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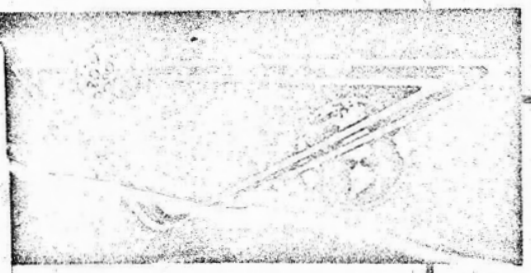

APOLLO

SUPPORT PROGRAM

PHASE 1

APOLLO TERMINOLOGY STANDARDS FINAL STUDY REPORT

Contract NASw - 410

31 AUGUST 1962

GENERAL ELECTRIC

NASw-410-20-13-1

APOLLO

Support Program

PHASE 1
APOLLO TERMINOLOGY STANDARDS
FINAL STUDY REPORT

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Contract NASw-410

31 August 1962

Defense Systems Department

General Electric Company

Syracuse, New York

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ABSTRACT

This report concludes the Phase 1 study activities on the requirements for terminology standardization of the Apollo Integration Support Program.

A review is made of the studies conducted and the findings resulting from these activities. Conclusions are drawn and recommendations are made for a proposed Apollo Terminology Handbook.

An implementation plan for producing and maintaining an Apollo Terminology Handbook is included. A sample of such a terminology handbook is produced as Part 2 of this report.

Author

SUMMARY

This study concluded that a need exists for an Apollo Terminology Handbook which would consist of an alphabetical listing of words, terms and phrases applicable to the Apollo Program. A sample terminology handbook is included as Part 2 of this report.

The study consisted of a literature survey; a series of interviews and discussions concerning terminology requirements within NASA organizations; a review of methods for the rapid production, revision, and handling of a terminology document. Section 3 also includes an analysis of the findings resulting from this study.

The proposed implementation plan is given in Section 4 and the schedules are presented in Section 5.

Appendix A is a numerical listing of the terminology references used to obtain the sample terminology handbook. These references are categorized by source in Appendix B.

The basic philosophy behind the study was similar to that contained in Appendix C.

Part 2, the sample terminology handbook, concludes the report.

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PART 1
TERMINOLOGY STUDY

SECTION 1
INTRODUCTION AND OBJECTIVES

Effective and accurate communications between people is an age-old problem that continues to grow more severe as technology advances and the activities in which mankind participates become ever more complex. This is particularly true in the scientific fields of endeavor where many accomplishments now result from large coordinated programs involving many thousands of people who represent diverse interests and technologies. Since a person's vocabulary is accumulated throughout his lifetime and is the result of his education, interests, experience, and environment, people differ in their understandings of words and expressions. When misunderstandings between people cause them to take actions which are at cross-purposes, a serious handicap to progress develops. Conversely, a smooth flow of communications will maximize the efficiency of an operation.

With these thoughts in mind, the objective of this study was to determine whether there was a need for a program designed to improve communications among Apollo participants, and to develop and recommend for implementation such a program if it was concluded that the need truly did exist. To accomplish this objective, it was found necessary to rely heavily on past experiences of people who worked either on the preparation of aerospace dictionaries and glossaries or on the accomplishment of major space programs. The study approach, therefore, included literature surveys and personal interviews. Although time limitations of the study did not allow either of these activities to be pursued at length, information thus obtained dictated the formulation of a rather specific implementation plan.

The philosophy behind this study was closely allied to the philosophy contained in the Preface to the United States Air Force Dictionary excerpts of which appear in Appendix C of this report.

SECTION 2
CONCLUSIONS AND RECOMMENDATIONS

2.1 CONCLUSIONS

As a result of this study, it was concluded that a valuable service could be rendered to the Apollo Program by producing and maintaining a NASA Apollo Terminology Handbook. It was also concluded that the acceptance and full exploitation of such a handbook is dependent upon the adherance to several criteria regarding its preparation and use. These criteria are as follows:

a. The terminology handbook must truly identify, standardize, and record the language useful to the program without inventing a new and unused vocabulary.

b. The content of available aerospace dictionaries should not be duplicated in a general manner for the sake of completeness but should be used only when a specific purpose is served.

c. The definitions should be brief and concise as possible consistent with clarity. It is more important that they be useful than formal.

d. The policy regarding the use, approval, and revision of content and format should be established by OMSF as quickly as possible and made known to all program contributors.

e. The terminology handbook should be widely distributed among program participants consistent with reasonable cost. Like an ordinary dictionary, it will not be used unless it is in the office of the man who has a need for it.

2.2 RECOMMENDATIONS

The terminology handbook should consist of an alphabetical listing of words, terms and phrases and their definitions. Abbreviations and symbols, when available, should be included along with the applicable term rather than as a separate listing.

Diagrams and sketches should be used to supplement written definitions where such symbolic representation will more adequately define the term.

The following areas of interest should be investigated for terminology applicable to the Apollo Program:

a. Science and Technology, which includes the basic laws and technologies with which man must work, such as space environment, applied science, and engineering specialties and skills. Examples: solar radiation, life science, trajectory analysis, astronomy, propulsion, guidance, communications, aerodynamics, etc.

b. Program Management, including the planning, organizing, and executing of the effort required to accomplish the program's objectives. Examples: mission objectives, contract administration, documentation, scheduling, funding, integration, etc.

c. Equipment, which, in addition to flight hardware, includes all other hardware required by systems that support any phase of the mission. Examples: spacecraft, launch vehicle, ordnance tower, ground support equipment, life support system, deep space instrumentation facility, stage, module, etc.

Since the terminology handbook must obviously be a NASA document, NASA approval of all additions, corrections, and deletions must be obtained. It is recommended that the details of these procedures, as well as those of publication and distribution, be accomplished as presented in the Implementation Plan, Section 4 of this report.

It is further recommended that in addition to the basic terminology handbook mentioned above, a handbook of abbreviations for use in TWX communications be considered. Such a handbook would facilitate the reporting and interpretation of communications terminology and speed the flow of essential data. Consideration should also be given, as the need arises, to the development of specialized terminology handbooks produced for specific fields of interest. An example for instance would be an Apollo Reliability Terminology Handbook.

SECTION 3
STUDIES AND FINDINGS

3.1 LITERATURE SURVEY

Based on the assumption that much of the terminology applicable and useful to the Apollo Program has been recorded and is in many cases published, a cursory review of such literature has been made. The purpose of this review was to identify, and obtain if possible, any document that gave definitions that had significance in the Apollo Program. Although it was realized that many of the writings that contained aerospace vocabulary gave only clues as to how the language is best used without giving any definitions at all, it was nevertheless deemed necessary, during the study, to restrict the literature survey to documents that contained specific definitions of terms applicable to the Apollo Program. Documents uncovered in this search were categorized as:

a. Open literature.
b. Industrial documents.
c. Government publications.
d. Working papers and personal files.

3.1.1 OPEN LITERATURE

The open literature was a designation of anything published for use by the general public and available to anyone. This consisted mainly of books and periodicals issued by publishing houses. Most of these were encyclopedias, dictionaries, glossaries, handbooks, and technical magazines, and were quite general in nature.

3.1.2 INDUSTRIAL DOCUMENTS

This category included any paper, report, memo, or standard issued by members of the industrial community or associations or technical societies sponsored by industry.

3.1.3 GOVERNMENT PUBLICATIONS

This category included any publication issued by an agency or branch of the Government.

3.1.4 WORKING PAPERS AND PERSONAL FILES

This category included the large quantity of pertinent literature which had not been published. Because it was often preliminary in nature it required more careful review than published documents.

3.2 INTERVIEWS AND DISCUSSIONS

Many people participating in the Apollo Program are, of course, the same people who have participated in other major aerospace programs, and as such are in a position to apply these previous experiences in helping to satisfy the study objectives. During the study an attempt was made to establish communications and to interview these people on terminology matters. Initial discussions with Apollo participants revealed many questions requiring answers and many areas requiring intensive investigation. Unfortunately, the factual information relative to these questions on terminology are seldom documented and remain only as memories and opinions in the minds of men. The interview procedure is a good method of locating local efforts to identify and record applicable terminology. The following areas were investigated in this manner.

3.2.1 WITHIN THE GENERAL ELECTRIC COMPANY

The people most readily available to any individual for consultation are of course his associates. Although a person who consults only his associates is in danger of developing a distorted viewpoint, the danger of not taking full advantage of the background and knowledge of these associates may be just as great. In particular, it was observed that people in the General Electric Company working in various areas of the Apollo Support Program had an early opportunity to discover the many terminology requirements with which they were confronted as they gathered information for their study effort.

3.2.2 WITHIN NASA

NASA personnel, particularly at the centers, are in an excellent position to identify and evaluate terminology requirements of programs like Apollo. Results from interviews and discussions conducted at these centers are given in paragraphs 3.5.1 through 3.5.6.

3.2.3 WITH APOLLO CONTRACTORS

Because approval for visitations to Apollo Contractors was not forthcoming during this study, no attempt was made to interview and discuss terminology requirements in this area. These Contractors should be interviewed, however, at the earliest possible date so that their requirements can be satisfied.

3.3 METHODS OF PRODUCTION

Several methods of producing a document which must be continuously revised and updated rapidly were studied.

The production of the Apollo Terminology Handbook requires a system to integrate and film several thousand pieces of data. Each piece of data will contain:

a. The term to be defined.
b. A definition containing an average of 150-200 characters and an estimated maximum of 600 characters (see Figure 3-1).
c. An abbreviation, if required, and a symbol, if required.

It is desired that the system easily allow the addition of new data to facilitate revised printings. It may also be desired that the system be capable of automatically alphabetizing the data.

Two sequential listing systems were investigated with the purpose of satisfying the above requirements. They were:

a. The "Foto-List" system (Varityper Corp.) currently being used by the General Electric Company (HMED) to prepare the General Electric Syracuse area phone directory.
b. The "Listomatic" system (Recordak Corp.) which prepared and produced sample listings.

Both systems are identical in concept and function. Data is typed (or written) on tabulating cards, which are then processed through a high-speed camera. The output is a flim negative with all items listed thereon, in accordance with the pre-determined order of the cards. The negative is then used to make (offset) printing plates. Changes are accomplished by the preparation and insertion of cards into existing decks.

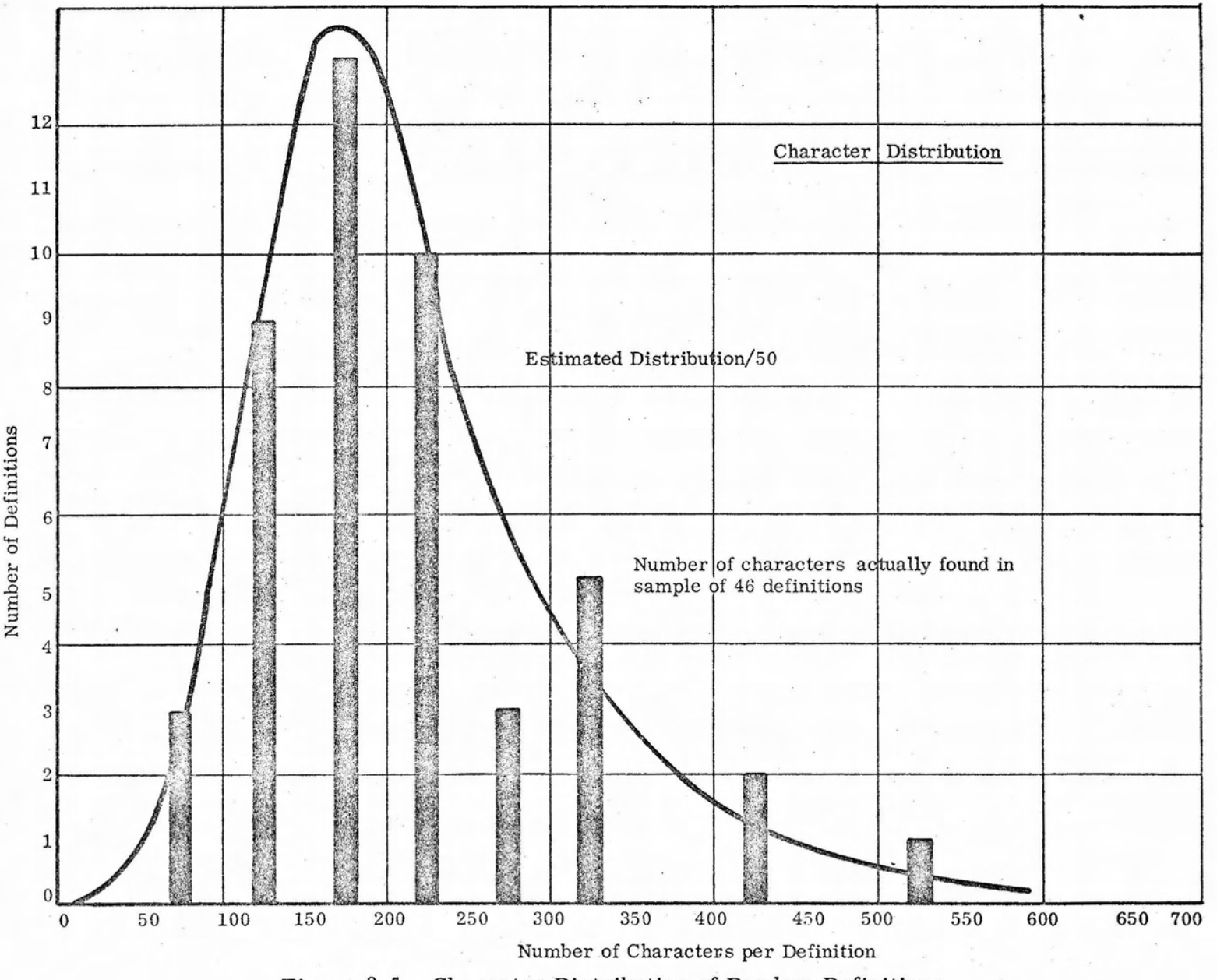


Figure 3-1. Character Distribution of Random Definitions

Using a veritype face (maximum of 22 characters per inch) the field will accommodate a maximum of six lines of 147 characters each. Using any of the suggested card formats illustrated in Figure 3-2, an adequate amount of spaces should be available for most definitions. In the event that a definition should exceed the limits of one card, a second card may be prepared and keyed to the first. Utilizing this system, listings that require multi-word descriptions may be efficiently processed and published.

The sample terminology listing contained in Part 2 of this report was not prepared utilizing either of these systems. A pilot run (Figure 3-3) of a few terms and definitions was made, however, and details of future use are covered under the Implementation Plan, Section 4.

3.4 STUDY FINDINGS

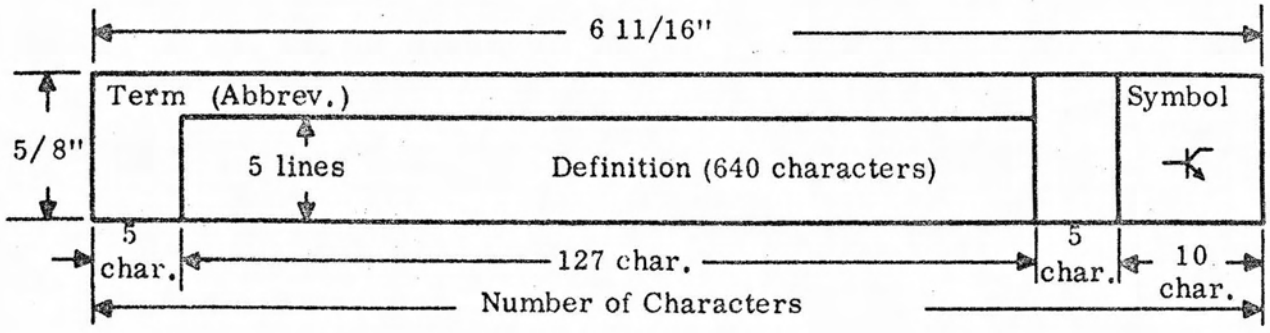
As a result of conducting this terminology study, several generalities about the subject became obvious. Everyone interviewed was in agreement that some degree of terminology standardization or clarification is desirable, but very few people felt that they could afford to devote any time to such an effort. Furthermore, many expressed pessimism about the probability of successfully identifying and recording any common language among large scattered groups of technical people. Despite these contradictions, the frequency with which small groups compile glossaries for their own purposes is an indication of the existing requirement for terminology standardization.

It was found that many general aerospace dictionaries, glossaries, and encyclopedias have been published. Although they undoubtedly serve well the purpose for which they were intended, the predominance of generic definitions (mostly of scientific terms not applicable to the Apollo Program) makes their use extremely limited.

Federal and Military standards and specifications are good sources for certain types of definitions, particularly those in the drawing and documentation areas of interest.

The technical magazines occasionally publish a special glossary section of aerospace terms. These should be reviewed for specific application and incorporated as required.

The greatest area requiring terminology standardization lies in the communications between NASA centers and Apollo Contractors and among Apollo Contractors. Apollo work statements contain an occasional definition, but none of those inspected to date have imposed any terminology requirements on the contractors.



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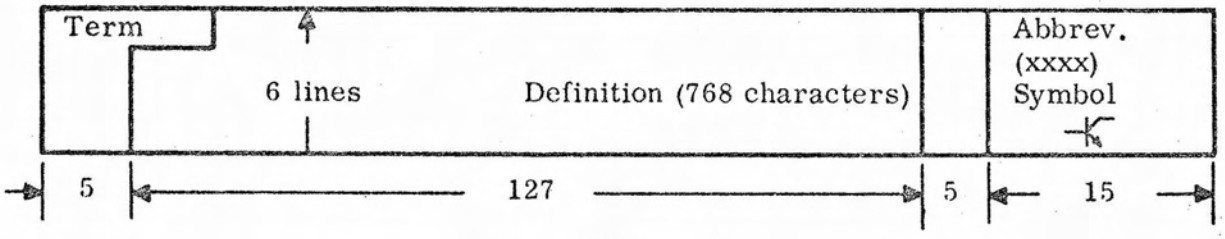

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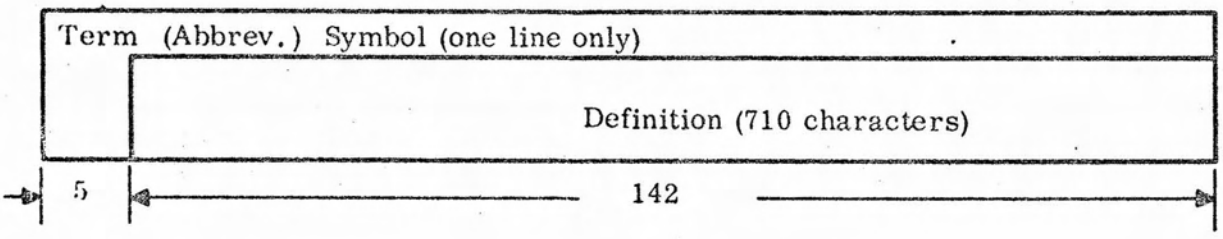
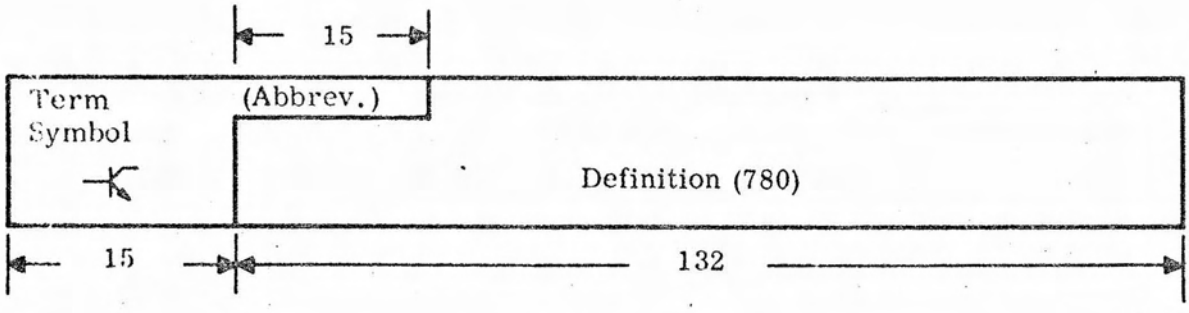


(c)



(d)

Figure 3-2. Suggested Card Formats

Acceptable Quality Level (AQL) A nominal value expressed in terms of percent defective or defects per hundred units specified for a given group of defects of a product.

Apollo Program The NASA Program responsible for establishing manned lunar landing. The Program scope includes supporting developments which are required to develop feasibility of operational and design concepts; some of which are rendezvous, mating and docking, lunar sample return, propulsion techniques, special studies and others.

Apollo Project The element of the Apollo Program as described when assigned to each sub unit of organization performing effort in the program as in the NASA centers or at the contractors.

assembly (assy) A number of parts or subassemblies or any combination thereof joined together to perform a specific function.

Associate Contractor The contractor who performs the (sub) system work excluded from the principal contract and under direct contract to NASA. The Associate Contractor is responsible to the principal Contractor for technical in egration of the (sub) system and must coordinate technical developments and requirements in a timely and organized manner.

Breadboard Model An assembly of preliminary circuits and parts to prove the feasibility of a device, circuits, equipment, system or principle in rough or breadboard form, without regard to the eventual overall design or form of parts.

Command Module The portion of the spacecraft which houses the crew, serves as the center for crew-initiated command functions and as the recoverable portion of the spacecraft.

component An article which is normally a combination of parts, sub-assemblies, or assemblies and is a self contained element of a complete operating equipment and performs a function necessary to the operation of that equipment.

contractor An individual, agency or organization which contracts to do work in accordance with a specification or work statement for any agency or branch of the United States Government.

critical defect A defect that judgment and experience indicate could result in hazardous or unsafe conditions for individuals using or maintaining the product.

Debugging A process of shakedown operation of each item of finished product which is performed prior to placing the item in use.

defect Any deviation of a product from specified requirements. A product may contain more than one defect.

down time Time during which equipments are not capable of doing useful work because of malfunction. This does not include preventive maintenance time.

flight reliability The probability that a flight will be successfully completed, given successful completion of countdown.

functional reliability The probability that a system will successfully complete the final checkout preparatory to launching, given that it was ready at demand.

Gemini Program A follow-on program to Mercury to develop orbital rendezvous techniques and advance manned spacecraft technology in support of the Apollo Program.

Gemini Project The element of the Gemini Program as described when assigned to each subunit of organization performing effort in the program as in the NASA center or at the contractors.

Ground Operational Support System (GOSS) All ground based world wide support stations which are required to provide tracking, communication, instrumentation, evaluation, data processing and direction for the space vehicle in all phases of the flight mission starting at launch.

Ground Support Equipment (GSE) All equipment necessary to support the operations of receiving, handling, assembly, test, checkout, and launch from the time of arrival of the space vehicle in the launch area to lift-off.

Ground Tracking and Communication Net That part of GOSS which furnishes the tracking and communication links required by a particular mission.

Human Engineering The application of scientific knowledge concerning human limitations and performance capabilities to the establishment of requirements for, and to the design, development, evaluation and utilization of all types of airborne and ground equipments and subsystems required for the accomplishment of the mission. The purpose of such application is: (1) to minimize demands upon human skill, training and manpower resources, and (2) to maximize the effectiveness of man-equipment combinations.

inspection The process of measuring, examining, testing, gaging or otherwise comparing the "unit of product" with the applicable requirements.

launch The period between start of countdown and post launch (lift-off).

Launch Control Center (LCC) Centralized overall control point for all phases of prelaunch and launch operations at the launch facility on a specific program. Handover of control to Mission Control Center occurs at separation of the space vehicle from all hard ground connections.

Figure 3-3. Sample Page "Foto-List" System

3.5 NASA CENTERS

Specific findings resulting from interviews and discussions at various NASA centers is contained in the following paragraphs.

3.5.1 NASA (OSTI)

The Special Publications Branch of the Office of Scientific and Technical Information is presently publishing a "Dictionary of Space Terms." (See Reference 6.) Inspection of an approval copy of this document leads to the conclusion that it will be one of the better aerospace dictionaries, but that it, too, will consist largely of generic definitions of scientific terms, and as such will complement but not substitute for the proposed Apollo Terminology Handbook. OSTI has also published a pocket-sized handbook of excerpts from the larger document. It is called "Short Glossary of Space Terms." (See Reference 16.)

3.5.2 NASA (OMSF/OS)

The Office of Systems within the Office of Manned Space Flight has a group located in Huntsville and reporting to Dr. Rudolph. This group has seen the need for, and has started to prepare, a glossary which has no official status as yet. (See Reference 11.) This document contains many useful operational terms which could be applied to the Apollo Program.

3.5.3 NASA (MSFC)

There has been at least one attempt at the Marshall Space Flight Centerwithin the P and VE Division to produce a glossary. This effort was dropped before completion, presumably because of the practical difficulties encountered when one division tries to prepare a glossary acceptable to all divisions in the center.

3.5.4 NASA (MSC)

There is no evidence of any attempt to produce a glossary or standardized terminology at the Manned Spacecraft Center.

3.5.5 NASA (GSFC)

At the Goddard Space Flight Center, there was no indication of any activity on terminology. There was, however, an acknowledgement of the need for such a document

and an accompanying offer of cooperation with the provision that the time that Goddard people would have to spend on such work be minimized.

3.5.6 NASA (LOC)

No indication of terminology standardization has been found within the Launch Operations Center. Interest in the subject was exhibited, however, particularly in the areas of ground support equipment, criticality of parts, and failure effect analysis.

SECTION 4
IMPLEMENTATION PLAN

4.1 INTRODUCTION

In order to properly implement the publishing of the Apollo Terminology Handbook, a definite procedure must be established that encompasses all phases of the operation. This procedure will be composed of the following steps.

a. Collection of Material.
b. Evaluation.
c. Selection.
d. Approval.
e. Publication and Distribution.

A flow diagram of the implementation procedure is shown in Figure 4-1.

4.2 COLLECTION OF MATERIAL

All available material that may be helpful in identifying and clarifying the language peculiar to the Apollo Program will be collected. This material will include, but not be limited to, the following:

a. Government publications (NASA, DOD, etc.).
b. Industry publications (reports, memorandums, etc.).
c. Open-market literature (books, periodicals, etc.).
d. Working papers and personal files.

Interviews and discussions, as a source, will supplement the written material. A complete library of references will be established and maintained.

4.3 EVALUATION

Concurrent with the gathering of source material will be the evaluation of words and terms that could possibly be appropriate material for inclusion in the handbook. In making this evaluation, a file card will be maintained on each term for every reference

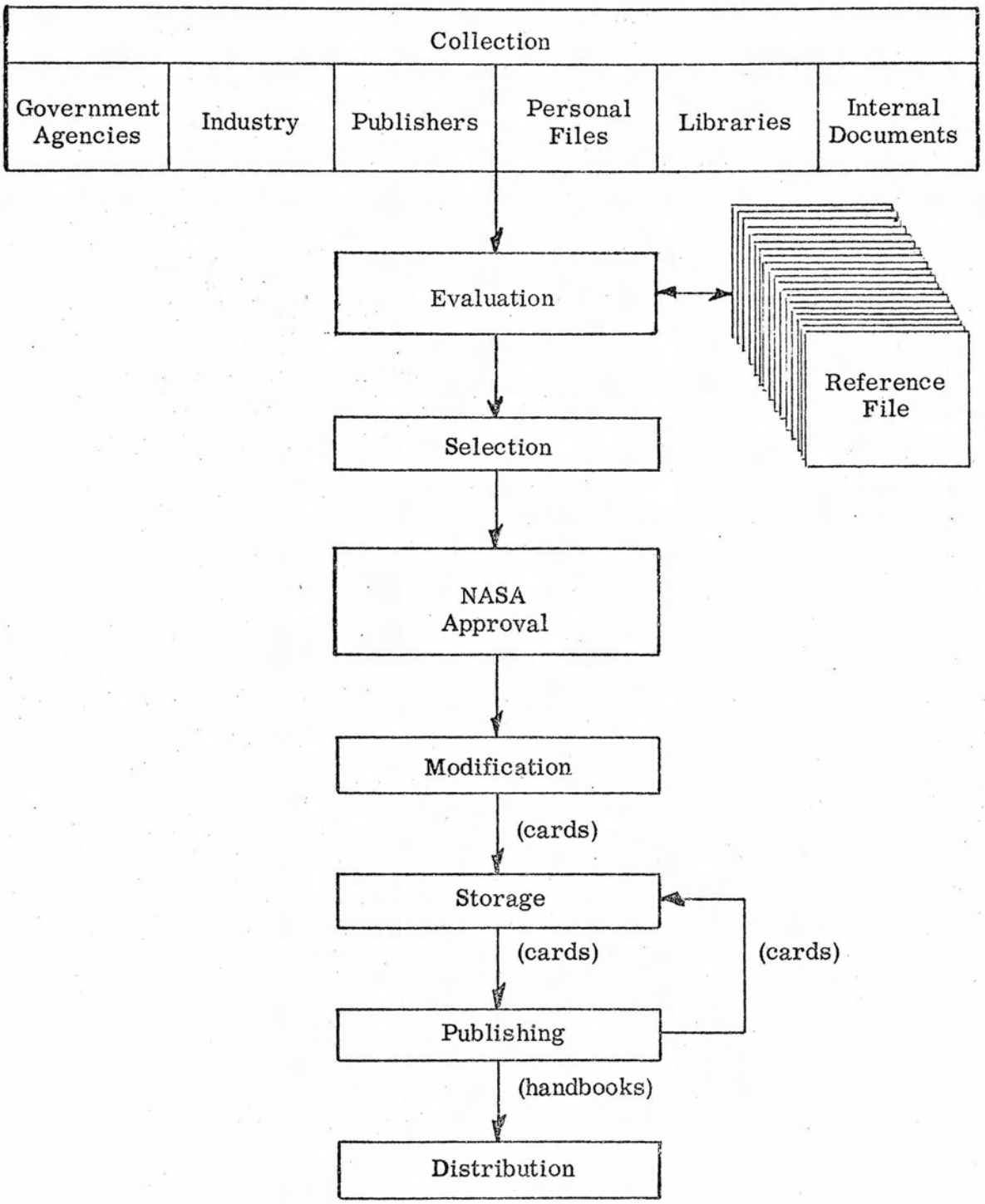


Figure 4-1. Implementation Procedure Flow Diagram

document in which it appears. Each card will contain the term, the reference (by established code), and the definition as it appears in the reference document. There will be several cards for most terms.

4.4 SELECTION

The selection phase of operation requires the efforts of highly experienced personnel. During this process, the decisions are made as to exactly which terms and definitions are to be recommended for approval. It is probable that different references will give different definitions for the same term. The personnel responsible for selecting the definition to recommend for official adoption must be capable of demonstrating sound judgment in arriving at their decisions. These personnel will also decide upon the use of abbreviations and the necessity for supporting illustrative material.

The terms and definitions selected during this phase will be typed on cards for processing through the sequential-listing system. An approval copy will be made for submission to NASA.

4.5 APPROVAL

NASA approval will be required on all entries for the handbook; therefore, copy will be sent directly to the appropriate NASA authority. Upon receipt of approval from NASA, definitions will be modified in accordance with NASA comments. Definitions requiring major modifications will be returned to NASA for final approval.

4.6 PUBLICATION AND DISTRIBUTION

The handbook will be published as a bound document and issued on a semiannual basis. Supplements will be issued on a monthly basis and the latest supplement will include all previously issued supplements to facilitate maintenance of the handbook.

In the publishing of this handbook, page negatives will be made directly from sequential-listing cards. After the negatives have been made, the cards will be returned to the card storage area for future use.

The distribution list will be maintained up-to-date on sequential-listing cards. It will be updated automatically with every revision (semiannually) and as required during the interim periods.

4.7 SUPPLEMENTS AND REVISIONS

Handbook supplements will be published monthly, and complete revisions will be published semiannually. Collection, evaluation, and selection activities will be continuous operations. Not only will there be a constant searching for new terms, but definitions of all terms will be constantly reviewed for possible changes. During the course of the program, many terms will become obsolete; therefore, deletions will have to be made. To assist the handbook control personnel, a form (see Figure 4-2) will be distributed to all personnel on the handbook distribution list. Use of this form by all concerned will help maintain the handbook in a current and useful manner.

Word or Term		Abbreviation (If Any)
(Check One) Addition_____ Revision_____ Deletion_____	Source of Definition Original _____ Other_____ _____ _____	Symbol (If Any)
Definition (If Available)		
Submitted By Name_____ Date _____ Affiliation_____ Address_____ _____		

Objective

The objective is to obtain help in selecting, recording, and distributing the terminology specifically related to Apollo that must be used in a consistent manner if misunderstanding and confusion is to be avoided. This will result in a glossary of words, terms, abbreviations, and symbols that will be maintained for current accuracy. There is no desire to duplicate published aerospace dictionaries except in the areas of interest where this might be useful to participants of the program.

Suggestions

Please supply definitions when available, but don't let lack of definition prevent you from supplying words and terms you feel should be included. Any other suggestions you may have regarding the glossary are welcome. Please print, type, or write legibly. Copy may be attached if this is easier. If a contact person in your organization is available, submit your proposals to him. If not, please send to:

General Electric Company
Northern Lights Office Building (Rm 22)
Attention: Apollo Terminology
Syracuse, New York

Figure 4-2. Proposal for Addition, Revision, or Deletion of Terminology

SECTION 5
SCHEDULES

Figure 5-1 illustrates the eight major milestones for the terminology standardization effort.

Number	Milestone Description	Date
1	Submit recommendation of approval procedure to NASA	12/1/62
2	Receive NASA approval or comments on approval procedure	1/15/63
3	Submit, for NASA approval, first issue of terminology handbook	2/1/63
4	Receive NASA approval or comments on first issue of terminology handbook	3/1/63
5	Complete publication of first issue of terminology handbook	4/1/63
6	Complete distribution of first issue of terminology handbook	4/15/63
7	Issue supplements to terminology handbook	Monthly
8	Issue completely revised terminology handbook	Semi-annually

Figure 5-1. Terminology Milestones

APPENDIX A

NUMERICAL LISTING OF TERMINOLOGY REFERENCES

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APPENDIX C

PREFACE TO THE UNITED STATES
AIR FORCE DICTIONARY

1. PURPOSE

The purpose of the United States Air Force Dictionary is to provide guidance to all interested persons in the use of that part of the English language that relates in some significant way to the United States Air Force. This purpose rests upon the premise that although the language of Air Force people is indeed English, a certain part of it is in the nature of special usage. Because this usage is not adequately treated in other dictionaries, it is accorded detailed analysis in this publication, in terms of both the Air Force's own operations and the English language as a whole.

2. COMMUNICATION: NEED FOR DISCIPLINE

In matters of communication, every person must use the sounds or symbols of his language in definite ways and patterns so as to express himself to those about him. And those about him likewise must use and understand the sounds and symbols in the same general ways, else there will be no communication through their use. Thus language incorporates certain disciplines, handed down from one generation to another. Although these disciplines are constantly undergoing change, they constitute an essential part of the language. The disciplines of spelling, of grammar, of sentence structure, of rhetoric, and of logic, each has a place in language, each lends it form, each makes for exactness of communication.

3. EXTENSIONS OF MEANING

But a person uses his language for other purposes than communication. He uses it to think by and to persuade. In thinking - that is, in advancing his thoughts into fields never before probed - he leans heavily upon words and phrases already in use, for he finds extension of meaning so natural and so full of pregnant thought that he assigns new meanings to old words without hesitation, and depends upon context to keep his ideas straight. Likewise, when his purpose is to persuade, he finds that exactness of expression is not necessarily to his purpose. Instead, words and phrases are used for their connotations, for their appeal to private interest, or for their emotional impact.

4. COMPLEXITY OF LANGUAGE

In these respects, the Air Force language is like the English language as a whole. It is complex and of great variety. Now its vocabulary is made to expand and adapt, developing in one instance a multiplicity of meanings for a single word, but specifying in another instance a single meaning for a given word or phrase. To know how to read and use this language, how to interpret it in context, how to exploit and refine its imagery, how to resort to its deeply rooted connotations, and how to curb it and turn its words and phrases into code or precise symbols - to know these things is to know how to make the language serve us not only in military life but in all our relations with our fellow men.

5. CONTEXT, THE CLUE TO MEANING

In this publication, the attempt is made to present the Air Force language in all its aspects. No Air Force person desires to shackle his thought and imagination by a language of code; neither can he carry out some of his operations without a certain amount of coded language. The dictionary provides the contexts in which to use one or the other; it is context that gives clue to meaning.

6. SOURCES OF EVIDENCE

When the dictionary staff set out to achieve its objectives, certain things had to be done. First of all, there had to be a systematic reading of writings considered to contain the vocabulary of Air Force people. Thus were read numerous regulations, doctrinal and other manuals, pamphlets, general and special orders, technical orders, combat orders, war plans, operational reports, engineering reports, historical accounts, flying instructions, scientific reports, aeronautical charts, memoirs, pieces of correspondence, officially published books, popular books, official news releases, magazine articles - in sum, any written product, whether published or not, that cast light upon the way in which the language is used.

7. 200,000 QUOTATIONS

Out of this reading came some 200,000 quotations, each illustrating the use of some word or phrase. These were brought together by the coordinated effort of several score people who extracted them in context on 4" x 6" slips. Once these quotations had been arranged in such order as to be systematically available, they constituted a body of primary evidence on how the Air Force language has been used. The slow

process of analysis then followed, done by relatively few people, but in accordance with methods considered sound for developing any historical or general dictionary.

8. OBJECTIVES OF ANALYSIS

This analysis had two objectives: First, to discover the meanings of the words and phrases used in conducting Air Force business; and Second, to provide guidance in their use so as not only to keep them in harmony with the English language as a whole but to make them serve Air Force purposes. Completion of the first objective provided the groundwork for achieving the second.

PART 2
SAMPLE TERMINOLOGY HANDBOOK

The terms and definitions appearing in this sample handbook are not approved and represent an attempt to show the type of material which should be considered for inclusion in an Apollo Terminology Handbook.

ABLATING MATERIAL

Special materials on the surface of a spacecraft that can be vaporized or melted during re-entry into the earth's atmosphere. Kinetic energy is dissipated and excessive heating of the main structure of the spacecraft is prevented.

ABLATION COOLING

Cooling by the sublimation, decomposition, or vaporization of the outer surface of a body passing through a fluid or gas.

ABORT MISSION

A secondary flight plan which may be selected when the primary flight plan has been abandoned because of an abort.

ACCEPTABLE QUALITY LEVEL (AQL)

A nominal value expressed in terms of percent defective or defects per hundred units, whichever is applicable, specified for a given group of defects of a product.

ACCEPTANCE (ACC)

The act of an authorized representative of the Government by which the Government assents to ownership by it of existing and identified articles, or approves specific services rendered as partial or complete performance of the contract.

ACCEPTANCE TEST

Tests to determine conformance to design or specifications as a basis for acceptance.

ACCESSORY (ACCRY)

A part, subassembly or assembly designed for use in conjunction with or to supplement another assembly, or a unit or set, contributing to the effectiveness thereof without extending or varying the basic function of the assembly or set.

ADAPTER SKIRT

A flange or extension of a space vehicle stage or section that provides a ready means for fitting some object, such as another stage or section, to it.

ADVANCED SCHEMATIC

A schematic diagram with additional information for exact terminal numbers and wire connections but without physical location of components. All the information of a wiring diagram is included except for wire routings. This type of schematic is most useful in maintenance or trouble location.

AEROMEDICINE

Alternate term for aerospace medicine.

AERONOMY

The study of the atmosphere, especially its relation to the earth and the effect upon it of bombardment by radiation from space.

AEROSPACE MEDICINE

That branch of medicine dealing with the effects of flight through the atmosphere or in space upon the human body, and with the prevention or cure of physiological or psychological malfunctions arising from these effects.

AFTERBURNING

Irregular burning or fuel left in the firing chamber of a rocket after fuel cutoff.

ALTERNATE MISSION

A secondary flight plan which may be selected when the primary flight plan has been abandoned for any reason other than abort.

AMES RESEARCH CENTER

One of NASA's field installations.

The principal mission of the Ames Research Center is basic and applied research on aerodynamics of re-entry vehicles, flight control of space vehicles and aircraft, and

space environment physics. Ames conducts flight research into vertical and short takeoff aircraft problems, and landing problems of the supersonic transport.

The aerodynamic research is concentrated on problems of spacecraft flight out through the atmosphere and return to safe landings. Flight control studies are concerned with systems for stabilization, navigation, guidance, and control for aircraft and manned and unmanned space vehicles. Investigations of space physics include studies of the effects of micrometeorite bombardment of surfaces and techniques for detecting and understanding interplanetary gases and other matter. NASA life sciences advanced research and technology has been assigned to Ames.

In addition to its office buildings, shops, hangars and flight simulators, this center has many specialized wind tunnels, hypervelocity test ranges, and other laboratory facilities.

Ames Research Center is located at Moffett Field, Mountain View, California, at the southern tip of San Francisco Bay, approximately eight miles northwest of San Jose, and 40 miles south of San Francisco.

ANACOUSTIC ZONE

Zone of silence in space. The region of altitude where distances between rarefied air molecules are so great that sound waves are not propagated.

APOLLO

A term generally used to describe the NASA manned lunar landing program but specifically used to describe the effort devoted to the development, test and operation of the space vehicle for long duration, earth orbit, circumlunar and lunar landing flights.

ARTIFICIAL ENVIRONMENT

The state or conditions produced in a controlled test space with a selected artificial natural environment as an input which generates an artificial induced environment.

ASSEMBLY (ASSY)

A number of parts or subassemblies or any combination thereof joined together to perform a specific function.

ASSEMBLY DRAWING

An assembly drawing depicts the assembled relationship of two or more items or a group of items and assemblies, or a group of assemblies required to make up an assembly.

ASSOCIATE CONTRACTOR

The contractor who performs the (sub)system work excluded from the principal contract and under direct contract to NASA. The Associate Contractor is responsible to the Principal Contractor for technical integration of the (sub)system and must coordinate technical developments and requirements in a timely and organized manner. The Associate Contractor is directly responsible to NASA for administrative and contractual matters.

ASTRO

A prefix meaning "star" or "stars" and, by extension, sometimes used as the equivalent of "celestial," as in "astronautics." Sometimes compressed as in "astrionics."

ASTROGATION

Contraction of "astronavigation."

ATLANTIC MISSILE RANGE (AMR)

NASA uses this military facility as its primary site for launching space vehicles into nominal earth orbits, deep space highly elliptic orbits and deep space probes.

AMR was originally established as the research and development base for missiles and vehicles under the cognizance of the Department of Defense. Since the creation of NASA, Defense and NASA have made arrangements to share many of its launch pads, hangars and other facilities. More recently NASA has funded completely the construction of new complexes for Saturn and larger rockets.

The management of NASA affairs at AMR is under the Launch Operations Directorate of the Marshall Space Flight Center.

The principal facilities are located at Cape Canaveral, on the east coast of Florida, 50 miles east of Orlando.

ATTACHMENT

A part, subassembly or assembly designed for use in conjunction with another assembly or a unit or set, contributing to the effectiveness thereof by extending or varying the basic function of the assembly, unit or set.

AUTOPILOT (A/P)

Short for automatic pilot.

AUXILIARY POWER UNIT (APU)

A separate electrical or hydraulic power supply unit, either engine or turbine driven, used to furnish the electrical and hydraulic requirements of a spacecraft.

BACKOUT

An undoing of things already done during a countdown, usually in reverse order.

BACKUP

An item designed to come closely behind an earlier item to complement the latter by taking advantage of information gained from it or replacing it in the event of unsatisfactory performance.

BACKUP ITEM

An additional item under development to perform the general functions of another item under development. The item may be secondary to an identified primary item or a parallel development to enhance the probability of success in performing the general function. The backup item may occur at any point in the development cycle from part to system and/or any type of end item.

BIOMEDICINE

Combined discipline of biology and medicine for analysis of human tolerances to and protection against environmental variances.

BIOPAK

A container for housing a biological organism in a habitable environment and to record biological functions during space flight.

BLOWOFF

A rudimentary term used to describe the separation of a part of a missile by explosive force for recovery purpose. The term loses significance with the refinements in separation design techniques.

BREADBOARD

An assembly of preliminary circuits or parts used to prove the feasibility of a device, circuit, system, or principle without regard to the final configuration or packaging of the parts.

BREAKOFF

The psychological phenomenon which occurs during high-altitude flights of being totally detached from earth and human society.

BUFFETING

A term often used to describe the vibratory motion of a component or the airframe as a whole which is being subjected to the vibratory impulses contained within an aerodynamic wake.

CAPSULE

A small, sealed, pressurized cabin with an acceptable environment, usually for containing a man or animal for extremely high-altitude flights, orbital space flight, or emergency escape.

CAPTIVE TEST

A test conducted while the missile is secured to a test stand. Primarily intended to verify proper operation of the propulsion and flight control subsystems under full thrust conditions. May also test the operation of any or all of the remaining airborne subsystems.

CATASTROPHIC FAILURE

A sudden change in the operating characteristics of some part or parameter resulting in a complete failure of the item. Examples: circuit opens or shorts, structural failures, out of specification, etc.

CHARACTERISTIC

Any dimensional, visual, functional, mechanical, electrical, chemical, physical, or material feature or property; and any process-control element which describes and establishes the design, fabrication, and operating requirements of an article.

CHECKOUT

A test or procedure for determining whether a person or device is capable of performing a required operation or function. When used in connection with equipment, a checkout usually consists of the application of a series of operational and calibrational tests in a certain sequence, with the requirement that the response of the device to each of these tests be within a predetermined tolerance. For personnel, the term checkout is sometimes used in the sense of a briefing or explanation to the person involved, rather than a test of that person's capability.

CHUFFING

A form of combustion instability, especially in a liquid-propellant rocket engine, characterized by a pulsing operation at a fairly low frequency, sometimes defined as occurring between particular frequency limits; the noise made in this kind of combustion. Also called "chugging."

CHUGGING

A form of combustion instability, especially in a liquid-propellant rocket engine, characterized by a pulsing operation at a fairly low frequency, sometimes defined as occurring between particular frequency limits; the noise made in this kind of combustion. Also called "chuffing."

CIRCUMLUNAR

Specifically; around the moon. Generally, this term has become associated with the program missions in which a spacecraft will circle the moon one or more times and return to earth.

CISLUNAR

Of or pertaining to space between the earth and the orbit of the moon, or to a sphere of space centered on the earth with a radius equal to the distance between the earth and the moon.

CLUSTER

Two or more engines bound together so as to function as one propulsive unit.

COASTING FLIGHT

The flight of a rocket between burnout or thrust cutoff of one stage and ignition of another, or between burnout and summit altitude or maximum horizontal range.

COMMAND MODULE (CM)

The portion of the spacecraft which houses the crew, serves as the center for crew-initiated command functions and is the recoverable portion of the spacecraft.

COMMERCIAL ITEM

Commercial items are supplies or services which normally are offered and sold to the public commercially by any supplier.

COMMUNICATIONS (COMM)

A method or means of conveying information of any kind from one person or place to another, except by direct unassisted conversation. In aerospace application, communications generally means the voice and data links employed during any phase of the launch and flight operations either by hardwire or RF. Included are telephone systems, TWX's, television, radio transmission, commutated UHF, telemetry, lasers, and so forth.

COMPATIBILITY

A characteristic ascribed to a major subsystem that indicates it functions well in the over-all system.

COMPONENT (CMPT)

An article which is normally a combination of parts, subassemblies, or assemblies and is a self-contained element within a complete operating equipment and performs a function necessary to the operation of that equipment.

COMPONENT ACCEPTANCE TEST

Acceptance test of an individual component (consisting of a number of parts) to determine if these components will meet specifications prior to assembly in a subsystem.

CONFIGURATION (CONF)

The relative disposition of parts, the figure, the contour, or the arrangement of parts within a structure.

CONTRACT

The prime contract executed by the Government and the Prime Contractor which, in addition to the terms and conditions thereof, includes by reference or otherwise, specifications, drawings, exhibits, and other data necessary to its proper performance.

CONTRACTOR (CONTR)

The individual(s) or concern(s) who enter into a prime contract with the Government.

CONTRACTOR-FURNISHED EQUIPMENT (CFE)

That portion of contractor-furnished property which is included in the system by the contractor.

CONTRACT SCHEDULE

That portion of a Government prime contract which describes the articles or services desired for that particular contract. Not to be confused with contract time-schedule or delivery schedule.

CONTRACTUAL COVERAGE

The coverage of a legally binding document which requires the contractor to satisfy Government requirements for supplies or services defined by such document.

COUNTDOWN

The step-by-step process leading to launching. It is performed in accordance with a predesigned time schedule, measured in terms of T - time (T minus time prior to initiation of engine start sequence and T plus time thereafter).

CRITICAL DEFECT

A defect that judgment and experience indicate could result in hazardous or unsafe conditions for individuals using or maintaining the product, or result in failure in accomplishment of the ultimate objective.

CRYOGENIC

The science of physical phenomena in the temperature range below about -50°C (-58°F), although some usages restrict the term to the temperature range within a few degrees of absolute zero. More generally, cryogenics, or its synonym "cryogeny," refers also to methods of producing very low temperatures.

CUTOFF

The cessation of burning in a jet or rocket engine owing to an intentional command action, as distinct from burnout which signifies a cessation of burning because of the exhaustion of the fuel.

DEBUGGING

A reliability conditioning procedure which is a method of aging the equipment by operating it under specified environmental and test conditions in accordance with an established procedure in order to eliminate early failures and age or stabilize the equipment prior to final test and shipment. Also known as burn-in or infant mortality.

DEFECT

Any nonconformance of the unit of product with specified requirements.

DEFECTIVE UNIT

A unit of product which contains one or more defects.

DESIGN (DSGN)

As applied to a product, it is the engineering drawings and specifications which permit fabrication of the product.

DESIGN ACTIVITY

A design activity is an activity having responsibility for the design and preparation and maintenance of engineering drawings for a given item of supply. The activity may be a Government activity or a contractor, vendor or others.

DESIGN ACTIVITY STANDARD

A design activity standard is a standard developed by a design activity.

DESTRUCT

The action of detonating or otherwise destroying a vehicle after it has been launched, but before it has completed its course, usually for reasons of safety.

DETAIL DRAWING

A detail drawing delineates information to describe an item, and shall include form, dimensions, materials, finish, tolerances, and other requirements as applicable.

DETAIL PART

A detail part is defined as an article which is an element of a subassembly, minor assembly, or installation (complete equipment), and is of such simple or inexpensive construction that it is neither practical nor economical to further disassemble for maintenance purposes.

DEVELOPMENT

The application of known techniques and principles to produce a desired result from the discoveries of research. In the development stage a device is visualized and its performance is anticipated. Development is characterized by deliberate planning, by ingenuity, and by synthesis of knowledge in many fields. The result of development is the creation of plans or models for a new device, and the demonstration by test that the prototype of the device fulfills the objective of the development.

DEVIATION (DEV)

A specific authorization, granted before the fact, to depart from a particular requirement of specifications or related documents.

DIRECT ASCENT

A boost trajectory that goes directly to the final burnout conditions and the coast trajectory without requirements for a parking orbit or staging location.

DIRECT FLIGHT

A mode that accomplishes a mission without rendezvous or combination after leaving the earth's surface.

DISPLAY

The visual and/or graphic presentation of the output data of any device or system.

DOCKING

The technique of closing and locking together two or more spacecraft in orbit; the final stage of the rendezvous operation.

DOCUMENT

Document describes the specifications, drawings, pamphlets, sketches, lists, standards, reports and other printed or written information which relates to the design, procurement, manufacture, test, installation, maintenance or inspection of items or services under contract.

DOWN-TIME

The total time during which the system is not in condition to perform its intended function. Down-time can in turn be subdivided into the following categories: repair time, logistic time and administrative time.

EARTH ORBIT RENDEZVOUS (EOR)

A mode involving rendezvous and coupling, fueling, or transfer in an earth parking orbit to accomplish a mission.

EGRESS

The act of or the mechanism for exit from an enclosure. In spacecraft this can relate to the act of a crew member exiting from the vehicle or it can describe the exit chamber, pressure lock and hatchways.

ELEMENTARY SCHEMATIC

A schematic diagram drawn without regard to exact connection of wires. This type of drawing is most useful as an engineering development drawing and for explanations of system operation or design.

ENVIRONMENT

The aggregate of all the conditions and influences which affect the operation of equipments and components, e.g., physical location and operating characteristics of surrounding equipments and/or components; temperatures, humidity and contaminants of surrounding air; operational procedures; acceleration, shock and vibration; radiation; method of utilization, etc.

EQUIPMENT (EQUIP)

One or more assemblies, or a combination of items, capable of independently performing a complete function.

ESCAPE

To achieve a sufficient velocity outward from a primary body, as earth, so as neither to fall back to the body nor to orbit it.

FAILURE

The inability of a system, subsystem, component, or part to perform its required function.

FLIGHT RESEARCH CENTER

The NASA Flight Research Center is a unique and highly specialized facility, emphasizing research on manned flight in extreme-performance aircraft and spacecraft. This includes research on flight operations, guidance and control including the effects of near space environment and the required pilot support systems, together with the effects of high-speed controlled flight on the aerodynamic and structural characteristics of flight vehicles.

The X-15 airplane is the principal research tool used by the center but its research pilots fly a number of other high speed aircraft. The flight research program is supported by a 500-mile tracking range, ground tracking and data acquisition equipment, and flight simulator facilities. This work is conducted in close cooperation with the Air Force and Navy. The center participated in the supersonic transport and the Dyna-Soar projects.

The Flight Research Center is located at Edwards, California, adjacent to Edwards Air Force Base, approximately fifty miles west of Barstow and seventy miles north and east of Los Angeles, in the Mojave Desert. The tracking range consists of stations at Wendover, Utah; Ely, Nevada; Beatty, Nevada and at Edwards Air Force Base. These stations are on Air Force sites.

FLIGHT RELIABILITY

The probability that a flight will be successfully completed, given successful completion of countdown.

FLIGHT SIMULATOR

Synthetic flight trainer, capable of simulating complete flight of a specified space vehicle.

FLIGHT TEST

Test of an aircraft, rocket, missile, or other vehicle by actual flight or launching. Flight tests are planned to achieve specific test objectives and gain operational information.

FUNCTION

The role in which a person, activity, organization, equipment or document serves or performs.

FUNCTIONAL RELIABILITY

The probability that a system will successfully complete the final checkout preparatory to launching, given that it was ready at demand.

GANTRY

A crane-type structure, with platforms on different levels, used to erect, assemble, and service large rockets or missiles. It may be placed directly over the launching site and rolled away before firing.

GEMINI

A project to develop space rendezvous and docking techniques in orbit, using a two-man capsule, now scheduled to begin in mid-1963.

GODDARD SPACE FLIGHT CENTER (GSFC)

NASA's Goddard Space Flight Center is responsible for development of unmanned sounding and earth orbiting spacecraft experiments in basic and applied fields. The work covers scientific earth satellites and the space-applied communications and meteorological satellites, and sounding rockets. Goddard also carries prime responsibility for an extensive tracking, data acquisition, and data reduction network. Among other programs it has charge of the scientific orbiting observatories, the Delta rocket, Tiros weather satellite and Echo communications satellite. It operates NASA's Institute for Advanced Studies in New York City.

Goddard Space Flight Center is located at Greenbelt, Maryland, approximately fifteen miles north and east of Washington, D.C.

GOVERNMENT FURNISHED EQUIPMENT (GFE)

That portion of government-furnished property which, under the terms of a NASA contract, is procured and furnished by NASA directly to the contractors for inclusion in the system.

GOVERNMENT FURNISHED PROPERTY (GFP)

Property in the possession of, or acquired directly by the Government, and delivered or otherwise made available to the contractor.

GOVERNMENT STANDARD

A Government standard is a standard developed by or for a Government activity.

GROUND OPERATIONAL SUPPORT SYSTEM (GOSS)

The GOSS is defined as a system of ground stations and complexes that are distributed worldwide and that are implemented and operated so as to provide spacecraft mission support during the launch, flight, recovery, and post-flight phases of operation. The GOSS includes the mission control center and all network facilities providing tracking, recording, communicating, monitoring, and computational support during these mission phases.

GROUND SUPPORT EQUIPMENT (GSE)

All equipment necessary to support the operations of receiving, handling, assembly, test, checkout, and launch from the time of arrival of the space vehicle at the launch site to liftoff.

GROUND TRACKING AND COMMUNICATION NET

That part of GOSS which furnishes the tracking and communication links required by a particular mission.

HARDWARE (HDW)

The physical object, as distinquished from its capability or function. The actual engines, case, pumps, guidance system, or other components of the missile. Often used in regard to the stage of development, as in the passage of a device or component from the design or planning stage into the hardware stage as the finished object.

HARDWIRE LINK

Direct connection of the vehicle measuring system to the recording system through wire.

HOUSING

Covering over apparatus, usually removable. Also, large, usually high headroom, structures used to enclose space vehicle assemblies and operations.

HUMAN ENGINEERING

The application of scientific knowledge concerning human limitations and performance capabilities to the establishment of requirements for, and to the design, development, evaluation and utilization of, all types of airborne and ground equipments and subsystems required for the accomplishment of the mission. The purpose of such application is: (1) to minimize demands upon human skill, training and manpower resources, and (2) to maximize the effectiveness of man-equipment combinations.

IGNITION

The initiation of combustion of a rocket engine.

IMPLEMENTATION

The process of putting into effect and accomplishing a program plan.

INDUCED ENVIRONMENT

The state or conditions which exist due to the interaction of the natural environment and the test subject.

INDUSTRY STANDARD

"Industry standard" is a standard developed and promulgated by a technical society, trade association, or federation thereof.

INGRESS

The act of or the mechanism for entrance to an enclosure. In spacecraft this can relate to the act of a crew member entering the space vehicle or it can describe the entrance chamber, pressure lock and hatchways.

INSPECTION (INSP)

The process of measuring, examining, testing, gaging, or otherwise comparing the "unit of product" with the applicable requirements.

INSTRUMENTATION

The installation and use of electronic, gyroscopic, and other instruments and sensors for the purpose of detecting, measuring, recording, telemetering, processing or analyzing different values or quantities as encountered in the flight of a missile or spacecraft. Instrumentation applies to both flight borne and ground-based equipment.

INSTRUMENT UNIT

This is a specific piece of hardware for the Saturn series. It is an adaptor section between the launch vehicle and spacecraft.

INTEGRATION

The bringing together of the individual and diverse contractual requirements of several prime systems which compose a Space Vehicle Program in a timely and effective manner to result in achievement of program objectives on schedule.

INTERCHANGEABILITY

A condition of design wherein any and all mating parts will assemble and function properly without the need for any selecting, machining or fitting at assembly.

INTERCONNECTION DIAGRAM

A drawing showing interconnections between components of a system..... (The remainder of the definition together with the sample included on sheet 41 of 10443260 identifies this as an intercabling diagram already commonly used by many Astronautics Design Groups.)

INTERFACE

An interface is the physical and functional interaction between two parts, components, subsystems, systems, or any mode of contact between two or more elements, including the crew, during any operation of a system.

INTERFACE DRAWING

The engineering drawing which graphically or discriptively displays the conditions of the interface which exist between assemblies.

INTERPLANETARY

Between the planets; within the solar system.

INTERSTAGE

Between stages.

ITEM

An all-inclusive term, to include assemblies, subassemblies, accessories, components, and equipment which can be disassembled, reassembled, or replaced.

JET PROPULSION LABORATORY (JPL)

The Jet Propulsion Laboratory is operated for NASA under contract by the California Institute of Technology. Its prime mission is the development of spacecraft for unmanned lunar and planetary space exploration and for operation of a world-wide deep space tracking and control network. JPL's researches cover the broad spectrum of activities associated with deep space programs, including propulsion, chemistry, guidance, and communications. Here are centered the Ranger, Surveyor, Mariner and Prospector and other projects in NASA's deep space exploration programs.

The facilities at Pasadena, California, include celestial and solar simulation facilities, and a spacecraft environmental test laboratory. In addition to the Goldstone deep space tracking station, JPL has cognizance over other stations in Australia and South Africa in support of its deep space assignment.

The main laboratories and offices are in Pasadena, California; a test station is located at Edwards, California and the Goldstone Tracking Station, operated by JPL, is on the Camp Irwin military reservation, about thirty miles north of Barstow, California, in the Mojave Desert.

LANGLEY RESEARCH CENTER

One of NASA's field installations. The mission of the Langley Research Center is research on a broad scale into vehicle configurations, materials and structures for space and aeronautics. This work is concentrated on problems of flight re-entry into the earth's atmosphere; application of new materials in space environment; supersonic and hypersonic flight; and other areas to provide a technical base for development of space vehicles. The work includes investigations of problems of the supersonic transport, the helicopter and low-speed aircraft. The center also conducts development programs such as the Scout launch vehicle, and inflatable spacecraft for Project Echo.

The center has many facilities for simulating atmospheric flight conditions at speeds ranging from the very lowest to the extreme hypersonic. Specialized facilities are used for structures and materials research programs. Laboratory work is supplemented by free-flight studies with models and full-scale aircraft, and with research vehicles launched by rocket from NASA's Wallops Station.

It is located at Langley Field, Hampton, Virginia, approximately twenty-five miles north of Norfolk, Virginia and about ten miles north of Hampton. It is divided into two separate areas by Langley Air Force Base.

LAUNCH CONTROL CENTER (LCC)

Centralized, over-all control point for all phases of pre-launch and launch operations at the launch facility on a specific program. Handover of control to Mission Control Center occurs at separation of the space vehicle from all hard ground connections.

LAUNCH OPERATIONS CENTER (LOC)

The Launch Operations Center is responsible for the over-all planning and supervision of the integration, test, checkout and launch of space vehicle systems at the Atlantic Missile Range.

LAUNCH VEHICLE (LV)

The part of the spaceborne equipment which furnishes the propulsion and guidance during the initial part of the trajectory to provide the prescribed velocity, position, and attitude required for injection into the desired trajectory. Launch vehicles are commonly called "boosters" and consist of two or more propulsive stages.

LAUNCH VEHICLE SYSTEM

Defined as the launch vehicle (flight hardware) and all equipment on the ground or in space that is associated with flight preparation and required during the flight operation.

LAUNCH WINDOW

The mission conditions which impose launch time limitations on the launch vehicle for any given trajectory, such as relative position of earth and moon or planets, mid-course propulsion capabilities, guidance limits and so forth.

LEWIS RESEARCH CENTER

The Lewis Research Center initiates and conducts basic and applied research in propulsion and space flight. Major scientific effort is concentrated on chemical, electric and nuclear propulsion systems. Problems under study encompass materials, structures, propellants, lubricants, fluid systems and controls, as well as missions, and space and atmospheric environments. Lewis conducts propulsion research for the Rover (nuclear rocket) project and the electric propulsion research programs.

Its facilities include advanced space environment chambers, material testing laboratories, supersonic and hypersonic research facilities, and rocket test stands. Its location is at Cleveland, Ohio, in the southwest portion of the city adjacent to the Cleveland-Hopkins Airport.

LIFE SCIENCE

Generally used to describe the science of adapting the physiological and psychological requirements of man to spacecraft and space flight.

LIFTOFF

The initial motion along the trajectory of a space vehicle or ballistic missile as it rises from the launch stand under rocket propulsion; the takeoff.

LOGIC DIAGRAM

A logic diagram is a drawing which employs electrical symbols such as gates, amplifiers, etc., with interconnecting lines to illustrate electrical system operation. Arrows may be used to indicate signal flow.

LUNAR EXCURSION MODULE

The portion of the spacecraft which can be separated to provide the capability for lunar de-orbit, lunar manned landing, re-orbit, rendezvous and docking and crew transfer. The module is discarded after crew and equipment transfer in lunar orbit.

LUNAR ORBIT RENDEZVOUS (LOR)

A mode involving rendezvous and coupling, fueling, or transfer in a lunar parking orbit to accomplish a mission.

MAINTAINABILITY

The probability (when maintenance action is initiated under stated conditions) of restoring a system to its specified operational conditions within a specified total down time.

MAINTENANCE (MAINT)

Maintenance is the function of retaining material in, or restoring it to, a serviceable condition. Its phases include servicing, repair, modification, modernization, overhaul, rebuild, test, reclamation, inspection, and condition determination.

MAJOR ASSEMBLY

A major assembly is defined as an article which is a combination of detail parts and subassemblies. As an assembly it is issued as an element of an installation, performs a major function necessary to the operation of the installation, is constructionally relatively complex and, except for minor mechanical repairs and adjustments, generally requires the use of special tools and test equipment for maintenance.

MAJOR DEFECT

A defect, other than critical, that could result in failure, or materially reduce the usability of the product for its intended purpose.

MALFUNCTION

A general term used to denote the occurrence of failure of a product to give satisfactory performance. It need not constitute a failure if readjustment of operator controls can restore an acceptable operating condition.

MAN-RATED

A term used to describe an acceptable standard of operational reliability for manned spacecraft in which the standards of performance and reliability established as a requirement for a manned flight program have been achieved.

MANNED SPACECRAFT CENTER (MSC)

This center is responsible for development and operation of the manned spacecraft and its associated ground support equipment. It is located at Houston, Texas. A portion of the center's staff and major facilities, such as a checkout hangar, altitude test tank, procedures trainer and Mercury Control Center, are located at Cape Canaveral, Florida.

MARSHALL SPACE FLIGHT CENTER (MSFC)

The Marshall Space Flight Center is charged with development of major launch vehicles to meet NASA's space mission requirements. Major projects conducted by Marshall are the Saturn class, Centaur and Nova.

Supporting these operations is an integrated complex of engineering, laboratory, fabrication and test facilities. Major items include fabrication and assembly buildings, a static test complex and a dynamic test facility for boosters of the Saturn class.

The Marshall Space Flight Center is located at Huntsville, Alabama.

MICHOUD PLANT

The development activity at the Michoud Plant is under the direction of the Marshall Space Flight Center. The Saturn C-1 and Advanced Saturn boosters and other large vehicle stages for use in the manned lunar landing program, and other NASA space projects will be manufactured at this plant. Plant operation is conducted by various companies under contract with NASA.

The plant is located at Michoud, Louisiana, approximately fifteen miles east of New Orleans.

MIDCOURSE

For lunar and planetary missions, this is the period between excape from the originating point and before commitment to entry or orbit at the destination.

MIDCOURSE MANEUVER

Changes introduced in the spacecraft flight path during the midcourse period through the guidance system to maintain the desired trajectory.

MILESTONE

An activity or action within the research, development, test, evaluation, production, and in-service life of a system, equipment, or effort. The milestone possesses a distinct, objectively identifiable terminal point which can be used as a means of evaluating progress in terms of an estimated time schedule.

MINOR ASSEMBLY

A minor assembly is defined as an article which is a combination of detail parts and subassemblies. As an assembly it is usually issued as an element of an installation, performs usually a minor function necessary to the operation of the installation as a whole, is constructionally relatively simple, and is capable of being maintained using only common tools and simple test equipment.

MINOR DEFECT

A defect that does not materially reduce the usability of the unit of product for its intended purpose, or is a departure from established standards having no significant bearing on the effective use or operation of the unit.

MISSION

The objective; the task, together with the purpose, which clearly indicates the action to be taken and the reason therefor.

MISSION ANALYSIS

A comprehensive evaluation of all the parameters which affect the events of a mission.

MISSION CONTROL CENTER (MCC)

Centralized over-all control point for all phases of the flight mission from prior to launch through preparation of the Mission Performance Report.

MISSION PROFILE

A graphic or tabular presentation of the flight plan of a spacecraft showing all pertinent events scheduled to occur.

MISSION RELIABILITY

The product of readiness, functional, and flight reliability.

MISSION SUITABILITY

Mission suitability can be defined as the ability of the Manned Space Flight System to perform missions other than those for which it was primarily designed.

MISSION VERSATILITY

Mission versatility can be defined as the ability of the Manned Space Flight System to perform missions other than those for which it was primarily designed.

MISSISSIPPI TEST FACILITY

NASA will use this facility for the static test site for Saturn and Nova-class launch vehicles.

The site is located in southwest Mississippi, approximately fifty miles east of New Orleans, Louisiana.

MODIFICATION (MOD)

Any change or alteration of a rocket missile or vehicle, or of its ground support equipment, that brings about a change in the vehicle's capabilities or characteristics.

MODULE

A combination of components, contained in one package or so arranged that together they are common to one mounting, which provide a complete function or functions to the subsystems and/or systems in which they operate.

MONITOR PANEL

Panel (on which are devices for indicating operating conditions of a component or system) connected to a component or system but with no means of control.

MONOPROPELLANT

A rocket propellant in which the fuel and oxidizer are pre-mixed ready for immediate use. A monopropellant may be a mixture of compounds, such as hydrogen peroxide and alcohol, or it may be a compound itself, such as nitromethane.

NATURAL ENVIRONMENT

The state or conditions which would exist in the absence of the test subject.

NAVIGATION

The art or science of guiding ships, aircraft, etc. from place to place, including determining position and distance traveled, and making use of any of several different methods or combinations of methods involving geometrical calculations, reference to celestial bodies, reference to landmarks, radio aids or other navigation aids.

NUCLEAR ROCKET DEVELOPMENT STATION

This joint NASA-AEC facility is principally concerned with performing research and development work on and testing nuclear powered rocket engines such as the KIWI series to be used for upper-stage space flight propulsion.

The Nevada Test Site of the Atomic Energy Commission is located at Jackass Flats approximately sixty miles northeast of Las Vegas, Nevada.

OPERATIONAL

Equipment, for example, a spacecraft, for which all research and development has been completed with achievement of performance objectives.

OPERATIONAL FLIGHT CONTROL

The spacecraft in-flight control after launch. This is accomplished by adaptive control before launch vehicle separation and by the on-board crew after launch vehicle separation.

ORBITAL VELOCITY

Velocity required to establish and maintain a satellite in orbit. The term refers to average velocity, since the velocity is greater at the perigee than at the apogee.

ORBIT

The path in which one body revolves about another under the gravitational attraction of the latter, as a planet or comet around the sun, or a satellite around a planet.

ORDNANCE TOWER

A specific structure employed in the Apollo Program at the launch facility where the ordnance items are installed, checked out, and connected in a relatively remote area and under closely controlled safety and test conditions.

OXIDIZER

A substance, though not necessarily containing oxygen, that supports the combustion reaction of a fuel or propellant.

PACIFIC MISSILE RANGE (PMR)

The mission of this military range for NASA is to provide launching sites for polar orbiting spacecraft and for deep space probes. The range is also used for experimental ballistic and guided space vehicles in connection with exploration of the upper atmosphere with sounding rockets.

NASA has a minimum of activity at PMR and its facilities are nominal at this time. Currently four launch pads are assigned to NASA.

The PMR launch complex is located on the coast of California about midway between Los Angeles and San Francisco at Point Arguello. The range includes a headquarters and other installations at Point Mugu, about sixty miles northwest of Los Angeles, plus down-range tracking facilities. Operations are also conducted at Vandenberg Air Force Base which is contiguous to Point Arguello.

PARKING ORBIT

An intermediate orbit around a celestial body where the spacecraft can await development of trajectory conditions required for its next phase of the mission.

PART (PT)

An article that is not operationally useful by itself but is an element of a subassembly, an assembly, or a component, and is of such construction that it is practically or economically not amenable to further disassembly for maintenance purposes.

PLUM BROOK RESEARCH STATION

This station conducts research pertinent to nuclear rocket systems, chemical rockets, and power generation systems. It is operated by the Lewis Research Center.

Plum Brook's major installation is a 60-megawatt nuclear reactor. Other facilities at this location provide for research with liquid hydrogen, fluorine and similar propellants.

The station is located at Sandusky, Ohio, approximately sixty miles west of Cleveland.

POST-FLIGHT

Post-flight is the phase of space vehicle operations beginning with the landing of the command module upon the earth and ending when the final flight test report is completed.

POST-LAUNCH

The period following separation of hard ground connections from the space vehicle at launch.

POST-STATIC TEST

System or subsystem tests to detect possible damage or conditions incurred during static test, plus test of additional components or systems not used during the static test. Example: Only vehicle booster is static tested, then upper stages are checked with booster.

PRE-LAUNCH

The period between the arrival of equipment at the launch area and the start of countdown.

PRE-STATIC TEST

System or subsystem tests to insure proper operation of a vehicle which is to be static fired.

PRIME CONTRACTOR

A contractor who has total system responsibility for the execution of work on contract to a Government agency. This includes all functional and administrative responsibilities necessary to satisfy contract requirements. Major programs can be established with separate Prime Contractors for essentially independent systems, but each will perform as a contractual entity with respect to the contracting agency.

PRINCIPAL CONTRACTOR

A term developed for application to the Apollo spacecraft contract. The Principal Contractor has responsibility for a defined system with specific (sub)system exclusions. The Principal Contractor retains functional responsibility for technical integration but has no responsibility for administrative or contractual matters of the excluded (sub)-systems - these latter are retained by the contracting agency.

PRODUCTION DRAWING

Final engineering drawings to which parts are fabricated.

PROGRAM (PROG)

A related series of undertakings which are funded for the most part from NASA's Research and Development appropriation, which continues over a period of time (normally years), and which are designed to accomplish a broad scientific or technical goal in the NASA long-range plan.

PROJECT (PROJ)

Within a program, an undertaking with a scheduled beginning and ending, which normally involves one of the following primary purposes:

(1) The design, development and demonstration of major advanced hardware items;

(2) The design, construction and operation of a new launch vehicle (and associated spacecraft and ground support) during its research and development phase; or

(3) The construction and operation of one or more space vehicles and necessary ground support in order to accomplish a scientific or technical objective in space.

QUALIFICATION TEST

Qualification tests are tests performed on samples submitted for approval as qualified products. Qualification tests normally include all the acceptance tests in the specification and the additional tests designed specifically for the qualification procedure.

QUALITY ASSURANCE (QA)

A planned and systematic pattern of all actions necessary to provide adequate confidence that the end items will perform satisfactorily in actual operations.

QUALITY CONTROL (QC)

A factory-oriented operation for causing a process to manufacture a uniform product within specified limits of percent defective in accordance with the design requirements.

REDUNDANCY

A design technique which introduces a superfluous component, subassembly, or assembly in the configuration of a system to replace a functional component, subassembly, or assembly in the event that it fails. It allows the adoption of more than one course of conduct in achieving a given effect.

READINESS RELIABILITY

The probability that a mission system will be in operating condition when an operational demand is made on it, i.e., that the system will be ready to begin the final checkout preparatory to launching.

RELIABILITY

The probability that system, subsystem, component, or part will perform its required functions under defined conditions at a designated time and for a specified operating period.

RENDEZVOUS

The event of two or more aerospace vehicles meeting in flight at a preconceived time and place.

REPLACEABILITY

The characteristics of an item that allows it to substitute for another item under one of three conditions: functional interchangeability with physical modification; physical interchangeability with functional modification; or both physical and functional modifications.

RESEARCH

A continued process of scientific investigation prior to and during development. It has for its aim the discovery of new scientific facts, techniques, and natural laws.

RESTART

A boost trajectory that passes through a parking orbit of circular or near-circular conditions such that if thrust is cut off at that condition the vehicle would remain in the parking orbit. Continuation to other trajectories (e.g., escape) would be accomplished by restarting the engine(s) that was shut down. There is no requirement for staging at the parking condition.

RETRO

In reverse direction as with a retrorocket employed for the purpose of firing opposite to the velocity vector to slow a vehicle, usually for re-entry or landing.

SATURN

NASA designation for a series of high thrust multistage launch vehicles with an initial first stage thrust of 1,500,000. The Saturn vehicle will be employed as the Apollo launch vehicle.

SCHEMATIC DIAGRAM

An electrical drawing showing the electrical circuit of an item. The parts are indicated by sequence of functions. No attempt is made to indicate actual physical locations. Lines are drawn from symbol to symbol to aid circuit tracing.

SEPARATION

In multistage space vehicles, the action time or place at which a burned-out stage is discarded and the remaining missile continues on its way.

SERVICE MODULE

The portion of the spacecraft housing the stores and systems which do not require maintenance or direct operation by the crew and are not required by the command module after separation. This includes the attitude and vernier propulsion systems, and other propulsion units which depend upon particular mission requirements.

SHUTDOWN

The process of reducing engine thrust to zero. Synonymous with cutoff.

SIMULATED FLIGHT TEST

This could be classed as an over-all test in which all vehicle subsystems are operated in so far as possible through a typical sequence simulating the entire flight of the vehicle. This test also provides a compatibility test of all the vehicle system and quantitative indication of RF noise level emanating from the vehicle which might interfere with the operation of other systems or devices.

SIMULATOR

A device which substitutes for any part or all of a system as an alternative means of determining system characteristics or operation. A simulator usually is furnished at much lower cost, earlier availability, with more manageable physical characteristics and often with greater capability for variation.

SPACE

In ordinary terms, the void between celestial bodies in the general region beyond the sensible atmosphere of the earth. In specific terms, near space is the first region beginning at an altitude of about 120 miles; deep space is the region beyond this, which includes the moon; and outer space is the interplanetary region where the significance of the earth as a primary no longer exists. (The exosphere begins at approximately 350 miles altitude; some definitions observe the convention that "space" does not begin until past it.) In other designations, outer space is the region between galaxies, middle space is the region between stars of a galaxy, and inner space is the realm within the system of planets.

SPACECRAFT (SC)

The spacecraft is the vehicle required to perform the mission after injection into the mission trajectory. It consists of the Command Module, Service Module and Lunar Excursion Module.

SPACECRAFT SYSTEM

Is defined as the spacecraft (flight hardware) and all equipment on the ground or in space that is associated with flight preparation and required during flight operation.

SPACE EXPLORATION

Commonly considered a primary function of the charter assigned by Congress to the NASA. The effort established through the space programs to develop man's knowledge of the universe.

SPACE FLIGHT PROJECT

A task within the realm of space flight which leads to the accomplishment of any of the following mission objectives:

(1) Collection of scientific data.

(2) Transportation of cargo and personnel between two terminals.

(3) Satisfaction of commercial requirements.

SPACE PROBE

A research vehicle intended to reach a distant point in space, possibly to return to earth, or to impact on some distant celestial body, or to escape from the solar system.

SPACE SCIENCE

The specific discipline associated with the development of knowledge about the universe.

SPACE TRANSPORTATION SYSTEM

Is defined as all elements and their support systems of a Space Flight Project which are designed for transferring cargo or personnel from one celestial body to another or to the point of flight origination. The Space Transportation System consists of the Launch Vehicle System and the Spacecraft System.

SPACE VEHICLE (SV)

The space vehicle is the entire spaceborne element; it consists of the spacecraft and the launch vehicle.

SPACE VEHICLE SIMULATOR

An assemblage of equipments that simulates the entire space vehicle to validate the vehicle integrated checkout system.

SPACE VEHICLE SYSTEM

The over-all complex of equipments, methods, procedures, and personnel requirements needed to fulfill the mission of the space vehicle. There are many items which will, of necessity, be common to various space vehicles but which by assignment are considered integral parts of each system and are so defined in each program requirement. Notable in this category are the numerous systems of GOSS.

SPECIFICATION (SPEC)

A detailed description of the characteristics of a product and of the criteria which must be used to determine whether the product is in conformity with the description.

SQUIB

A small pyrotechnic device, usually electrically detonated, used to ignite rocket motors, initiate explosive bolts, or for other applications where a low order explosion or a simple fire source is desired. Squibs require a fractional ampere current for initiation.

STAGE

The independent propulsive sections of a launch vehicle which are progressively jettisoned during or immediately following the powered portions of flight.

STAGED-IN-ORBIT (SIO)

A boost trajectory similar to the "restart" except that stage burnout and separation occur simultaneously with the parking orbit condition. Continuation to other trajectories would be accomplished by ignition of another stage.

STAGE INTERFACE SIMULATOR

Those elements of the vehicle integrated checkout system that simulate the effects of the remainder of the vehicle on a particular stage.

STAGE SUBSTITUTE

Those elements of the vehicle integrated checkout system which take the place of a stage during times when the particular stage is not available for continued space vehicle checkout. It is a functional substitute for a stage.

STANDARD (STD)

Documents that establish uniform engineering and technical criteria and applications for items, materials, processes, methods, design, and engineering practices.

STANDARDIZATION

A process of establishing by agreement, engineering criteria, terms, practices, item configuration and processes, to achieve the greatest practicable uniformity, to assure the minimum variety of such items and practices, and, to effect the optimum interchangeability of equipment parts and components.

SUBASSEMBLY

A combination of parts comprising a definable entity of a component and performing a function essential to the proper operation of that component.

SUBCONTRACTOR

Any contractor under contract to another contractor. These are usually qualified further as first tier, second tier, etc. First tier subcontractors are those under contract to the prime, principal or associate contractors. Second tier is next level removed, etc.

SUBSTITUTE ITEM

Substitute items are two or more items which possess such functional and physical characteristics that permit their being exchanged only within the limitations imposed by the application requirements.

SUBSYSTEM (SUBSYS)

A major functional subassembly or grouping of items or equipment which is essential to operational completeness of a system.

SYSTEM

One of the principal functioning entities comprising the project hardware within a project or flight mission. The terminology may vary to suit a particular project. Ordinarily, a "system" is the first major subdivision of project work. (Similarly, a "subsystem" is a functional entity with a system.)

TELEMETERING SYSTEM

A method of taking measured values within an aerospace vehicle and transmitting these values electronically to a ground station.

TOUCHDOWN

The action or moment of landing a space vehicle, manned or unmanned, on the surface of a planet.

ULLAGE

The amount that a container, such as a fuel tank, lacks of being full.

UNIT

Anything considered as complete in itself but functioning as a part of an assembly, subsystem, or system.

WALLOPS STATION

The Wallops Station provides a launch, tracking and data acquisition capability for small launch vehicles and many of the sounding rockets used in NASA's program, serves as an experimental station in support of advanced aerodynamic research programs, and provides for flight tests on instrumentation. It has facilities for conducting experimental flights of small spacecraft without the attendant expense, difficulties of scheduling and other interference problems encountered at the large military test ranges. Many of the instruments and flight packages flown at Wallops are prototypes of space payloads to be launched by major vehicles.

Wallops Station is the site of the launch development program for the Scout rocket, which has successfully placed two earth satellites in orbit. It will continue as a launch site for Scout payloads. The station also conducted many supporting tests with Little Joe and smaller rockets, for Project Mercury, and weather and communications satellites.

The Wallops Station launching site is located on a small island off the east coast of Virginia, about ten miles from Chincoteague. Offices, shops and tracking facilities are located on the mainland at the site of the former Chincoteague Naval Air Station.

WESTERN OPERATIONS OFFICE

NASA's Western Operations Office at Santa Monica, California, serves all operational interests of the agency as a headquarters branch in the western region of the United States. The office, reporting to the Headquarters Office of Administration, has as its primary mission contract negotiation and management of research and development contracts with the aeronautical and space industry in its territory.

In carrying out these duties, the office serves NASA as a source of information of technical and other developments within the industry, monitors projects under way, evaluates effectiveness of quality and reliability programs and performs a variety of other administrative services including legal counsel, public information, security, personnel and financial management.