.	11 Yr
K. J. Bossart	M.S.	20
W. H. Patterson	M.S.	11
Cyril C. Campbell	M.S.	4
George Granger	M.S.	7
W. Rosenbaum	B.S.	18
C. S. Ames	B.S.	16
K. J. Jeremiah	B.S.	17
W. H. McNabb	B.S.	11
G. L. Croghan	B.S.	4

ENGINEERING TEST LABORATORY

NAME	COLLEGE	EXPERIENCE
M. C. Brady	B.S.	11
L. B. Gilmer	B.S.	4
E. R. Birdsall	B.S.	40
T. J. Galvin	B.S.	40
R. A. Welch	B.S.	18
E. F. Strong	B.S.	14
W. M. Sutherland	A.B.	13
R. A. Hollein	B.S.	12
R. R. Adams	B.S.	11
R. C. Bier	B.S.	12
J. R. Williams	B.S.	12
C. R. Walker, Jr.	B.S.	8
L. C. Fischer	B.S.	4
E. D. Mapes	B.S.	7
G. W. Carrey	B.S.	6
R. W. Nelson	B.S.	6
L. F. Edwards	B.S.	4
J. Q. A. Wickam	B.S.	9
A. J. Gilbert	B.S.	5
F. J. Lukas	B.S.	5
F. Wallace, Jr.	B.S.	5
T. R. Barkley	B.S.	5
R. G. Camp, Jr.	B.S.	7
C. G. Erickson	B.S.	7
G. D. Lindstrom	B.S.	4
R. A. Smith	B.S.	5
A. C. Durban	B.S.	3
W. M. Gross	B.S.	3
E. E. Keller	B.S.	3
R. E. Pondford	B.S.	3
R. W. Cifka	B.S.	3
J. P. Dominik, Jr.	B.S.	3
D. J. Henderson	B.S.	2
R. M. Rutzberg	B.S.	2
J. J. Wolfe	B.S.	2
P. R. Tarr	3 Yr	30
R. J. Campbell	3	20
C. J. Bolter	4	11
E. A. Kope	2	14
F. L. Coots	1	12
R. R. Lutz	0	10
A. W. Meeron	4	10
R. C. Cochran	0	8
R. L. Barker	3 yr	13 yr
R. DeLa Cruz	1	3

WEIGHTS

NAME	COLLEGE	EXPERIENCE
E. W. Koester	B.S.	6 yr
R. L. Fisler	2 yr	16
C. B. McCarty	2	16

AERODYNAMICS

NAME	COLLEGE	EXPERIENCE
George L. Blue	Ph.D.	10
Hyman Serbin	Ph.D.	11
Russell M. Mark	Ph.D.	3
Wm. R. Dermody	M.S.	4
John M. DeBevoise	M.S.	4
Richard C. Bassett	M.S.	6
Frank J. Dore	M.S.	7
Robert G. Scott	M.S.	5
Charles R. Nixon	M.S.	5
Robert J. Kirby	M.S.	4
Ralph H. Mork	B.S.	11
Lawrence E. Spivey	B.S.	12
Willis R. Mitchell, Jr.	B.S.	6
Frank M. Perkins	B.S.	6
Walter J. Goodhart, Jr.	B.S.	4

DESIGN

NAME	COLLEGE	EXPERIENCE
J. L. Wainwright	B.S.	28-1/2
Harry Beels	B.S.	20
R. S. Gault	B.S.	17
T. C. Bomeker	B.S.	11
M. A. Chapman	B.S.	11
Freeman D'Vincent	B.S.	16
J. W. Collins	B.S.	7
R. L. Frey	B.S.	8
E. E. Lindgren	B.S.	6
R. E. Stewart	B.S.	4
J. S. Coombes	B.S.	2-1/2
Mark Tryon	B.S.	3
C. L. Ives	B.S.	2-1/2
O. R. Benvrud	B.S.	3
A. D. Rupert	4 Yr	20-1/2
J. J. Stokers	1	17
J. W. Stone	4	19
L. Medearis	2	18
C. O. Bessert	2	18
Lloyd Currie	1	18
D. R. Collins	3-1/2	11
Paul Roberts	1	15
O. D. Harris	4	10-1/2
C. Prochnow	2	1
G. R. Dunn	1	7

GEL SPECIAL PROJECTS

NAME	COLLEGE	EXPERIENCE
W. J. Schart	Ph.D.	11 yr
A. E. Dreyzer	B.S.	11
W. E. Moore	B.S.	12-1/2
P. W. Keeler	B.S.	11
T. R. Beeston	B.S.	5
J. F. Fischer, Jr.	B.S.	6
G. C. Tweed, Jr.	B.S.	3

ELECTRICAL

NAME	COLLEGE	EXPERIENCE
F. Ferrara	B.S.	12 yr
E. Batch	B.S.	19
C. Grow	B.S.	17
Dave Beall	B.S.	16
R. Fiske	8 yr	19
I. J. Foster	4	12
R. Wesberg	4	10

GUIDANCE

NAME	COLLEGE	EXPERIENCE
C. K. Smith	Ph.D.	20 yr
D. M. Hill	Ph.D.	33
R. G. Wilson	Ph.D.	17
W. H. Schwidetzky	Ph.D.	17
C. T. Dozier	M.A.	40
D. F. Folland	M.S.	18
J. A. Elkelman	M.S.	18
R. M. Lager	M.S.	17
C. C. Douglis	M.S.	11
K. C. Mohler	M.S.	6
Olga Kobelkova	M.A.	6
H. H. Sharicks	M.S.	6
J. F. Langston	M.S.	7
L. Greenberg	M.S.	7
J. R. Brubaker	M.S.	6
L. Kelly, Jr.	M.S.	5
F. R. Tagliaferri	M.S.	4
Dick Cline	M.S.	2
W. A. Jones	M.S.	1
W. Gross	M.S.	1-1/2
R. F. Wehrmann	B.S.	23
C. S. McInnes	B.S.	15
R. J. Cornell	B.S.	18
R. O. Parker	B.S.	13
R. T. Eppenstein	B.S.	17
R. C. Nix	B.S.	12
R. Bestul	B.S.	12
J. W. Crooks, Jr.	B.S.	13
M. M. Cox	B.S.	12
C. Brooks	A.B.	11
D. C. Trim	B.S.	11
W. L. Brown	B.S.	11
J. R. Moulton	B.S.	10
W. A. Hearthen	B.S.	10
I. J. Deane	B.S.	8
R. C. Gastel	B.S.	7-1/2
T. E. Rosolinski	B.S.	7
L. R. Lawbend	B.S.	7
J. E. DeMoork	B.S.	7
T. W. Runyan	B.S.	6
J. A. Callen	B.S.	6

GUIDANCE

NAME	COLLEGE	EXPERIENCE
A. Roth	B.S.	8 yr
M. Blum	B.S.	6
W. W. Bryan	B.S.	5-1/2
W. W. Crane	B.S.	5-1/2
W. M. Taylor	B.S.	5
E. C. Oetjenk	B.S.	4
W. G. Karaschke	B.S.	5
[illegible]	B.S.	4-1/2
[illegible]	B.S.	4
[illegible]	B.S.	
R. Campbell		
M. Z. Lavis	B.S.	
J. C. VanCuren	B.S.	3
J. A. Winkler	B.S.	3
W. F. Sears	B.S.	3
J. R. Blackwood	B.S.	3
M. E. Fowler	B.A.	3
R. R. Bodkey	B.S.	3
R. C. Bauer	B.S.	2-1/2
P. W. Payne	A.B.	2-1/2
J. D. Rhodes	B.S.	2
J. G. Wills	B.S.	1
T. F. Young	3 yr	31
D. M. Pell		23
A. Alderley	4	21
R. G. Hudson	1	14
R. E. Parker	4	12
J. R. Mitchell	2	5
C. G. Moses		
R. T. Conner (T)		4
A. Enfield (T)	3	
C. Gendreon (T)	2-1/2	
M. J. Burchett (T)		
R. J. Wasik (T)		

POWER PLANT

NAME	COLLEGE	EXPERIENCE
R. C. Nelson	M.A.	10 yr
R. L. Hobson	B.S.	19
R. R. Ward	B.S.	19
L. L. Jones	B.S.	15
A. P. Tradell	B.S.	15
G. T. Herring	B.S.	10
D. R. Jenkins	B.S.	6
J. A. Ross	B.S.	3
W. A. Lester	1 yr	27
A. C. Nelson (T)		2
T. L. Holmber (T)	2	4
J. C. Wilson (T)	4	1
J. C. Bell (T)	2	2

DIGITAL COMPUTING LABORATORY

NAME	COLLEGE	EXPERIENCE
Marvin L. Ross	Ph.D.	6-1/2 yr
Charles J. Swift	Ph.D.	2
Thomas W. Wilder	M.S.	5
Norman LaVine	M.S.	4
Richard G. Bacell	M.A.	4
James Orr	M.A.	2-1/2
Ben Fortner	B.S.	12
Thomas E. Shaw	A.B.	3-1/2
Jack Rees	A.B.	2

SERVICE ENGINEERING

NAME	COLLEGE	EXPERIENCE
Durand Kinley	B.S.	18
Julius C. Hunter	B.S.	2
R. F. Nelson	B.S.	
David Harford	B.A.	3
Robert Plumer	4 Yr	20
William F. Brown	2	18
Edward Graham	2	4-1/2
Farrell Marvin Ross	1	8
Thomas Stanberry	2	4-1/2
Charlene Peter (T)	0	4-1/2
Bettye O'Connor (T)	0	1-1/2
Ernest Vincent Ross (T)	0	1
Barbara J. Ward (T)	0	1

FLUID MECHANICS

NAME	COLLEGE	EXPERIENCE
Frank Bock	B.S.	10 yr
Daniel L. Gray	B.S.	4-1/2
Murray Ogden	B.S.	4
Ralph E. Tuma	B.S.	4
A. E. Monson	3 yr	20

DYNAMICS

NAME	COLLEGE	EXPERIENCE
S. B. Friedrich	Ph.D.	17
Martin Barn	Ph.D.	2
Ole Brisy	M.A.	25
W. Mandy	M.S.	3
L. A. Payne	M.S.	3
H. T. Weiser	M.S.	9
G. R. Holmes	M.S.	3
R. L. Bear	M.A.	8
J. Bohaveli	M.A.	6
R. E. Martin	M.S.	4
[illegible]	B.S.	11
[illegible]	B.S.	14
[illegible]		2
Yolanda V. [illegible]		2
Neida Platt (T)	B.S.	9 Mo.
Mrs. D. Evelith (T)	B.S.	
R. B. Lincoln	2 Yr	5 Yr

MECHANICAL DESIGN

NAME	COLLEGE	EXPERIENCE
R. C. Parcell	Ph.D.	12 Yr
J. W. Lawner	B.S.	18
L. B. Loss	B.S.	17
A. C. Trendo	B.S.	16
W. H. Barr	B.S.	15
W. R. Ross	B.S.	14
J. L. Bohrman	B.S.	14
D. J. Schroeder	B.S.	16
R. Jachowski	B.S.	13
R. W. Goldberry	B.S.	7
C. B. Collins	B.S.	6
R. R. Stoughton	B.S.	3-1/2
J. R. Wessel	B.S.	3
R. F. Baker	B.S.	4-1/2
C. W. Leonard	B.S.	2
A. A. Fordon	B.S.	3
J. E. Merritt, Jr.	B.S.	3
C. Brenner	1-1/2 Yr	20
R. F. Nelson	4	20
R. W. Weber	3	19
R. J. Ossell	2	12
R. E. Wolf	2	11
C. S. Willis, Jr.	3	11
C. L. Smith	3	10-1/2
W. R. Kinney	2	16
W. J. Riley	2	8
G. Long	2-1/2	9
W. F. Joseph, Jr.	2-1/2	6
R. V. Barcarelli	1	7-1/2
R. F. Michalowski	1	3-1/2
R. A. Kenyon	2-1/2	3
R. G. Calhoun (T)	0	1-1/2
A. L. Schmidt (T)	2	1
J. Fink (T)	3	2 Mos

OPERATIONS ANALYSIS

NAME	COLLEGE	EXPERIENCE
W. R. Becker	M.S.	4 yr
D. W. Boyd	M.S.	3-1/2
W. J. Beaman	M.S.	2
J. T. Montgomery	M.S.	2
B. Rain	M.A.	1
L. Kale	A.B.	3
V. Murdock	A.B.	1-1/2
R. Schaeffer (T)	3-1/2 yr	1

THERMODYNAMICS

NAME	COLLEGE	EXPERIENCE
R. F. Dunholter	Ph.D.	10 yr
J. Fisher	Ph.D.	6
E. L. Katz	Ph.D.	6
W. H. Thiel	M.S.	14
W. F. Radcliffe	M.S.	12
J. C. Denton	M.S.	7
R. J. Belch	M.S.	7
J. R. Hellman	M.S.	6
R. I. Gerts	M.S.	3-1/2
R. A. Campbell	M.S.	3
D. R. Otis	M.S.	3
R. C. Sonderskov	M.S.	2-1/2
C. S. Chapman	B.S.	15
W. L. Dittman	B.S.	12
F. T. Gardner	B.S.	18
R. F. Holmes	B.S.	18
E. W. Schwartz	B.S.	18
M. L. Neuff	B.S.	11
R. S. Wenzel	B.S.	7
G. D. Weatherall	B.A.	5
P. A. Tip	B.S.	3-1/2
O. O. Hershman	B.S.	1
V. Salvig	B.S.	1

EXPERIMENTAL FLIGHT

NAME	COLLEGE	EXPERIENCE
R. E. Clamey	B.S.	17 yr
T. L. Bixby	B.S.	18
G. Chaconovic	B.S.	15
D. R. Bassett	B.S.	12
J. S. Harrison	B.S.	12
M. I. Edelstein	B.S.	8
G. M. Derr	B.S.	9
R. G. Greenbaum	B.S.	9
M. C. [illegible]	B.S.	7
R. Brazell	B.A.	6
D. Johnson	B.S.	5
R. C. Parker	B.S.	5
C. E. Wilson	A.B.	1
W. J. Bossert	B.S.	4-1/2
A. B. Chamberlain	B.S.	4
J. D. Kyser	B.S.	4
J. E. Elliott	B.S.	4
C. B. Estes	B.S.	4
M. Porter	B.S.	3-1/2
L. W. Rosecrans	B.S.	1
D. F. Powell	B.S.	2
W. E. Bopp	B.S.	2-1/2
R. G. Killion	B.S.	1
R. W. Seibert	3 yr	10
A. D. Monroe	2	11
W. O. Blakesley	2-1/2	10
J. E. Lumpkin	1 yr	16 yr
J. B. Kenny	1-1/2	12-1/2
J. Ambers (T)		11

STRUCTURES

NAME	COLLEGE	EXPERIENCE
Norman E. Lange	Ph.D.	20-1/2 yr
G. G. Green	M.S.	20
J. E. Goldberg	M.S.	23
M. F. Capp	M.S.	14
R. S. Berry	B.S.	13-1/2
A. C. Ward	B.S.	16-1/2
A. L. Williams	B.S.	9-1/2

STANDARD LABORATORIES

NAME	COLLEGE	EXPERIENCE
R. C. Delcrush	M.S.	9 yr
C. F. Thompson	B.S.	29
E. S. Ames	B.S.	18-1/2
A. J. Woodington	B.S.	3
R. W. Mellis	B.S.	2
S. W. Gill	B.S.	6
J. Eimore	B.S.	6
R. H. Buff	1 yr	11
J. E. Scott, Jr.	4	14
L. H. Mobley	1	11
C. F. Hill	1	16
F. C. Thompson (T)	B.A.	6
A. E. Clarke (T)	1 yr	34
H. A. Simons (T)	0	33
O. O. Benson (T)	0	31
W. D. Davis (T)	0	23
A. L. Weinstein (T)	2	25
M. E. Cox (T)	0	24
J. Peterson (T)	0	23
J. J. Coutis (T)	2	21
M. R. Sonnekamp (T)	0	21
R. R. McAfee (T)	0	21
J. W. Collins (T)	1-1/2	16
E. J. Risser (T)	0	18
H. W. Harrington (T)	0	17
R. Maddox (T)	1	16
G. A. Dimatteo (T)	1	14
I. L. Leffer (T)	0	14
J. R. Roberts (T)	2	13
J. P. Cassens (T)	1	11
R. Chapin (T)	0	11
R. A. Jones (T)	0	10
C. R. Schulte (T)	0	10
C. W. Byers (T)	2 yr	8 yr
J. E. Peters (T)	0	8
A. S. Spitzer (T)	0	8
L. Simons (T)	3	6
P. E. Pease (T)	0	6
D. N. Clark (T)	1	7
C. A. Haskell (T)	0	7
E. R. Ewing, Jr. (T)	2-1/2	6
H. B. Young (T)	1	6
I. Dorrington (T)	2	6
R. Scott, Jr. (T)	0	5
A. G. Cheney (T)	0	4
G. C. Cooper (T)	0	4
R. D. Lewis (T)	2	4
M. Daniels (T)	0	3
R. Billingsley (T)	0	3
M. D. Smith (T)	0	2
F. M. Spear (T)	1	1

PLANNING & ESTIMATING

NAME	COLLEGE	EXPERIENCE
Robert W. Fowler	B.S.	11 yr
Tom L. Moody	B.S.	5
Donald T. Griffin	B.S.	4
Robert M. Frost	3 yr	15
Virginia C. Saks (T)		10
Gustav W. Prochel (T)	1	3
Willa B. Schell (T)	1	

UNCLASSIFIED

SECRET

Classification Changed to: UNCLASSIFIED

Authorized by: AFPR Date 5-17-57

Reclassified by: [signature] Dept. [illegible] Date 6-18-57

CONVAIR'S TERRIER EXPERIENCE AND PERFORMANCE

As an indication of Convair's direct experience and performance in establishing and operating a Missile Division, the present status of the Terrier Missile Program is indicated here. Since clear cut responsibilities were established about a year ago on this program, production has been exactly on schedule and the missile performance has been exceptional as noted. A considerable amount of experience in the initiation of a large program such as this has been accumulated in the B-58 Program. This experience has been the basis for recommendation of the methods indicated previously in selecting and administering sub-contractors for major sub-systems where development is required in addition to production.

UNCLASSIFIED

SECRET

SECRET

CONVAIR'S TERRIER MISSILE — UNCLASSIFIED

EXPERIENCE AND PERFORMANCE APPLICABLE TO ATLAS DEVELOPMENT AND MANAGEMENT:

★ **EXPERIENCE** AT MISSILE DIVISION, POMONA, CALIFORNIA

- ▲ CONVAIR ORGANIZED – CONVAIR OPERATED FOR 2 YEARS. 3,500 EMPLOYEES
- ▲ 330 MISSILES SINCE JANUARY, 1953 – ON SCHEDULE, BELOW ESTIMATED COST.
- ▲ 40 MISSILES PER MONTH NOW – 100 PER MONTH BEGINNING MARCH 1956.

★ **PERFORMANCE** WITH PRESENT PRODUCTION MISSILES (OP DEV 4 EVALUATION)

- ▲ OF ALL ROUNDS FIRED – 91 % HIT
- ▲ LAST 17 ROUNDS – WITHIN LETHAL DISTANCE OF DRONE
- ▲ 4 ROUNDS DESTROYED DRONE – BY COLLISION, WITHOUT WARHEAD.

SECRET UNCLASSIFIED

One specific missile configuration is the basis for this detailed program plan which is shown on the opposite page.

APPROXIMATELY ONE-HALF THE DESIGN EFFORT AT CONVAIR HAS, SINCE JULY 2, BEEN DEVOTED TO THE STUDY OF A TWO-STAGE PARALLEL CONFIGURATION INCLUDING WIND TUNNEL TESTS.

This study will be complete on September 20 for presentation to General Schriever and his Scientific Advisory Group at their meeting now tentatively scheduled for mid-October.

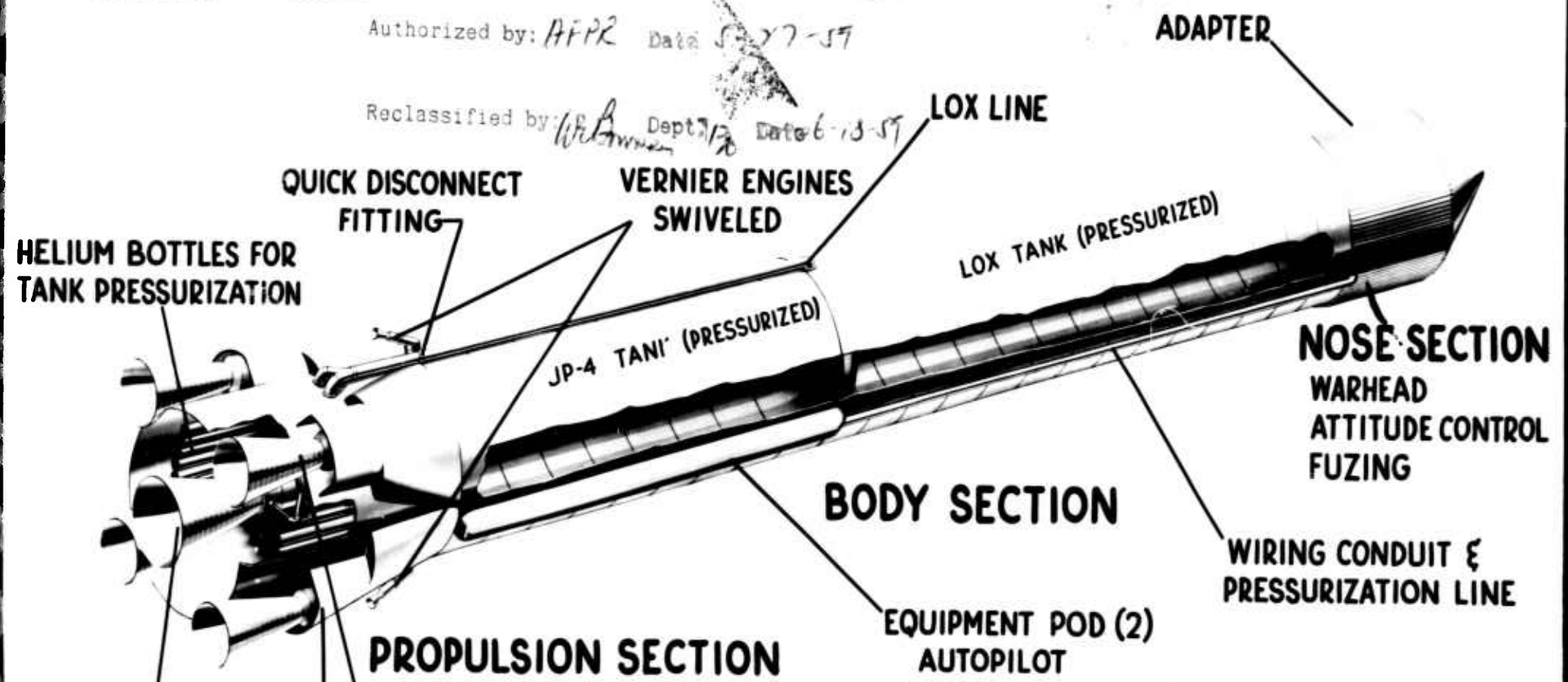
All work is being accomplished so that if a later change in configuration is warranted, a maximum of the current effort will be useful.

[redacted]

SECRET

THE XB-65

DIAMETER - 12 FT.
LENGTH - 88 FT.



SECRET

JULY 1954

[redacted]

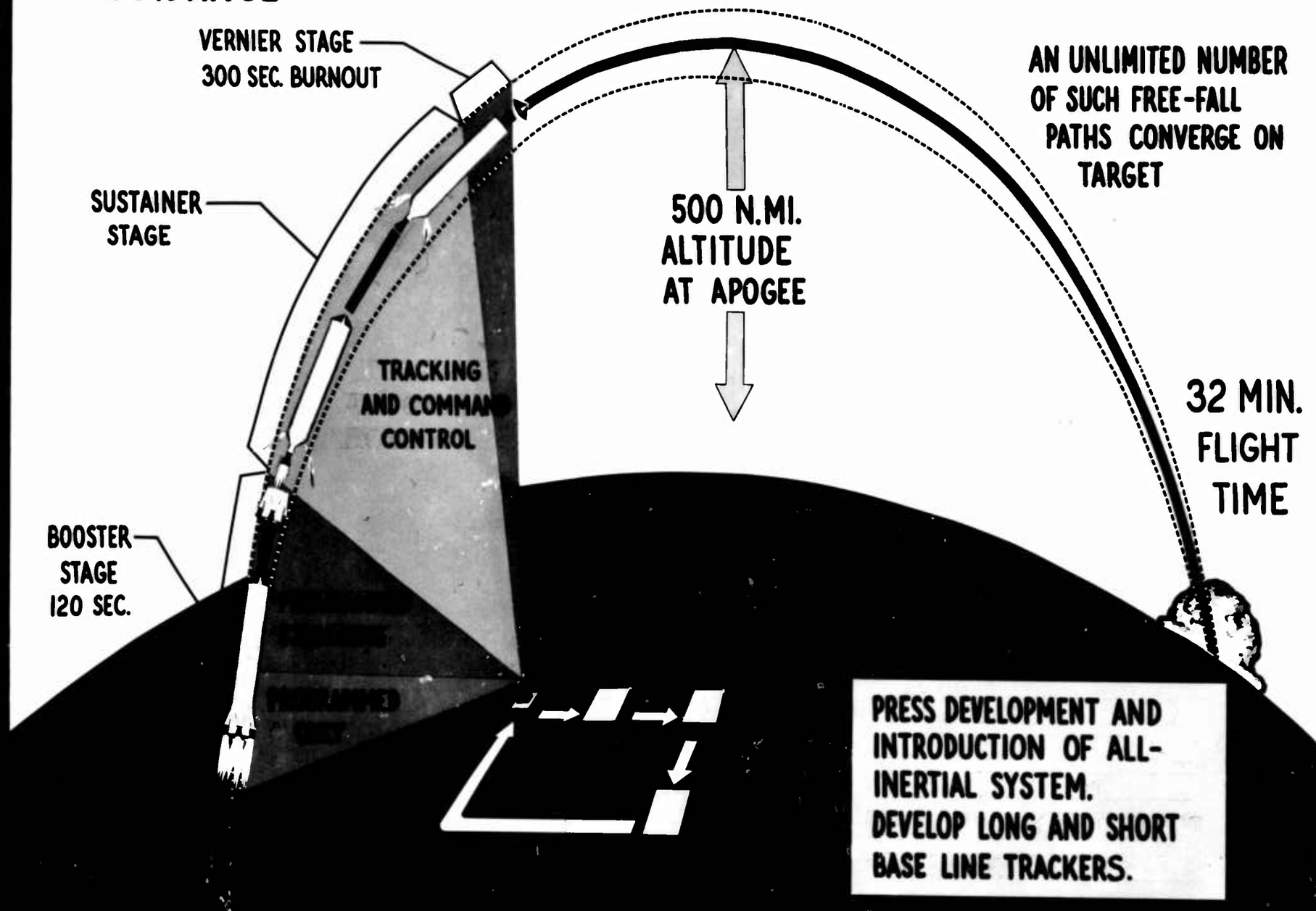
GUIDANCE

The all inertial guidance system is considered to be most desirable from an operational standpoint since it is entirely self-contained within the missile. It is not believed, however, that it can be developed to the necessary accuracy in the time period of this program and its development is recommended as a backup and product improvement for the operational system. The radio inertial system development will include the development of both long and short baseline trackers, at least to the point where a decision can be made as to which system is preferred for operational use.

A MAXIMUM EFFORT STUDY, INVOLVING APPROXIMATELY ONE-HALF THE GUIDANCE SYSTEMS ENGINEERING GROUP AT CONVAIR, IS BEING DEVOTED TO THE LONG BASELINE SYSTEM.

[redacted]

GUIDANCE



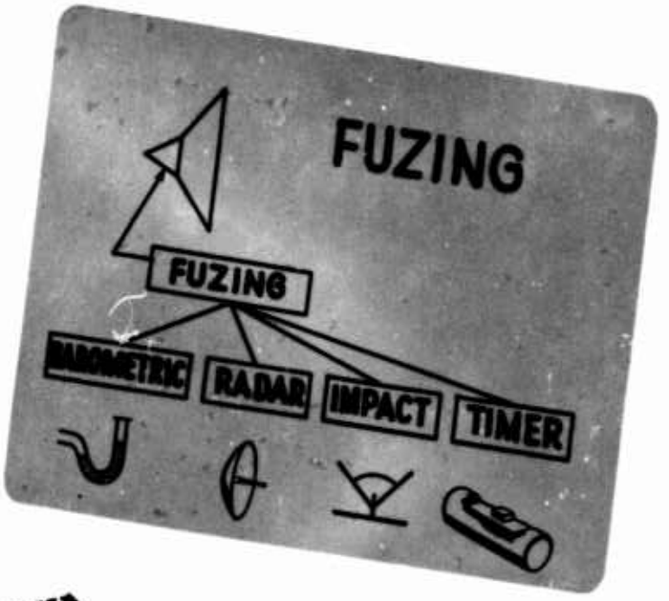
PRESS DEVELOPMENT AND INTRODUCTION OF ALL-INERTIAL SYSTEM. DEVELOP LONG AND SHORT BASE LINE TRACKERS.

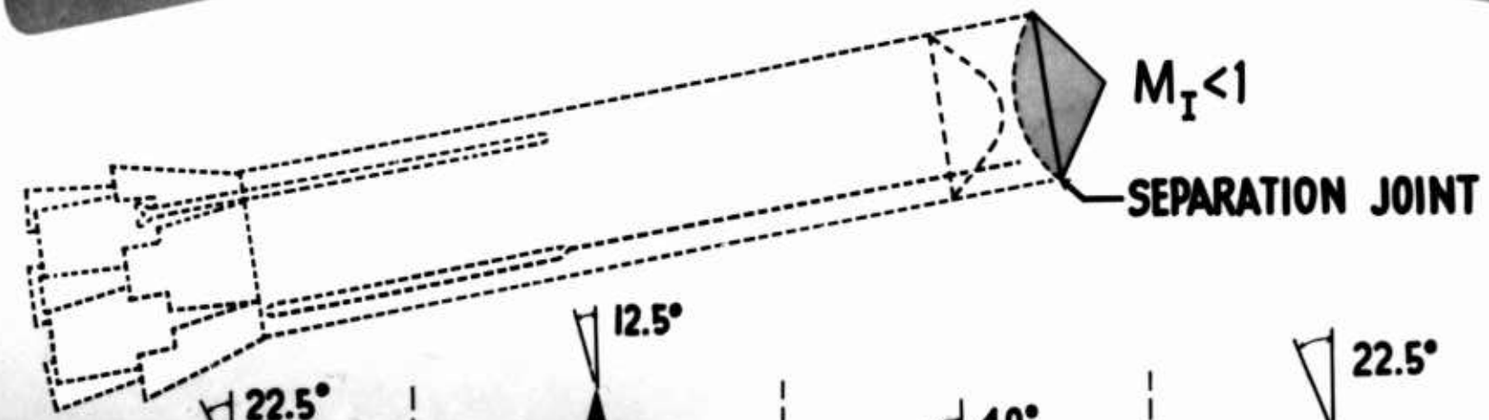
NOSE SECTION

It is not possible with the present state of experimental evidence to conclude definitely the best nose configuration. It is nearly certain that a blunt nose cone whose re-entry impact would be a Mach number could be successfully built. In addition to this configuration it is proposed to develop and test three additional nose cone shapes as shown.

In addition to this unpowered nose cone, a powered nose is recommended for development as a backup for possible weight growth and extension of flexibility of the basic missile configuration.

NOSE SECTION





M_I = SUPERSONIC LAMINAR FLOW-SOLID HEAT SINK

M_I > 1
TURB. FLOW
TRANS. COOLED

M_I > 1
TURB. FLOW
TWO STAGE SHIELDED
SOLID HEAT SINK

POWERED NOSE

JULY 1954

SECRET

Classification Changed to: [redacted]

Authorized by: AFPR Date 5-27-57

Reclassified by: W. Braun Dept: 130 Date 6-18-57

SECRET

Primary attention is being given initially to design and development of a test vehicle which would be utilized to test in flight a large rocket engine which will form the basis for the operational missile propulsion system. Design of this test vehicle is being conducted so that maximum utilization and tooling of the test vehicle can later be used for the operational missile. The test vehicle will provide the following important advantages for the program:

1. Partly simulate flight conditions of vibration, acceleration, pressures and atmospheric environment of the operational system which cannot be simulated on the ground.

2. Provide early flight test experience.

3. Proof out flight test handling, check out and limitation procedures.

THE MOCK-UP FOR THIS TEST VEHICLE IS UNDER CONSTRUCTION AND WILL BE COMPLETED LATE IN OCTOBER FOR A MOCK-UP BOARD THE FIRST WEEK IN NOVEMBER.

INITIAL ENGINEERING RELEASES HAVE BEEN MADE AND TOOL CONSTRUCTION IS IN PROCESS IN THE FACTORY.

[redacted]

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SECRET

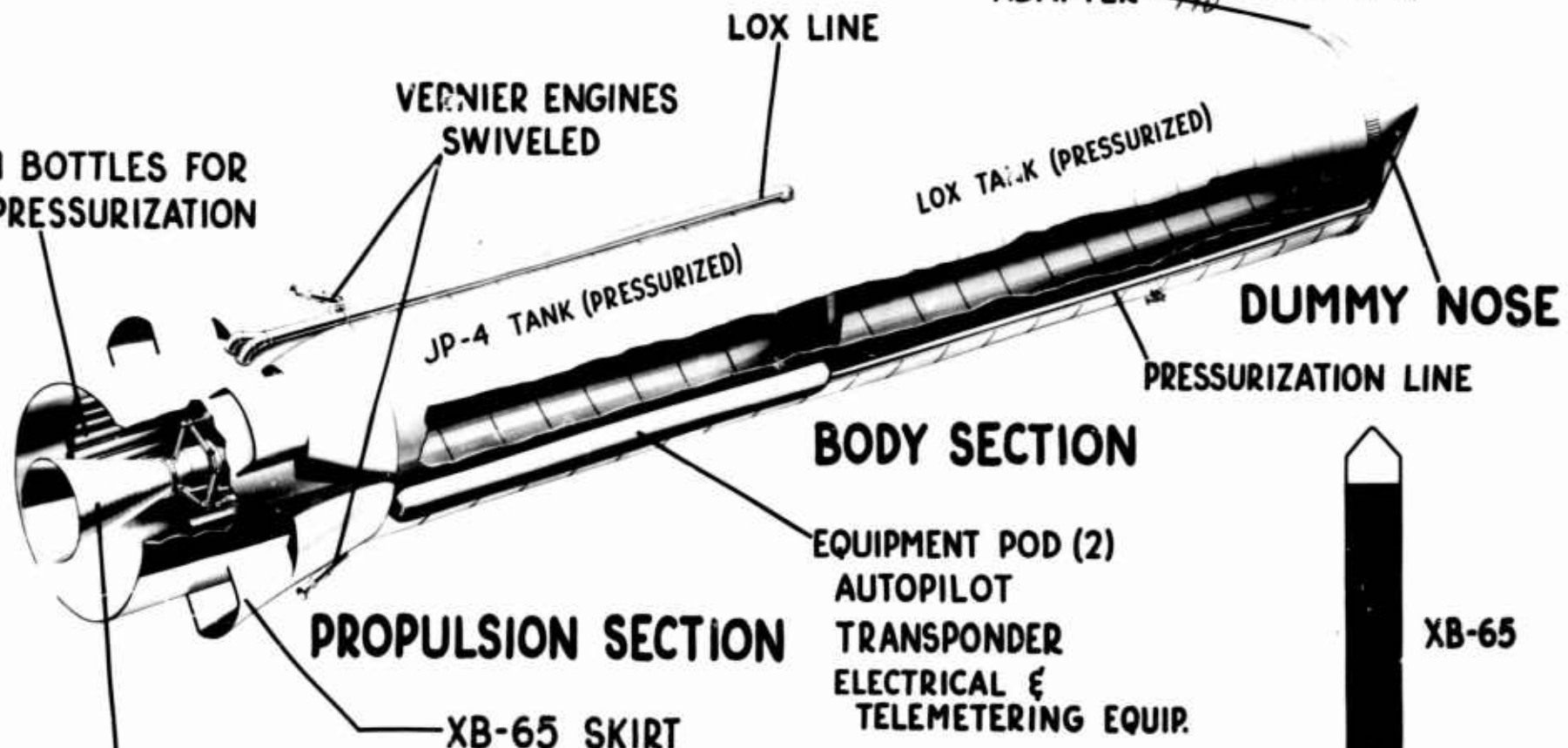
SINGLE ENGINE TEST VEHICLE

DIAMETER - 12 FT.
LENGTH - 83 FT.

Classification Changed [redacted]

Authorized by: AFPR Date 5-27-59

Reclassified by: [redacted] Dept. [redacted] Date 6-18-59



XB-65

[redacted] COMMON COMPONENTS

[redacted]

SECRET

JULY 1954

TOP SECRET

SECRET

Classification Changed to [redacted]

Authorized by: AFPR Date 5-27-57

MANUFACTURING SCHEDULE

Classified by: W. Bowman Dept: 130 Date 6-18-57

The following two charts show the proposed schedule for the Atlas Program including test vehicles, missiles, nose cones and the associated handling, check out and launching equipment.

The flight test schedule is established with the peak rate of five per month, which appears to be the maximum efficient rate which can be supported by real estate at AFMTC. It is proposed to divert missiles from production to stock pile as early as possible. By adding requirements of flight test to these figures and introducing necessary lead time for flight test, the production schedule is established as shown, resulting in a total quantity of 240 missiles by the end of 1960. Nose cone configurations are shown as described previously with an allowance of the sub-sonic nose cones for stock pile missiles until the final operational nose can be selected and introduced to production.

Support equipment is scheduled according to need dates established by flight test and stock pile schedules; quantities are based on an estimate of five missiles to each launching crew. Operational ground base guidance systems are scheduled on the basis of two launching complexes by the end of 1960 with four guidance stations for each one.

[redacted]

TOP SECRET

SECRET

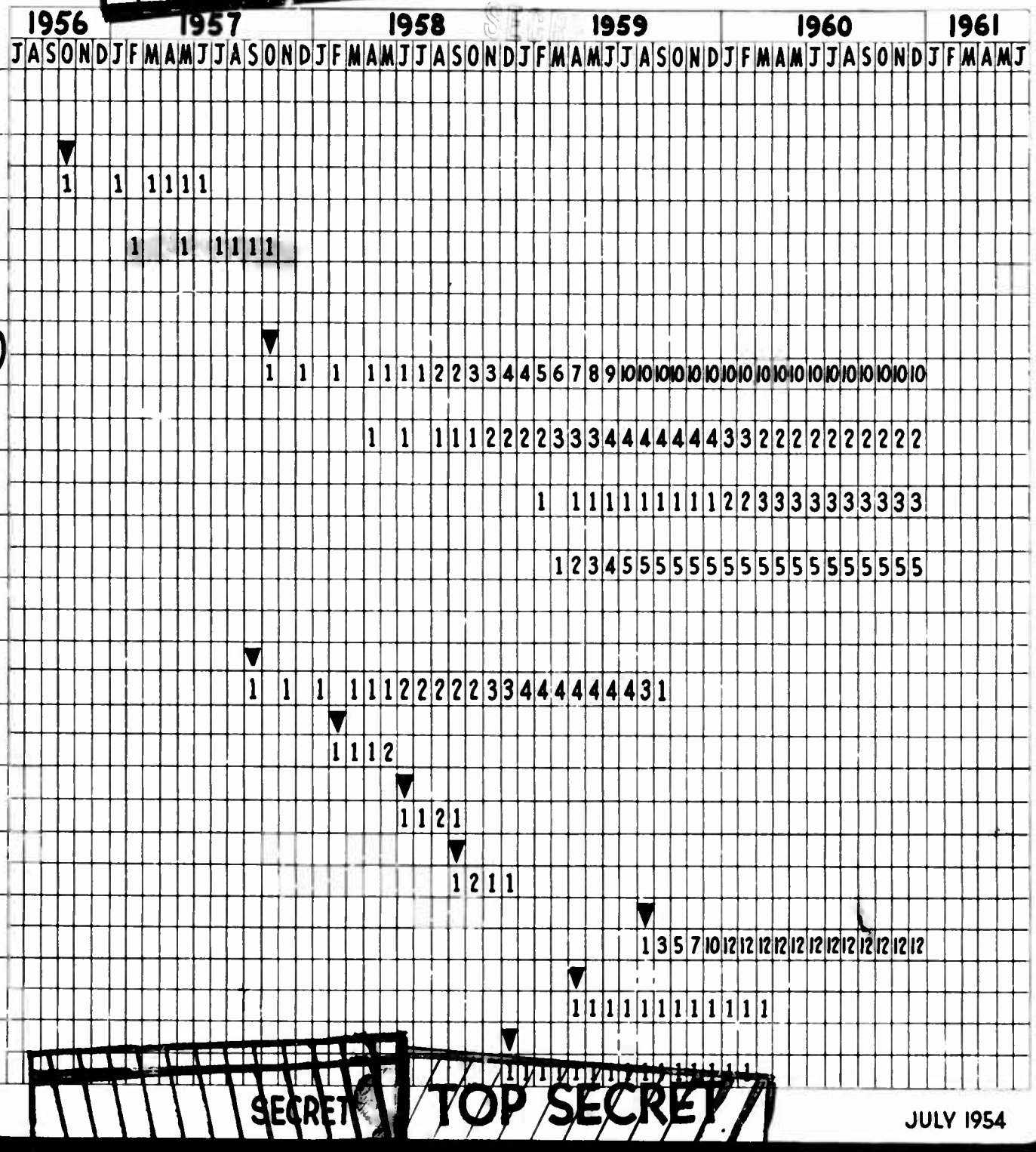
23

TOP SECRET

SECRET

MFG. SCHEDULE
AIRBORNE COMPONENTS

FIRST FLIGHT TEST ✓
FIRST FACTORY COMPLETION



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JULY 1954

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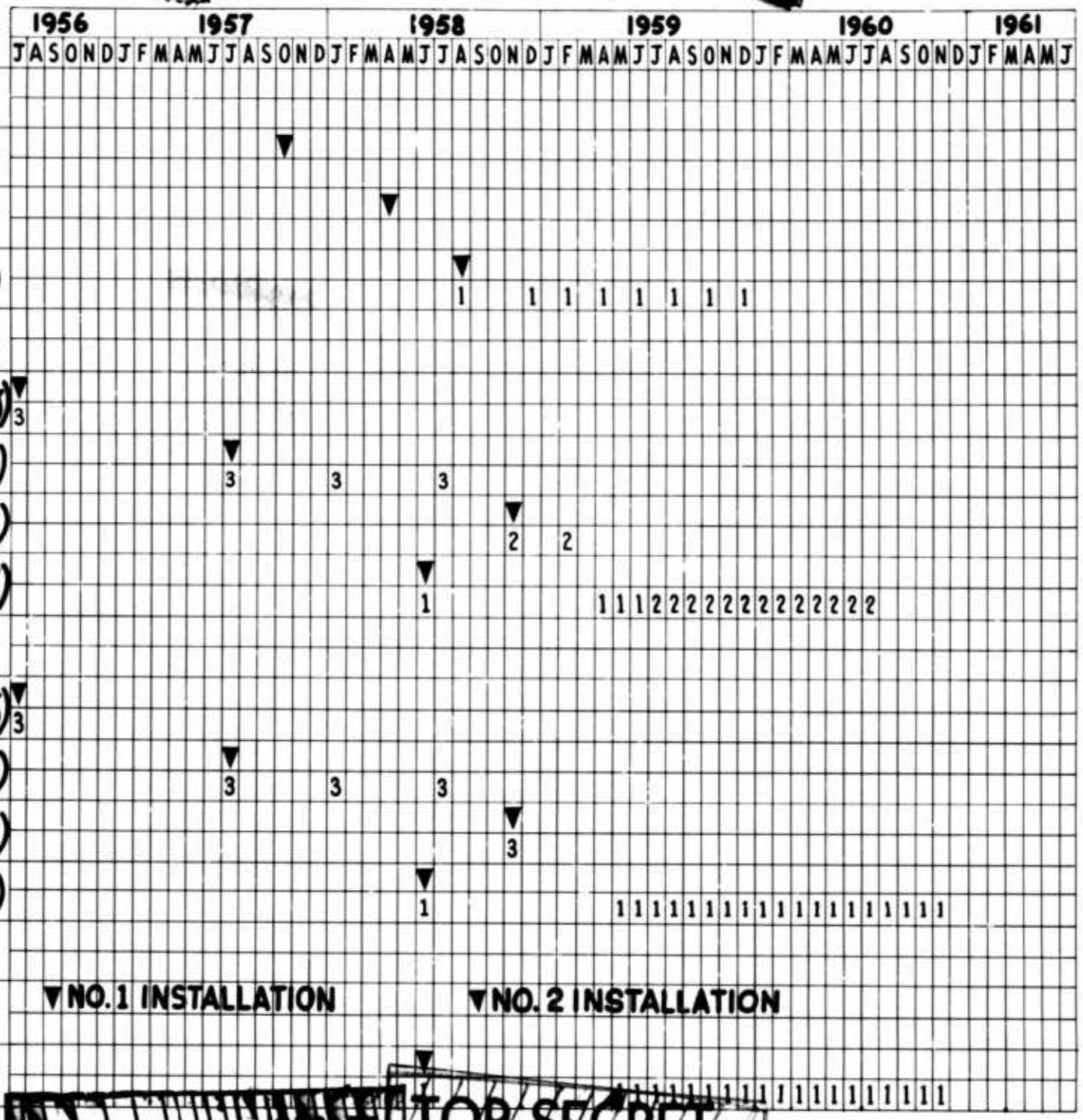
MFG. SCHEDULE GROUND SUPPORT EQUIP.



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JULY 1954

[redacted]

MANUFACTURING SEQUENCE OF FLOW

The production breakdown of the XB-65 is shown here which would be applicable also to the test vehicle. A point of major importance in the flow is that of final assembly and check out where final systems tests are made prior to shipment to flight test base. Convair's experience with the Terrier Program has indicated that systems check out is a problem or major proportions in missile production and requires special attention at all stages of planning. It also represents a major item of cost in the development and production of guided missiles.

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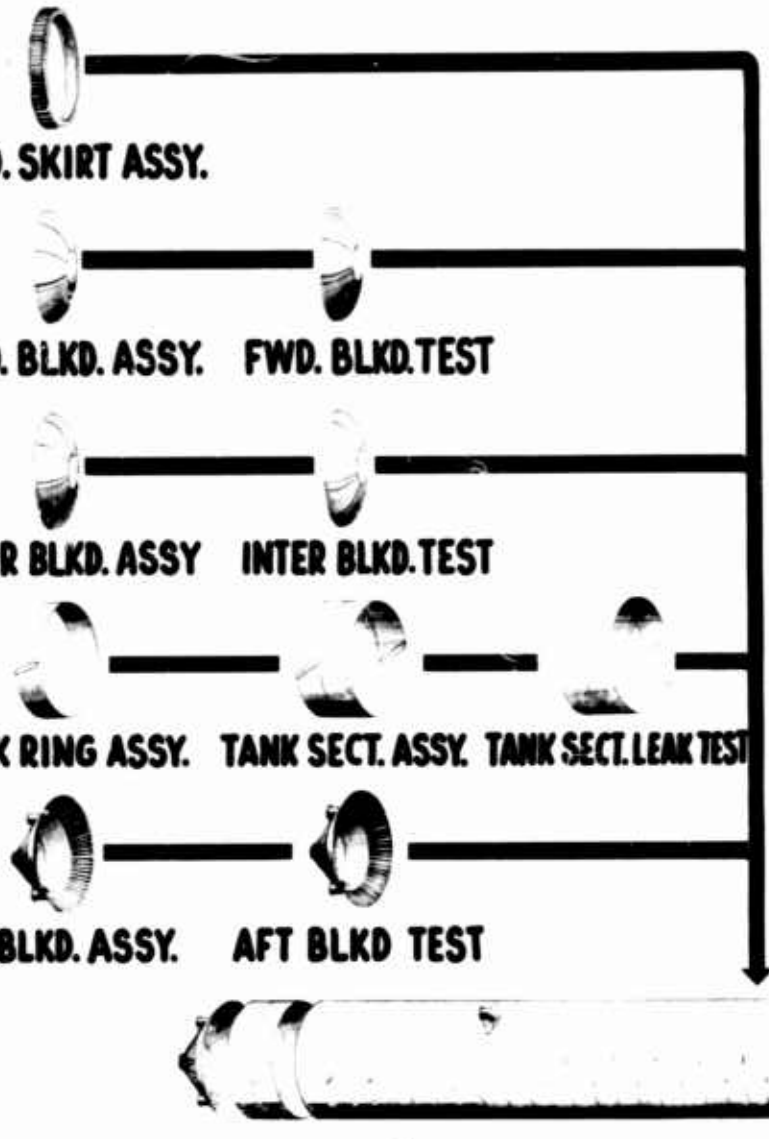
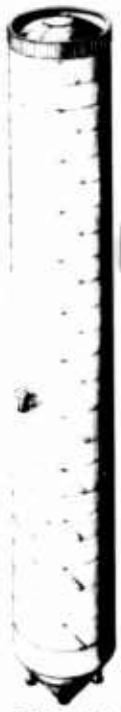
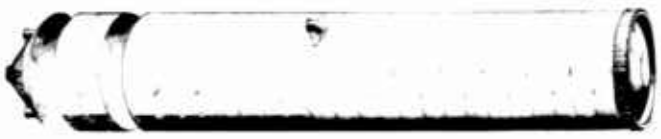
MANUFACTURING SEQUENCE & FLOW

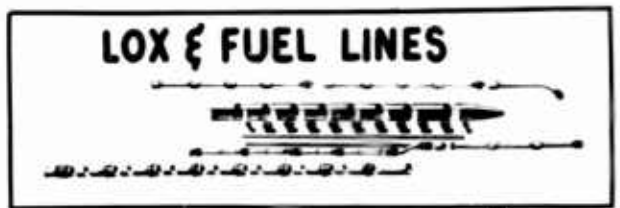




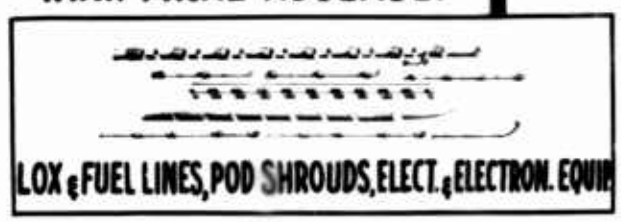
TANK VERTICAL (TEST IN TOWER)



TANK ASSY. & LAP WELD LEAK TEST



TANK FINAL ASSEMBLY



ROCKET ENGINES

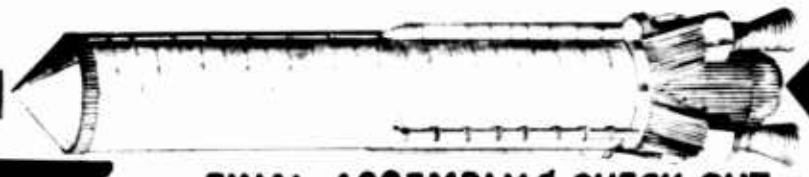
THRUST STRUCT. ASSY. THRUST STRUCT. FAIRING & ROCKET ENG. ASSY (INCLD. VERNIER ROCKETS)

THRUST STRUCT. & FAIRING HALVES

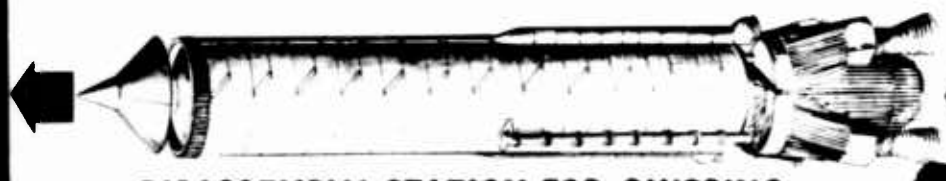
POWERED ADAPTER ASSEMBLY

ADAPTER NOSE MATING

NOSE ASSEMBLY PRES. TEST



FINAL ASSEMBLY & CHECK OUT



DISASSEMBLY STATION FOR SHIPPING

JULY 1954

[redacted] SECRET

Classification Changed to [redacted]

Authorized by: AFPR Date 5-27-59

Declassified by: Dept. Date 6-18-59

W. Bowman 130

SPECIAL TEST EQUIPMENT

This chart lists the different types of special test equipment which will be required for the Atlas Program. Convair's experience in producing the Terrier missile will prove invaluable in this respect. In Convair's Engineering Department a special section has already been established to develop and specify test equipment which will be required in all phases of the Atlas Program.

[redacted]

SECRET

SPECIAL TEST EQUIPMENT

[redacted]

FOR DEVELOPMENT PROGRAM

MISSILE SYSTEMS DEVELOPMENT STAND (INSTRUMENTATION AND EQUIPMENT)

ENGINEERING TEST EQUIPMENT

- MECHANICAL DESIGN
- ELECTRONIC DESIGN
- THERMO & PROPULSION DESIGN
- FLIGHT TEST INSTRUMENTATION
- OTHER (PHOTO *ETC.*)

STANDARDS MAINTENANCE EQUIPMENT

FOR FLIGHT TEST PROGRAM

BLOCKHOUSE and LAUNCHER (INSTRUMENTATION AND EQUIPMENT)

FLIGHT TEST EQUIPMENT

SUPPORTING EQUIPMENT

FOR MANUFACTURING PROGRAM

INSPECTION

PRODUCTION CHECK-OUT

Classification Changed to [redacted]

Authorized by: AFPR Date 5-[illegible]-57

Reclassified by: [illegible] Dept. [illegible] Date 6-13-57

MISSILE SYSTEMS DEVELOPMENT STAND

In order to accomplish the development of the missile system, a test stand capable of full duration static firing of the complete missile is required. For reasons of economy, efficiency of operation and time saving, this stand should be constructed near San Diego since there is presently no available stand in the country for this purpose.

A considerable survey has been made in the San Diego area. From the standpoint of nearness to Convair, topographical suitability and availability of the necessary utilities, the most suitable location is a site in the West Sycamore Canyon on Camp Elliott, presently operated by the Navy.

Local Navy authorities have indicated that they know of no objection by the Navy to use of this particular site for this purpose.

The stand to be constructed would be a minimum facility to perform necessary operations as indicated schematically on the opposite chart.

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MISSILE SYSTEM DEVELOPMENT STAND

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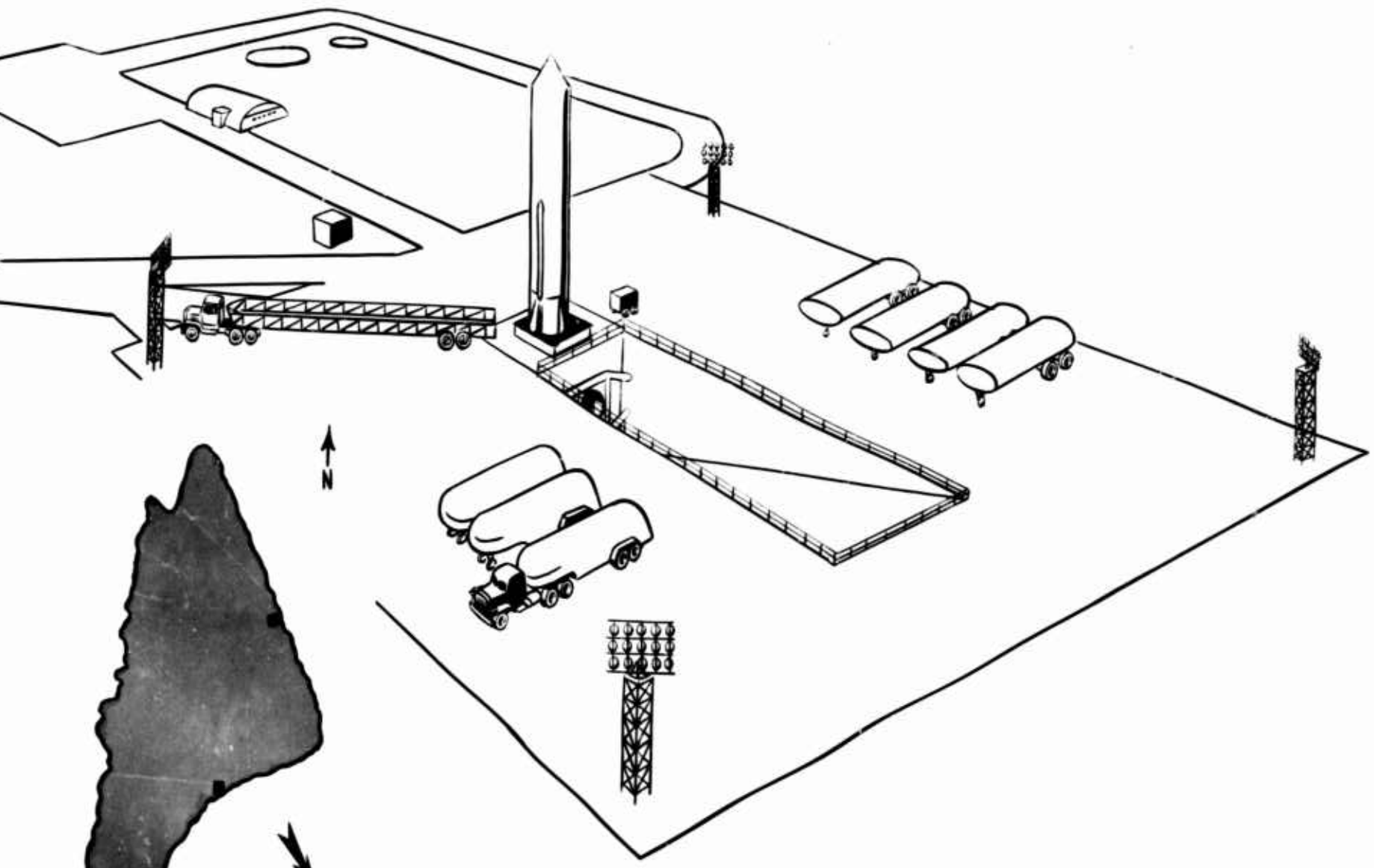
JULY 1954

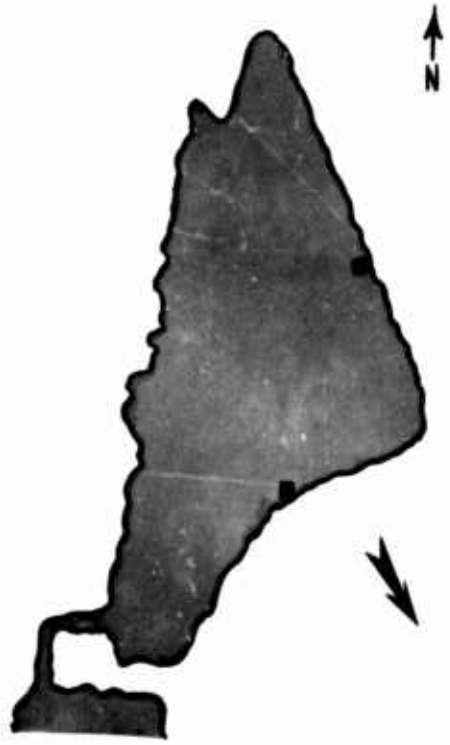
FLIGHT TEST FACILITY

A blockhouse and launcher are required at AFMTC to support the initial test vehicle program and a total of four launchers with associated double blockhouses for the maximum flight test rate.

The launchers must be capable of supporting a static firing of the missile since it is contemplated that no firing would be accomplished prior to arrival of the missile at the flight test center. Experience acquired by the Germans in V-2 development support the conclusion that each missile should be test fired prior to launching in order to assure the maximum reliability.

FLIGHT TEST FACILITY



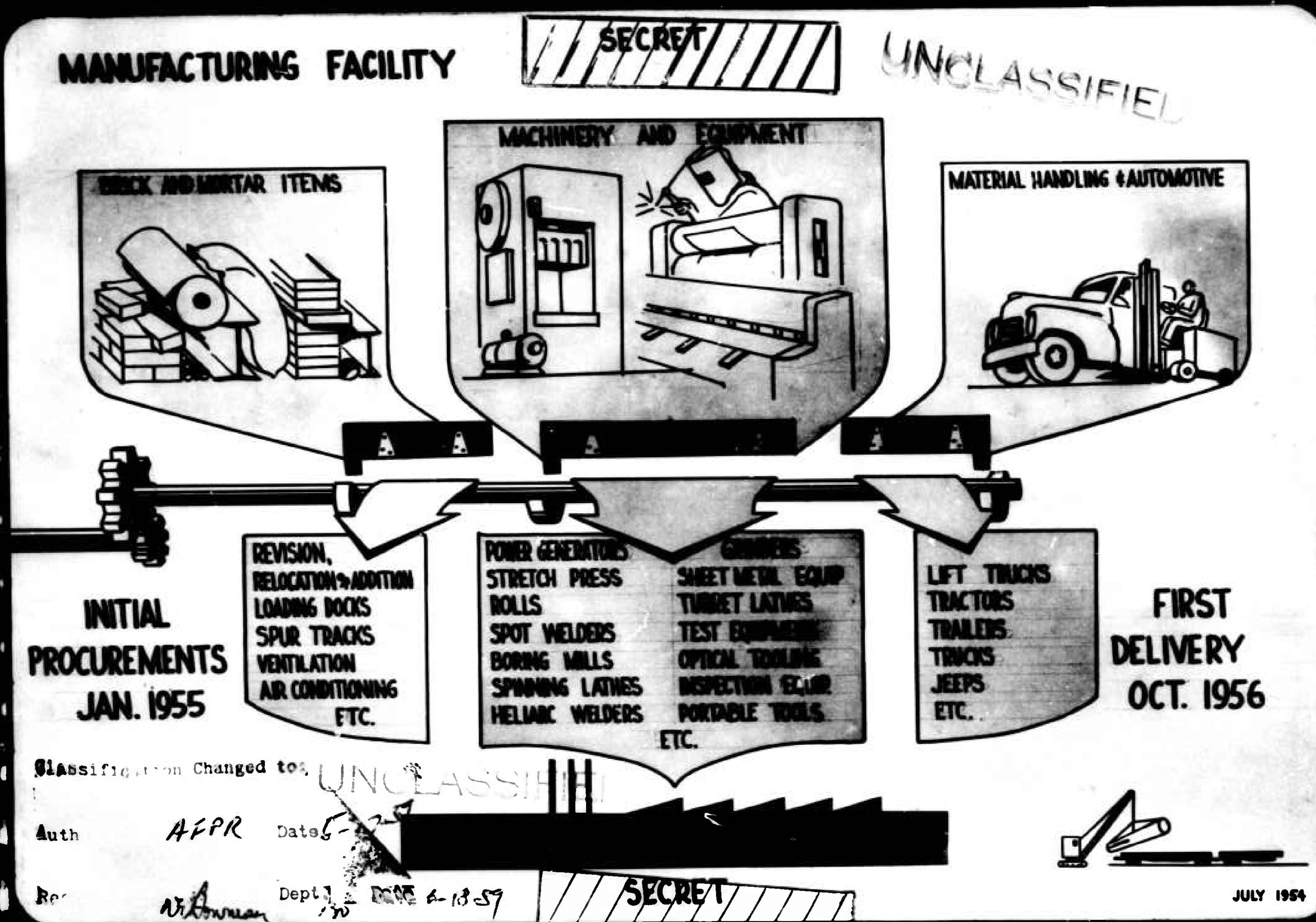


JULY 1954

MANUFACTURING FACILITY

Production of a test vehicle and subsequent production of the XB-65 will require certain facility items which are indicated on the opposite chart. Initial procurements must be made in January 1955 in order to support delivery of the first test vehicle in October 1956. Earlier commitments will be required if an earlier schedule is established by the Air Force.

78


MANUFACTURING FACILITY
SECRET
BRICK AND MORTAR ITEMS
MACHINERY AND EQUIPMENT
MATERIAL HANDLING & AUTOMOTIVE
REVISION, RELOCATION & ADDITION
LOADING DOCKS
SPUR TRACKS
VENTILATION
AIR CONDITIONING
ETC.
POWER GENERATORS
STRETCH PRESS
ROLLS
SPOT WELDERS
BORING MILLS
SPINNING LATHES
HELIARC WELDERS
GRINDERS
SHEET METAL EQUIP
TURRET LATHES
TEST EQUIPMENT
OPTICAL TOOLING
INSPECTION EQUIP
PORTABLE TOOLS
ETC.
LIFT TRUCKS
TRACTORS
TRAILERS
TRUCKS
JEEPS
ETC.
INITIAL PROCUREMENTS JAN. 1955
FIRST DELIVERY OCT. 1956
SECRET
JULY 1954

UNCLASSIFIED

Classification Changed to: UNCLASSIFIED

Auth AFPR Date 5-?

Re: [signature] Dept 130 Date 6-13-59

THE ESTIMATING PROCEDURE

The following three charts are included here to indicate the magnitude of the task of estimating a program such as this and to show the detail work which has gone into it.

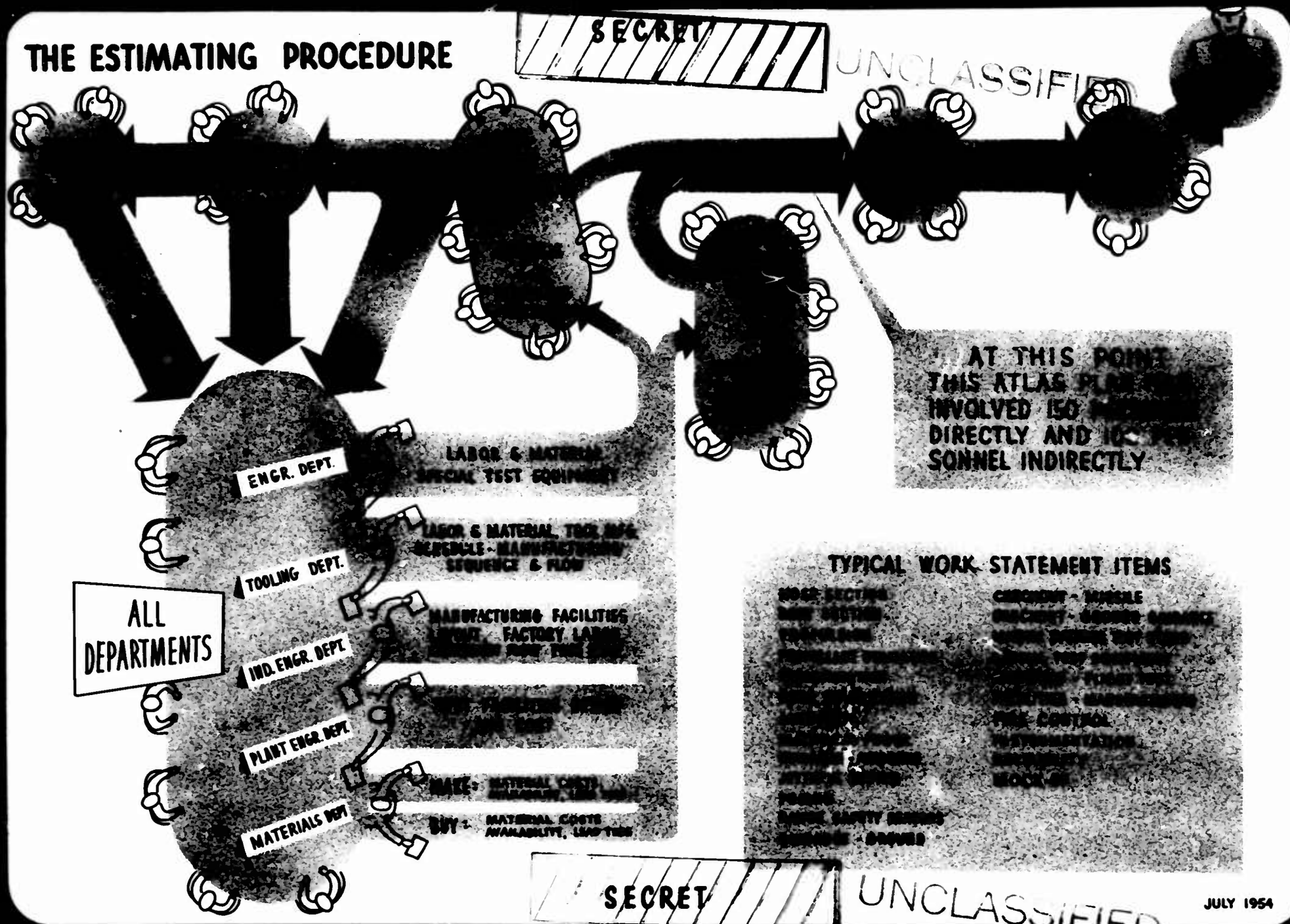
The first chart indicates the general procedure which is used and the type of work statement items involved.

The following two charts indicate the detail which is accorded each of the individual items prior to consolidation into an over-all estimate.

THE ESTIMATING PROCEDURE

SECRET

UNCLASSIFIED



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JULY 1954

THE ESTIMATING PROCEDURE

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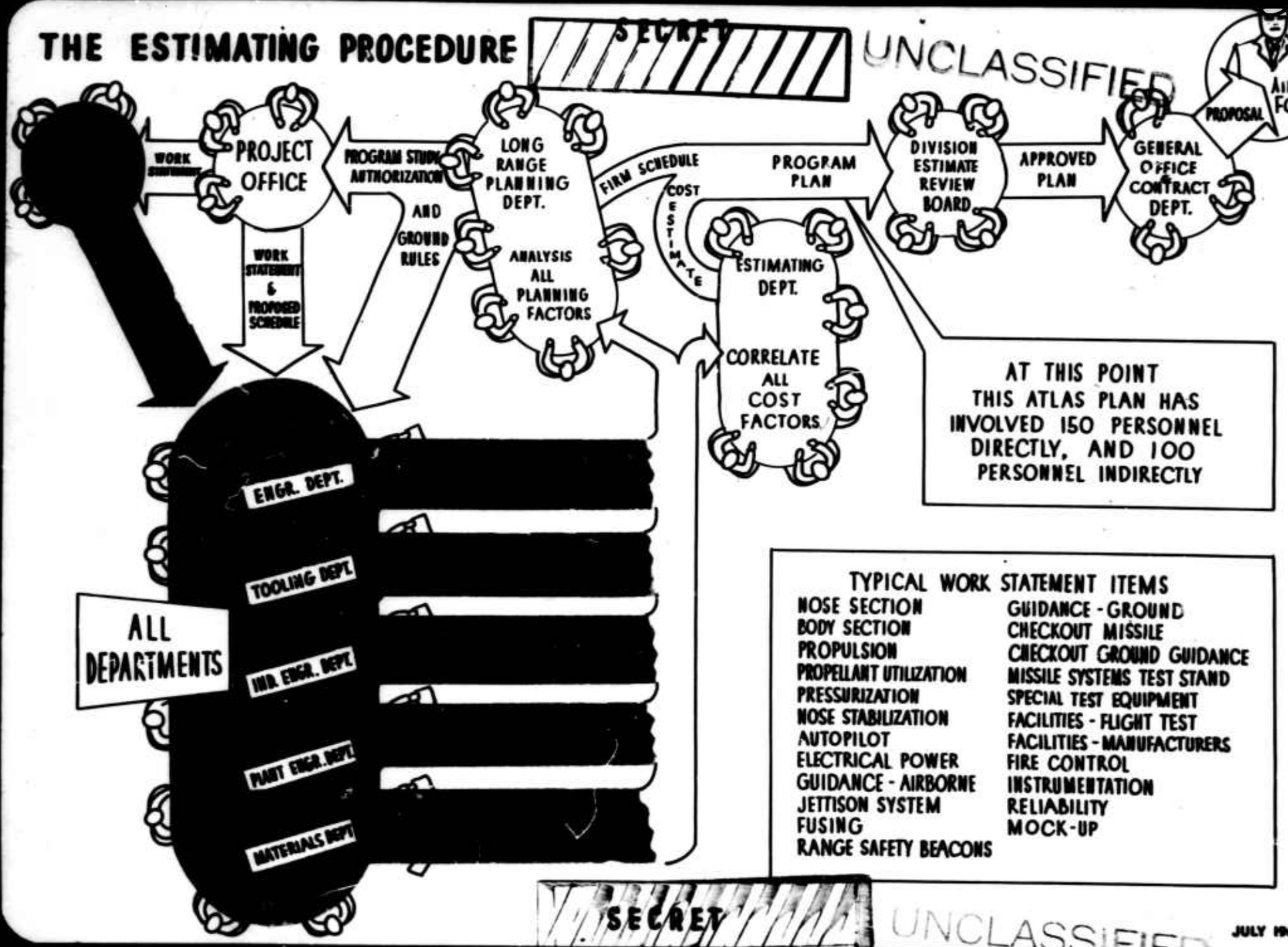


AT THIS POINT
THIS ATLAS PLAN HAS
INVOLVED 150 PERSONNEL
DIRECTLY, AND 100
PERSONNEL INDIRECTLY

TYPICAL WORK STATEMENT ITEMS

- NOSE SECTION
- BODY SECTION
- PROPULSION
- PROPELLANT UTILIZATION
- PRESSURIZATION
- NOSE STABILIZATION
- AUTOPILOT
- ELECTRICAL POWER
- GUIDANCE - AIRBORNE
- JETTISON SYSTEM
- FUSING
- RANGE SAFETY BEACONS
- GUIDANCE - GROUND
- CHECKOUT MISSILE
- CHECKOUT GROUND GUIDANCE
- MISSILE SYSTEMS TEST STAND
- SPECIAL TEST EQUIPMENT
- FACILITIES - FLIGHT TEST
- FACILITIES - MANUFACTURERS
- FIRE CONTROL
- INSTRUMENTATION
- RELIABILITY
- MOCK-UP

SECRET

UNCLASSIFIED

JULY 1964

ESTIMATING PROCEDURE--SUB-CONTRACT SOURCES

As an example of the procedure used in estimating the costs of a sub-contractor's item, the opposite chart shows how the costs for propulsion were obtained for this estimate.

The figures afforded by North American for a 5-engine power plant (exclusive of Vernier engines) are those used in the estimate. It is significant that North American's estimate of the engine cost increased in some six months from about $500,000 per cluster to the currently stated $1,200,000. This is the result, in part, to a significant increase in the ground testing program in the interest of reliability.

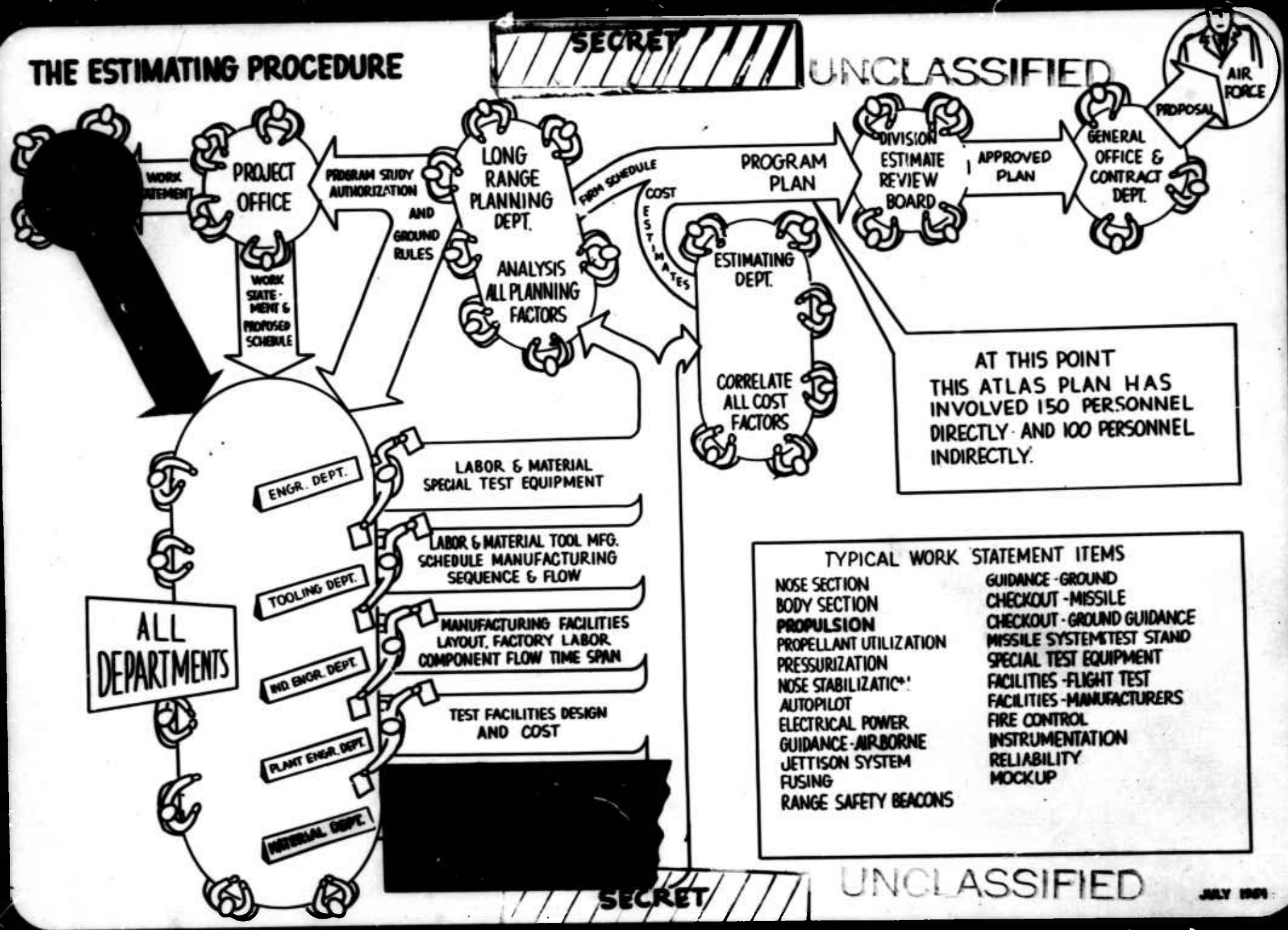
It is also significant that General Electric's proposal was in the same area of magnitude as that of North American's; while Aerojet's and Reaction Motors' total somewhat less than half the costs cited by North American and General Electric.

It is this sort of disparity of estimates in such a fundamental sub-system as the engine that further leads Convair to the conclusion that the Air Force would be wise to accomplish as thorough an evaluation of all industrial elements to be concerned with the Atlas as can be obtained through the recommended System Contractor approach.

THE ESTIMATING PROCEDURE

SECRET

UNCLASSIFIED



AT THIS POINT
THIS ATLAS PLAN HAS INVOLVED 150 PERSONNEL DIRECTLY AND 100 PERSONNEL INDIRECTLY.

TYPICAL WORK STATEMENT ITEMS

- NOSE SECTION
- BODY SECTION
- **PROPULSION**
- PROPELLANT UTILIZATION
- PRESSURIZATION
- NOSE STABILIZATION
- AUTOPILOT
- ELECTRICAL POWER
- GUIDANCE - AIRBORNE
- JETTISON SYSTEM
- FUSING
- RANGE SAFETY BEACONS
- GUIDANCE - GROUND
- CHECKOUT - MISSILE
- CHECKOUT - GROUND GUIDANCE
- MISSILE SYSTEM TEST STAND
- SPECIAL TEST EQUIPMENT
- FACILITIES - FLIGHT TEST
- FACILITIES - MANUFACTURERS
- FIRE CONTROL
- INSTRUMENTATION
- RELIABILITY
- MOCKUP

SECRET

UNCLASSIFIED

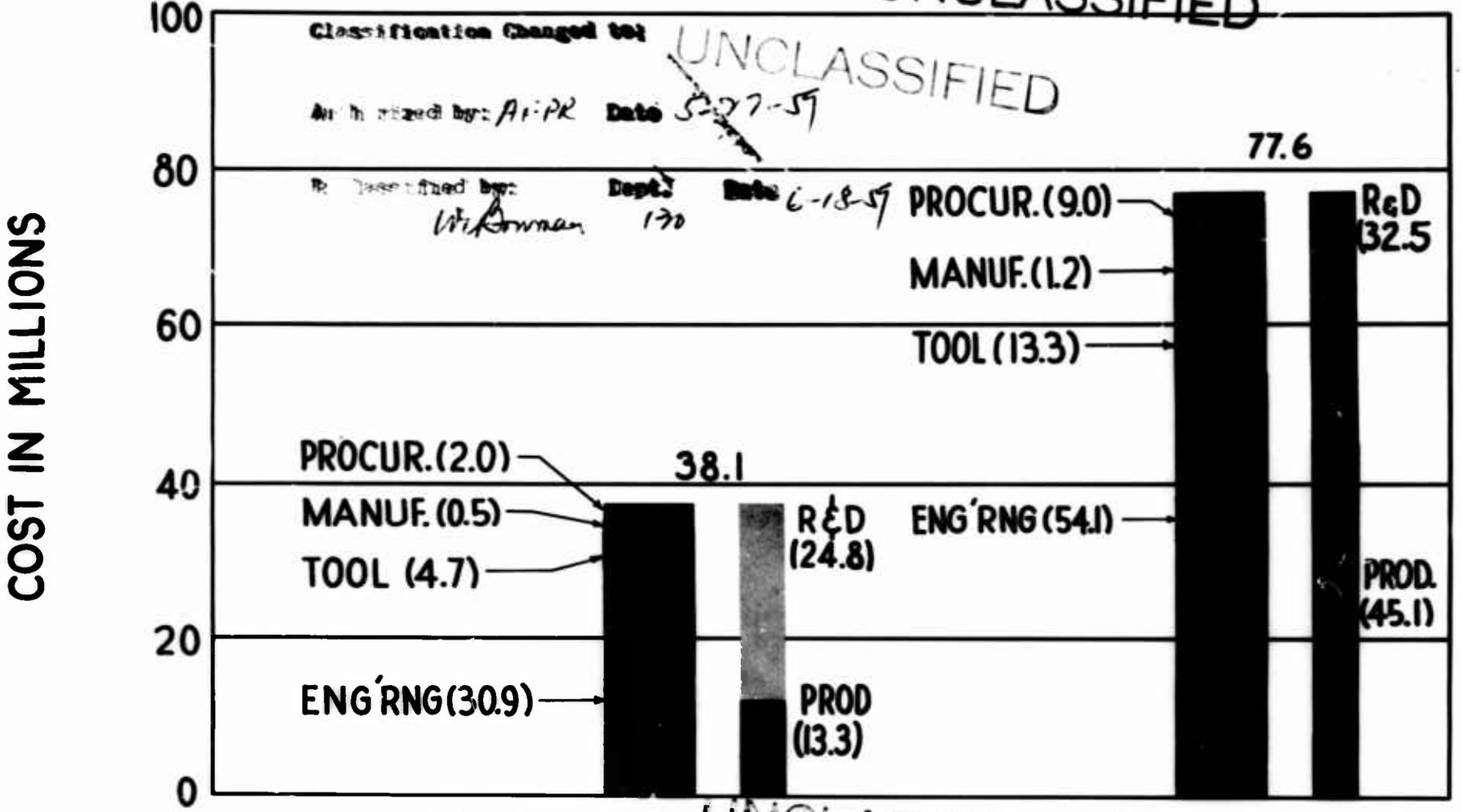
JULY 1961

FUNDING - CONVAIR

The charts which follow show for fiscal years 1955 and 1956 the funding requirements to support the Atlas Program according to the schedule previously shown. The detailed funding requirement is broken down into four groups. First, funds which would be expended by Convair; second, the items which would be sub-contracted by Convair; third, the propulsion requirement for a single source; and fourth, facilities requirements. A total chart follows. Then follows the requirements for dual source primary propulsion development and the totals which would result in this case.

On each chart the funds are broken down by fiscal year according to function and according to type of funding with the estimated total costs through 1960 shown at the bottom of each chart. The funding estimates given do not include sub-contractor facilities, fuel, operational bases or operation of Air Force facilities. They do include all other elements of the Atlas program as described herein.

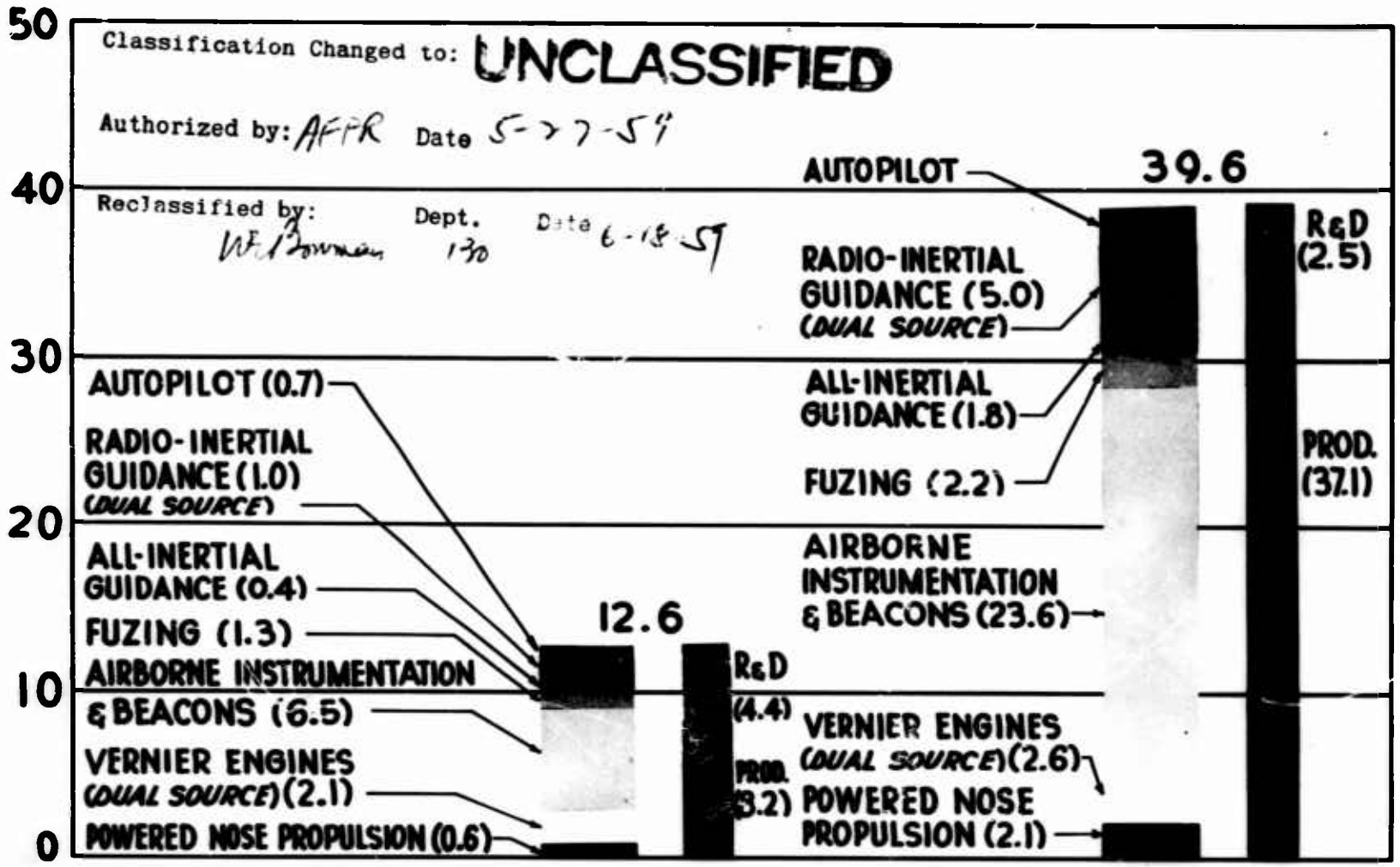
FUNDING - CONVAIR



ESTIMATED TOTAL COST THRU 1960 - $629 MILLION

JULY 1954

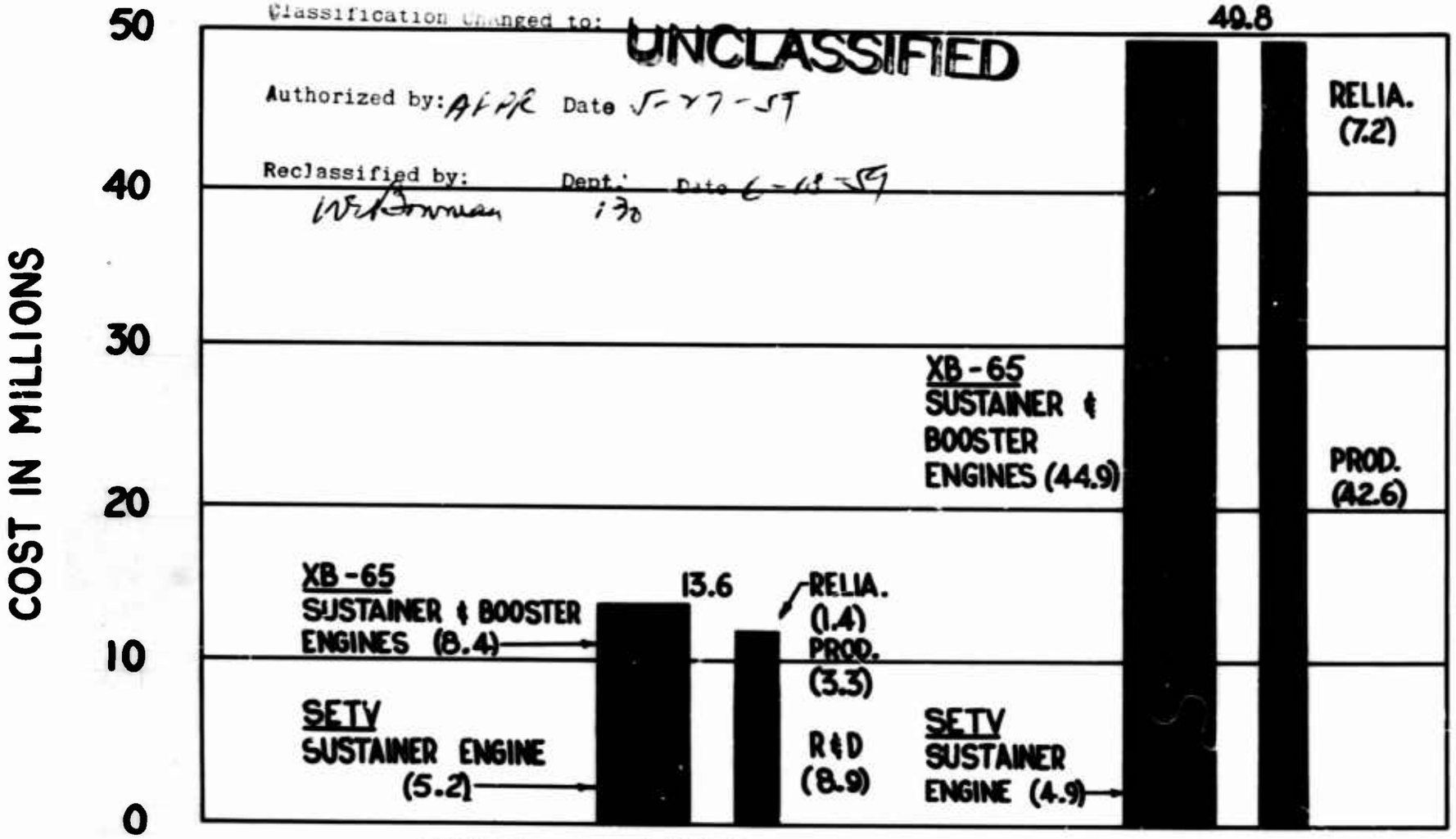
FUNDING - SUBCONTRACT



ESTIMATED TOTAL COST THRU 1960 - $403 MILLION

JULY 1959

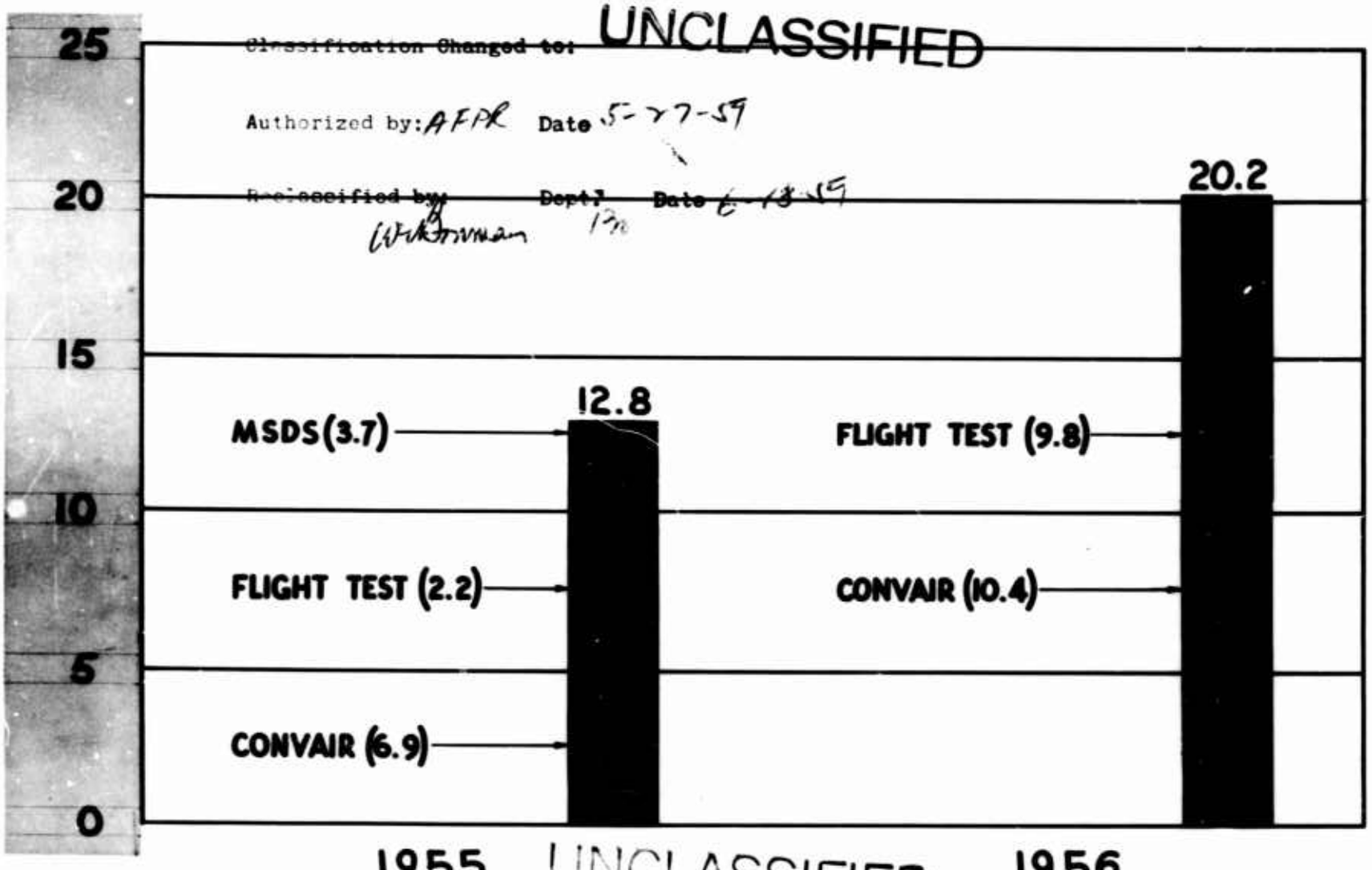
FUNDING - PRIMARY PROPULSION (SINGLE SOURCE)



ESTIMATED TOTAL COST [illegible] $540 MILLION

JULY 1954

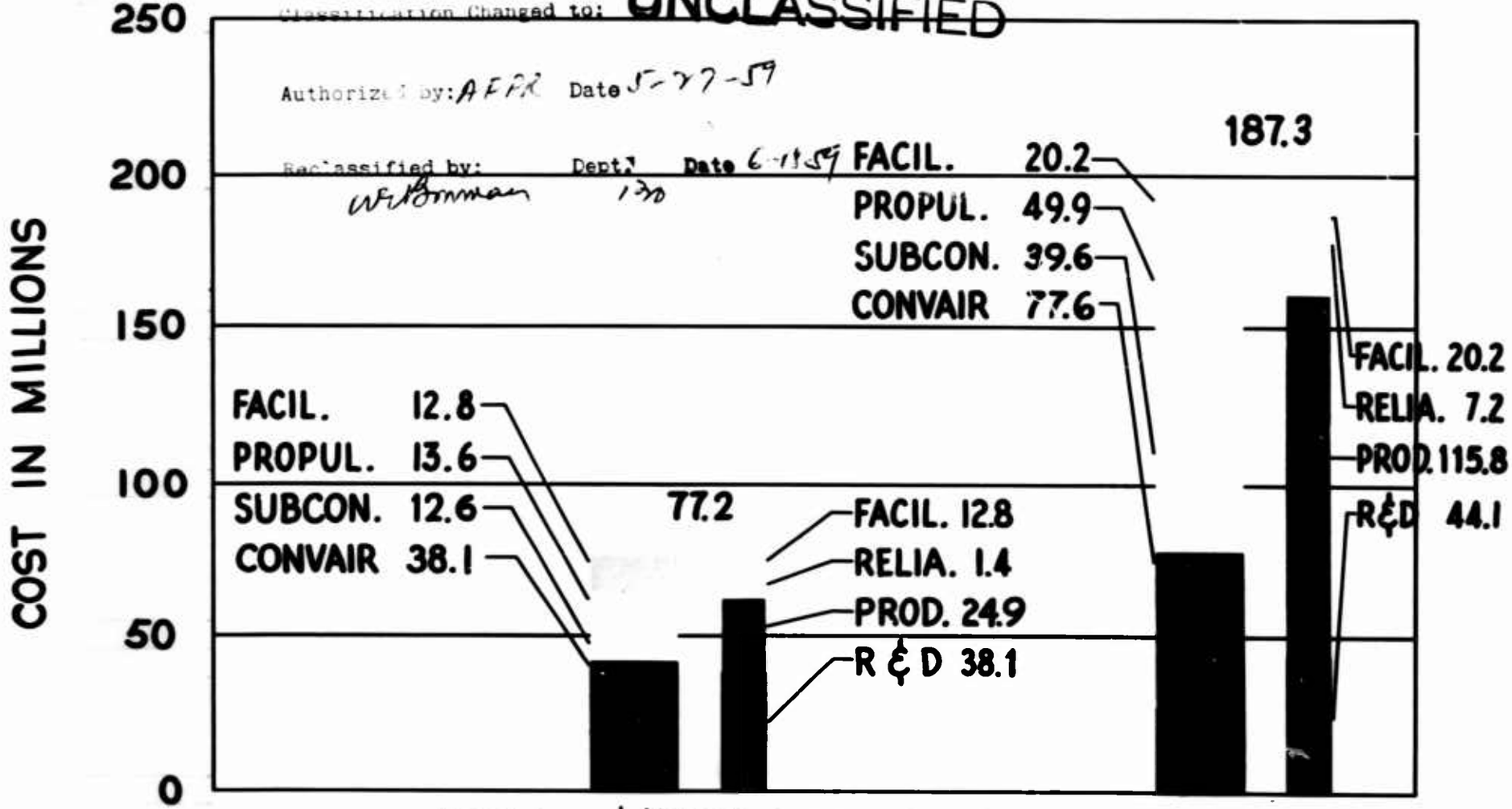
FUNDING - FACILITIES



ESTIMATED TOTAL COST THRU 1960 — $35.2 MILLION

JULY 1954

TOTAL FUNDING - SINGLE SOURCE



ESTIMATED TOTAL COST THRU 1960 = $1,607 MILLION

FIGURES DO NOT INCLUDE FEE

JULY 1954

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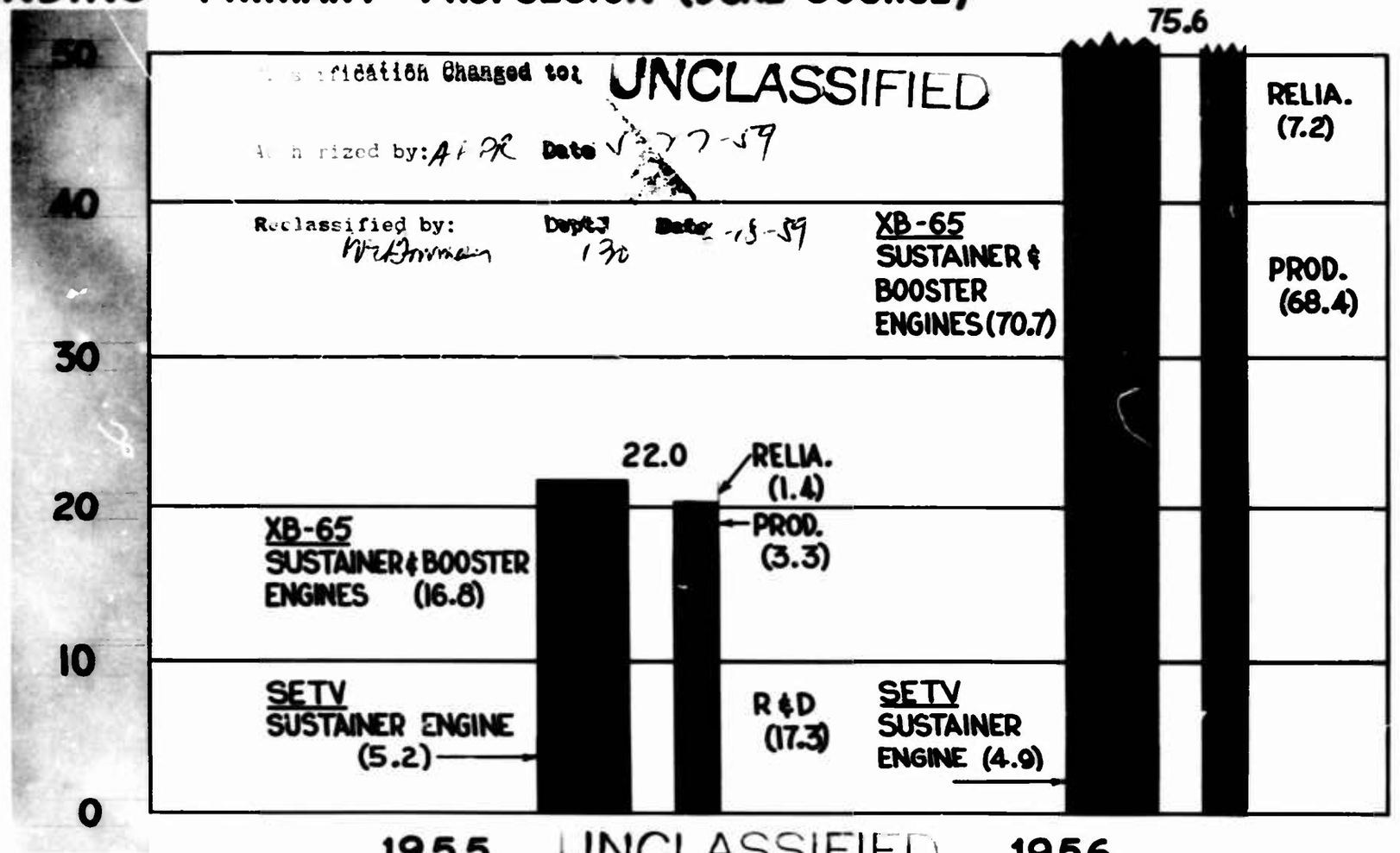
FUNDING - PRIMARY PROPULSION (DUAL SOURCE)



UNCLASSIFIED

ESTIMATED TOTAL COST THRU 1960 $625 MILLION

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JULY 1954

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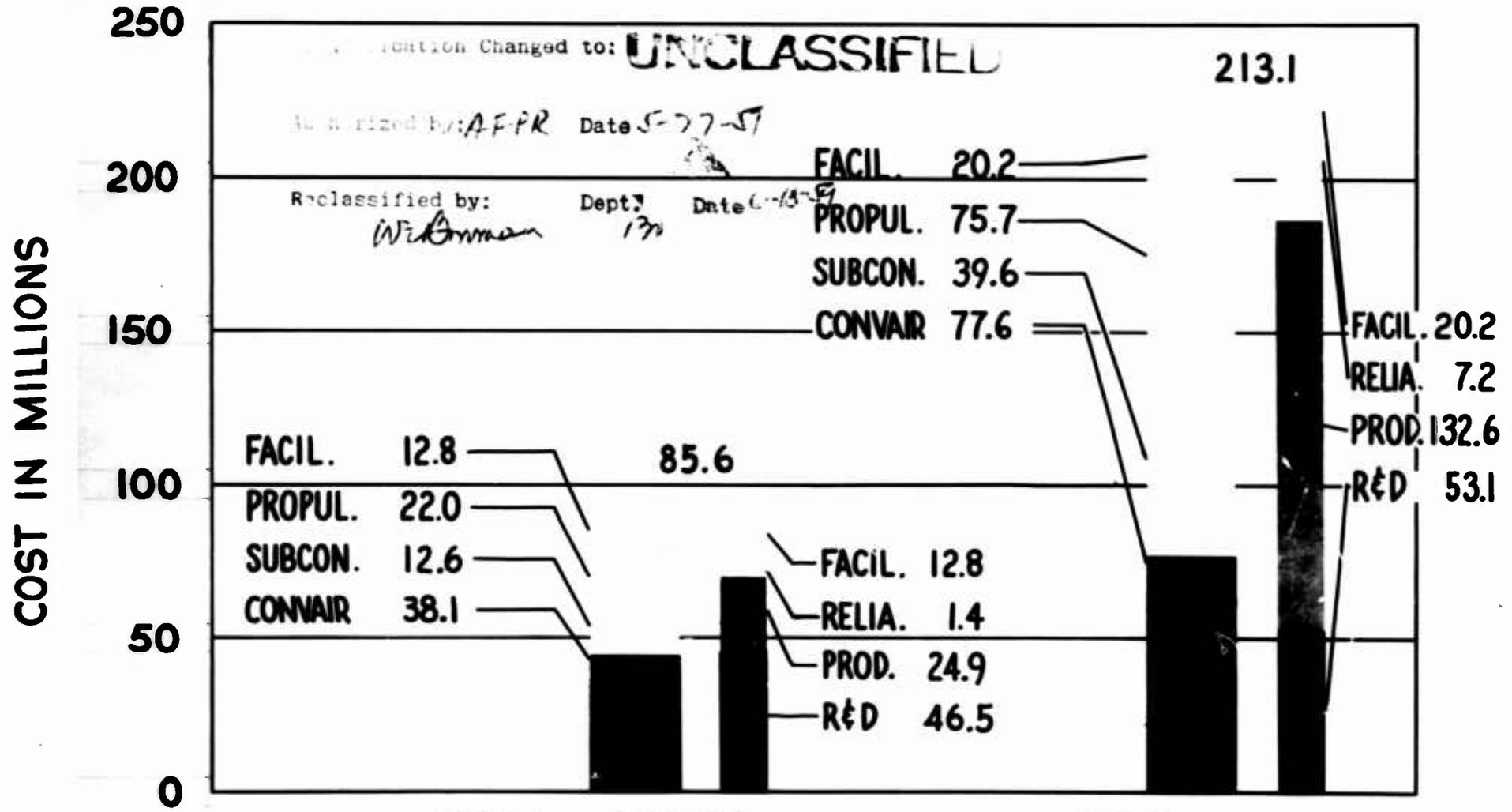
TOTAL FUNDING (DUAL SOURCE)



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ESTIMATED TOTAL COST THRU 1960 - $1,697 MILLION

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FIGURES DO NOT INCLUDE FEE

JULY 1954

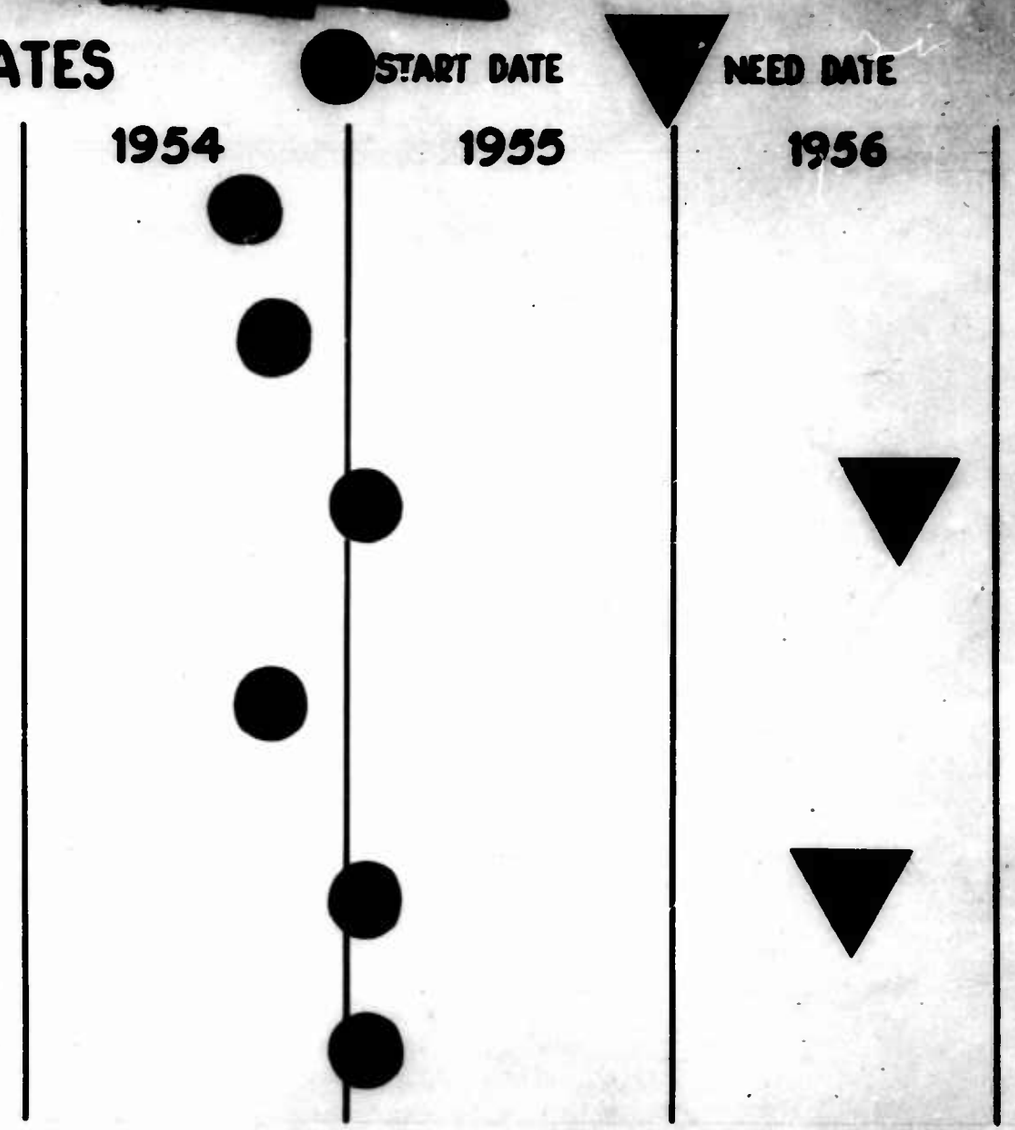
[redacted]

ESTIMATED DECISION DATES

The decision dates shown here have been assumed as the basis for the schedule, beyond which delays would result in the proposed schedule. If facilities funding and construction can be gotten by the Air Force prior to January 1955, a schedule improvement could be made accordingly.

[redacted]

ESTIMATED DECISION DATES



JULY 1954

[redacted]

CONTRACT CHANGES

Initial changes to the current Convair contract required to accomplish the program outlined herein are shown here. (Convair has received teletype authorization for Items I through III as of 11 August 1954, including acceleration of the X-11 at the maximum effective rate.)

[redacted]

CONTRACT CHANGES

I RE-DEFINE SINGLE ENGINE TEST VEHICLE (*present X-11*).

II DELETE X-12 (*Three-engine test vehicle*).

III RE-STATE WEAPON SYSTEM REQUIREMENTS.

IV ESTABLISH SCHEDULE REQUIREMENTS.

V PROVIDE FUNDING TO SCHEDULE REQUIREMENTS.