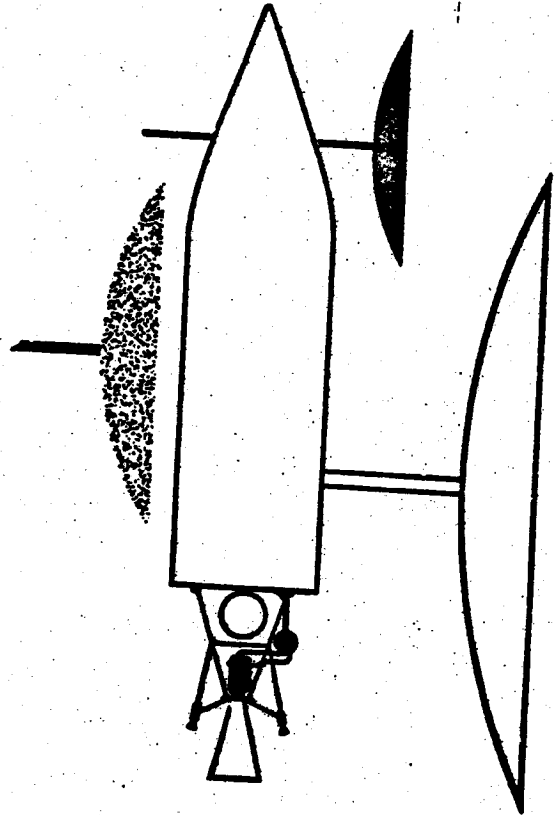


CONFIDENTIAL

LMSC LIBRARY INVENTORY - PALO ALTO
Return to LMSC Library. Do not destroy
or transmit to another person or office.

MSD 1536
1 MARCH 1956
COPY NO. E-50
57 SHEETS

DOWNGRADED AT 12 YEAR INTERVALS;
NOT AUTOMATICALLY DECLASSIFIED
DOD DIR 5200.10



*Pied
Piper*
**DEVELOPMENT
PLAN**

VOL. II SUB-SYSTEM PLAN
L. Ground Support and
Test Instrumentation

~~In addition to security requirements which must
be met, this document is subject to special export
controls which restrict its release to foreign governments
and other nationals only by the authority with prior
approval of the Department of State.~~

LOCKHEED AIRCRAFT CORPORATION
MISSILE SYSTEMS DIVISION
VAN NUYS, CALIFORNIA

CONFIDENTIAL

~~CONFIDENTIAL~~
SECRET

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 & 794. ITS TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

MILRE SYSTEMS DIVISION

~~CONFIDENTIAL~~

AIRCRAFT CORPORATION

~~SECRET~~

MSD 1536

FOREWORD

The Advanced Reconnaissance System (ARS) consists of a satellite vehicle containing equipment to perform visual, ferret, and infrared reconnaissance, together with the necessary system of ground stations and data processing centers.

This Development Plan for the accomplishment of the ARS was prepared by the Missile Systems Division, Lockheed Aircraft Corporation and its subcontractors, CBS Laboratories and Eastman Kodak Company. The specifications for the system were determined in the course of a one-year study now being conducted for the United States Air Force under contract AF 33(616)-3105. The plan is presented in two parts; Volume I, System Plan, and Volume II, Subsystem Plan. The subsystems are described in separate books, Volume II-A through II-L.

MISSILE SYSTEMS DIVISION

~~SECRET~~

LOCKHEED AIRCRAFT CORPORATION

~~SECRET~~

MSD 1536

PIED PIPER DEVELOPMENT PLAN

VOLUME I. SYSTEM PLAN

VOLUME II. SUBSYSTEM PLAN

- A. Airframe
- B. Propulsion
- C. Auxiliary Power
- D. Guidance and Control
- E. Visual Reconnaissance
- F. Electronic Reconnaissance
- G. Infrared Reconnaissance
- H. Vehicle Electronics
- I. Airborne Test Systems
- J. Vehicle Intercept and Control Ground Station
- K. Ground Data Processing
- L. Vehicle Ground Support

MISSILE SYSTEMS DIVISION

~~SECRET~~

LOCKHEED AIRCRAFT CORPORATION

CONTENTS

Subsystem L-Vehicle Ground Support

RDB PROJECT CARD (Form DD 613)

Tab 1 General Design Specifications

Tab 2 Subsystem Summaries

Milestones

Hardware Delivery

Test Schedules

R and D Schedules

Tab 3 R and D Tests (Form ARDC 105)

Tab 4 R and D Test Aircraft (Form ARDC 106)

Tab 5 R and D Materiel (Form ARDC 107)

Tab 6 Required Facilities

Tab 7 R and D Contract Funds

Tab 8 Estimate of Manpower Requirements

APPENDIX

1. In-Plant Facility Survey

2. Test Instrumentation (Ground Support)

3. Development and Check-out at System Test Facility

4. AFMTC - Facilities, Support and Equipment Requirements

5. Facilities

1. PROJECT TITLE VEHICLE GROUND SUPPORT SUBSYSTEM FOR ADVANCED RECONNAISSANCE SYSTEM (Uncl) (Pied Piper)	2. SECURITY OF PROJECT Secret	3. PROJECT NUMBER 1115
	4.	5. REPORT DATE 1 March 1956

21 a. Summary of Operational Scheme

The ultimate attainment of a facility, with supporting equipment, which insures an acceptable logistics plan and provides methodical assembly, pre-launch checkout, handling and erecting the ARS booster-vehicle combination on the firing pad is the primary objective of this subsystem.

Prior to the acceptance of a final scheme many preliminary steps must be analyzed and either accepted, modified, or discarded. The step-by-step analysis commences with the first fabrication of a flight hardware article and continues through flight test to data processing and assimilation. First fabrication of flight hardware assumes that component testing and evaluation has been accomplished in order to select and modify components and to insure their reliability. For the most part component testing and evaluation will occur at "in-plant" test facilities. These test facilities are various laboratories devoted to testing such elements as telemetry, transducers, electronics, gyros, controls and computers.

Fabrication and assembly facilities present no unusual requirements that need be detailed herein, since vehicles will be transported fully assembled to the various sites.

A System Test Facility will be required for complete vehicle systems tests under hot run conditions. This facility will also provide for separate sustainer and control engine tests along with auxiliary power units and other hazardous components testing which cannot be performed at the "in-plant" site.

For the initial flight test programs a complete test base will be required at AFMTC, at Cape Canaveral, Florida. Test programs that will be conducted at this facility include the system test vehicle (STV), the orbital test vehicle (OTV), the nonorbiting vehicle (NOFV), and payload test vehicle (PTV).

The requirements for launching of operational test vehicles dictate the need for an alternate launching site, separate from AFMTC. Consideration has been given to the west coast and the Pacific area (Hawaiian Islands). Since the logistic problems for the island site are not much more difficult than for an isolated continental site, and because a data processing and an intercept station are both planned for the Hawaiian Islands, this location was used in analyzing a typical alternate site.

1. PROJECT TITLE VEHICLE GROUND SUPPORT SUBSYSTEM FOR ADVANCED RECONNAISSANCE SYSTEM (Uncl) (Pied Piper)	2. SECURITY OF PROJECT Secret	3. PROJECT NUMBER 1115
	4.	5. REPORT DATE 1 March 1956

21 b. Approach

The approach to satisfying the ground support requirements will begin by indoctrinating personnel assigned to duty at the facilities. This will be accomplished by integrating these personnel in the design fabrication and liaison groups in their particular fields to acquaint them with fundamental problems likely to occur in the field. They will be phased into the proper facilities as their services are needed.

21 c. Follows on p 4

1. PROJECT TITLE VEHICLE GROUND SUPPORT SUBSYSTEM FOR ADVANCED RECONNAISSANCE SYSTEM (Uncl) (Pied Piper)	2. SECURITY OF PROJECT Secret	3. PROJECT NUMBER 1115
	4.	5. REPORT DATE 1 March 1956

21 c. Subsystem Tasks

1. a. In Plant Facilities

b. Contractor: Lockheed Aircraft Corporation, Missile Systems Division.

c. Research, development and engineering tests for design and evaluation will be the responsibilities of the various departments assigned subsystem and systems tasks. Existing test equipment will be expanded and supplemented by the addition of considerable specialized equipment.

The normal facility expansion will include electronic, telemetry, gyro simulators, propulsion components, structures, materials, environmental and control test equipment. The requirements for specialized facilities include gyro environment tables, rapid altitude chambers, electronic system checkout consoles, hazardous fuel chemistry and material testing, and life test equipment. The basic philosophy of all in-plant facilities is to provide services to duplicate within reason "in-flight" conditions on the ground.

2. a. System Test Facility

b. Contractor: Lockheed Aircraft Corporation, Missile Systems Division.

c. The facility for supporting tests of the propulsion system, vehicle system and hazardous components is to be isolated from the general manufacturing and office areas in the interest of safety. This facility is to be divided into three sections, one for vehicle and propulsion, one for components and hazard, and a central instrumentation data acceptance office.

Basic vehicle system, propulsion system and full environmental (altitude, etc.) testing will be centered around a single control building. Provision for control booths, offices, shops and local fuel support control will be in this building. Four pads are planned in this area to be operated as desired. There will be two for vehicle testing and calibration, one for environmental, and one for system investigation.

The component and hazard area is to be devoted to testing materials, auxiliary power units in suitable altitude chambers, components, pneumatic devices under radiation and similar conditions. The general arrangement again is to be based upon a single

1. PROJECT TITLE VEHICLE GROUND SUPPORT SUBSYSTEM FOR ADVANCED RECONNAISSANCE SYSTEM (Uncl) (Pied Piper)	2. SECURITY OF PROJECT Secret	3. PROJECT NUMBER 1115
	4.	5. REPORT DATE 1 March 1956

control building housing control booths, cells, shop and office area. The fuel support for the two areas will be designed to properly contain any fire and to suppress all toxic vapors and waste by filtration..

The central instrumentation and data facility will handle all information from the various areas. Multiple quick-look, control data recorders, "go no-go" inspection control and tape recorders will be provided. The existing computers will be utilized for reduction and analysis.

A change to dangerous propellants will possibly require relocation at a remote site.

3. a. AFMTC

b. Contractor: Lockheed Aircraft Corporation, Missile Systems Division and Government Furnished Equipment.

c. The initial flight program of the System Test Vehicle, Orbital Test Vehicle and the Payload Test Vehicle will be activated at AFMTC, Florida. Facilities required for this program are independent of existing X-17 Facilities. One-half of a Missile Assembly Building, approximately 16,238 sq. ft., is required for assembly and checkout of all three vehicles.

Launching Support for the STVs will be on a joint use basis with the X-17 program. Specifically, common use of the pad, blockhouse and modified firing console is intended. Launching support for the OTVs and PTVs will require use of a WS-107 launch pad and blockhouse for independent checkout. Joint use of a WS-107 pad and blockhouse with Convair crews to accomplish mating with the booster and final checkout will also be required.

With the addition of supplementary equipment to the X-17 ground station and mobile checkout consoles, it will be possible to use this gear commonly for both programs. Special checkout equipment for major subsystems will be required for checkout and secondary subsystem modification. Ground handling equipment in general will duplicate that used on the X-17 project because of simultaneous schedules.

4. a. Alternate Launching Site

b. Contractor: Lockheed Aircraft Corporation, Missile Systems Division.

<p>1. PROJECT TITLE</p> <p>VEHICLE GROUND SUPPORT SUBSYSTEM FOR ADVANCED RECONNAISSANCE SYSTEM (Uncl) (Pied Piper)</p>	<p>2. SECURITY OF PROJECT</p> <p>Secret</p>	<p>3. PROJECT NUMBER</p> <p>1115</p>
		<p>5. REPORT DATE</p> <p>1 March 1956</p>

c. Basically, the alternate site will be another Cape Canaveral with the supporting features of Patrick Air Force Base incorporated. The major difference is the emphasis on data acquisition and reduction as opposed to in-flight tracking.

To support the eighty personnel required in the test operations, it is estimated an additional 750 people will be required for program support at the alternate site. The site should include two launching pads and blockhouses, data and telemetering building, assembly building, control equipment, electronic equipment, liquid oxygen plant, fuel and oxygen storage, generator plant, complete internal communication, outside communication, tracking support, range safety, housing, ground equipment, air conditioning of critical areas, air-strip logistics support, transportation and special electronic, radar and nuclear equipment.

5. a. Vehicle Intercept, Control and Data Stations

b. Contractor: Lockheed Aircraft Corporation, Missile Systems Division and Government Furnished Equipment.

c. Initial plans and considerations have been formulated on the premise that facilities will be required at three different locations for intercept, control and data processing for the ARS. Locations that provide maximum intercept capabilities of the vehicle are of primary consideration. As a result of studies conducted in this regard and described in detail in the second Pied Piper Quarterly Progress Report, locations have been tentatively selected for installation on the East Coast, West Coast and in the Hawaiian Islands. The requirements for equipment and instrumentation for these stations are discussed under Subsystem J, Vehicle Intercept and Control, Ground Station and Subsystem K, Ground Data Processing.

6. a. Advanced Reconnaissance System Intelligence Center

b. Contractor: Lockheed Aircraft Corp., Missile Systems Division
Eastman Kodak Company
CBS Laboratories
GFF

c. Tentative requirements for a central data assimilation center are presented in the volume describing Subsystem K, Ground Data Processing. In general, it is expected that the facilities will be operated by contractor personnel in order to provide a stable organizational structure. Location of the facility has not been

1. PROJECT TITLE VEHICLE GROUND SUPPORT SUBSYSTEM FOR ADVANCED RECONNAISSANCE SYSTEM (Uncl) (Pied Piper)	2. SECURITY OF PROJECT Secret	3. PROJECT NUMBER 1115
	4.	5. REPORT DATE 1 March 1956

suggested in the requirements; however, it should be where transportation for both military and contractor personnel is readily available. This includes an airstrip for all types of military aircraft. The site should also be easily accessible to top level military strategists. The vicinity of Washington, D.C. would satisfy these requirements.

Equipment and instrumentation required for the Intelligence Center will, for the most part, be fabricated by the Lockheed Aircraft Corporation, Missile Systems Division, the Eastman Kodak Company and the CBS Laboratories.

This task encompasses the obvious aspects of real estate acquisition as well as design, construction and installation of building facilities. Shops for general maintenance and repair will be included. Additional instrument shops and electronic laboratories will provide for the installation and maintenance of the components of the center.

7. a. Personnel Protection and Material Safety

b. Contractor: Lockheed Aircraft Corp., Missile Systems Division.

c. Consideration has been given to personnel protection and material safety in planning of all facilities, handling and test equipment. Protection of operational personnel through use of protective clothing and sprays, and provision of escape areas is a standard practice used in the propulsion and chemical industries. Protection of "nearby" personnel and work areas will be by filtration (modification of vapors to secondary products) of vapors and deep sea disposal of waste liquids and solids.

Other buildup and operational personnel will be shielded against blast, noise and vibration by the latest design techniques developed by the propulsion industry. Ground vibrations are of low magnitude and are not considered a serious problem.

<p>1. PROJECT TITLE</p> <p>VEHICLE GROUND SUPPORT SUBSYSTEM FOR ADVANCED RECONNAISSANCE SYSTEM (Uncl) (Pied Piper)</p>	<p>2. SECURITY OF PROJECT</p> <p>Secret</p>	<p>3. PROJECT NUMBER</p> <p>1115</p>
		<p>4. REPORT DATE</p> <p>1 March 1956</p>

21 d. Other Information

Detailed requirements of base support and equipment requirements are presented in the appendix to this subsystem. Many of the support services required for the vehicle ground support program currently exist at AFMTC. Those not currently in use are contained in the AFMTC development plan for support of the ICBM program. These support services will be employed to the fullest extent in the ARS program and only specific items not currently planned for at AFMTC will be delineated in the support requirements detailed in the following tabs.

21 e. Background History

The requirements that have originated specifically for ARS ground support can be traced in part to the effort of LMSD in establishing the X-17 (RTV) as a forerunner of the WS107A (ICBM) at AFMTC. Many deficiencies in the operation of the range have been uncovered and in the interest of expediting the development of a satellite vehicle continued surveillance of the base operations must be critically examined to furnish procedures and data required to establish an alternate launch facility.

21 f. Future Plans

The ARS ground support subsystem will adequately comply with the requirements that have been dictated in an effort to permit the achievement of orbital capabilities with maximum reconnaissance utility. Since the booster for this system is the initial stages of the WS-107 A program the flight article the support plan will adhere as closely as possible to the WS 107 A system. Future plans will emphasize the compatible design and construction of handling equipment and other base and range support equipment so long as orbital and reconnaissance capability can be demonstrated.

21 g. References

1. Lockheed X-17 Facilities Requirement Report, MSD 1075
2. Ramo-Wooldridge - Collection of WS 107 A program technical data, submitted to Pied Piper Phase I Contractors January 3, 1956
3. Lockheed First Quarterly Progress Report, MSD 1363, Sections 5.3, 5.4, 5.5.
4. AFMTC Operations Directive, 11-55.

SECRET

*Pied
Piper*

MSD 1536

LOCKHEED AIRCRAFT CORPORATION
MISSILE SYSTEMS DIVISION

TABS

SECRET

~~SECRET~~

MEID 1536

Subsystem L - VEHICLE GROUND SUPPORT

Tab 1 - General Design Specifications

I. GENERAL

A. Statement of the Problem

The problem of this subsystem is to provide plans, designs and schemes for facilities, ground handling, test equipment and general support of the Advanced Reconnaissance System.

B. Approach

Preliminary studies have been made in order to evaluate the total problems that will be encountered in establishing a suitable vehicle fabrication schedule to match testing and flight schedules. In addition, consideration has been given to component evaluation tests at in-plant laboratories before components are approved for subsystem use and subsequent subsystem prototype installation.

An evaluation has been made of the preliminary requirements for the Systems Test Facility which will be primarily concerned with testing of liquid propellant engines, propulsion system, complete vehicle systems during hot firing runs, complete vehicle systems in radiation environments, and other hazardous components.

The present X-17 facility at AFMTC has been critically examined in an effort to provide a well organized scheme of operation for the support of the Advanced Reconnaissance System and to insure that the operation will integrate easily and remain compatible with the WS 107A operation.

Consideration has been given to the problems that will be encountered in establishing an ultimate launching facility which for purposes of discussion appears to have requirements for launching and tracking similar to the current facility at AFMTC although functional support will not be as elaborate.

The tentative requirements for establishing three vehicle intercept and control stations which will serve also as data processing stations have been established.

L-Tab 1, p 1

MISSILE SYSTEMS DIVISION

~~SECRET~~

LOCKHEED AIRCRAFT CORPORATION

In addition a study has been made to plan for a central intelligence center which will serve as the focus for data interpretation, data analysis, and data display. Problems of manning the data stations and intelligence center have been considered and discussed in detail in Subsystem K - Ground Data Processing and Subsystem N - Intelligence Operational Training.

C. Solution or Recommendations

Since in-plant facilities of the vehicle ground support subsystem involve the design of many different units of test, check-out, handling and processing equipment and since much of this equipment is standard laboratory equipment or handling equipment as used on other current programs no effort has been made to present general design specifications of the units. Equipment lists and facility requirements have been delineated in the following tabs.

The principal ground handling units will be similar to those used on the X-17 (RTV) program which were previously presented and discussed in the first Pied Piper Quarterly Progress Report - Volume IV.

Re-evaluation of the vehicle logistic flow scheme has been made and is presented in Fig. 1.

A proposed manufacturing schedule for vehicle hardware fabrication is presented in Fig. 2. The necessity of providing System Test Vehicles (STV) for component flight test during the period from October 1956 to December 1957 indicates immediate action in the hardware fabrication phase. Since the first units of the STV will be unseparable units of simple construction it appears that the units can be constructed in approximately one month.

Preliminary engineering drawings will be available at the date of receipt of contract for the STV units. The modification to the RTV- sergeant booster will be only an increase in fin size, however, it will not be necessary to accomplish this task for STV #1 through STV #4 because ballast will be added to simulate weight for the satellite nose configuration. Little tooling beyond the present RTV tooling will be necessary because of the simplicity of construction. Fabrication of the telemetry package will be available immediately. Fabrication of the electrical and electronic components can commence immediately and will be more or less identical to the scheme used presently in construction of RTV components.

L-Tab 1, p 2

~~SECRET~~

MSD 1536

The plans for the fabrication of other vehicles which include "dog birds", captive test vehicles, Non-Orbiting Test Vehicles (NOTV), Orbital Test Vehicles (OTV), Payload Test Vehicles (PTV) and Operational Vehicles (OPV) use existing facilities available to Lockheed with some expansion regarding equipment and testing.

A survey was conducted by the manufacturing branch to ascertain the capabilities in the event a contract was awarded this facility. Detailed information is presented in Appendix L.

AFMFC FACILITY. Consideration has been given to the handling of the vehicle with regards to assembly on the Atlas booster. Although little detail concerning the type of equipment which is to be supplied at the Atlas launching pads has been supplied by the Air Force for study, preliminary design of the vehicle places emphasis on using cranes and hoisting gear similar to that which will be used for handling and assembly of the Atlas warhead. If the more advanced vehicles require additional clearance of the Atlas gantry equipment, it appears that a modification to the equipment can be made as the subsequent pads are built. It appears also that the early vehicles, at least through Program III of the ARS, will not require such a modification to the gantry equipment but will involve only modifications to electrical and electronic wiring and equipment.

A critical examination will be made of the Atlas ground handling and launcher design to provide a foundation for design optimization with the ARS vehicle. This design will be evolved at a later date for inclusion at the Alternate Launch Facility.

L-Tab 1, p 3

MISSILE SYSTEMS DIVISION

~~SECRET~~

LOCKHEED AIRCRAFT CORPORATION

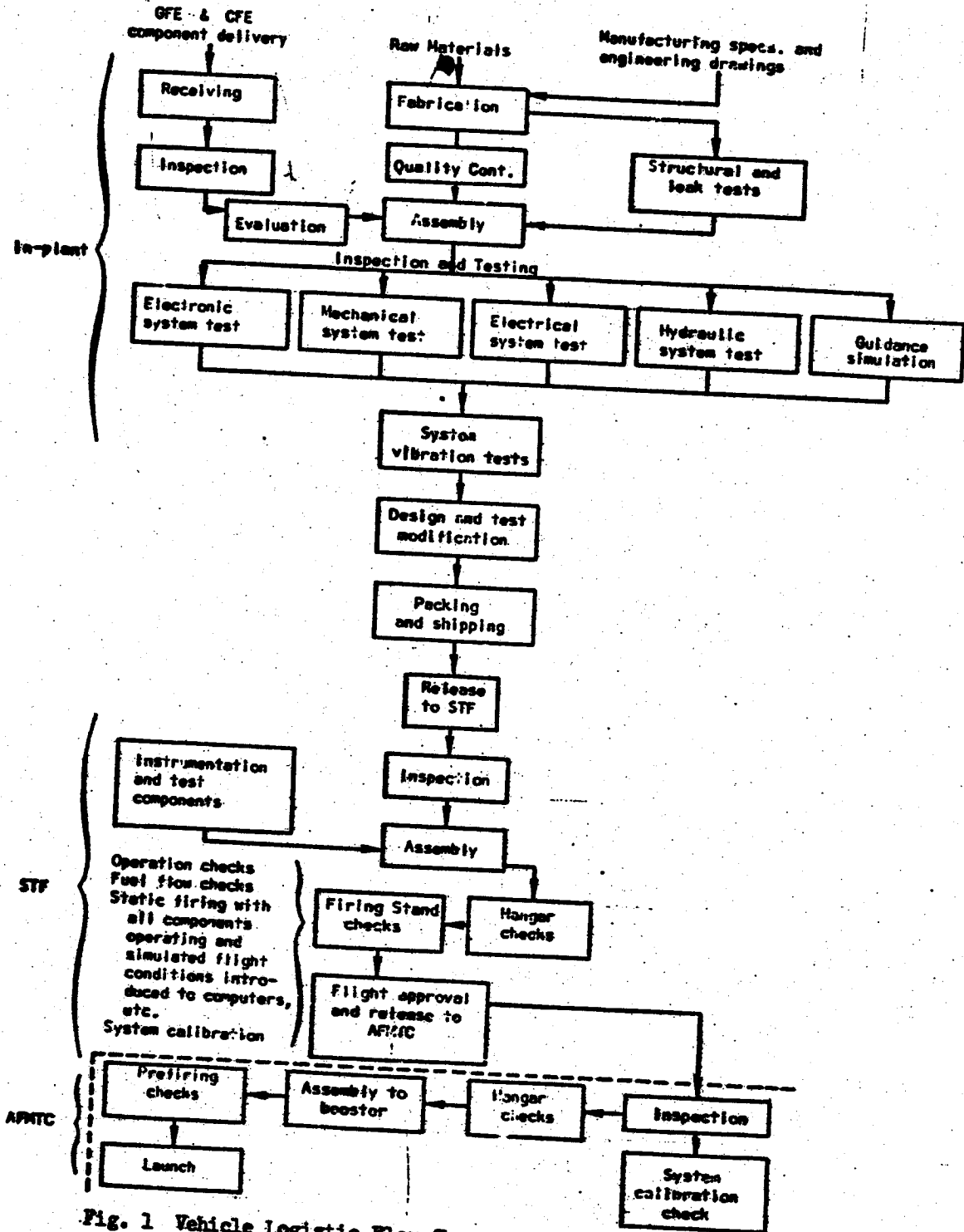


Fig. 1 Vehicle Logistic Flow Chart