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1 JUNE 1963

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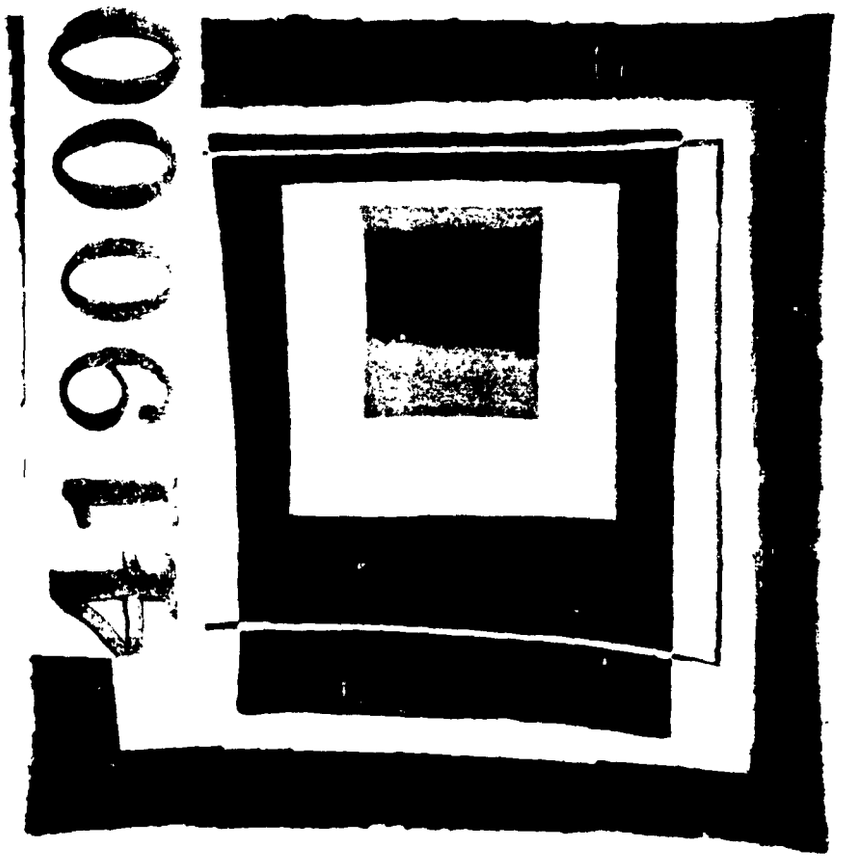
UNITED STATES AIR FORCE

AIR FORCE SYSTEMS COMMAND



A SUMMARY OF LESSONS LEARNED FROM AIR FORCE MANAGEMENT SURVEYS

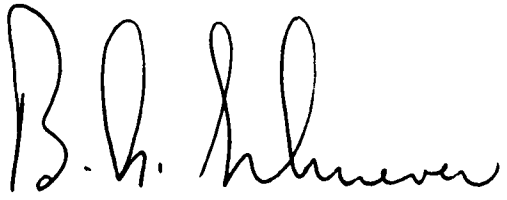
FOREWORD

In January 1961, General Curtis E. LeMay expressed concern over the steadily increasing costs of new weapon systems. He directed the Inspector General to conduct a series of surveys of major Air Force contractors' management policies, procedures, and practices, and the costs generating therefrom which result in charges against Air Force contracts. He also desired that management efficiencies and economics be cited and, wherever possible, be given wide aerospace industry dissemination. In combination with that activity, we in the Air Force Systems Command (AFSC) began critical reappraisal of our own activities. The AFSC appraisal culminated in a number of System Program Management Surveys (SPMS), which reviewed both Air Force and contractor management of specific system programs.

During 1962, the USAF Inspector General and AFSC completed surveys of a representative group of Air Force contractors. This pamphlet provides a summary of the more significant lessons learned from surveys of twenty-four major contractors. For those who attended the Monterey Management Conference, many of the topics in this pamphlet will be familiar. The corrective actions reported are not offered as the final solutions or the only solutions for these problems. Nor, for that matter, are the causes which are identified with the problems considered to be absolute and unqualified in every sense. In some cases the corrective measures have proved satisfactory, others have yet to complete or undergo trial periods and evaluation. They are typical of some of the actions taken by industry and the Air Force—not the whole story of what is being done in these areas. The many excellent accomplishments and management practices reported by survey teams warranted expeditious dissemination apart from this pamphlet.

A candid treatment such as this may permit the drawing of incorrect inferences as to the general efficacy of industry/Air Force management, particularly by those uninitiated to the complexity of some of the common deficiencies. The complexity of the interrelations which must be considered in resolving these problems is the principal reason that more satisfactory permanent solutions have not been found long ago. Improvements require emphasis by management at all levels. The extent to which these same problems repeatedly occur should eliminate any complacency or rationale on the part of any manager that such shortcomings apply only to others.

To the managers in the aerospace industry, it is my earnest desire that you assess your own activities in the light of the lessons contained in this pamphlet.



B. A. SCHRIEVER
General, USAF
Commander

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1 June 1963

Systems Management

A SUMMARY OF LESSONS LEARNED FROM AIR FORCE MANAGEMENT SURVEYS

This pamphlet is presented as an aid for industry and Air Force Managers concerned with System Management or managment functions related to Air Force contracts. It summarizes the AFSC analysis of repetitive management deficiencies found by Air Force surveys of major contractors, and provides information concerning the corrective actions by contractors and the Air Force.

NOTE: Send recommended changes to this pamphlet to: Hq AFSC (SCS–8), Andrews AFB, Washington 25, D. C.

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FOR THE COMMANDER

E. L. JACKMAN
Lt Colonel, USAF
Director of Administrative Services

CHAPTER I
Introduction

WHAT'S THE SUBJECT?

▲ Recurring management deficiencies that are:

- Common to companies working under Air Force contracts
- Problems of joint concern to the Defense Industry and the Air Force

WHY THIS PAMPHLET?

▲ To inform Air Force and Industry management of the nature of the deficiencies repeatedly found by management survey teams

▲ To indicate the causes as interpreted by the AFSC analyses

▲ To report the corrective measures taken by some contractors and the Air Force

▲ To stimulate Air Force and Industry managers to take a critical look at their own activities to prevent or correct similar problems

WHO PREPARED IT?

▲ The Office of the Assistant for Management Surveys, DCS/Systems, assisted by other staff offices of the Headquarters, Air Force Systems Command.

HOW WERE DEFICIENCIES REPORTED?

▲ By Air Force management surveys of two types:

- Industrial Management Assistance Surveys (IMAS) conducted by the USAF Inspector General (IG) by direction of the Secretary of the Air Force, which are—
  - — Surveys of major AF contractors to evaluate their management effectiveness in fulfilling contractual obligations.
  - — Detailed examinations of a contractor's total AF contractual activities, usually at one location.
- System Program Management Surveys (SPMS) performed by AFSC personnel by direction of the Commander AFSC are—
  - — Surveys of specific system acquisition programs, or portions thereof, to evaluate management effectiveness, and may include cognizant AF organizational elements, prime or associate contractors and subcontractors.

WHAT WAS THE SCOPE OF CONTRACT ACTIVITIES?

▲ The twenty-four contractors surveyed are a cross-section of major electronic, aeronautical, ballistic, and space systems producers.

- Contractual obligations ranged from:
  - — Companies responsible for integration and turnover of complete operational system, to—

— Companies responsible only for equipment design, development and production.

- Types of contracts included:
  - — Cost plus fixed fee
  - — Cost plus incentive fee
  - — Fixed price
- AF contracts had high value, generally above $25 million.

ARE ALL IMPORTANT MANAGEMENT PROBLEMS INCLUDED? NO.

There exists, for any given time period, a set of causual factors tending to destabilize the industry/government relationship. This condition is generated by the conflicting viewpoints about management concepts which always prevail to some degree within government circles. The dominant viewpoints upon which management policy is based in the various governmental departments (DOD, NASA, etc) may at times be in conflict. Similarly, conflicting viewpoints may dominate intra-departmental policy (DOD or within a Service Department). Such conflicting, dominant viewpoints have resulted in inconsistencies, not only about the respective management roles of the contractor and the government contracting agency, but also on other facets of program and functional management. The broader aspects of this problem are obviously beyond the purview of the Air Force to deal with unilaterally; therefore, such factors were not explored in the problem analyses of this pamphlet. However, the effects of inconsistant application of Air Force policies, are included in the summary analysis.

It suffices here to recognize the broad problem and to acknowledge that some defense industry leaders feel there can be no real solution to the cost estimation—cost overrun problem until the government achieves greater consistency in its concepts of management.

CHAPTER II

Analyses of Management Repetitive Deficiencies

SECTIONS

NOTICE TO THE READERS

This report is intended primarily for top-level Air Force/Industry managers who are busy people, not likely to spend much time on another lengthy, difficult-to-read report. Generally, they are quite familiar with the topics to be covered here. The format favors brevity over detailed treatment, accepting that some intelligence is lost, misinterpretations may occur, and the summary format may not be useful to people unfamiliar with the problems.

Each deficiency summarized is common to several contractors whose organizations and contract obligations may differ greatly. The degree of seriousness varies with the conditions relevant to each contractor. The symptoms listed are manifestations of a given problem, usually side effects or after effects, but some may in turn be causes of other problems. They have been determined from analysis of each contractor's specific case, and are not necessarily applicable where conditions differ from those analyzed.

The causes reported for a given problem are determined by analysis of specific conditions relevant to each contractor having the problem. They are not necessarily applicable in entirety to any individual contractor. Similarly, solutions by contractors for a given problem are based upon those contractors' judgments as to preferred corrective actions under the relevant conditions. They are not the only solutions that can be applied under the identical conditions, and not necessarily appropriate for conditions different from those analyzed.

SECTION I

Program and Contract Function

SUBJECT

DECENTRALIZED PROGRAM MANAGEMENT LACKED ESSENTIAL CONTROLS

FINDING No. 1

IN CONTRACTOR ORGANIZATIONS THAT WERE STRUCTURED ACCORDING TO FUNCTIONAL LINE DEPARTMENT CONVENTIONS, TOP MANAGEMENT DID NOT TAKE ACTION TO INSURE THAT INTERNAL POLICIES, PROCEDURES, AUTHORITY AND RESPONSIBILITIES WERE CLEARLY DEFINED FOR INTEGRATED PROGRAM CONTROL.

Symptoms of Basic Deficiencies:

- Uncertainty or confusion on the part of line organization managers as to exact responsibility and authority on program matters.
- Program decisions are not made in timely manner or not implemented promptly.
- Program financial control is fragmented among various line organizations, program financial accounting weak or non-existent.
- Engineering decisions are made unilaterally by design groups with little regard for total program effects.

Fundamental Causes:

- Corporate/division official, or level at which semi-autonomous line organizations report, does not have overview of essential elements of the program; SPD must go to several departments to obtain answers to program matters.
- Nominal program manager does not have true control over program finances, schedule, design decisions, or design change decisions.
- Contractor's inter- and intra-organization policies and procedures do not insure integrated program management by the semi-independent line organizations.
  - Vested interests prevail rather than decisions in program best interest.
  - Conflicts between functional managers not readily brought up to higher level for timely resolution.
  - Duplication between functional organizations.
  - Difficulty in determining when breakdown in program coordination or communication has occurred between parallel organizations until a serious problem occurs.
  - Lack of program familiarity and level of detailed program knowledge at corporate decision-making level (above semi-independent departments) increases likelihood of erroneous program decisions.
  - Strong policy and procedural discipline, essential to achieve effective program management by semi-autonomous organizations, is not enforced or even defined in some cases.
  - Lack of integrated program planning.

Actions By Contractor:

- Assignment of a program manager and vertical program organization to assure financial, schedule and design control. Program authority clearly vested in the program manager.
- On programs where vertical program organization was uneconomical or otherwise not feasible, inter- and intra-departmental policies and procedures revised to improve program control and decision-making. In all cases, a central configuration-control board was established with all program-active departments represented.
- Organizational discipline enforced rigorously.

Actions By Air Force:

- Established clear cut management interfaces between SPO and company management; reporting procedures from contractor to SPO better defined.
- In a few cases the contractor was requested to establish a program manager and vertical organization for program management on high priority programs of large magnitude, or where contractor had a mixture of efforts on AF and non-AF programs with CPFF and fixed price contracts.
- Require program management plan and resumes of key program management individuals from bidders responding to Air Force Request for Proposal (RFP) as a part of the proposal package on new programs.

SUBJECT

DEFICIENCIES IN CONFIGURATION MANAGEMENT

FINDING No. 2

INADEQUATE MANAGEMENT OF THE CONFIGURATION OF EACH END ITEM OF HARDWARE TO BE DELIVERED TO THE AIR FORCE MAKES LOGISTIC SUPPORT DIFFICULT, COSTLY, AND COMPROMISES THE OPERATIONAL EFFECTIVENESS OF THE SYSTEM. DIFFICULTIES IN THE EARLY BALLISTIC MISSILE PROGRAMS LED TO RECOGNITION BY THE AIR FORCE AND BALLISTIC SYSTEM CONTRACTORS THAT NEW POLICIES, IMPROVED TECHNIQUES AND PROCEDURES WERE VITALLY NEEDED FOR CONFIGURATION MANAGEMENT. THE NEW METHODS THUS DEVELOPED WERE FIRST APPLIED TO THE BALLISTIC SYSTEM PROGRAMS.

THE PAST YEAR HAS BEEN ONE OF PROGRESSIVE EXTENSION OF THESE METHODS TO ALL AIR FORCE SYSTEMS/EQUIPMENTS.

Symptoms of Basic Deficiencies:

- Inability to determine exact end item hardware configuration from technical documentation at time of shipment from factory.
- Inability to determine status of changes incorporated at field locations or status of changes being processed, or status relative to approved changes.
- Failure to meet program milestones for installation, check-out and system integration.
  - Inability to forecast work-to-completion of work tasks—schedule unrealistic.
- Technical Orders/Manuals not updated to latest hardware changes.
- Spares not updated—incompatible with operational or R&D system.
- Excessive time and effort required to isolate design deficiencies from failed or malfunctioning components resulting from partial incorporation of total change, out-of-phase incorporation of sequenced change; or improper operation or maintenance resulting from procedures not updated to latest hardware change.
- Technical description documentation late, inadequate for Air Force acceptance of integrated system.
- Hardware configuration identification and accounting status at turnover inadequate to operate, maintain and logistically support operational systems.
- Increased program costs.
  - Contract cost overruns.
  - Program schedule slippages.

Fundamental Causes:

- Lack of full understanding by SPO of total technical description required for the Air Force to operate, maintain and logistically support operational system. As a result:
  - Contractual requirements for configuration management by contractor not definitive.
  - Documentation required for configuration identification, control and status accounting not defined.
  - Omitted essential elements of management and safeguards embodied in current configuration management regulatory documents when adapting to specific program.
  - Inadequate SPO planning for configuration management.
  - Inadequate system/equipment specifications; inadequate use of specifications.
  - Failure to establish configuration pre-baseline control and documentation procedures.
  - Failure to set configuration baseline by end items.
  - Failure to designate proper program event for start of baseline control.
  - Air Force acceptance of end items and change control deferred until turnover of total system.
  - Requirements for Air Force approval limited to major change of engineering significance only, up to the point of turnover of first operational system.
- Contractor lacks full appreciation of Air Force configuration management objectives, as well as understanding of the procedures; where contract work statement is not definitive these conditions usually exist:
  - Top management did not centralize program management, and is reluctant to do so.
  - Managed according to self-determined internal requirements based on past limited role as equipment/vehicle manufacturer.
  - Underestimated task of configuration management when responsible for producing equipment compatible with total system or responsible for integration of system.
  - Adhered to conventional semi-autonomous line organizations with fragmented change control and administration.
  - Policies, procedures and documentation inadequate to integrate change control, identification, and status accounting with semi-autonomous line organizations.
  - No management overview of the complete internal configuration management function and documentation flow between engineering groups and between engineering—manufacturing—material—test—product services or site activation organizations.

- Discontinuities induced by engineering practices.
  - Semi-autonomous design groups, each with independent design release authority for all practical purposes.
  - Engineering design release and drawing control practices inadequate for integrated system design.
  - Engineering release, for a given design deficiency, does not package and uniquely identify total change to all affected equipment/spares/procedures.
  - Do not employ packaged change control with multiple engineering release capability, i.e., retain in engineering data bank old configuration still in use, along with new configuration which is a single design solution of the problem for both the production and the field retrofit change.
  - Design parameters/detailed criteria for design change levels at which system analysis/review is mandatory are not established definitively or set at proper design indenture levels.
  - System design review/analysis is not prerequisite for any design change release.
  - Lax discipline and control of drawing/part numbers; engineering by-passes formal company change procedures as matter of general practice.
- Further degradations of configuration control, identification and status accounting.
  - Lack of a central change control board with representation from all internal action organizations.
  - Inadequate documentation of changes during the manufacturing process.
  - Inadequate documentation, status accounting and maintenance of equipment log books by company field organization.

Actions By The Contractor:

- Centralization of program management.
  - Established central program configuration management and administration with configuration control board.
  - Revised internal configuration management policies and procedures to conform with AFSCM 375-1 concepts.
  - Revoked authority for independent release by design groups.
- Established packaged change control procedures with multiple engineering release capability.
- Established technical criteria for mandatory system analysis/reviews.
- Design review group formed and staffed with senior design specialists to review changes from system viewpoint.

Actions By Air Force:

- Numerous Air Force, AFSC and joint AFSC/AFLC regulations and manuals as well as military specifications pertaining to engineering changes were revised to reflect the new policies and procedures for configuration management.
  - Air Force-Navy Aeronautical Bulletin No. 445, "Changes: Engineering to Weapons, Systems, and Equipments" scheduled for tri-service/industry distribution on 22 May 1963. This new bulletin combines and supersedes ANA Bulletins 390a and 391a; it revises engineering change policies and procedures so that they are compatible with AFSC Manual 375-1. While Bulletin 445 is AF-Navy sponsored, it has been coordinated with and will be used by the Army also.
- AFSC Manual 375-1, "Configuration Management During the Acquisition Phase", was published 1 June 1962. This manual provides guidance for implementing established policies on configuration management by delineating responsibilities and defining typical formats; for making concurrent decisions for approval or disapproval of development, production and retrofit requirements of engineering changes and implementing these decisions; and for configuration accounting during the acquisition phase of a given series of a system/equipment program.
- The established objectives of configuration management are to insure that:
  - All end items of equipment in a given series will be the same.
  - Appropriate procedures, documentation and organizations are initiated and completed during the design, development, and early test phases to facilitate transition into formal configuration management.
  - Delivered end items of equipment are accurately and completely described by all identifying documentation.
  - For every approved change in end item configuration, the corresponding changes are made in all related support elements of Aerospace Ground Equipment (AGE), including depot tooling, spare parts, training equipment, technical order data, engineering data, checkout, operational and maintenance computer programs, and attending records.
  - There exists a configuration record documenting all approved changes to all end items.
  - All changes involving more than one Air Force Configuration Control Board (CCB) will be fully coordinated prior to implementation.
  - The specific location and status of each end item of equipment, by part number and serial number, are known at all times during the acquisition phase.
  - The specific location and status of end items of equipment that have been selected as configured articles are known by part number and serial number at all times during the operational phase.

- All proposed system/equipment/facility changes will be evaluated and resolved by the cognizant AF-CCB.

- All new programs entering into the acquisition are required to comply with AFSCM 375-1, including the pre-baseline configuration management procedures.

- All programs already under contract and in the acquisition phase are required to implement the procedures of AFSCM 375-1 as rapidly as the training of SPO people permits and to the extent possible within constraints of the given program.

Actions To Be Accomplished By the Air Force:

- AFSC is developing a manual for systems management. This manual will include policies and procedures for the Program Definition Phase. AFSCM 375-1 will be revised as necessary to be compatible with this new manual.

Additional Actions Recommended:

- Contractors should become familiar with the requirements of AFSCM 375-1 if they are not now acquainted with these policies and procedures.

- Contractors practicing decentralized program management should review and revise internal policies and procedures to insure integration of total program activities, for which they are responsible, throughout all functional departments.

SUBJECT

LATE DEFINITIZATION OF LETTER CONTRACTS

FINDING No. 3

DELAYS IN DEFINITIZING LETTER CONTRACTS RESULT IN CREATION OF WORK FORCES WITHOUT POSITIVE DIRECTION, HANDICAP PROGRESS EVALUATION, STIMULATE CONTINUED PROGRAM RE-DIRECTION AND EXPENDITURE OF AIR FORCE FUNDS ON TASKS THAT DO NOT CONTRIBUTE FULLY TO ACHIEVEMENT OF PROGRAM OBJECTIVES.

Symptoms of Basic Deficiencies:

- Inability of Air Force and contractor to reach agreement on scope of work without prolonged negotiations.
- Cost controls and work keyed to contractor estimates rather than firm contract provisions.
- Disagreement between Air Force and contractor on cost estimates.
- Work nearly completed under letter contract.

Fundamental Causes:

- Work statement not definitive because:
  - AF requirements not adequately defined, or
  - Contractor analysis of AF requirements was hasty and incomplete (Ref System Integration Deficiency).
  - Contractor lacked firm procedures for developing proposals.
- Disagreement on cost estimates because:
  - Contractor estimates not supported by definitized statement of work, or
  - Different interpretation of AF requirements.
  - Contractor estimates not developed from cost data accumulated from similar work performed.
- Desire to keep contract open so that new work can be added with minimum of administrative actions.
- Negotiations unduly prolonged after initial disagreements because:
  - Delay used as negotiation tactic.
  - Negotiators are often reluctant to closely question methods and techniques used by the technical groups that developed or evaluated technical work statements and cost estimates.
- Desire to accumulate actual cost data before agreeing to fixed or target prices.
- Slowness in negotiating letter subcontracts.
- Weak AF bargaining position when going to sole source.

Actions By Contractors:

- Revised procedures and methods of developing proposals which emphasize definition of work and cost estimating.
- Education and training programs established for preparation of proposals.

Actions By Air Force:

- Revised Request for Proposal checklist and instructions to obtain improved statements of AF requirements (PMI 1-9).
- Training program set up to develop improved cost estimating methods and to improve in-house AF estimating capability.
- Ballistic Systems Division Exhibit 26-101 requires more detailed system definition requirements for missile programs.
- Take time to definitize contract at the outset.
- Buy first increment of work when impossible to define entire program.
- AFSC Controlled Letter Contract Reduction (CLCR) Plan establishes "number" and "dollar" levels for each division, which cannot be exceeded without Hq AFSC approval.
- AFSC emphasis on challenging delivery schedules to validate essentiality of letter contracts.
- AFSC emphasis on technical/procurement interface to improve completeness and timeliness of work statements.

Actions To Be Accomplished:

- Program definition concept being developed by DOD and the services will keep two or more competitors active until definitive contract is signed with one.
- Revise AFSC Program Management Instructions to require more detailed procurement planning in Proposed System Package Programs and System Package Programs. Emphasize alternatives to letter contracts and definization milestones when letter contracts are unavoidable.

SUBJECT

COST CONTROL AND ACCOUNTING DEFICIENCIES

FINDING No. 4

INADEQUATE COST CONTROL AND ACCOUNTING PRACTICES CONTRIBUTED TO INACCURATE COST ESTIMATES, UNANTICIPATED OVERRUNS AND DELAYED PROGRAM DECISIONS.

Symptoms of Basic Deficiencies:

- Unable to identify and compare detail actual costs with proposals.
- Improper identification and allocation of costs to contracts.
- Cost proposals incomplete.
- Late cost proposals.
- Cost proposals included unrelated elements.
- Delays in contract negotiations and definitization.
- Potential overruns identified late to AF management.

Fundamental Causes:

- Inadequate segregation of contract costs.
- Systems do not allocate costs accurately on multiple contracts for same production items.
- Cost controls do not relate work accomplishment to actual costs.
- Inadequate or nonexistent records and management information about business data processing.
- Costs not accumulated against work packages.
- Air Force changing data requirements cause confusion within the accounting system.
- Air Force not gaining maximum benefit from contractor management experience.
  - Air Force denied access to records.
  - Cost data not effectively utilized for contract program control purposes.
- No formal, centralized estimating system.
- Program manager not familiar with cost details.
  - No system of controlling costs of work transferred to another division.
  - Gross fund allocations to operating divisions with no requirement for regular expenditure reports.

Actions By Contractors:

- Program to instill cost consciousness in middle management.
- Revised accounting and estimating system to correct co-mingling of direct charges.
- Instituted a program to develop and direct a "Cost Proposal System."
- Established a Program Review Board to refine cost control, budgeting and cost reporting systems.
- Prepared a cost estimating manual.
- Appointed cost control coordinator.
- Planned expenditure rates established and monitored on all major contracts.
- Established system to provide cost information by sub-project or work package.
- Updated procedure manuals and improved forms control.
- Developed EDP system for maintaining up-to-date contract value for all authorized work and a budgetary estimate for un-negotiated authorized work.
- Established dollar and quantity controls on overhead supplies.
- Reduced volume and complexity of cost transfers.
- Enforced cost transfer pricing directives.

Actions By Air Force:

- Verify that contractors use current historical data.
- Improved contractor cost estimating manual.
- Revised AFSC "Contractor Cost Study" Program.
- Revised AFSC pricing manual.
- PERT/Cost test program.
- AFSC plan for a source of historical cost information for use by all AFSC organizations.
- Cost Estimating Course established at Wright-Patterson AFB to train AF personnel in estimating and analysis capability.
- RAND Computer Program for total force structure costs for ten years. Costs developed by system, mission and support, include total resources allocated yearly to the Air Force based on program requirements, with shred-outs by mission, weapon system, groups of systems and R&D; investment and operating costs by appropriations.
- Use of "General Standard for System Source Selection Cost Proposals" to stimulate submission of proposals in similar format and detail, consistent with AFSC Contractor Cost Study.

SUBJECT

MAKE-OR-BUY POLICIES NOT ENFORCED

FINDING No. 5

MAKE-OR-BUY DECISIONS WERE NOT MADE OR EVALUATED IN ACCORDANCE WITH ASPR POLICY OR INTENT, THEREBY PERMITTING POOR UTILIZATION OF INDUSTRIAL RESOURCES, CONTRIBUTING TO LATE DELIVERIES, POOR PERFORMANCE, AND INCREASED COSTS.

Symptoms of Basic Deficiencies:

- Contractor making items not normal to production.
- Absence of competitive procurement by contractors.
- Domination of make-or-buy decisions by one department.
- Assignment of potentially competitive fixed-price buy items to other corporate divisions on cost reimbursement work orders.
- Pulling in large dollar-value subcontracts without economic justification.
- Expansion of facilities or work force when adequate capacity exists elsewhere.
- Little or no documentation of "make" decisions.
- Establishment of arbitrary make-or-buy ratios.
- Protracted AF review of contractor proposals.

Fundamental Causes:

- Contractor directives do not provide specific guidance.
- No corporate enforcement of directives on operating divisions.
  - Directives confined to existing make-or-buy structures.
- Little or no analysis by contractor or AF buyers.
  - Contractors do not evaluate all factors in developing a make-or-buy program.
  - Purchasing contracting officers rubber stamping make-or-buy structures.
  - Insufficient evaluation of make-or-buy proposals by AF field activities.
- Letter contracts signed prior to review or approval of make-or-buy proposals.
  - Contractor later negotiates from "fact accomplishment" position.
- Undue emphasis on one or two factors in evaluation by AF buying and field activities.

Actions By Contractors:

- Internal audit of make-or-buy compliance.
- Revising instructions to incorporate the ASPR and AFPI requirements.
- Detailed operating procedures to provide guidance and direction on how data used in the make-or-buy determination will be obtained.
- Document rationale for decisions.
- Establish make-or-buy committee.

Actions By Air Force:

- AFSC study group analyzing make-or-buy problems in defense industry.
- AFSC action to standardize contractor data in support of make-or-buy programs to the minimum consistent with the intent of ASPR.
- Division supplements to ASPR requiring early submission of proposed make-or-buy structure.

Actions To Be Accomplished:

- More fixed-price and incentive contracts which obviate government concern with contractors' make-or-buy decisions (unless use of government-owned facilities is involved).

SUBJECT

COSTS ARE UNDERESTIMATED

FINDING No. 6

CONSISTENT UNDERESTIMATING OF COSTS CAUSES DELAYS IN PROGRAM DECISIONS, PROGRAM STRETCH-OUTS OR TERMINATIONS, AND RESULTS IN COST OVERRUNS.

Symptoms of Basic Deficiencies:

- Consistent underestimates of engineering hours, particularly on cost reimbursement contracts.
- Prolonged delays in negotiations and in definitizing letter contracts.
- Support data not developed.
- Use of questionable and obsolete estimating factors.
- Estimating systems and procedures poorly defined.
- Estimates overdue.

Fundamental Causes:

- Incomplete description of products procured.
- Lack of management attention.
- Failure of AF to emphasize procedures.
- The AF and contractors had not reached a mutual understanding as to what constituted an acceptable estimating system.
- Inability to support estimating factors.
- Insufficient time allowed (or available) to prepare realistic estimates.

Actions By Contractors:

- Regularly reviewing estimating factors.
- Accepting the bilateral (AF-contractor) method of improving estimating methods.
- Develop/update estimating manual.
- Establish estimating training program.

Actions By Air Force:

- Review and revise estimating factors if necessary every six months.
- Reviews of major contractors' cost estimating techniques on continuing basis.

- Published AFSCM 70-4, 20 Dec 62, for review of contractor estimating methods. Will provide unified guidance and improve estimating methods review procedures.
- Evaluation of outstanding contractor estimating techniques which may be useful throughout defense industry.
- Ballistic Missile Division Exhibit 62-101 on program definition being service tested on MMRBM and Titan III. AFSC working groups are preparing a system management manual which will have a publication date established in July 1963. This manual will include Program Definition instructions.

SUBJECT

INEFFECTIVE MANAGEMENT AUDIT

FINDING No. 7

CONTRACTORS GENERALLY WERE NOT ASSESSING EFFECTIVENESS OF OR COMPLIANCE WITH COMPANY POLICIES AND PROCEDURES.

Symptoms of Basic Deficiencies:

- Policies and procedures out of date.
- Conflicting directives assign responsibilities to more than one department or division.
- Duplication of work by separate departments.
- Confusion generated from failure to follow established directives.
- No written procedures to cover accepted standard practices, with consequent problem of training new employees.
- Staff assumption of line responsibility.
- Work initiated without authorization.
- Basic management decisions requiring action by several departments not documented or publicized.
- Unfamiliarity of program managers with supporting departmental procedures.
- Undefined areas of program management responsibility.
- Prolonged communication processes.

  (Surveys indicate a direct relationship between the number and seriousness of basic deficiencies and the effective use of management audits.)

Fundamental Causes:

- Lack of acceptance and recognition for the need of independent policies and procedures audit system.
- Fragmentary management audits without comprehensive plan.
- Audit limited to financial activities.
- Understaffing of audit activity.
- Audit group reported to operational activity instead of top management.
- Weak or no follow-up system.

Actions By Contractors:

- Establishment of permanent independent audit groups, reporting to top management.

- Establishment of corporate audit cadre to form ad hoc surveys of division program management.
- Establish top management ad hoc audit groups.

Actions By Air Force:

- Coordination between government and company audit activities to reduce duplication.
- Encourage contractors to establish independent internal policy and procedures audit and reduce need for government inspection.
- Establishment of AFSC management survey activities.

SUBJECT

LIMITED STANDARDS FOR MANPOWER UTILIZATION

FINDING No. 8

STANDARDS FOR ASSESSING MANPOWER UTILIZATION/ REQUIREMENTS GENERALLY WERE RUDIMENTARY AND APPLIED TO A LIMITED PORTION OF THE WORK FORCE. AS A RESULT MANAGEMENT EXERCISED ONLY LOOSE CONTROL OVER THE LARGEST SINGLE ELEMENT OF COST.

Symptoms of Basic Deficiencies:

- Manpower controls are based on historic employment data and gross estimates of people needed for projected tasks. Such methods incorporate organizational, procedural, and supervisory inefficiencies in the historical base.
- Little or no effort to base standards for unit or individual performance on actual work measurement.
- Use of handbook "feeds and speeds" data rather than timed operations.
- Use of "activity indicator" work measurement systems not related to actual productivity.
- No standards or guides for supervisor—worker ratios.
- No standard hours or cost data.

Fundamental Causes:

- Cost reimbursement contracts do not motivate companies to manage manpower efficiently.
- Preference of buying activities for contractors with "in being" engineering capabilities.
- Resistance of departmental managers to have performance reported as a numerical rating.
- Preference of middle managers to justify overall manpower ceilings rather than match jobs against specific measured standards which take out "fat."

Actions By Contractors:

- Established work measurement programs in direct labor and supporting departments.
- Evaluate departmental "earned hours" against standard hours with consequent improvement in efficiency and reduction of labor force.
- Established manpower authorized/controls based on job measurement and task definition.

Actions By Air Force:

- Emphasizing fixed price and incentive contracts which will motivate contractors to develop and apply manpower controls.
- Making manpower controls special subject of management surveys.

Actions Recommended:

- Rate contractors' manpower controls as major management factor in source selection.

SUBJECT

DEFICIENT REPORTS CONTROL PROCEDURES

FINDING No. 9

FAILURE TO CENTRALLY MANAGE REPORTS RESULTED IN PROLIFERATION AND DUPLICATION WITH CONSEQUENT UNNECESSARY COST INCREASES.

Symptoms of Basic Deficiencies:

- No central review or control of internal or external reporting requirements.
- Duplication/overlapping of reports.
- No formal reports control program.
- No current inventory of reports.
- No accounting of individual report costs.
- No periodic evaluation of individual report need and use versus cost.
- No central forms control activity.

Fundamental Causes:

- Reports producing group functions as service organization with no responsibility to make management evaluations.
- Management not aware of manhour or dollar costs of total reports, or extent of duplication.

Actions By Contractors:

- Established central reports/forms control group.
- Approval mandatory for new reports.
- Up-dated complete report inventory.
- Altered accounting procedures to produce costs of individual reports.
- Established formal reports control/reduction program.
- Require periodic economic justification of existing reports and tab runs.

Actions By Air Force:

- Reduced contractual reporting requirements.
- Standardized procedures (PMI 1-8).
- Centralized control (SPO) of contractual reporting requirements.
- Periodic reviews—AF/Industry on specific weapon system programs.

SECTION II

Engineering Functions

SUBJECT

INSUFFICIENT SYSTEM DESIGN AND DETAILED DESIGN INTEGRATION

FINDING No. 10

SOME DEGREE OF DIFFICULTY WAS EXPERIENCED BY ALL CONTRACTORS IN THESE TWO TECHNICAL MANAGEMENT AREAS. A WIDE VARIETY OF AFTEREFFECTS CAN BE TRACED TO THE ENGINEERING PRACTICES USED IN THE INITIAL SYSTEM DESIGN PROCESS. OTHER EFFECTS ARE CAUSED BY PRACTICES USED IN THE DETAILED DESIGN PHASE WHEREBY EXCESSIVE ANOMALIES ARE INTRODUCED INTO THE TOTAL SYSTEM. IN GENERAL, THE QUALITY AND DEPTH OF ANALYTICAL WORK THAT IS A FUNDAMENTAL PART OF THE EQUIPMENT DETAILED DESIGN PROCESS DOES NOT COMPARE FAVORABLY WITH THAT AT THE SYSTEM DESIGN LEVEL. THE LIMITED SCOPE OF THE EQUIPMENT DESIGNER'S EFFORT IS GRAPHICALLY REVEALED, BELATEDLY, WHEN THE HARDWARE IS PHYSICALLY INTEGRATED INTO THE SYSTEM.

Symptoms of Basic Deficiencies:

- High percentage of design changes are made to correct previous design oversights.
- Letter contracts in force for prolonged periods—as long as two or three years.
- Subcontract and in-house workstatements not definitive, usually attended by inability to relate engineering hours expended to design accomplished and the occurrence of contract cost overruns.
- Identification and justification of AGE and facility items late, incomplete and inadequate.
- Development of system/equipment interface specifications and detailed specifications late and inadequate to needs.
- Development of technical data late and of poor quality.
- High rate of system design incompatibilities revealed by system testing; feedback from system test inefficiently utilized or given low priority treatment by design groups.
- Essential reliability considerations are predominantly made on after-the-fact basis, i.e., after design release.
- Unilateral design releases by design groups (group release) permitted and constitute highest percentage of total release design.
- Engineering recommendations or proposals not supported by analysis; potential design trade-offs not identified.

Fundamental Causes:

- Air Force and contractor top management are prone to apply corrections to secondary effects or visible problems rather than to seek and correct basic causes; e.g., joint negotiation team is set up to

definitize letter contract when cause of late definitization is an inadequate engineering or technical workstatement wherein AF/contractor engineering groups assert better definitization not possible until system/equipment is invented—at this point, top management does not question whether engineering has applied adequate methods and techniques in developing workstatement, or has simply made off-the-cuff "guestimates".

- In system acquisition programs—top management has often failed to appreciate the extent to which the engineering discipline should be the forcing function in the acquisition process and as a corollary, they do not recognize the magnitude of the cascade effect of inadequate and incomplete engineering upon production, purchasing, materiel control, quality control, logistics, etc., and ultimately the impact upon the customer.
- Many contractor engineering top managers, as they have advanced to present positions, have retained biases of the design engineer which are reflected in the organization and management of the engineering effort—propensity for undue personal involvement with the more interesting and esoteric design problems—tendency to organize solely for hardware design task with slight attention to equally fundamental responsibilities for output of technical data and timely support of other departments—tendency toward excessive "management by exception" where organizationally and procedurally they have not adequately prescribed realistic technical and management boundary conditions or criteria that will insure control, which in turn results in significant technical decisions being made at or below the group engineer levels that are unknown to higher management or where important engineering functions are unaccomplished and not detected until highlighted as a problem.
- The following factors predominate in producing cascades of problems in contract definition, purchase, cost control, materiel control, production, quality control, reliability, system check-out and turnover to Air Force. The conditions noted above are not necessarily prerequisite to these factors; however, the impact of the following factors will be more severe if those conditions exist.
- *Simultaneity of the design process which is an inherent characteristic of this process and independent of whether or not the program concept is one of concurrency or of sequenced development, production and deployment.*
  - Extreme difficulty of timely, accurate communication between large numbers of designers who have been educated and specialize in different engineering disciplines and fields of technology.
  - Further accentuated by the iterative nature of the design process.
- *Initial system definition either was not acomplished by an orderly analysis process or effort was incomplete and inadequate; there was no continuing requirement to perform system analysis on selective basis during acquisition phase.*
- Decentralized program management.
  - Authority to make design decisions and design releases delegated to too low organizational levels.

- Autonomous or semi-autonomous design groups combined with excessive reliance on voluntary lateral coordination between groups.
- Design groups predominantly equipment oriented and have little capability for system engineering and integration.
- Lack of design review for system compatibility and optimization above group engineer levels.

- System engineering or design integration group, if it exists, is impotent because:
  - Authority, responsibility and accountability not clearly defined, or
  - Group has limited function such as review of design released in administrative sense only and not from technical viewpoint, or
  - Useful criteria for determining, routinely, when design reviews or system analyses will be performed have not been developed; or, the criteria do not adequately define technical conditions in quantitative terms for which design reviews and system analyses are mandatory in initial design and design changes.
  - System analyses and design reviews are accomplished only upon request of design groups.
  - Design Integration Group not in design release channel; in practice decisions for release are made routinely and unilaterally by design groups.
  - System Engineering or Design Integration Group lacks technical competence and capability to perform functions.

- Separate department external to engineering established to manage reliability program, but assigned responsibilities that properly cannot be separated from the basic design function.

Actions By Contractors:

- Voluntary establishment of distinct System Integration or Design Review Group, as appropriate, with functions and responsibilities clearly defined and executed by experienced, competent senior engineering specialists.

- Reorganization along project lines—vertical organization for improved program control and design decision making.

- Education and training of personnel in preparation of engineering workstatements and engineering change proposals.

- Contractor management teams with buyer-engineer-materiel-quality control representation established for each major subcontract.

- Responsibility and accountability for reliability considerations in original design and in design changes reassigned to basic design groups. The external Reliability and Quality Assurance Department assigned independent, reliability evaluations and manages the failure and consumption data program, testing for reliability (search for critical weaknesses), etc.

Actions By Air Force:

- Request for proposals (RFP) now includes specific instructions on contract and program definition requirements.
- Increasing use of two or three phase contracting for system acquisition where: Phase I—is solely for *program definition*—a funded effort where two or more contractors are selected on competitive basis to perform program definition; based on evaluation their efforts one contractor is selected for a Phase II—using the program definition developed in Phase I, Phase II may be either for RDT&E only or it may proceed with both RDT&E and production.
- For all new system programs in the future, system analysis methods will be required by contract to be employed for system definition and selectively required throughout the acquisition phase (example—BSD Exhibit 62-101). The System Analysis Program provides the management means for:
  - Identification of system requirements in a systematic manner on total system basis, including hardware, procedural data, facilities and personnel.
  - Development of design requirements on basis of time, performance and cost trade-offs.
  - Integration and trade-offs of design constraints, i.e., reliability, maintainability, producibility, procurability, safety, human engineering and value engineering.
  - Progressive and evolutionary development and approval of specifications as the forcing function on design.
  - Establishment of method of control which permits design flexibility.
  - Development of definitized information which forms basis for and inter-relates test, production, system activation and check-out.
  - Provide early information necessary for determination of items in DOD inventory which meet system requirement.
  - Provide basic data necessary for networking system milestone activities into program review control techniques such as PERT and PERT/Cost.
  - Provide single source of documentation for evaluating design to insure total system objectives are met.
- For older programs already on contract, the system analysis techniques are selectively applied by contract change notices (CCNs) as required to produce progressive controls of Air Force requirements and the design process through the use of multiple sequential baselines. These baselines are progressively:
  - Design requirements.
  - Design configuration.
  - Hardware configuration.
- AFPROs or CMDs and SPOs follow-up on contractor's corrective actions and/or execution of the contractual requirements for system analysis and the contractor's performance in design integration.

Actions To Be Accomplished By Air Force:

- AFSC is developing a manual for Systems Management which includes program definition instructions and system analysis procedures. This manual will include contract exhibits such as the BSD Exhibit 62-101, "System Definition/Analysis Procedures," which will be revised to reflect the practical experience gained from use by contractors with system integration and sub-system/equipment responsibilities.

Additional Actions Recommended:

- Contractor technical managers in general should give more thought and attention to their total management role. Periodically they should personally check into specific details of the management system to determine whether the system is functioning in practice as they had believed. Specifically, they should have more intimate knowledge of the actual functional flow channels, the decision making channels and levels, the adequacy of methods and techniques for work definition, and the practices in work approval, assignment, and control for items not routinely brought to top management levels.
- Critical evaluations should be made by the Air Force and contractors in the early design stages concerning the specification requirements. They should be evaluated from both viewpoints—too tight, too loose.

SUBJECT

INADEQUATE CONSIDERATION OF RELIABILITY IN DETAILED DESIGN; UTILIZATION OF FAILURE AND CONSUMPTION DATA BY DESIGN GROUPS

FINDING No. 11

THE CONTRACTORS WERE GIVING INADEQUATE ATTENTION TO RELIABILITY IN INITIAL DESIGN EFFORTS AND/OR INSUFFICIENT ATTENTION LATER ON TO FAILURE AND CONSUMPTION DATA REPORTS.

Symptoms of Basic Deficiencies:

- Many changes to delivered equipment are required to obtain minimum acceptable reliability, with attendant higher program costs.
- High spares levels to support development tests and/or operational system.
- Upgrading to meet approved reliability objectives accomplished by "follow-on" programs.
- Contractor design groups not aware of failure and consumption trends in functional and development tests on equipment of their design.
- Low "in-commission" status of equipment in custody of user organization; using agency has low degree confidence in reliability of equipment.

Fundamental Causes:

- Air Force did not provide quantitative reliability requirements timely to contractor's initial design efforts. (Reference program definition and detailed design integration in technical section.)
  - Failure to require formal program definition analyses which would have highlighted lack of requirements.
  - Air Force planning documents (SOR, PSPP, and BPP) lacked quantitative reliability requirements.
  - Lack of appreciation and understanding that quantitative requirements are necessary in detailed design initial efforts.
  - Reluctance to place quantitative reliability requirements on contract.
  - Value engineering requirements conflict with or contradict reliability goals.
  - Extreme emphasis on program cost and schedules which adversely affected consideration of reliability in necessary detail during the design process.

- Lack of full appreciation by a few contractors and Air Force Program Offices that consideration of reliability is integral to the design process.
  - Design groups were not held responsible and accountable for reliability in detail design because complete responsibility for all aspects of the reliability program was assigned to an autonomous reliability organization, separate and apart from the engineering department and which was ineffective in keeping abreast of the detail design process. (NOTE: This is not to say that autonomous reliability organizations are undesirable. Such organizations are particularly effective where this function is one of reliability assurance, i.e., management of the reliability data reporting system, reliability testing of components, search for critical weakness testing, reliability trend analyses, etc.)
- Inadequacies of the Failure and Consumption Reporting System was frequently the reason for apparent failure of design groups to utilize Failure and Consumption Data.
  - Failure and Consumption Reports did not contain meaningful or pertinent information, either because the data card format was not sufficiently comprehensive, or field personnel lacked proper training in making card entries.
  - Excessive flow times—4 to 6 months—for Failure and Consumption Data Reports to filter in from field through the reliability organization to the design groups. (However, design groups were usually acting on information from field obtained directly through engineering channels and the problem usually was one of reconciling that action with what was apparently required by Failure and Consumption Data Reports.)

Actions By Contractors:

- Issued new policy clarifying responsibilities of engineering department and independent reliability organization for the reliability program.
  - Engineering held responsible and accountable for attainment of reliability program design objectives or requirements.
  - Reliability organization redesignated Reliability Assurance (or Quality and Reliability Assurance) Department responsible for management of the reliability data gathering system, for reliability trend analysis, testing for reliability of components and search for critical weaknesses, functioning as the policing agency to assure that the reliability loop is closed throughout the requirements, design, development, production and deployment cycle.
- Several companies have analyzed their entire design process to improve methods and techniques of designing and to develop a better capability to "design it right the first time."
  - The increased use of high-speed digital computers, statistical theory, and mathematical models in the initial design process.

- Revised Failure and Consumption Data Card formats in order to obtain more comprehensive data; educated field personnel in reliability data reporting.
- Streamlined Failure and Consumption data reporting channels to provide timely information and engineering.

Actions By Air Force:

- System Acquisition Programs are now required to undergo a Program Definition Phase. One objective of this phase is the early identification of total reliability requirements for injection into the original designs.
- Military Specification MIL-R-27542 and AFSC Regulation 80-1 have been updated to take advantage of the improved reliability techniques.
- AFSC procedures have been tightened up to insure that quantitative reliability requirements are both in the planning documents and, later, in contracts before award approval.
- Air Force Institute of Technology has established several formal courses on reliability, one of which leads to a Masters degree in reliability engineering.

Actions To Be Accomplished:

- Continuous modification of failure reporting requirements and procedures to obtain information essential for reliability analysis.

SUBJECT

UNREALISTIC DEVELOPMENT ENGINEERING AND TEST SCHEDULES

FINDING No. 12

DEVELOPMENT ENGINEERING AND TEST SCHEDULES ESTABLISHED EARLY IN A PROGRAM GENERALLY PROVE TO BE OPTIMISTIC AND SELDOM ARE ACHIEVED.

Symptoms of Basic Deficiencies:

- Failure to meet original program milestone dates by a wide margin.
  - New schedules show ever-increasing concurrent achievement of individual milestones.
- Methods of recording progress are changed as program schedules are slipped.
- Increased program costs.
  - Contract and subcontract cost overruns.

Fundamental Causes:

- Planning not based on past experience.
- Insufficient analysis for determination of significant factors influencing engineering and test schedules, or,
- Insufficient time allotted for developing schedules.
- Contractors propose unrealistic schedules in order to be competitive.
- Type and terms of contract impose no penalty on contractor for failure to meet schedule.
- Added requirements imposed by Air Force without changing program key end dates, particularly the operational dates.
- "Most optimistic possible" dates selected as technique to exact best performance of personnel, for which probability of accomplishment is low or non-existent at outset.

Actions By Contractors:

- Established "unified" test program concept, reorganized test structure with all engineering test efforts under one department, including planning of test schedules.
- Applied PERT netting to development engineering and test scheduling to better identify influencing factors.
- Applied past experience on similar programs in estimating schedules initially.

Actions By Air Force:

- Implementation of a competitive, funded program definition phase as a part of the acquisition cycle.

- Source selection for later phases of acquisition based on evaluation of contractor inputs from program definition phase.
- use of fixed price or performance incentive type contracts for development, test and evaluation phase and for production and deployment phase.
- Require implementation of the PERT system, when appropriate, for new programs.

Actions To Be Accomplished:

- AFSC is developing a System Management Manual, which includes program definition/system analysis procedures. Target date for publication is to be established by July 1963.

SUBJECT

INEFFICIENT UTILIZATION OF ENGINEERING MANPOWER, AND ASSIGNMENT AND CONTROL OF ENGINEERING WORK

FINDING No. 13

THE COMMON FINDING WAS THAT, IN GENERAL, ENGINEERING WORK STATEMENTS DID NOT SUFFICIENTLY DEFINE THE TASKS AND, THEREFORE, WERE NOT ADEQUATE INSTRUMENTS FOR EVALUATION OF WORK PERFORMANCE. TWO CIRCUMSTANCES UNDER WHICH THIS SITUATION OCCURS ARE OF PARTICULAR INTEREST TO THE AIR FORCE; NAMELY, WHERE THE CONTRACTOR HAS MULTI-PROGRAM EFFORTS WHICH MAY INCLUDE A MIXTURE OF AF AND NON-AF PROGRAMS, AND WHERE THE CONTRACTOR'S EFFORT IS LARGELY A SINGLE AF PROGRAM BUT A SIGNIFICANTLY LARGE AMOUNT OF THE ENGINEERING HOURS IS CHARGED TO A VERY FEW "CATCH-ALL" ENGINEERING WORK ORDERS.

Symptoms of Basic Deficiencies:

- Inability to closely relate engineering manhours to work performed.
  - Work statement not sufficiently definitive in many instances; however, some may be completely detailed.
- Inability to accurately segregate engineering hours expended on a given program from total departmental effort.

Fundamental Causes:

- Decentralized program management within engineering department(s).
  - Functionally oriented rather than program-minded.
  - More concerned with having flexibility considered necessary for best results from the total departmental effort on all programs.
  - Less concerned with precise distinction of effort expended on any one program.
- Engineering top management did not place emphasis on definitive written work statements.
  - Oral description of details was considered adequate or details of work required was considered to be self-evident.
  - Further written definitization was considered superfluous.
  - No written or oral instructions were issued, however, as to the most essential elements of work or which categories required greater or lesser detail.
- Lower level supervisors did not directly use statements of work in measurement of group work output nor for evaluating technical proficiency of engineers assigned to job, although manhour charges were made to the work order numbers.
- Underlying all other factors in utilization of engineering manpower are the inherently conflicting demands of the relatively short-term

AF programs and the long-term company interest in maintaining its competitive, technical position for future business.

- Rapid manpower build-up initially and tail-off at program completion; proper phasing for program economy in AF interest.
- Stable engineering force in best interest of company.
- Potential compromise of AF program interest when company efforts include both AF and non-AF programs and/or mixture of fixed price and cost plus fixed fee types of contracts, all in conjunction with non-definitive statements of work.
- Company position that written definitization of all tasks not warranted or economical in every case and most efficient day-to-day utilization of engineering manpower is in best interest of all programs has some validity; however, the position is weakened by lack of supporting evidence that can be evaluated by AF.

• Long-term interests of AF and industry on utilization of engineering manpower are more in agreement.

- In AF interest that a number of companies are equally competitive on future programs.

Actions By Contractors:

• Increased definitization of engineering tasks by enforcing compliance with existing policies and procedures.

- Most companies already have in being good written procedures for assignment and control of engineering tasks.

• Training programs have been started to provide a greater capability at all levels in the preparation of engineering work statements.

• Centralization of program management.

Actions By Air Force:

• Required centralized program management for large AF programs or where contractor has diversified engineering effort involving fixed price and CPFF contracts or mixture of AF and non-AF programs.

• Tighter control of engineering studies and analyses, by specific identification of effort and approval by Contract Change Notices; increased use of design problem log books in SPOs indicating nature of problem area, task number, objectives, estimated engineering manhours, actual manhours, schedule, and end product, i.e., ECP, design change prototype, R&D test schedule, qualification test, etc.

• Increased surveillance of engineering tasks by AFPRO/CMO on periodic basis.

• Required better contract definition by SPO of work to be performed.

Additional Actions Recommended:

• Joint studies by the Defense Industry and the AF of the engineering manpower problems with the objectives of determining whether new

techniques, policies or methods can better reconcile long-term interests with short-term program requirements, to recommend what policies or methods are needed, and to recommend implementation plans.

- As a part of the negotiated contracts, the AF and contractors should work out a "Chart of Accounts" which identifies and relates major engineering tasks to cost and schedule as a means of uniform measurement of technical progress.

SECTION III

Production & Quality Assurance Functions

SUBJECT

INADEQUATE FACILITIES MANAGEMENT

FINDING No. 14

LACK OF FACILITIES MANAGEMENT EMPHASIS DELAYED DEVELOPMENT, PRODUCTION AND TEST PROGRAMS; DUPLICATED INVESTMENT; RESULTED IN LOW RESOURCES UTILIZATION; AND INCREASED COSTS TO THE GOVERNMENT AND INDUSTRY.

Symptoms of Basic Deficiencies:

- Low facilities utilization.
- Late and high cost production.
- Capital equipment charged to contracts as direct costs.
- Retention of government-furnished facilities after program completion.
- Failure to correctly identify and report idle facilities.
- Poor maintenance of equipment.
- Industrial facilities classified as special tooling or test equipment and vice-versa.

Fundamental Causes:

- Facilities screening not carried out aggressively by contractor or Air Force.
- Expansion requirements not identified in time to provide facilities for production.
- Loose inventory control.
- Weak enforcement of ASPR/AFPI by AF and contractor.
- Desire of contractors to maximize government facilities investment, minimize own long-term capitalization.
- Lack of top management concern.
- Misclassification as an expediency because of program schedules and funding delays anticipated.

Actions By Contractors:

- Improved screening and disposal of machine tools.
- Improved classification procedures.
- Improved organizational distribution of tools to minimize duplication.
- Earlier release of production/test plans with facilities impact.
- Increased subcontracting of peak loads.
- Top management review of government as well as company facilities expansion requirements.

Actions By Air Force:

- Project "Tide" established by Hq USAF to re-examine the entire area of policies, procedures, and industry practices of acquiring, classification and control of specific tooling.
- Intensified review of facilities acquisition, utilization, maintenance, storage, and disposition by Air Force Plant Representative Office/ contract management divisions and contract management regions.
- Establishing central control of Army, Navy, AF idle equipment inventory under Defense Supply Agency.
- Top management review of government as well as company facilities expansion requirements.
- Facilities costs, in support of production, programmed and funded directly from within the total system program budget. Elimination of all direct system facilities costs from current separate industrial facilities budget programs, i.e., BP-1400, BP-2400, and BP-8600.

Actions To Be Accomplished:

- AFPI to be revised as result of findings under project "Tide."

SUBJECT

LATE DELIVERIES OF END ITEMS

FINDING No. 15

LATE DELIVERIES CREATE TRAINING AND LOGISTIC SUPPORT PROBLEMS, INCREASE UNIT COSTS, AND JEOPARDIZE OPERATIONAL CAPABILITIES.

Symptoms of Basic Deficiencies:

- Unavailability of items to user.
- Undefinitized letter contracts.
- Increased program costs.
- Excessive overtime.
- Shop orders behind schedule.
- Continuous expediting of items through shops.

Fundamental Causes:

- Poor production control.
- Basic design inadequate.
- Unrealistic scheduling.
- Excessive design changes.
- Late engineering releases.
- Late receipt of vendor items.
- Delays in receiving inspection.
- Material shortages to production line.
- Ineffective in-house expediting procedures.

Actions By Contractors:

- Revised manufacturing schedule.
- Requests waiver from Air Force to use R&D drawing in lieu of Class II.
- Aggressive search for other sources for components/materials.
- Established automated parts control system.
- Established "line-of-balance" and other advanced production control techniques.

Actions By Air Force:

- Amended contracts, establishing realistic delivery schedules.
- Granted waiver for use of R&D drawings.
- Implemented AFSCM 375-1 to establish configuration management and reduce number of changes.

SUBJECT

CALIBRATION OF TEST OR PRECISION MEASURING EQUIPMENT DELAYED

FINDING No. 16

ALMOST WITHOUT EXCEPTION THERE WAS LATE CALIBRATION WITH CONSEQUENT IMPACT ON QUALITY ASSURANCE.

Symptoms of Basic Deficiencies:

- Overage calibration tags.
- Delivery of out-of-tolerance hardware.
- Rejections at subsequent production stations and in the field.
- Excessive rejects of out-of-tolerance hardware.

Fundamental Causes:

- No central control of calibration records and schedules.
- Inadequate calibration procedures.
- Insufficient amount of calibration equipment.
- Poor discipline and enforcement of procedures.

Actions By Contractor:

- Revised procedures and emphasis on procedural discipline.
- Coded calendar dates for recalibration abandoned in favor of actual dates.
- Auditing techniques introduced.
- Central control and records established.

Actions By Air Force:

- Revoke contractor Quality Assurance system approval for lack of compliance.
- Increased surveillance by AFQAR.
- Improve contractual requirements by use of MIL-C-45662A, "Calibration System Requirements."

SUBJECT

QUALITY ASSURANCE AUDITS NOT EFFECTIVE

FINDING No. 17

FAILURE TO AUDIT QUALITY ASSURANCE PROCEDURES ALLOWED SOME QUALITY ASSURANCE SYSTEMS TO OPERATE INEFFICIENTLY AND INEFFECTIVELY WITHOUT MANAGEMENT'S KNOWLEDGE.

Symptoms of Basic Deficiencies:

- Quality procedures not followed.
- Production frequently failed to meet contract specifications.
- Excessive rework.
- Rejectior of hardware.
- Repetitive discrepancies/defects.
- Failure reports not fully used.
- Lack of communication between quality, reliability, engineering, manufacturing, and test personnel.

Fundamental Causes:

- Inadequate manning of QA organization.
- Incomplete support of top management.
- Absence of written quality audit procedures.
- Absence of trend data.
- Quality Assurance and audit low in organization structure.
- Quality audit results not enforced.
- Lack of follow-up to evaluate effectiveness of corrective action.

Actions By Contractors:

- Improved vendor audit system to concentrate corrective efforts on poor performing vendors.
- Elevated organization placement and scope of responsibilities of quality audit group.
- Increased staffing of QA departments.
- Written quality audit directi/es issued.
- QA trend charts and trend levels established.
- Quality Review Board established.

Actions By Air Force:

- Continuous surveillance by AFQAR and contract management region staff quality assurance offices.
- Incorporation of "Quality Audit" requirements in contracts by amendments to MIL-Q-9858, "Quality Assurance System Requirements."
- Provide for Air Force feedback of malfunction data (AFM 66-1) to contractor.

SECTION IV

Purchasing & Materiel Functions

SUBJECT

INADEQUATE COMPETITION AND PRICE ANALYSIS IN AWARD OF SUBCONTRACTS

FINDING No. 18

THE COMMON FINDING IS THAT INADEQUATE COMPETITION AND PRICE ANALYSIS GENERATE HIGH COSTS, ONE-SIDED CONTRACT TERMS, AND A WEAK POSITION FOR FOLLOW-ON PROCUREMENT.

Symptoms of Basic Deficiencies:

- Repetitive purchases from same supplier.
- Many single or sole source pu-chases.
- Frequent expedited procurements.
- Cursory price analysis.
- Delay in definitizing letter subcontracts.
- Over-runs on CPFF subcontracts.
- Excessive subcontract costs.

Fundamental Causes:

- Compressed procurement lead times caused by:
  - Unrealistic delivery schedules.
  - Late engineering releases.
  - Delays in processing requirements through materiel control.
  - Lack of knowledge concerning lead times by ordering personnel.
  - Concurrent development/production.
- Failure of management to audit or enforce policies, procedures and controls governing competitive procurement.
- Insufficient management review of purchase orders and price analysis.
- Limited experience of procurement and pricing people.
- Cursory purchase order evaluation by ACO and price analysts.

Actions By Contractors:

- Closer purchasing/engineering liaison to expedite earlier release of longer lead time items.
- Procurement lead times emphasized in establishing effectivity of proposed changes.
- Purchasing department representative participates in engineering change activity.
- Electronic data processing system instituted to reduce flow time of materiel requirements paper work.
- Lead time report published for major items.

- Top management project of developing corporate standards, methodology and techniques for cost analysis manuals.
- Vendor Evaluation Group to participate in source selection.
- Cost analysis and audit procedures improved to give buyer complete cost history records.
- Procurement Review Board established to review all orders over $10,000 for extent of competition, cost analysis, and justification of single or sole source procurement.
- Expanded training program introduced in purchasing and cost analysis functional areas.

Actions By Air Force:

- Continuous evaluation of delivery schedules.
- Increased effort on the part of AFPR price analysts in review of subcontracts.
- Purchase Systems Manual published (AFSCM 70-3).
- Annual purchasing review of major contractors' purchasing systems.
- Continuous training of purchasing system analysts.

SUBJECT

LATE DEFINITIZATION OF LETTER CONTRACTS WITH SUBCONTRACTORS

FINDING No. 19

EXCESSIVE DELAYS ARE OCCURRING IN THE DEFINITIZATION OF LETTER CONTRACTS WITH SUBCONTRACTORS AND VENDORS REDUCING ABILITY OF PRIMES TO CONTROL COSTS AND TO NEGOTIATE FAVORABLE SUBCONTRACT TERMS. FREQUENTLY RESULTS IN NO RISK FEATURES AND OTHER DISADVANTAGES OF COST REIMBURSEMENT AGREEMENTS, WITH FEE AND PROPRIETARY FEATURES OF FIXED PRICE CONTRACTS.

Symptoms of Basic Deficiencies:

- Contract completed shortly after definitization.
- Frequent increases in dollar limit on undefinitized letter contracts.
- Hasty source selection.

Fundamental Causes:

- Indefinite or ill-defined statement of work.
  - Insufficient time allotted for engineering to prepare technical work statements; time allotted for administrative approval cycle frequently greater by factor of 10 than time to define work tasks.
- Poor management and cost controls over procurement actions.
- No periodic accounting of expenditures required until contract was definitized.
- Failure of management to enforce established procurement policies.
- Contractors' opinion that delays will permit price reductions by the addition of quantities to existing procurements.
- Lack of engineering—purchasing coordination.

Actions By Contractors:

- Restrict the use of letter contracts to those instances where procurement lead-time dictates.
- Established a limitation of 40 per cent of maximum cost data accumulation at which point the contract or purchase order must be negotiated.
- Education and training program for defining work statement packages.
- Established a monthly management control report to be submitted by each Procurement Department for letter contracts or open purchase orders.
- Established training course for engineers in preparation of technical work statements.

- Improved exchange of information between engineering and purchasing.

Actions By Air Force:

- Continuous surveillance by purchase method analysts.
- Increased emphasis on program definition prior to award of contract.
- Restricted use of CPFF contracts and subcontracts.

SUBJECT

INADEQUATE SUBCONTRACT MANAGEMENT

FINDING No. 20

SUBCONTRACTOR MANAGEMENT WAS DEFICIENT IN THE AREAS OF PRICE REDETERMINATIONS, CONTROL OVER EXPENDITURES, AND TECHNICAL PROGRESS EVALUATION, WITH RESULTING UNANTICIPATED OVERRUNS, AND PERFORMANCE/SCHEDULE SLIPPAGES.

Symptoms of Basic Deficiencies:

- Delinquent price redeterminations.
- Subcontractor cost overruns.
- Little use of learning curves in negotiations.
- Unawareness of subcontractor technical and production problems.

Fundamental Causes:

- Late submission of vendor cost data and untimely audit suport.
- Unrealiable financial reports.
- Failure of subcontractors to report financial data required by the contractor.
- No single organizational element responsible for controlling subcontract costs.
- Failure to follow existing procedures.
- Expedited procurements.
- Inadequate review of pricing and cost estimating of subcontractor proposals.
- Inexperienced buyers.
- Inadequate technical surveillance of subcontractors.
- Failure to examine subcontractor's management as part of source selection.

Actions By Contractors:

- Policies revised to establish the requirement for determining the adequacy of the subcontractor's accounting system prior to negotiation of subcontracts.
- Status reports revised to provide more timely cost control information.
- Audit group reorganized to provide adequate audit support.
- Subcontract management team established for major subcontracts with engineer, Quality Control, and material members.
- Formalized source selection for major subcontractors.

Actions By Air Force:

- Continuous surveillance by purchase method analysts.
- Increased technical/production surveillance of subcontractors by buying activities.
- Delegation of secondary contracting responsibility to administrative contracting officer having cognizance over subcontractor.
- AF-industrial symposia on improving subcontract management.

SUBJECT

MULTIPLE PURCHASE ORDERS FOR SAME ITEM

FINDING No. 21

SOME CONTRACTORS WERE ISSUING MULTIPLE PURCHASE ORDERS WITHIN THE SAME TIME PERIOD FOR LIKE ITEMS, THUS INCREASING ADMINISTRATIVE AND UNIT COSTS.

Symptoms of Basic Deficiencies:

- Large numbers of purchase orders per dollar volume of procurements.
- Variations in unit costs.
- Excessive documentation requirements for:
  - Receiving reports.
  - payment vouchers.
  - Change orders.

Fundamental Causes:

- Purchase order procedures tied to need to segregate costs by contract and to automated data processing system.
- Failure to consolidate requirements.
- Failure to follow established procurement policies and procedures.
- Lack of uniform procedures for all purchasing departments.

Actions By Contractors:

- Improved communications between purchasing and materiel control.
- Revised scrap processing procedures.
- Proper use of multiple buy cards.
- Study extent of economies through combining of purchase orders.
- Use of corporate purchase agreements, blanket orders, open end orders, etc.

Actions By Air Force:

- Continuous surveillance and assistance by purchase method analysts.

SUBJECT

DELAYED TERMINATION OF SUBCONTRACTS

FINDING No. 22

LACK OF STRICT PROCEDURAL DISCIPLINE, DELAYED NOTIFICATION AND SETTLEMENT OF TERMINATED SUBCONTRACTS, AND INCREASED COSTS TO THE AIR FORCE.

Symptoms of Basic Deficiencies:

- Lack of control and aggressive follow-up by the buyer.
- Subcontractor claims not settled promptly.
- Increased subcontract termination costs.
- Delays by buyers in updating purchase order files prior to forwarding to termination coordinator.
- Delayed transmittal of termination notice.
- Delays in subcontractor notification.

Fundamental Causes:

- Lack of managerial emphasis on the termination function.
- Contractor decentralization of the terminations function coupled with lack of standardized procedures.
- Slowness by the Air Force in (a) requesting audit assistance, (b) auditing a claim, and (c) submitting a claim to the Air Force Review Board.

Actions By Contractors:

- Standardized terminations policies.
- Procedures revised to provide quicker response on termination notices.
- Procedures implemented that provide instructions to subcontractors immediately after termination notice.
- Regular top management review of termination status.
- EDP system to reduce flow time of paper work in materiel control areas.

Actions By Air Force:

- Termination functions emphasized and placed under a single control point in contract management districts to assure expeditious action by Air Force and contractor personnel to accomplish timely settlements.

SUBJECT

MATERIEL CONTROL DEFICIENCIES

FINDING No. 23

THIS IS A COMBINATION OF SURVEY FINDINGS WHOSE IMPACT IS TO DELAY PRODUCTION AND DELIVERIES, STIMULATE OVERTIME, AND INCREASE SPACE REQUIREMENTS AND COSTS.

Symptoms of Basic Deficiencies:

- Materiel late or arrives before requirement.
  - Inaccurate stock reports and inventory records.
  - Undependable stock levels.
  - Materiel requirements established without knowledge of stock on hand.
- Failure to coordinate shipments and materiel requirements.
- Materiel control delays between termination notice and termination instructions to subcontractors.
  - Inaccurate lead times.
- Value analysis program in contractors Materiel Department ineffective.
- Supplies not standardized.
- Insufficient consolidation of purchases.
- Government-furnished equipment lost, or location and condition unknown.
- Hurried purchases.
- Delay of critical items in receiving inspection.

Fundamental Causes:

- Late release by engineering.
- Inexact procedures and assignment of responsibility.
- Insufficient lead time on purchase requests.
- Unrealistic end item delivery schedules.
- Insufficient control over materiel transfers.
- No top management audit of materiel control of policies and procedures.
- Insufficient source solicitation.
- No evaluation of vendor capabilities.
- Incomplete purchase order data.

Actions By Contractor:

- Feedback system of statistical data to focus attention on substantial inventory variations.

- Materiel Engineering Coordination Unit within the Purchasing Group.
- Detailed operating procedures for materiel control formalized.
- Visitor control procedures enforced in stockroom and warehouse areas.
- Full-time stockroom supervision established.
- Audits instituted.
- Employees trained in data processing.
- Established GFP record and control center with responsibility for property accountability and reporting.
- Increased effort to standardize items and extend program to other than industrial supplies.
- Publishing a periodic lead time report for major buy items.
- Contract negotiation team formed for all major procurements.
- Purchase Order Review Board established to measure effectiveness of purchasing.

Actions By Air Force:

- Follow-up in the purchase system reviews and by Air Force resident procurement analysts.
- Ship GFE to contractors only to firm requirements.

SECTION V

Product Support Functions

SUBJECT

LOGISTIC MANAGEMENT FUNCTIONS NOT ADEQUATELY RECOGNIZED

FINDING No. 24

A MAJORITY OF CONTRACTORS DID NOT HAVE EFFECTIVE LOGISTICS MANAGEMENT ORGANIZATIONS. AS A RESULT THERE WAS GREAT VARIATION IN THE TIMELINESS AND QUALITY OF LOGISTICS SUPPORT PLANNING DOCUMENTATION AND DELIVERIES.

Symptoms of Basic Deficiencies:

- Late delivery of and inaccurate technical order publications.
- Delinquent delivery of spare parts.
- Excess Air Force material for support of contractor, depot-level, maintenance and/or site activation tasks.
- Slippage in programmed milestones.

Fundamental Causes:

- Company precedent followed in placement of functions to fit existing organization.
- Rapid expansion of contractors' programs.
- Lack of experience and appreciation of importance of logistic support.
- Lack of management emphasis of support functions.

Actions By Contractor:

- Reorganized to assure alignment of homogeneous functions under a single logistic director.
- Strengthened position of the director and the logistic function.
- Implemented procedures to clarify interdepartmental responsibilities and interfaces.

Actions By Air Force:

- Emphasis to contractors on need for improved logistic management.
- Management responsibility for technical order validation, and AGE design, requirements, provisioning, etc., assigned to SPO.
- Enforce provisions of MIL-D-9412 and MIL-M-26512; MEP 71-650 and other contractual requirements.

SUBJECT

TECHNICAL DATA LATE, COSTLY, AND INACCURATE

FINDING No. 25

THE SURVEYS INDICATE A GENERAL LACK OF EMPHASIS BY THE AIR FORCE AND CONTRACTORS IN THE MANAGEMENT OF TECHNICAL DATA. THE RESULTS ARE FREQUENT CHANGES, HIGH COSTS, AND DATA INCOMPATIBLE WITH DELIVERED HARDWARE.

Symptoms of Basic Deficiencies:

- Inability of the contractor to produce technical publications on time.
- Inability of the contractor to accurately estimate cost of development of technical data.
- Extremely high cost for technical data.
- Constant change and revision of technical publications.
- Incompatibility of technical data (publications) and the related hardware.
- Duplicate contractual requirements for data.

Fundamental Causes:

- Inability of the Air Force (AFSC, AFLC, using command, ATC) to define requirements for data at an early stage.
  - Lack of standardized approach.
  - Failure to agree on maintenance between interested commands and SPO.
- Lack of attention and emphasis by Air Force and contractors on importance of technical data compared with hardware.
- Contractor split management responsibility for technical data/technical manuals.
- Lack of coordination between engineering/design and tech data people.
- Lack of methods and procedures in contractor organizations to assure adherence to contract provision down to lower levels.
- Lack of Air Force and contractor control over engineering change proposals.
- Air Force frequent changes in requirements for data during development.

Actions By Contractor:

- New operating instructions, emphasizing responsibilities in technical data areas.
- Organizational changes in engineering and product support departments to strengthen capability in development of technical data.

Actions By Air Force:

- New AF System Programs will include a funded program definition phase which, among other objectives, will be a forcing function for earlier, systematic identification of technical data requirements and data development.
- AFSC established as the single command responsible for establishing requirements, funding, procuring and reviewing development of technical data and subsequently, publications.
- Hq AFSC established separate functional activity with responsibility for management of technical data.
- A Data Management Working Group established in July 1962 to examine all aspects of the technical data problem, including proprietary rights. A major objective of the group is the development of a Basic Data Package, consisting of minimum data requirements necessary for the conception, acquisition and/or operation of complete system/equipment. (This AFSC group has close liaison with the Aerospace Industries Association.) In the development of the Basic Data Package, the group is progressing along these lines:
  - Identify and evaluate AFSC concepts and procedures to acquire control and use the data required for system programs.
  - Select a standardized approach for systematic, time-phased development of data required during the conceptual and acquisition phases.
  - Develop a uniform system of implementation.
  - Identify changes required in existing regulatory documents, including regulations, specifications, military contractual provisioning documents, technical orders and contractual exhibits.
- Air Force has been authorized to withhold up to ten per cent of contract price until data is delivered or deficiencies are corrected (when contractor is negligent).
- AFSC requires a joint Air Force/contractor review of data requirements on at least one system program at each division (ASD, BSD, ESD, SSD) each year to insure the essentiality of existing data requirements and to determine that the procedures used are effective.

Actions To Be Accomplished:

- Completion of follow-up actions resulting from Data Management Working Group's efforts—revision of requirements document, regulatory documents, and exhibits.
- Emphasize and manage the technical data programs as strenuously as the hardware developments, since hardware is of little use if it cannot be operated and maintained.
- Establish methods of accurately costing publications, including technical input as well as publication and printing.

Additional Actions Recommended:

- Contractors should establish company policy and procedures (organizations if necessary) to control development schedules of all forms of technical data and insure accurate cost accounting.

SUBJECT

TECHNICAL MANUALS NOT VALIDATED/QUALITY SUBSTANDARD; DELIVERY OF TECHNICAL MANUALS/ DATA NOT TIMELY FOR PROGRAM

FINDING No. 26

THE SURVEY FINDINGS REVEALED SUBSTANDARD QUALITY OF TECHNICAL MANUALS AND DEFICIENT OR NONEXISTENT VALIDATION PROCEDURES.

Symptoms of Basic Deficiencies:

- Long delay in delivery of manuals as compared to hardware (not concurrent or even closely concurrent).
- Inability to operate and maintain equipment with instructions contained in the manuals.
- Excessive changes generated during verification by Air Force.
- Excessive AFTO 22 field deficiencies submittals.

Fundamental Causes:

- Lack of effective coordination between contractors' engineering and technical publications organizations.
  - Inadequate inter- and intra-departmental procedures.
  - Indifference on part of engineering in providing basic technical data and support to the technical publications people.
- Inadequate configuration management.
  - Procedures and controls were concerned with the hardware only.
- Multiple/late changes in requirements by the Air Force.
- Inadequate "in-process" reviews and guidance by the responsible Air Force Program Office, or lack of timely planning for and scheduling of technical manual/technical order validations.
- Failure of the contractor to adhere to contract provisions due to lack of emphasis and adequate instructions within the company organization.

Actions By Contractors:

- Revised inter- and intra-departmental procedures for development of technical data and the planning, identification, scheduling, publication and validation of technical orders and manuals.
- Some contractors have unified management of the total technical order publication function where this did not exist.
- Construction of special training/validation facilities at plant.

Actions By Air Force:

- AFSC has been designated the responsible Air Force agency for development of technical orders/manuals during the acquisition phase.
- AFR 80-14, "Testing/Evaluation of Systems, Subsystems and Equipments," is in process of revision. This regulation contains policy, procedures and general test objectives which include the determination of necessary data for handbooks/technical orders/manuals during the Category I test phase and the verification and validation of all necessary technical data during the Category II test phase.

Actions To Be Accomplished:

- Continue implementation of AFSCM 375-1, "Configuration Management During the Acquisition Phase," procedures to establish quick reaction to and greater control over engineering change proposals, and to provide better coordination between engineering/design changes and their incorporation in technical orders/manuals.
- Contractors take necessary action to provide better coordination between engineering/design organizations and technical publications groups.
- Greater use of the in-process reviews.
- Exercise of greater management control over development/delivery of technical orders/manuals by both Air Force and contractor.

Additional Actions Recommended:

- That contractors study their current organization and procedures devised for management of technical manual/technical order programs. There is seemingly a breakdown in translation of engineering and design data into useable manuals and technical orders, which indicates lack of coordination between engineering design people and the technical publications people who actually prepare the documents. On an overall basis, evidence of lack of validation of manuals and hardware, and excessively long delays between scheduled delivery and actual completion of the manuals/technical orders seems to point to the need for more strenuous effort to control management of these programs equally as well as the hardware program's.

CHAPTER III

Summary and Conclusions

Management Deficiencies—

▲ *WHAT ARE THEY?*

■ They are:

- All occasions of omission or commission (in direction, control, conduct, and administration of necessary functions and processes) which compromise attainment of programmed costs, schedules and product performance objectives.

▲ *WHY DO THEY OCCUR?*

■ They occur because of *imperfect:*

- *Planning*—each and every action necessary to attain program objectives was either not recognized or not properly phased.
- *Communications*—policies and procedures (instructions, work-orders, etc.) do not define authorities and responsibilities sufficiently to direct, control, conduct, administer, or integrate the characteristic functions and processes.
- *Discipline*—Managerial discipline in requiring compliance was lax in areas where plans, policies, and procedures are adequate.
- *Training or education*—Wherein greater details of who, why, what, when, where, and how of particular actions were not sufficiently elaborated for people responsible at lower levels for control, conduct, or administration.
- *Judgments*—which can have two basic effects: (1) an impractical program where costs, schedules, or product performance objectives were wrongly determined from information available and cannot be practically met within the time and resources allotted; or, (2) where wrong decisions are made in subsequent plans, communication, discipline, and training which jeopardize attainment of program objectives under any circumstances.

▲ *WHAT ARE THEIR CHARACTERISTICS?*

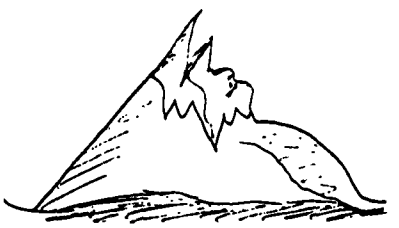
■ Generally, they are encountered in defense programs of large magnitude and associated with:

- Multi-agency direction and participation.
- Incremental funding.
- Contracting/subcontracting.
- Program management structure.
- System design and integration complexity.
- Cost control and accounting.
- Purchasing and estimating.
- Technical data.
- Configuration management.
- System hardware assembly, checkout, and turnover to Air Force.

- Occurrence is highly sensitive to conditions established at outset of program.
  - Realism of program objectives.
  - How program is contracted—prime/associate/subcontractor.
  - SPO and contractor organizations, policies and procedures, etc.
- Derive from the inherent nature of the process(es) to which they pertain, for example:
  - Detailed design poorly integrated as system because of the—
    - — Simultaneity and iterative nature of the design process.
    - — Different engineering disciplines and technologies that are involved.
- Rarely isolated to a single cause or functional area, for example:
  - Late definitization of letter contracts.
  - Technical data requirements, development, and delivery.
  - Cost control.
  - Reliability.
  - Configuration identification, control and accounting (see chart 1 for details).
- Frequently they are caused by non-compliance with policy and procedures—both contractor/Air Force, and a laxity in managerial discipline, for example:
  - Make-or-buy.
  - Calibration of precision measuring equipment.
  - Classification, acquisition, and disposition of facilities and special tooling.
  - Quality control.
  - Manpower control.

▲ *HOW SERIOUS ARE THEIR IMPACTS?*

- The important question is not merely whether a discrepancy exists—but how *serious* is the problem. The degree of seriousness is a function of the *specific conditions relevant* to the *particular problem.* Depending upon the relevant conditions, the problem may be a:
  - *MOUNTAIN*—(Example)
    - — *Technical data deficiencies may*—
      - .. Have multi-agency impacts.
      - .. Affect AF operation, maintenance and logistic support.
      - .. Degrade system performance and reliability.



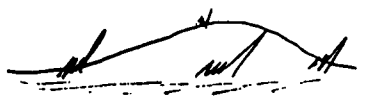
OR

  - *ICEBERG*—(Example)
    - — *Design and Engineering integration deficiencies may impact upon:*
      - .. Cost control and program schedules.
      - .. System definition and end item identification.
      - .. Contract and subcontract technical workstatements.
      - .. Program and contract/subcontract management.
      - .. Configuration management.
      - .. Materiel and logistics management.
      - .. Manufacturing schedules and quality.
      - .. Identification AGE and system facilities.
      - .. System/equipment interfaces.

.. Technical data.
.. System assembly, checkout, and integration.
.. System turnover to AF.
.. System performance/reliability.

OR

- *MOLEHILL*—(Example)
  - — *Purchasing systems deficiencies:* (when deficiencies, though real, represent a fraction of total effort).
    .. Inadequate competition, when schedule is over-riding.
  - — *Excess floor space:* (when facility is either company or government owned and the curve of production is in a valley).



▲ *IN SUMMARY, DEFICIENCIES DO:*

- Vary in degrees of seriousness.
- Vary in degrees to which basic causes and interrelated effects are understood.
- Concern some management areas for which no universally accepted criteria for measuring performance now exists.
- Indicate where improvements can be made.

BUT

▲ *THESE DEFICIENCIES DO NOT ALWAYS:*

- Result in increased costs.
- Reflect a degradation in program/contract management.
- Justify unlimited application of resources to attain perfection.

▲ *WHY DEFICIENCIES ARE CONSISTENTLY FOUND*

- Perfect judgment, planning, communications, discipline, and training are unlikely to be achieved simultaneously.
- Standards of performance have not been set. (par unknown).
- Contractor and AF buying/contract management agencies minimize importance of problems.
- Insufficient attention by contractor/AF management.
- When no penalties assessed, indifference and callousness develop.
- Survey teams concentrate on same items.
- Policies and procedures do not integrate semi-autonomous activities on program basis (for some applications).
- Compromises between performance—schedules vis-a-vis following established procedures.
- Multi-agency direction, policy/procedures.
- Communication barriers between Air Force and contractors.
- Initial program decisions and conditions affect contractor's performance.

- Top management emphasis on program objectives rather than detailed procedural compliance.
- Facts of life:
  - People sense and interpret pressures and direction with varying results.
  - Differences in understanding and objectives.
  - Discipline varies from company to company, from supervisor to supervisor.
  - Instability of work force—changing program and fluctuations in workload.
  - Performance criteria established by DOD/AF has been steadily changing over the past few years.
  - Major changes require period of evolution, e.g., PERT, configuration management, and program definition.

Air Force/Industry Management May Bring About General Improvements Through—

▲ *INCREASED ATTENTION TO MANAGEMENT IN ITS TOTAL PERSPECTIVE BY:*

- Appreciation of relationships between deficiencies—they are seldom isolated (see chart 1 and 2).
- Increased understanding in depth of the interrelations of functional processes.
- Recognition that initial conditions of program can create impossible management situations later on.
- Making a more exacting evaluation of the management structure, policies, and procedures to eliminate soft spots to start of program—where work assignments are made to functional organizations, insure total program processes are integrated.
- Recognition of the limitations of expedient solutions to visible management problems.
- Avoiding the proliferation of sophisticated topical solutions and their application to other problems as panaceas.
- Recognition that most survey findings are identified with functions which are, or should be, under surveillance by both contractor and Air Force contract management people. Therefore, improvements lie principally with the contractor and local Air Force management.

▲ *NEW POLICY AND PROCEDURES BY THE AIR FORCE*

- Many findings reflected conditions that were due to inadequate procedures and operation under the old ARDC/AMC arrangements, such as:
  - Configuration management, where split management existed, which allowed duplication of procurement and change actions. New regulations and manuals have been issued which consolidate management in AFSC for acquisition.
  - Technical data management, which also had split management, is now consolidated under AFSC for acquisition.

▲ *IMPROVED TECHNIQUES*

- Program definition—where a funded, competitive phase is accomplished for the purpose of better defining the program by means of cost trade-off studies and technical analyses.
- System definition procedures/analysis requirements are selectively applied throughout the acquisition cycle.
- PERT/Cost—which will aid cost estimating and, through earlier identification of cost increases, will provide better cost control.

▲ *WIDER DISSEMINATION OF SURVEY FINDINGS/CORRECTIVE ACTIONS*

- Management symposiums—AF/Industry.
- Newsletters and other media are being used to provide contractors with current information on repetitive problems as well as new techniques and policies employed by the Air Force and industry.

▲ *TRAINING AND EDUCATION PROGRAMS*

- Courses are now being provided for Air Force and Industry personnel on such important subjects as:
  - Cost estimating.
  - Incentive contracting.
  - PERT.
- Some contractors have initiated courses for subcontract management and workstatement preparation for buyers and engineers.
- Air Force has established a system management course for training senior AF officers on the fundamentals of program management.

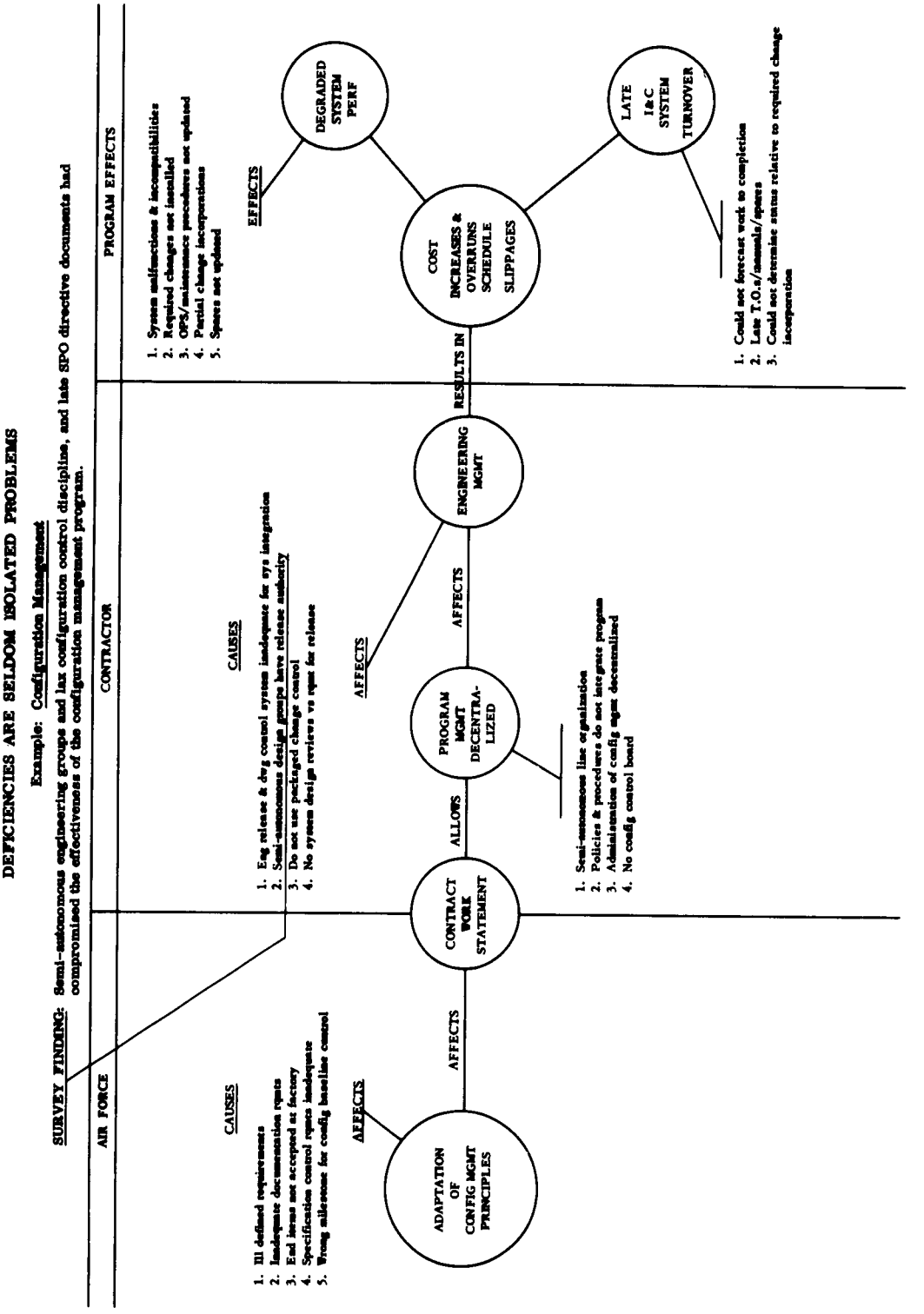

DEFICIENCIES ARE SELDOM ISOLATED PROBLEMS
Example: Configuration Management
SURVEY FINDING: Semi-autonomous engineering groups and lax configuration control discipline, and late SPO directive documents had compromised the effectiveness of the configuration management program.
AIR FORCE
CONTRACTOR
PROGRAM EFFECTS
CAUSES
1. Ill defined requirements
2. Inadequate documentation reqmts
3. End items not accepted at factory
4. Specification control reqmts inadequate
5. Wrong milestone for config baseline control
AFFECTS
ADAPTATION OF CONFIG MGMT PRINCIPLES
AFFECTS
CONTRACT WORK STATEMENT
ALLOWS
PROGRAM MGMT DECENTRA-LIZED
AFFECTS
ENGINEERING MGMT
RESULTS IN
COST INCREASES & OVERRUNS SCHEDULE SLIPPAGES
EFFECTS
DEGRADED SYSTEM PERF
1. System malfunctions & incompatibilities
2. Required changes not installed
3. OPS/maintenance procedures not updated
4. Partial change incorporations
5. Spares not updated
LATE I&C SYSTEM TURNOVER
1. Could not forecast work to completion
2. Late T.O.s/manuals/spares
3. Could not determine status relative to required change incorporation
CAUSES
1. Eng release & dwg control system inadequate for sys integration
2. Semi-autonomous design groups have release authority
3. Do not use packaged change control
4. No system design reviews vs reqmt for release
AFFECTS
1. Semi-autonomous line organization
2. Policies & procedures do not integrate program
3. Administration of config mgmt decentralized
4. No config control board

CHART 1

MANAGEMENT DEFICIENCIES INTERRELATIONSHIPS

DEFICIENCY HERE → / CAN IMPACT HERE ↓

DEFICIENCY HERE \ CAN IMPACT HERE	1 Program Mgt	2 Mgt Audits	3 Definitization of Letter Contracts	4 Cost Control & Acctg	5 Make-or-Buy	6 Subcontract Mgt	7 Engineering Mgt & Design Practices	8 Definitization of Subcontracts	9 Utilization of Engineering Manpower	10 Configuration Mgt	11 Product Support Mgmt	12 Materiel Management	13 Cost Estimates	14 Subcontract Awards & Price Analysis	15 Reliability/Design	16 Development of Tech Data	17 Quality Assurance	18 Facilities/Machine/Tool Test Equip Mgt	19 Eng & Test Schedules	20 Contract Deliveries	21 Tech Data-Quality/Delivery	22 Multiple Purchase Orders	23 Calibration of Test/Precision Eqpt	24 Subcontract Termination	25 Reports Control
1. Program Mgt	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. Management Audits	X	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	—	—	—
3. Definitization of Letter Contracts	X	—	O	X	X	X	X	—	X	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—
4. Cost Control & Acctg	X	—	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5. Make-or-Buy	X	—	X	X	O	X	—	—	—	—	—	—	—	X	—	—	—	X	—	—	—	—	—	—	—
6. Subcontract Mgmt	X	—	—	X	X	O	X	—	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7. Engineering Mgmt & Design Practices	X	—	X	X	—	X	O	X	X	X	X	X	X	—	X	X	X	X	X	X	X	X	X	X	X
8. Definitization of Subcontracts	X	—	—	X	—	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9. Utilization of Engineering Manpower	X	—	X	X	—	X	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10. Configuration Mgt	X	—	X	X	—	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11. Product Support Mgmt	X	—	X	X	—	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12. Materiel Management	X	—	X	X	—	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X
13. Cost Estimates	X	—	X	X	—	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X
14. Subcontract Awards & Price Analysis	X	—	X	X	—	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X	X
15. Reliability/Design	X	—	X	X	—	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	X
16. Development of Tech Data	X	—	X	X	—	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X
17. Quality Assurance	X	—	X	X	—	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X
18. Facilities/Machine/Tool Test Equip Mgt	X	—	X	X	—	X	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X
19. Eng & Test Schedules	X	—	X	X	—	X	X	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X
20. Contract Deliveries	X	—	X	X	—	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X
21. Tech Data-Quality/Delivery	X	—	X	X	—	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X
22. Multiple Purchase Orders	X	—	X	X	—	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X
23. Calibration of Test/Precision Eqpt	X	—	X	X	—	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	X	X
24. Subcontract Termination	X	—	X	X	—	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	X
25. Reports Control	X	—	X	X	—	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O

CHART 2

Toward A More Useful Pamphlet

- IMPROVEMENTS—What are your suggestions on:
  - Format, style, or presentation of problems?
  - Impacts/effects that should be included?
  - Symptoms and causes of the problems?
  - What was done to correct problems?

We welcome your comments and suggestions

- A second edition may be published depending upon the general response and suggested improvements.
- Address your comments to:

Assistant for Management Surveys
Hq AFSC (SCS-8)
Andrews AFB
Wash 25, DC