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MILITARY STANDARD

SYSTEM SAFETY PROGRAM FOR SYSTEMS AND ASSOCIATED SUBSYSTEMS AND EQUIPMENT: REQUIREMENTS FOR

FSC MISC

FOREWORD

The Department of Defense System Safety Program's principal objective is the protection of the public and the individual. This is closely followed by its concern to conserve the other national resources.

To insure that these receive due consideration, this military standard has been written and approved by the Department of Defense and is mandatory for use by all departments and agencies of the Department of Defense effective 15 JULY 1969.

The degree of safety achieved in a military system is directly dependent upon management emphasis. Management emphasis on safety must be applied by the Government and contractors during the conception, development, production, and operation of each military system.

The results of the system safety effort is dependent upon the procuring agency clearly stating safety objectives and requirements, and the Contractor's ability to translate these into functional hardware.

Recommended corrections, additions, or deletions should be addressed to the Air Force Systems Command (SCIZ), Andrews AFB, Washington, D.C. 20331.

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APPENDIX

1. SCOPE

1.1 Purpose. The purpose of this standard is to provide uniform requirements and criteria for establishing and implementing system safety programs and to provide guidelines for preparing System Safety Program Plans (SSPP).

1.2 Application. This standard is applicable to Department of Defense procurement of military systems, subsystems, and equipment, such as aeronautical, nautical, vehicular, missile, space, electronics, weapons and munitions. This standard will be used during concept formulation, contract definition, engineering development, production, and operational phases.

1.3 Implementation. This standard will be used in preparing safety requirements for inclusion in contract work statements. system safety program plans, and other contractual documents.

1.3.1 Each provision of this standard shall be considered for the extent of applicability, deviations, or supplementary requirements. Where the paragraph or subparagraph of this standard would require duplication, wholly or in part, of design, analysis, test, demonstration, or organizational requirements already specified by the procuring activity, those requirements, functions and efforts shall be identified and utilized in the plan rather than be duplicated. This standard applies to those activities through which a contractor manages his system safety effort to the extent specified in the contract statement of work and approved SSPP. The SSPP shall be incorporated or referenced in contractual documents as necessary to define the safety program.

1.3.2 When the scope and magnitude of a program does not warrant the requirement for a comprehensive system safety program, the procuring activity shall specify to the contractor the minimum acceptable safety program requirements.

1.3.3 The safety life cycle as described herein (see 4.2) is for a system program which includes all phases: concept formulation, contract definition, development, production, and operational. Since all system programs do not follow the phases as distinctly as stated, each system safety program plan and activity must be tailored to the specific requirements and peculiarities of the system or project. The sequence of activities described in the safety life cycle, however, shall be accomplished at some time during the life cycle to insure that a balanced, effective system is developed. Accordingly, when a system program does not require a formal contract definition phase, the essential safety activities for that phase shall be accomplished early in the development phase.

2. REFERENCED DOCUMENTS

None applicable to this standard.

3. DEFINITIONS. The following definitions apply to this standard.

3.1 Safety. Freedom from those conditions that can cause injury or death to personnel, damage to or loss of equipment or property.

3.2 System. A composite, at any level of complexity, of operational and support equipment, personnel, facilities, and software which are used together as an entity and capable of performing and/or supporting an operational role.

3.3 System safety. The optimum degree of safety within the constraints of operational effectiveness, time and cost, attained through specific application of system safety management and engineering principles throughout all phases of a system's life cycle.

3.4 System safety management. An element of program management which insures the accomplishment of the system safety tasks including identification of the system safety requirements; planning, organizing, and controlling those efforts which are directed toward achieving the safety goals; coordinating with other (system) program elements; and analyzing, reviewing, and evaluating the program to insure effective and timely realization of the system safety objectives.

3.5 System safety engineering. An element of systems engineering involving the application of scientific and engineering principles for the timely identification of hazards and initiation of those actions necessary to prevent or control hazards within the system. It draws upon professional knowledge and specialized skills in the mathematical, physical, and related scientific disciplines, together with the principles and methods of engineering design and analysis to specify, predict, and evaluate the safety of the system.

3.6 Contractor. An industrial or governmental agency engaged to provide services or products within agreed limits.

3.7 Prime contractor. One who enters into agreement directly with the Government to provide a product or service.

3.8 .Integrating contractor. The contractor assigned responsibility by the procuring activity for overall scheduling and system interface of associate contractor activities and equipment, and for the furnishing of specified support services which are common to two or more of the contractors.

3.9 Associate contractor. A prime contractor for the development or production of subsystems, equipments, or components meeting specifications furnished or approved by the procuring activity. An associate contractor can be one member of a group of contractors developing and producing a complete system.

3.10 Subordinate (sub)contractor. One who enters into agreement with a prime contractor or other subordinate contractor to provide a product or a service.

3.11 Crash safety. A manned-system characteristic that allows the system occupants to survive the impact and evacuate the vehicle in potentially survivable accidents. Crash safety implies:

(a) Crashworthiness
(b) Provisions for timely evacuation

3.12 Crashworthiness. The capacity of a vehicle to act as a protective container and energy absorber during potentially survivable impact conditions.

3.13 Hazard. Any real or potential condition that can cause injury or death to personnel, or damage to or loss of equipment or property.

3.14 Hazard level. A qualitative measure of hazards stated in relative terms. For purposes of this standard the following hazard levels are defined and established: Conditions such that personnel error, environment, design characteristics, procedural deficiencies, or subsystem or component failure or malfunction:

(a) Category I - Negligible

.... will not result in personnel injury or system damage.

(b) Category II - Marginal

.... can be counteracted or controlled without injury to personnel or major system damage.

(c) Category III - Critical

.... will cause personnel injury or major system damage, or will require immediate corrective action for personnel or system survival.

(d) Category IV - Catastrophic

.... will cause death or severe injury to personnel, or system loss.

4. GENERAL REQUIREMENTS

4.1 System safety program. The contractor shall establish and maintain an effective system safety program that is planned and integrated into all phases of system development, production, and operation. The system safety program shall provide a disciplined approach to methodically control safety aspects and evaluate the system's design; identify hazards and prescribe corrective action in a timely, cost effective manner. The system safety program activities shall be specified in a formal plan (see 5.2) which must describe an integrated effort within the total program. The system safety program shall be based upon such factors as the system objectives, criticality of the safety requirements, the complexity of design, and total cost. The system safety program objectives are to insure that:

(a) Safety consistent with mission requirements is designed into the system.
(b) Hazards associated with each system, subsystem, and equipment are identified and evaluated, and eliminated or controlled to an acceptable level.
(c) Control over hazards that cannot be eliminated is established to protect personnel, equipment, and property.
(d) Minimum risk is involved in the acceptance and use of new materials and new production and testing techniques.
(e) Retrofit actions required to improve safety are minimized through the timely inclusion of safety factors during the acquisition of a system.
(f) The historical safety data generated by similar system programs are considered and used where appropriate.

4.2 System safety program activities and sequences. The application of this military standard to a specific contract requires a complete review of the standard to determine the degree of applicability of each paragraph to the contract. The safety requirements will vary depending on the amount of research, development, test, and engineering, and the intended use of the contract end item. The following paragraphs will give a general indication of when the requirements of this standard should be met during the development of a system for the Department of Defense when the formal DOD development process is applied. (See Appendix B).

4.2.1 Concept Formulation Phase. A formal SSPP is not required in the concept formulation phase. As system concepts and functions are identified, safety studies shall be performed to determine the adequacy of design concepts to meet the essential safety characteristics of the system. These studies also shall:

(a) Evaluate technical approaches to system safety design features.
(b) Identify possible safety interface problems.
(c) Highlight special areas of safety consideration, such as system limitations, risks, man-rating requirements.
(d) Define areas requiring further safety investigation and describe safety tests or data needed from exploratory or advanced development activities.

4.2.1.1 A preliminary hazard analysis (see 5.8.2.1) shall be performed as an integral part of the system concept studies to identify inherent hazards, or risks, associated with each design.

4.2.1.2 The contractor shall submit a summary statement of any additional safety design analysis, test, and demonstration requirements and recommendations resulting from these studies and analyses which are not already specified by the procuring activity.

4.2.2 Contract Definition

4.2.2.1 Contract Definition Phase (CDP) (Phase A). In his response to a Request for Proposal (RFP) for CDP, the contractor:

(a) Shall submit a preliminary SSPP (as a separate entity) prepared in accordance with the requirements of the RFP. The SSPP shall describe the proposed integrated effort of how the contractor plans to conduct his system safety program to meet the requirements of the RFP, specifically:

(1) A firm proposal on the contractor's efforts and activities during the Contract Definition Phase (Phase B).

(2) A planning purpose proposal for evaluating the contractor's program for the Engineering Development Phase.

(b) Shall, in addition to preparing the SSPP:

(1) Perform necessary studies and analyses to define the system's safety technical specifications, performance requirements, and its operating safety characteristics. A preliminary hazard analysis (see 5.8.2.1) of the system in its intended operating environment shall be performed or revised to identify potential hazards and inherent risks. A system/subsystem/equipment safety interface study shall be performed to insure that compatibility between subsystem-equipment is maintained and safety is not degraded.

(2) Make tradeoff studies as necessary to reflect the impact on system safety requirements, and the identification of inherent risks and the required safety decisions.

(3) Identify and include in the appropriate specifications any resulting qualitative and quantitative requirements for the system, and subsystems including Government Furnished Equipment (GFE), and the proposed test plans to demonstrate their achievement.

(4) Submit a preliminary hazard analysis summary report which:

a. Identifies potential hazards and methods planned to eliminate or control them.

b. Outlines undefined areas requiring guidance or decisions.

c. Describes technical risks or problems in design. The contractor shall delineate the subsystem and component safety requirements for subcontractors and suppliers in order to meet the overall essential system safety requirements. The safety requirements for GFE and related data will be defined at this time and be submitted to the procuring activity for necessary action.

4.2.2.2 Contract Definition Phase (CDP) (Phase B). The contractor shall implement the SSPP as accepted or approved by the procuring activity. System safety studies shall be performed during system engineering, tradeoff studies and formulation of data requirements to insure that safety design requirements as identified in CDP Phase A are refined, updated and further expanded as necessary. Specifically the contractor will:

(a) Submit a firm SSPP for the Engineering Development Phase. This plan shall update the preliminary SSPP with a detailed description of aotivities, reviews, safety studies, analyses, and tests to be accomplished during the Engineering Development Phase Also, the SSPP shall include the projected activities anticipated during the production and operational phases to accomplish the objectives of 4.2.4 and 4.2.5.

(b) Update the system safety studies, analyses, and test plans to define safety design requirements and criteria. System safety personnel shall participate in system tradeoff studies to insure that the highest degree of safety is achieved consistent with performance and system requirements.

(c) Update safety requirements in the system specifications and criteria.

(d) Submit a system safety work breakdown statement for the engineering development program.

4.2.3 Engineering Development Phase. The system safety program during this phase is an amplification and the implementation of the program defined in the previous phases. The action is predominantly on the part of the contractor with the responsible Department of Defense organization monitoring the program. System and subsystem hazards, and operating hazard analyses shall be evaluated in phase with program reviews. The contractor's system safety organization will insure effective and timely implementation of the approved SSPP. It is during the early phases of engineering design that the system safety program can be most effective with the least impact on schedules, and provide the greatest potential on cost saving. To provide support to the system engineering program, the system safety engineering activities shall include, but not be limited to the following:

(a) Furnishing safety design criteria; establishing safety objectives; and, reviewing preliminary engineering designs to identify hazards, methods of detection, and any required safety changes.

(b) Performing hazard analyses and safety studies to evaluate the system design.

(c) Establishing test requirements and insure that safety verification of design and data are included in the engineering test program.

(d) Participating in technical design and program reviews.

(e) Reviewing and providing inputs to preliminary system operator and maintenance publications, emergency procedures, etc.

(f) Evaluating results of failure analyses and accident investigations; recommending corrective action.

(g) Determining, evaluating, and providing safety considerations in tradeoff studies.

(h) Reviewing engineering documentation (drawings and specifications) to insure safety coverage.

(i) Identifying required safety and protective equipment and devices.

(j) Providing safety inputs to training courses.

4.2.4 Production Phase. The contractor shall identify critical production techniques, assembly procedures, facilities, testing and inspection requirements which affect system safety. Adequate procedures shall be invoked through the planned, controlled, and scheduled system of quality control and monitoring specified contractually to insure that safety achieved in design is maintained during production. Corrective action shall be taken to eliminate, reduce or control hazards so identified. These corrections shall include necessary changes to engineering documentation. An audit shall be performed to identify any new system safety hazards which may result from the introduction of engineering changes. The impact of such changes on safety shall be evaluated to determine whether the previously established safety level of the system has been maintained; if not, redesign or change procedures shall be initiated to obtain the contracted level of safety.

4.2.5 Operational Phase (including disposal). The system safety program during the Operational Phase, and subsequent disposal, will include, but not be limited to the following functions:

(a) Operational safety review of system to determine if design, operating and maintenance procedures, and emergency procedures are adequate, based on user experience.

(b) Evaluation of design changes and modifications to operational equipment to insure inherent safety is not degraded.

(c) Continual review of operator and maintenance publication changes to insure that safety requirements, procedures, and cautions are adequate.

(d) Analyze system accidents/incidents or failures which caused, or could cause, an unsafe condition, and initiate corrective action.

(e) Data collection and analysis from system deficiency reports submitted by operating (user) personnel.

(f) Approval and application of procedures for disposal of hazardous material and equipment.

4.3 System safety organization. The contractor's organization shall be responsible for managing and performing the overall system safety program. The responsibilities and functions of those directly associated with system safety policies and implementation of the program shall be clearly defined. The authority delegated to this organization and the relationship between line, staff, and interdepartmental, project, functional, and general management organizations shall be identified. It is not the intent of this standard to prescribe or imply organizational structure, management methodology, implementation procedures, or internal documentation.

4.4 System safety program milestones. The system safety program shall be planned and scheduled to permit the contractor and the procuring activity to review its status, including the results achieved, at critical safety program checkpoints. These formal reviews and assessments of the system safety effort shall be performed concurrently with overall program milestones, such as requirements reviews, design reviews, and inspections. Safety milestones will be identified in a manner permitting evaluation of the effectiveness of the system safety effort. These milestones shall be presented in the SSPP and implemented as approved by the procuring activity.

5. DETAILED REQUIREMENTS

5.1 General. A system safety program is a formal approach to eliminate hazards through engineering, design, education, management policy, and supervisory control of conditions and practices. It insures the accomplishment of the system safety management and engineering tasks.

5.2 System Safety Program Plan (SSPP). The SSPP will be prepared in accordance with this standard and implemented as directed by the procuring activity. The SSPP, as approved by the procuring activity and incorporated into the contract, becomes the basis for contractual compliance. A sample SSPP outline is provided in Appendix A. When an integrating contractor is designated he will be responsible for the overall preparation, integration, and implementation of the SSPP. The plan shall describe an integrated effort within the total project, and shall include but not be limited to: CONTRACT!

(a) Identification of system activities (i.e. design analyses, tests, demonstrations) specified elsewhere by the procuring activity and show how they will be used to preclude duplication.

(b) Providing specific information showing how the contractor will meet the safety requirements during development and manufacture including the design concepts to be utilized.

(c) The manner of demonstrating quantitative system safety requirements (if specified).

(d) A detailed listing of specific tasks.

(e) A current description of each task to be performed.

(f) Identification of the organization unit with the authority and responsibility for executing each task.

(g) The method of control to insure execution of each task.

(h) The scheduled start and completion dates of each task.

(i) Procedures for problem identification and solution.

(j) Procedures for recording and reporting status of actions to resolve problems.

(k) Method of assimilation and dissemination of system safety requirements to designers and associated personnel to expedite correction of known deficiencies.

(l) Designation of milestones, definitions or interrelationships, and estimation of personnel and man-hours required for system safety program activities and tasks.

(m) Periodic recording and reporting of predicted and achieved system and equipment safety.

(n) Delineate the safety data and analyses (including GFE) required of and to the integrating and associate contractors.

(o) Identification of special safety studies, research and test data.

(p) Safety data coordination flow.

(q) Range, flight, and operational test safety programs.

(r) The mathematical methods to be used; e.g. describe the appropriate models and analytical techniques to be employed.

5.3 <u>Reviews</u>.

5.3.1 <u>Program and Design reviews</u>. Safety shall be an integral part of all program and design reviews held for the system, subsystem, or equipment. System safety program reviews shall be conducted as part of the scheduled overall design and/or program reviews to assess the status of compliance with the overall safety program objectives. This review shall identify any deficiencies of the system with respect to safety and provide guidance for further development which may be required. The procuring activity shall be notified prior to each system safety program review, to permit participation by the safety organization of the procuring activity. Additional ad hoc safety reviews may be scheduled or required at the discretion of the contractor or the procuring activity. Minutes of these system safety program reviews shall be recorded, and made available to the procuring activity.

5.4 System safety criteria and considerations.

5.4.1 General. System designs and operational procedures developed by each contractor should consider, but not be limited to, the following:

(a) Avoiding, eliminating or reducing significant hazards identified by analysis, design selection, material selection, or substitution. Composition of a propellant, explosive, hydraulic fluid, solvent, lubricant, or other hazardous material shall provide optimum safety characteristics. STRESS CORROSION

(b) Controlling and minimizing hazards to personnel, equipment, and material which cannot be avoided or eliminated.

(c) Isolating hazardous substances, components, and operations from other activities, areas, personnel, and incompatible materials.

(d) Incorporating "fail-safe" principles where failures would disable the system or cause a catastrophe through injury to personnel, damage to equipment, or inadvertent operation of critical equipment.

(e) Locating equipment components so that access to them by personnel during operation, maintenance, repair, or adjustment shall not require exposure to hazards such as chemical burns, electrical shock, electromagnetic radiation, cutting edges, sharp points, or toxic atmospheres.

(f) Avoiding undue exposure of personnel to physiological and psychological stresses which might cause errors leading to mishaps. HUMAN ENGR'G.

(g) Providing suitable warning and caution notes in operations, assembly, maintenance, and repair instructions; and distinctive markings on hazardous components, equipment, or facilities for personnel protection. These shall be standardized in accordance with the requirements of the procuring activity.

(h) Designing to minimize damage by enemy action.

(i) Minimizing severe damage or injury to personnel and equipment in the event of an accident.

5.5 Hazard levels. The hazard levels, Category I (Negligible); Category II (Marginal); Category III (Critical); and Category IV (Catastrophic) as defined in section 3, shall be used as a qualitative measure of a system's hazards. These categories may be further defined by the procuring activity or by the contractor in the SSPP.

5.6 System safety precedence. Actions for satisfying safety requirements in order of precedence are specified below:

(a) Design for minimum hazard. The major effort throughout the design phases shall be to select appropriate safety design features; e.g. fail safe, redundancy.

(b) Safety devices. Known hazards which cannot be eliminated through design selection shall be reduced to an acceptable level through the use of appropriate safety devices.

(c) Warning devices. Where it is not possible to preclude the existence or occurrence of an identified hazard, devices shall be employed for the timely detection of the condition and the generation of an adequate warning signal. Warning signals and their application shall be designed to minimize the probability of incorrect personnel reaction to the signals, and shall be standardized within like types of systems, in accordance with the directives of the procuring activity.

(d) Special procedures. Where it is not possible to reduce the magnitude of an existing or potential hazard through design, or the use of safety and warning devices, the contractor shall develop special procedures. Precautionary notations shall be standardized in accordance with the directives of the procuring activity.

5.7 Design criteria/specifications. When design criteria specified by the procuring activity is proved inadequate in regards to safety, the contractor shall report the deficiency and recommend corrective actions with supporting evidence to the procuring activity.

5.8 Analyses. Analyses are performed to identify hazardous conditions for the purpose of their elimination or control. Analyses shall be made to examine the system, subsystems, components and their interrelationship to include logistic support, training, maintenance, and operational environments. The analyses shall be accomplished to do the following:

(a) Identify hazards and determine any needed corrective actions.

(b) Determine and evaluate safety considerations in tradeoff studies.

(c) Determine and evaluate appropriate safety design requirements.

(d) Determine and evaluate operational, test, and logistic safety requirements.

(e) Determine whether the qualitative objectives or quantitative numeric requirement established by the procuring activity have been achieved.

5.8.1 Qualitative or quantitative analysis. Qualitative and/or quantitative analyses will be performed as specified by the procuring activity. These analyses shall be revised when changes are made in components, subsystems, or total systems. The various types of hazard analyses are described below.

5.8.1.1 A qualitative analysis provides a technical assessment of the relative safety of a system design.

5.8.1.2 A quantitative analysis provides a numerical assessment of the relative safety of a system design. A quantitative analysis will determine:

(a) The probability of occurrence of critical or catastrophic hazards.
(b) The calculated system, subsystem, or equipment numeric requirement risk level.

5.8.2 System hazard analyses.

5.8.2.1 Preliminary hazard analysis. A preliminary hazard analysis shall be performed as the initial analysis task during the acquisition of a system. This analysis shall be a comprehensive, qualitative study. Such information shall be used in the development of safety criteria to be imposed in performance or design specifications. Areas to be considered shall include, but are not limited to the following:

(a) Isolation of energy sources.
(b) Fuels and propellants: their characteristics, hazard levels and quantity-distance constraints, handling, storage, transportation safety features, and compatibility factors.
(c) System environmental constraints.
(d) Use of explosive devices and their hazard constraints.
(e) Compatibility of materials.
(f) Effect of transient current, electrostatic discharges, electromagnetic radiation, and ionizing radiation to or by the system. Design of critical controls to prevent inadvertent activation and employment of electrical interlocks.
(g) Use of pressure vessels and associated plumbing, fittings, mountings, and hold-down devices.
(h) Crash safety.
(i) Safe operation and maintenance of the system.
(j) Training and certification pertaining to safe operation and maintenance of the system.
(k) Egress, rescue, survival, and salvage.
(l) Life support requirements and their safety implications in manned systems.
(m) Fire ignition and propagation sources and protection.
(n) Resistance to shock damage.
(o) Environmental factors such as equipment layout and lighting requirements and their safety implications in manual systems.
(p) Fail safe design considerations.
(q) Safety from a vulnerability and survivability standpoint; e.g., application of various types of personnel armor (metals, ceramics and glass), fire suppression systems, subsystems protection, and system redundanoy.
(r) Protective clothing, equipment or devices.

(s) Lightning and electrostatic protection.
(t) Human error analysis of operator functions, tasks, and requirements.

5.8.2.2 Subsystem hazard analysis. This is an expansion of the preliminary hazard analysis. It shall be performed to determine, from a safety consideration, the functional relationships of components and equipments comprising each subsystem. Such analysis shall identify all components and equipments whose performance degradation or functional failure could result in hazardous conditions. The analysis should include a determination of the modes of failure and the effects on safety when failures occur in subsystem components.

5.8.2.3 System hazard analysis. The prime or integrating contractor shall conduct reviews or studies which define the safety integration and interface requirements of the total system. Analyses shall be performed of subsystem interfaces to determine the safety problem areas of the total system. Such analyses shall include, but not be limited to, review of subsystems interrelations for:

(a) Compliance with safety criteria.
(b) Possible independent, dependent, and simultaneous failures that could present a hazardous condition.
(c) Insuring that the normal operation of a subsystem cannot degrade the safety of another subsystem or the total system. When changes occur within subsystems, the system safety hazard analysis shall be changed accordingly. In the manned systems, consideration shall be given to crash safety, escape, egress, rescue, and survival.

5.8.2.4 Operating hazard analyses. Analyses shall be performed to determine safety requirements for personnel, procedures, and equipment used in installation, maintenance, support, testing, transportation, storage, operations, emergency escape, egress, rescue, and training during all phases of intended use as specified in the system requirements. Engineering data, procedures, and instructions developed from the engineering design and initial test programs shall be used in support of this effort. Results of these analyses shall provide the basis for:

(a) Design changes where feasible to eliminate hazards or provide safety devices, and safeguards.
(b) The warning, caution, special inspections and emergency procedures for operating and maintenance instructions including emergency action to minimize personnel injury.
(c) Identification of a hazardous period time span and actions required to preclude such hazards from occurring; and
(d) Special procedures for servicing, handling, storage and transportation.

5.9 Action on identified hazards. Action shall be taken to eliminate or minimize hazards revealed by analyses or related engineering efforts. Catastrophic and critical hazards shall be eliminated or controlled. If these hazards cannot be eliminated, or controlled to a specified probability of occurrence, the alternative controls will be immediately presented to the responsible procuring activity for resolution. Reporting shall be in accordance with the provisions of the System Safety Program Plan.

5.10 Supplier and subcontractor system safety program. Procedures shall be established to assure that the supplier and subcontractor system safety programs are consistent with overall system requirements. The contractor shall perform surveillance of the supplier and subcontractor system safety activities and insure adequate performance. Where the contractor and subcontractor determine that it is needed for satisfactory analyses, the contractor shall furnish in a timely manner sufficient system technical information to the subcontractor to enable the latter to consider system effects in a subsystem safety analysis.

6. DATA

6.1 Data requirements. The selected data requirements in support of this standard will be reflected in the Contractor Data Requirements List (DD Form 1423), attached to the request for proposal, invitation for bid, or the contract, as appropriate.

6.2 Data acceptance. Contractor-prepared data delivered in accordance with 6.1 to the procuring activity, shall be subject to review and approval by the procuring activity. In the absence of notification to the contrary within the time period specified in the contract, the data will be considered accepted. Non-delivered data shall be filed and maintained by the contractor for the duration of the contract period, but shall be made available for review and use by authorized representatives of the procuring activity upon request.

6.3 Acquisition and use of safety data. Safety data provided by the procuring activity should be used as a design aid to prevent repetitive design deficiencies. The contractor shall maintain liaison with other data sources to enable identification and evaluation of hazard and safety design deficiencies.

7. SAFETY TESTING

Tests shall be proposed in the SSPP to validate the safety of the product, including those tests already specified by the procuring activity. Safety tests shall be integrated into appropriate test plans. Where complete safety testing costs would be prohibitive, partial design verification of safety characteristics or procedures may be demonstrated by laboratory test, functional mockups or model simulation, when approved by the procuring activity.

Safety tests shall be performed on critical devices or components to determine the degree of hazard or margin of safety of design. Induced or simulated failures will be considered for demonstrating the failure mode of critical components. The detailed test plans for all tests shall be reviewed to insure that:

(a) Safety is adequately demonstrated.
(b) The testing will be carried out in a safe manner.
(c) All additional hazards introduced by testing procedures, instrumentation, test hardware, etc., are properly identified and minimized.

8. TRAINING

8.1 Safety Training for Operator and Maintenance Personnel. Safety information on approved methods and procedures will be included in instruction lesson plans and student examinations for the training of system (operator and maintenance) personnel. Protective devices and emergency equipment will be identified and included in training. Safety training aids, exhibits and displays may be used.

9. EFFECTS OF STORAGE, SHELF-LIFE, PACKAGING, TRANSPORTATION, HANDLING AND MAINTENANCE

The program shall consider, analyze, identify the effects of storage, shelf-life, packaging, transportation, handling and maintenance on the safety of the product. This shall include items such as:

(a) Identification of major or critical characteristics of safety significant items which deteriorate with age, environmental conditions, and other factors.
(b) Procedures for periodic field inspection or tests (including recall for test) of items to establish continuing acceptable levels of performance for parameters under test.
(c) Special safety procedures for maintenance or restoration.

10. INTEGRATION OF ASSOCIATED DISCIPLINES

10.1 Relationship to system engineering. Where the system engineering process is used as the mainstream engineering analysis effort, system safety requirements shall interface with the other engineering disciplines and tradeoff studies made in the interest of an optimum total system design.

Custodians:
Army - AV
Navy - AS

Reviewer activities:
Army - AV, AT, EL, WE, MU, MI
Air Force - 10
Navy - AS

Preparing activity:
Air Force - 10

Project No. MISC-0484

APPENDIX A

SYSTEM SAFETY PROGRAM PLAN OUTLINE

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CONCEPT FORMULATION PHASE	
	A
DOD conditional approval to initiate engineering development	RFP issued and definition contractors selected
1. Conduct concept safety studies. 2. Perform preliminary hazard analysis. 3. Define system safety performance envelope and requirements (i.e., maximum peacetime accident rate, etc.) 4. Select system safety effectiveness measures (i.e. estimated number of major accidents avoided vs cost of a proposed safety change). 5. Orient exploratory and advanced developments to enhance the safety feasibility of conceptual designs. 6. Incorporate safety assessment in the technical development plan.	Safety efforts in this phase involve actions by the procuring activity in preparing for Phase B of contract definition, and contractor response to the Request for Proposal (RFP). 1. <u>Procuring activity</u>: (a) Incorporate safety requirements into the statement of work. (b) Identify safety data to be provided to the definition contractor; e.g. preliminary hazards analysis (PHA), tradeoff studies. (c) Identify safety data to be required from the contractor, such as a System Safety Program Plan, Preliminary Hazard Analysis, concept safety analysis, etc. 2. <u>Contractor</u>: (a) Prepare and submit a proposed System Safety Program Plan. (b) Perform a preliminary hazard analysis, or revise, update, and refine the existing PHA provided by the procuring activity. (c) Identify system safety requirements in the system specifications (includes GFE requirements). (d) Include in tradeoff studies the impact on system safety requirements, and the required safety decisions to be made by the procuring activity.

APPENDIX B

SYSTEM LIFE CYCLE - SAFETY ACTIVITI

	CONTRACT DEFINITION PHASE		
	B	C	E
	Definition contractor's proposals submitted	Proposals evaluated and development contractors selected	D e
ve in e	Safety actions in this phase essentially involve efforts to be accomplished by the definitional contractor or contractors. 1. Implement the approved contract definition phase system safety program plan. 2. Update and complete the preliminary hazard analysis. 3. Verify or propose modifications to the RFP safety performance specifications provided in the RFP. 4. Update safety studies, analyses and test plans to define safety design requirements criteria, and the operating safety characteristics of the system. 5. Define and identify system safety requirements for the CEI specifications, including those to be developed and produced by subcontractors, and specify safety design criteria, objectives, and goals. 6. Insure highest degree of safety consistent with requirements is maintained during system tradeoffs. 7. Identify the safety decisions required to be made prior to proceeding into the development phase. 8. Submit a firm system safety program plan for the engineering development phase. 9. Submit system safety work breakdown statement for engineering development program.	In this phase the procuring activity evaluates the proposals submitted in response to the definition contracts, preparatory to the selection of a contractor for the development and production phases. Some typical safety matters to be evaluated are: 1. The proposed system safety program plan for the development phase and how it satisfies the applicable safety management and system safety engineering requirements. 2. Review and evaluate the results of the hazards analyses, and other related analyses which define the safety design features. 3. The safety requirements of the system specifications. 4. Make the required safety decisions based upon tradeoff proposals.	1 a 2 e a i 3 t s 4 C 5 m 6 v 7 o 8 v c c 9 s 10 ta 11 co 12

ENGINEERING DEVELOPMENT PHASE	PRODUCTION PHASE	
DOD approval for initiation of engineering development	DOD decision to produce operational quantities	Accepta
1. Implement the program approved in the previous phase. 2. Furnish design criteria; establish safety objectives; and review preliminary engineering designs. 3. Evaluate the system design through hazard analyses and safety studies. 4. Insure that designs meet CEI specifications. 5. Establish test requirements in test program. 6. Participate in program reviews. 7. Provide input and review operating publications. 8. Evaluate analysis and investigation results; recommend corrective actions (redesign/ change). 9. Participate in tradeoff studies. 10. Review engineering documentation. 11. Provide inputs to training courses and aids. 12. Prepare progress reports.	Assure that safety achieved in design is maintained during production through: quality control, specified monitoring, identifying critical techniques, procedures, facilities, inspections and tests, and by audits of engineering changes. Initiate redesign or changes to meet requirements.	1. Per and tes operat and eme 2. Eva modifi and pu safety 3. An failur tions; and pr these develo 4. Re materi

ͻN PHASE	OPERATIONAL PHASE
ͻduce operational	Acceptance of first operating unit
achieved in de- during produc- ity control, ng, identifying s, procedures, tions and tests, ngineering changes. or changes to meet	1. Perform operational safety review and tests to determine if design, operating and maintenance procedures, and emergency procedures are adequate. 2. Evaluate updating changes and modifications to operational equipment and publications to insure inherent safety is not degraded. 3. Analyze accidents, incidents, and failures, to identify unsafe conditions; eliminate these conditions, and provide a feedback system to avoid these conditions in systems under development and in future systems. 4. Review and approve hazardous material disposal procedures.

SPECIFICATION ANALYSIS SHEET

Form Approved Budget
Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION MIL-STD-882 SYSTEM SAFETY PROGRAM FOR SYSTEMS AND ASSOCIATED SUBSYSTEMS AND EQUIPMENT: REQUIREMENTS FOR

ORGANIZATION		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT $

MATERIAL PROCURED UNDER A

☐ Direct Government Contract ☐ Subcontract

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

   A. GIVE PARAGRAPH NUMBER AND WORDING.

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID.

3. IS THE SPECIFICATION RESTRICTIVE?

   ☐ YES ☐ NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.)

SUBMITTED BY (Printed or typed name and activity) DATE

DD Form 1426

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Andrews Air Force Base

Washington, D. C. 20331

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NATIONAL SECURITY MANAGEMENT

INDUSTRIAL COLLEGE OF THE ARMED FORCES

1. The World in Ferment
2. The Environment of National Security
3. National Urban Problems
4. Management: Concepts and Practice
5. The National Security Structure
6. Transportation: The Nation's Lifelines
7. The Industrial Sector
8. Human Resources for National Strength
9. Utilities: Electricity, Gas, Telecommunications
10. Natural and Energy Resources
11. The Industrial Sector
12. Elements of Defense Economics
13. National Aerospace Programs
14. Supply Management
15. Procurement
16. Production for Defense
17. National Urban Problems
18. Utilities: Electric Power, Natural Gas and Telecommunications
19. Defense Military Manpower
20. Case Studies in Military Systems Analysis
21. Requirements for National Defense
22. Defense Organization and Management

PLAINTIFF EXH.

1- FINAL AFTER ACTION REPORT (LOCKHEED + AIRFORCE
2- { LOCK MODEL)
3. DIAGRAM OF AIRCRAFT
4 FLIGHT HISTORY + SALVAGE RECOVERY
5- ACCIDENT INVESTIGATION BOARD ORDERS
6- STATEMENT OF SGT FIELDS
7. MANUAL 1C-5A-2-12
8- STATEMENT WILLIAM E. HELL
9- STATEMENT OF GLEN CRITCHFIELD
10- STATENTIMENT OF SGT LARRY G VAN DYNE
11- DIAGRAM OF FORWARD END OF AIRCRAFT
12- GEN SPILLERS REPORT - SAFETY FACTORS OF THE AFT CARGO PRESSURE DOOR SYSTEM
13- DOBSON TRIP REPORT TO CHARLESTON AIR FORCE BASE 13 NOV 73
13- POST ACCIDENT WORK REQUIREMENTS OF FORWARD + AFT RAMP LOCKING SYSTEM
15- MAINTENANCE SUMMARY OF AIRCRAFT 68-218
16- MATERIAL DEFICIENCY REPORT SUMMARY
17- AFTER ACCIDENT SAFETY INSPECTION FORWARD + AFT RAMP
18- AFTER ACCIDENT SAFETY TIME COMPLIANCE TECH ORDER
19- AIRFORCE INVESTIGATION + REPORTING ACCIDENTS + INCIDENTS 29 MAY 75
20 MEMO OF TELEPHONE CONVERSATION GEN. NEWBY + N.C. ARNOLD
21- FINAL REPORT CATEGORY III TESTING
22- METALLURGICAL LABORATORY REPORT 26 APR 75

PLAINTIFF EXHIBITS

23 TRIP REPORT TO ALTUS - COULD RIG AFT RAMP

24 REPORT OF AFT PRESSURE + CARGO DOOR FAILURE 19 OCT 70

25- REPORT OF UNLOCK AFT LOCKS DOVER A.F.B. 11 FEB 75

26 REPORT OF GAP IN AFT CARGO DOOR FAILURE

27- DOBSON NOTES OF ACCIDENT INVESTIGATION

28- TELEPHONE REPORT FROM LOCKHEED PERSONNEL TO BREINS

29- LOCKHEED NOTES OF CHANGES

30

31

32

33

United States Army Logistics Management Center

Reference Book for Army Maintenance Management Group Study, Part II

Course Number	Title	
ALM-43-4060-C(A)	M82 Overhaul	(Instructor)
ALM-43-4299-LC	The Army Maintenance Management Center	
ALM-43-1737-C(G)	Material Readiness Reporting	
ALM-43-3933-C	The Big Jump	(Instructor)
ALM-35-3606-LC	Introduction to Reliability (R) Availability (A) and Maintainability (M)	
ALM-43-1732-C(C)	Tire Retreading	
ALM-43-1732-H	The Components of Problem Solving--Tire Retreading	
ALM-43-3785-C	Contractor-Produced Publications	(Instructor)
ALM-43-430-C(G)	Buy, Borrow or Overhaul	
ALM-43-3451-C(A)	Maintenance Concepts Analysis	
ALM-43-3449-LP	Commercial Airlines Maintenance Practices	(Instructor)

Reference Book for Research and Development Management Course

Course Number	Title	
ALM-63-4162-LC(A)	Design to Cost	(Instructor)
ALM-35-3230-LC(E)	Introduction to Integrated Logistics Support and Maintenance Engineering Analysis	
ALM-31-2424-WS(D)	Laboratory Management	
ALM-45-2268-LC(E)	Introduction to International Logistics	

EXHIBIT
UU-7
PENGAD-Bayonne, N. J.

Reference Book for Research and Development Management Course (Cont'd)

Course Number	Title
ALM-31-2432-LC(A)	Research and Development Procurement
ALM-34-2664-H	The Technical Data Package and Competitive Procurement
ALM-35-3236-C(D)	Chronological History of the M561 Truck

Reference Book for Defense Advanced Dispoal Management Course

Course Number	Title
ALM-44-689-LC(M)	Defense Personal Property Disposal Program
ALM-44-3906-LC(C)	Donations
ALM-44-3895-LC(B)	Lost, Abandoned, or Unclaimed Privately Owned Personal Property
ALM-44-2610-LC(C)	Processing Property at the Defense Property Disposal Office
ALM-44-2610-PE	Processing Property at the DPDO
ALM-44-533-LC(I)	Screening of Excess and Surplus Property
ALM-41-4403-LC	Defense Inventory Management and Disposal Operations
ALM-44-2070-LC(C)	Introduction to Marketing
ALM-44-2073-LC(E)	Methods of Sale
ALM-44-2668-LC(C)	Contract Law in Disposal
ALM-44-561-LC(I)	Sale Terms and Conditions
ALM-44-561-PE(A)	Thought Provokers

Reference Book for Defense Advanced Disposal Management Course

Course Number	Title	
ALM-44-3955-LC(A)	Demilitarization	
ALM-44-1147-LC(E)	Salesmanship	
ALM-44-3788-PE(B)	Disposal Management Perplexities	
ALM-44-2482-C(F)	Default Dubitation	
ALM-61-2737-H(B)	Motivation and Productivity	
ALM-61-2737-H(B)	Human Nature and Organizational Realities	
ALM-44-1861-PE(F)	Disposal Management Exercise	

Research and Development Management Course

Course Number	Title	
ALM-31-3714	Material-Acquisition Process	
ALM-31-998	Management of Human Resources	
ALM-61-1002 ALM-31-3191	Defense Financial Management	
ALM-63-4230	Cost Estimating	
ALM-63-3149	Economic Analysis	
ALM-63-4162	Design to Cost	(Instructor)
ALM-35-3230	ILS and MEA	
ALM-31-2424	Laboratory Management	(Instructor)
ALM-35-3606	RAM	
ALM-45-2268	International Logistics (R&D in Foreign Military Sales)	
ALM-35-3303	Configuration Mangement	
ALM-31-2424	Laboratory Mangement	(Instructor)

Research and Development Mangement Course

Course Number	Title
ALM-34-2664 ALM-34-3559	Technical Data Package
ALM-31-2913 ALM-31-0264	Material Test and Evaluation
ALM-35-3236	In-Process Review

METALLURGICAL LAB: REPORT SUMMARY

E-9

MM (MME-5/Capt D. O. Scheiding/58685/1 Jul 75)

Request for Summary Analysis of Metallurgical Laboratory Analysis, C5A S/N 68-218 (Your Letter, 19 June 1975) ← No record

HQ 22 AF/JA
Travis AFB, CA 94535

In response to paragraph 4, subject letter, the attached material is presented. The scope of the information was limited to those areas specifically requested.

FOR THE COMMANDER

1 Atch
Metallurgical Analysis Reports

MME-5
Capt D.O. Scheiding 2 July 75
Capt Gregory 2 Jul 75
[signature] 2 Jul 75

MME
[signature]
JUL 2 1975

MMBT
M. Martin 7 Jul 75
[signature] 7 Jul 75

MMB
[signature] 7/7/75

EXHIBIT
44-10

MME-5 File Copy

SUMMARY OF METALLURGICAL ANALYSIS REPORTS

Accomplished by

SAN ANTONIO ALC METALLURGICAL LABORATORY

1. Reference Hq 22AF/JA letter, 19 June 1975, paragraph 4.

SA/ALC Task #1128, Attachment 1, No. 6 Left Side Bellcrank and Pushrod

The bellcrank material was determined to be 7075-T6 aluminum alloy. The laboratory concluded that the initial failure of this bellcrank was due to stress-corrosion. In addition, the laboratory concluded that other fractures on the assembly failed due to overload (impact) type failures.

SA/ALC Task #1128, Attachment 2, Left Side No. 6 Saddle Fitting

The saddle fitting material was determined to be 7075 aluminum alloy. Fractographic failure analysis of the crack failure surface resulted in the conclusion that the failure was a shear overload failure cause by an impact load from a foreign object.

SA/ALC Task #1128, Attachment 3, No. 7 Hook Bellcrank Assembly

The failure of this bellcrank was attributed to stress-corrosion. Other fractures were found to be overload type failures. NDI inspection of the ferromagnetic parts of the assembly revealed no discrepancies in these parts.

SA/ALC Task #1128, Attachment 4, Aft Ramp Section 4-4

Macro and microscopic investigation of the failure surface of this section of aft ramp resulted in the conclusion that failure occurred due to tearing or shearing action propagated by overload. The direction of loading was determined to have initiated underneath the left side of the leading edge of the aft ramp section and progressed upwards and diagonally across the ramp section to the right side. A second load was applied on the top right side of this section.

SA/ALC Task #1128, Attachment 5, Right B. L. 84 Hinge

The hinge material was determined to be 7075-T6 aluminum alloy. Failure analysis of the fractured surfaces was concluded to have occurred from tensile tear or shear due to overload.

SA/ALC Task #1128, Attachment 6, Left B. L. 84 Hinge

Visual and microscopic examination resulted in the conclusion that the fracture was caused by a cycling tensile shear mode brought about by overload. The initial load applied was a tension pull, with a secondary load developing in tensile shear. The cycling application resulted in extensive rubbing on the fracture surfaces.

SA/ALC Task #1128, Attachment 7, Right No. 4 Bellcrank

Fractographic examination of a crack found in the bellcrank resulted in the conclusion that the initiating cause was due to stress-corrosion. However, this crack was not the primary cause of bellcrank failure since it was away from the major failure zone. Analysis of the major failure zone revealed a combination of overload failures and "stress-corrosion type" separation zones.

SA/ALC Task #1128, Attachment 8, Right No. 5 Hook, Bellcrank and Pushrod

The major failure zone of this bellcrank was attributed to tensile impact overload. An additional crack was found away from the major fracture area. Fractographic analysis of this crack resulted in the conclusion that its cause was stress-corrosion. Examination of the pushrod fracture surface resulted in the conclusion that failure was due to a combination of rapid bending and torsional shear. NDI of the hook did not reveal any discrepancies.

SA/ALC Task #1128, Attachment 9, No. 1 / No. 3 Bellcrank Pushrod

Failure analysis of the fracture surface of the pushrod resulted in the conclusion that failure occurred due to flexing tensile shear mode of failure due to overload. Failure analysis of the bellcrank lugs also revealed a tensile shear mode of failure attributed to overload. There was no indication of material defects which would contribute to the ultimate failure.

SA/ALC Task #1128, Attachment 10, Left Side #5, Hook Bellcrank Assembly

The bellcrank material was determined to be 7075 aluminum alloy. The pushrod material was found to be 2024 aluminum alloy. Visual and microscopic examination of the pushrod fracture surfaces resulted in the conclusion that failure was due to a combination of tensile and torsional overload condition. Attachment 12 analyzed the matching failure surface and confirms this conclusion. The bellcrank was found to be cracked. Transmission Electron Microscope (TEM) analysis of this crack resulted in the conclusion that the cause was due to stress-corrosion. NDI inspection of the hook revealed no surface discontinuities, there was some impact damage on left side of the hook.

SA/ALC Task #1128, Attachment 11, Left Side No. 5 Saddle Fitting

The fitting material was identified as 7075-T6 aluminum alloy. Visual and microscopic examinations of the fractured surface resulted in the conclusion that the failure was caused by impact.

SA/ALC Task #1128, Attachment 12, Left 4 to 5 Pushrod

Microscopic analysis of the fractured surfaces lead to the determination that the failure mechanism was due to an overload in a bending and twisting motion. A tensile shear mode of fracture was observed on all fracture surfaces.

SA/ALC Task #1128, Attachment 13, No. 4 Left Side Hook and Bellcrank Assembly

NDI inspection of the bellcrank revealed a crack indication. Fractographic analysis of the crack attributed the crack cause to stress-corrosion. NDI inspection of the ferromagnetic components revealed no discrepancies.

SA/ALC Task #1128, Attachment 14, No. 7 Yoke Guide (Left) Support Backup Structure

Microscopic investigation of an elongated attachment fastener hole revealed no evidence of a recent repair or installation of a new fastener, nor any indication of the hole being re-drilled.

SA/ALC Task #1128, Attachment 15, No. 5 Pressure Door Roller Bracket

The bracket material was identified as 7075-T6 aluminum alloy. Metallurgical and TEM analysis revealed the mode of failure of the bracket was initiated by stress-corrosion of a crack initiated from both sides of the part. Other fractures on the bracket were found to be of the overload type (impact) failure.

SA/ALC Task #1128, Attachment 16, No. 7 Right Hook and Bellcrank Assembly

The failed bellcrank was subjected to a microscopic investigation which revealed no discrepancies other than the impact to one side of the hook.

SA/ALC Task #1128, Attachment 17, Ramp (Right Side) Part 4-8

The fracture surface of this ramp section was subjected to a microscopic examination to determine mechanism and mode of failure. It was determined that the failure was attributed to excessive shearing and tensile overload. The direction of failure was determined to be from right to left.

SA/ALC Task #1128, Attachment 18, Aft Ramp (Parts Labeled 4-6 and 4-5) Sections

Visual and magnified examination of the fracture surfaces of these ramp sections revealed a tensile and shear cleavage failure mode caused by overload. The direction of failure was determined to be from left to right.

SA/ALC Task #1128, Attachment 19, Aft Ramp Section (4-3)

Microscopic examination of the fracture surface revealed the mode of failure to be tension or tensile shear and/or cup overload, similar to the other ramp sections. An overall direction of failure pattern was not given.

SA/ALC Task #1128, Attachment 20, Aft Ramp Section Labeled (4-1)

Macro and microscopic investigation of these sections' fracture surfaces indicated all fractures modes were due to a tension overload. Many of the fractures show cycling, bending, twisting and vibration while being subjected to a tension force. The direction of failure pattern was indicated to be from right to left.

SA/ALC Task #1128, Attachment 21, Control Cables

Cable material was determined to be AISI302 stainless steel in the full hardened condition. The cable lock clad material was determined to be 6061-T6 aluminum alloy. Visual and microexamination of the fractured cables and their lock clad cover was attributed to a combination of tensile and torsional overloading.

SA/ALC Task #1128, Attachment 22, Hydraulic Lines

Two failed hydraulic lines taken from the hayloft area were analyzed. The lines had been dented, torn, kinked and finally failed through shear cleavage.

SA/ALC Task #1128, Attachment 23, Ramp Bulkhead

A small "bullet like" hole was analyzed in the bulkhead. A chemical spot test for lead traces proved positive but was inconclusive due to the primary presence of lead in the bonding medium between skin and honeycomb. No evidence of a projectile was found in the honeycomb material. The damage was concluded to be a glancing blow (projectile or obtrusion) encountered on impact, rather than by an impacted projectile. There also was no evidence of intense heat.

SA/ALC Task #1128, Attachment 24, Bellcrank and Pushrod

Three pieces of failed pushrod and a failed section of bellcrank from an unknown location were analyzed under this task. Examination of the fracture surfaces resulted in the determination that the fractures were caused by an overload condition attributed to bending, twisting, tension and impact. Material deficiency or defects were not considered as contributing to the failure.

SA/ALC Task #1128, Attachment 25, No. 2 Right Side Yoke Assembly

NDI inspection along with visual and microscopic examination of the assembly revealed only minor discrepancies. No evidence of overload was found on this assembly.

SA/ALC Task #1128, Attachment 26, Ramp Floor Fracture Surface

Microscopic investigation of the fracture surfaces of the ramp section recovered from the ocean floor revealed that the mode of failure was a combination of tensile shear and tensile cup attributed to overload. This mode of failure was accompanied by shearing, tearing and bending action. The direction of failure initiated on the right side of the ramp floor with an upward bending movement, followed by a tensile downward movement in overload.

SA/ALC Task #1128, Attachment 27, No. 3 Right Side Yoke Assembly

NDI inspection along with visual and microscopic examination revealed only minor discrepancies. There was some slight evidence of shear on the upper and lower yoke pin shafts. However, the amount of shear present does not indicate an overload condition.

SA/ALC Task #1128, Attachment 28, No. 5 Right Side Floor Bracket

Visual and microscopic examination of this floor bracket revealed indications of an extensive loading having been applied in a straight up direction.

SA/ALC Task #1128, Attachment 29, No. 4 Right Side Floor Bracket

Visual and microscopic examination of this floor bracket also revealed indications of extensive loading having been applied in a straight up direction.

SA/ALC Task #1128, Attachment 30, No. 6 Right Side Yoke and Floor Bracket Assembly

Visual and microscopic examination of this assembly revealed only minor discrepancies. The yoke mono-ball bearing was found to be cracked.

SA/ALC Task #1128, Attachment 31, No. 7 Right Side Yoke and Floor Bracket Assembly

Visual and microscopic examination showed extensive shear damage on the lower eccentric pin shaft. The mono-ball bearing at the bottom of the yoke was cracked in two places. The upper eccentric shaft on the yoke had a crack at each end. The upper arm portion of the yoke was slightly bent. It was concluded that the assembly was subjected to excessive loading.

SA/ALC Task #1128, Attachment 32, Burned Fragments and Gray Flake

The analysis of the burned fragments yielded a very heterogeneous mixture of molten metal, unmelted metal scraps, metal foil, straw, etc. The water extraction test yielded a neutral colorless solution with a medium amount of chloride. The gray flake was determined to be calcium carbonate and of marine origin.

SA/ALC Task #1128, Attachment 33, Winch Well Area

The majority of the fractures analyzed in the Winch Well area failed by the mode of tensile shear and/or tensile cup. The direction of impact load was from right to left with a slight aft movement. The bulkheads failed under a compressive load.

SA/ALC Task #1128, Attachment 34, Lower Skin

It was concluded that the bottom skin showed no evidence of object damage. The failing mode to cause the flexing, buckling, tearing, shearing was probably caused by either air or water impact.

SA/ALC Task #1128, Attachment 35, Southwest Research Report, "Fractographic Examination of Failed Bellcrank Fittings"

Five parts of failed bellcranks were analyzed. Fractographic examinations indicated the failure mode occurred by stress-corrosion. There was no evidence of fatigue crack propagation.

2. Reference Hq 22AF/JA letter, 19 Jun 1975, paragraph 4, a, b, and c.

DISCUSSION:

a. Response to 4a: Visual observation in conjunction with the results from the above 35 metallurgical laboratory analysis reports of the recovered parts support and confirm that the aft ramp came loose from the right side. The ramp was then torn right to left across the front of ramp station 33 bulkhead and rotated downward from its normal horizontal position to a near vertical position about the left side locking system before departing the aircraft.

This is supported by observation of the failure pattern of the recovered left hand side ramp locking hardware (floor brackets and yoke assemblies). All left hand floor brackets and yokes failed in a manner that indicates they were carrying load and the ramp rotated about a hinge line formed by these seven locks. Laboratory analysis of the recovered right side ramp locking hardware, in lock positions 4, 5 and 7, revealed failure due to excessive overload in the vertical direction. The hardware from lock positions 2, 3 and 6, were in good condition and the laboratory analysis of this hardware did not reveal signs of excessive overload. The hardware from lock position 1 was not recovered.

This evidence indicates that some of the right side locks were not carrying their share of the load. The direction of failure of the locks that were carrying load places the ramp in the normal horizontal position at the start of the sequence. In addition, the ramp rotation is confirmed by visual evidence found on the exterior skin of the recovered mating ramp to fuselage sloping longeron section. This evidence was in the form of scratches on the fuselage skin that match button head fasteners that are on the ramp floor. To cause the scratches the ramp would have to rotate approximately 90 degrees about the left side locking system. This also supports the sequence of initiation occurring in the right side lock system of the ramp.

The laboratory analysis of the fracture surfaces at ramp station 33 support the direction of ramp tearing from right to left. The laboratory analysis did have some variance in the failure direction indicated, however, impact damage from the crash occurred to the fracture surfaces that would make the direction determination more difficult. The majority of the analysis confirmed the direction of failure as right to left.

b. Response to 4b: The evidence from the laboratory analysis does not lead to factual supportive evidence of the actual initiating cause within the right side locking system. It does, however, point in the direction of a "most probable" cause that supports the above failure progression, involving the numbers 1, 2 and 3 right side locking mechanisms. A sudden dumping of the load from #1, 2 and 3 locks on the BL 84 ramp hinge could cause a simultaneous compressive failure of the hinge and failure of the lower beam cap at RS 33. This is supported by the laboratory analysis of the BL 84 hinge. The remaining load carrying locks on the right side (4, 5, 7) failed in overload and the ramp was forced down from the right, tearing completely across at the RS 33 bulkhead.

Since the pressure door is attached to the ramp its motion was influenced by the ramp movement. Visual inspection of the recovered parts verify a downward right to left rotating of the pressure door. It is assumed that the pressure door struck the sloping torque deck area of the aircraft fuselage, causing the empennage flight control cables and hydraulic lines for systems #1 and #2 to separate. The laboratory failure analysis of these items does support this type of sequence. However the support is not conclusive.

c. Response to 4c: Concerning the aspect of material or part failure, the laboratory analysis does give evidence that fatigue was not a factor in any of the parts that were analyzed. The subject laboratory analysis does provide supportive evidence that indicates a stress-corrosion problem with the bellcranks. However, through personal knowledge and observation of the system this conclusion must be tempered by the following information.

A situation can exist where the hook tip does not engage the upper yoke shaft in the proper manner. A mis-rigged lock can result in the hook tip impinging on the bottom side of the yoke shaft during the locking sequence. The hook tip is now essentially set on a hair trigger unstable arrangement where it can either slip into the locked or the unlocked position depending on just where the hook tip has engaged the yoke shaft. When the hook tip does slip into either the locked or the unlocked condition, there is a dynamic shock release of the binding force that is transmitted into the bellcrank. This sudden shock impact force can be of sufficient magnitude to crack the bellcrank. This situation was verified by the cracking of three bellcranks during the accomplishment of TCTO 1768. Inspection of these cracked bellcranks revealed that they had cracked in an identical manner and in the same location as the bellcranks that were analyzed above.

If this situation occurs, and the bellcranks are not inspected, a cracked condition in the bellcrank would go unnoticed. In time the surfaces of the crack would then be exposed to corrosion. This corrosion and resulting discoloration of the cracked surfaces could easily be misinterpreted as stress-corrosion. In time, the evidence of the overload failure would be reduced due to the corrosion effects. There is enough other evidence to make the stress-corrosion documentation inconclusive. The ruling out of fatigue failures is conclusive.

3. In summary the above failure sequence was termed the "most probable" but there are other sequences that could have occurred. Since all of the critical component parts were not recovered, the exact initiating cause of the failure sequence will most likely remain in the hypothesis state.

SUBSCRIBED and SWORN TO before me this 10th day of July, 1979, in the State and County aforesaid.

[signature]

NOTARY PUBLIC

IRENE A. CHURCHILL
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires January 27, 1980

My Commission Expires: January 27, 1980

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By [signature]
One of Counsel for Plaintiffs

CERTIFICATE OF SERVICE

I hereby certify that I have caused a true copy of the foregoing Plaintiffs' Supplemental Answers to Interrogatories to be mailed, postage prepaid, this the 16th day of July, 1979, to the following counsel:

CARROLL E. DUBUC, ESQUIRE
Haight, Gardner, Poor and Havens
Federal Bar Building
1819 H Street, N.W.
Washington, D.C. 20006

ISAAC N. GRONER, ESQUIRE
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1730 K Street, N.W.
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JAMES P. PIPER, ESQUIRE
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U.S. Department of Justice
550 11th Street, Room 906
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[signature]
Michael S. Marcus

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

IN RE AIR CRASH DISASTER
NEAR SAIGON, SOUTH VIETNAM
ON APRIL 4, 1975

Misc. No. 75-0205
All Cases

ELEANOR S. DOBSON, Administratrix of the Estate of JO-AN K. PRAY, Deceased and on behalf of all other similarly situated,

-and-

FRIENDS FOR ALL CHILDREN, INC., as Special Administrator of the Estate of TRAN THI BA and Seventy-Five other decedents,

Plaintiffs,

-against-

Civil Action No. 75-0874

LOCKHEED AIRCRAFT CORPORATION, A California Corporation,

Defendant/Third-Party Plaintiff,

-against-

THE UNITED STATES OF AMERICA,

Third-Party Defendant.

PLAINTIFFS' ANSWERS TO DEFENDANT LOCKHEED'S SUPPLEMENTAL WRITTEN INTERROGATORIES

Plaintiffs Burke C. Pray and Eleanor S. Dobson hereby submit answers to the Supplemental "expert witness" interrogatories propounded by defendant Lockheed Aircraft Corporation (hereinafter referred to as Lockheed). At the time of this submittal, plaintiffs' expert witness is in the process of his analysis, discovery is still in progress, important witnesses are yet to be deposed, and documents are yet to be received and/or analyzed. Plaintiffs are in the process of deciding whether to retain additional experts to testify at the trial (such individuals have not been retained and/or consulted by plaintiffs on any basis concerning this lawsuit). Plaintiffs reserve the right to change, alter, expand, refine, exclude, or otherwise modify the answers

D EXH VV1

provided herein as indicated by further formal and informal discovery in this proceeding, further analysis, a decision to retain and call additional expert witnesses and as otherwise appropriate.

INTERROGATORY NO. 80: State the names and addresses of each person whom plaintiff expects to call as an expert witness at trial and as to each such person state:

(a) the technical fields in which plaintiff claims him to be expert and the training, education and experience upon which such claims are made;

(b) the subject matter upon which each such person is expected to testify;

(c) the substance of the facts and opinions to which each such person is expected to testify; and

(d) a summary of the grounds for each opinion each such person is expected to give.

ANSWER 80:

A. William Timm, P.E.
William Timm and Associates
12 Laurel Hill Place
Armonk, New York 10504

(a) Plaintiffs claim William Timm, P.E. to be an expert in the following fields:

(1) technical writing

(2) safety engineering

(3) safety and maintenance manuals for armed service personnel

(4) chemical engineering

(5) design of locks, locking systems and other safety and securing mechanisms and other aspects of mechanical engineering

(6) compilation of failure mode and effects analyses

(7) structural testing

(8) metal analysis and selection; corrosion and corrosion related problems and testing

(9) adequacy of engineering design criteria

(10) hydraulic and pneumatic systems

(11) logistical and maintenance practices in the armed services, including the maintaining and rigging of aircraft

(12) drafting and interpretation of engineering specifications

(13) accident and damage investigations

The qualifications of William Timm, P.E. as an expert witness are as follows:

1. Holds a Bachelor and Masters Degree in Chemical Engineering and completed all courses, except for the writing of the thesis, for a Doctor of Engineering Degree. All such degrees and courses were obtained at New York University.

2. Is a licensed Professional Engineer in the states of New York, New Jersey, Connecticut and the Commonwealth of Virginia.

3. Is a member of the National Society and the New York State Society of Professional Engineers (NSPE and NYSSPE). Was a director and chairman of the Ethical Practice Committee of the Westchester Chapter and is a member of the State Society's Ethical Practice and Long Range Goal Committee.

4. Is a member of the American Society for Testing and Materials (ASTM) and is a member of C-16 (Thermal Insultations) and E-5 (Fire Standards) Committees.

5. Is a member of the National Fire Protection Association (NFPA) and a member of the Instrument Society of America (ISA).

6. Is a member of the American Institute of Chemical Engineers (AICHE) and the Association of Consulting Chemists and Chemical Engineers (ACC&CE).

7. Holds the rank of Lieutenant Colonel in the Army Reserves and has completed the following courses offered by the military:

   a) Both the Associated Engineer Company Officers and the Advanced Engineer Officers Course given by the Engineer School at Fort Belvoir, VA

   b) The Command and General Staff Officers Course from the United States Army Command and General Staff College at Fort Leavenworth, Kansas

   c) The National Security Management Course given by the Industrial College of the Armed Forces

   d) Is currently enrolled in the Logistical Management Course and has completed several phases of that course.

8. Reserve Assignment included 10 years with a Logistical Command during which time he taught and attended numerous classes on maintenance policies and during training at Fort Lee attended classes and demonstrations on aircraft loading and rigging.

9. Has worked in the aircraft industry and was employed by Curtis Wright Corporation in Woodridge, N.J. Was also assigned as a technical representative for the U.S. Air Force while employed with another company.

10. While in military service he prepared interim operating and spare parts manuals for gas generating equipment. Also supervised the military personnel who took part in the preparation of operating, maintenance and spare parts manuals for gas generating equipment.

11. In the course of his civilian engineering work he has:

   a) prepared several manuals for the operation and maintenance of special pieces of equipment and large chemical complexes

   b) drafted specifications for numerous different type projects ranging from buildings to complex machinery

   c) prepared test procedures to verify the safety of components

   d) prepared corrosion test procedures and conducted studies of corrosion problems, including stress calculations and the changes in corrosion resistant properties for various stress conditions

   e) advised on the selection of the proper materials for high stress points and/or corrosive environments.

12. Has made stress analysis on piping systems, structural members, equipment and supports. Has devised tests to determine the structural integrity of systems which were too complex to calculate directly.

13. Has designed hydraulic and pneumatic systems as well as safety latches and interlocks for special equipment.

14. Has made safety inspections to eliminate potential hazards and to assure compliance with OSHA and various local rules and regulations.

15. Throughout his engineering work, he has conducted safety engineering analyses and has been involved in safety aspects of engineering.

16. Through his engineering work, he has performed mechanical engineering and related tasks.

17. In the course of his civilian engineering work, he has conducted and participated in accident and damage investigations.

18. Other learning, education and experience.

(b) At the present time, it is contemplated that William Timm, P.E. may testify on the following subject matters:

   (1) Maintenance Manual T.O. 1C-5A-2-12

   (2) The lack of verification procedure for the rigging of the aft ramp locking systems

   (3) The location of the hydraulic lines and control cables in the torque deck area

   (4) The design of the aft ramp locks and locking system

(5) The design criteria utilized in the design of the aft ramp locks and locking system, the aft pressure door, the aft cargo door complex generally and the location of the hydraulic lines and control cables in the torque deck area.

(6) The failure mode and effect analysis as such pertains to the aft ramp, aft ramp locking system, aft pressure door, aft cargo complex generally and the location of the hydraulic lines and control cables in the torque deck area.

(7) The static and fatigue testing (and other structural testing) of the aft ramp locks, components of said locks and the aft ramp locking systems

(8) The selection of certain aluminum alloys for components of the aft ramp locks

(9) Corrosion testing as such pertains to the aft ramp locks and locking systems

(10) Corrosion prevention techniques as such pertains to the aft ramp locks and locking system

(11) Safety engineering analysis as such pertains to the aft ramp locks and locking systems, the aft pressure door, the aft cargo door complex generally and the location of the hydraulic lines and control cables in the torque deck area

(12) The competancy of the safety assurance department

(13) The competancy of the maintenance manual drafting department

(14) Other subject matters

(c) William Timm, P.E. is expected to testify that Lockheed's efforts were defective and deficient in the subject areas identified in 80(b), that Lockheed committed some or all of the acts and/or omissions in such subject areas enumerated in 63(a) and that the consequences of such acts and/or omissions are indicated in 63(b).

(d) William Timm, P.E. will rely on the depositions taken in this proceeding, the documents which have been produced to all parties and his experience, education and training as grounds for the opinions he will render at trial.

B. Plaintiffs may decide to call Air Force personnel who have already been deposed and/or who are scheduled to be deposed as expert witnesses.

C. Other expert witnesses yet to be determined.

INTERROGATORY NO. 81: State the names and addresses of any and all expert witnesses with whom plaintiff or his representative have consulted in connection with this lawsuit and as to each such expert state:

(a) the technical field in which plaintiff claims him to be expert and the training, education and experience upon which such claims are made;

(b) the subject matter upon which each such person is expected to testify;

(c) the substance of the facts and opinions to which each such person is expected to testify; and

(d) a summary of the grounds for each opinion each such person is expected to give.

ANSWER 81:

A. See answers to No. 80.

B. Steve Chris
13220 Wye Oak Drive
Gaithersburg, MD 20760

Steve Chris will not testify at trial.

Burke C Pray
BURKE C. PRAY, Co-Administrator of the Estate of JO-AN K. PRAY, Deceased

STATE OF New Jersey

COUNTY OF Burlington, to-wit:

I, Irene A. Churchill, a Notary Public in and for the State and County aforesaid, do hereby state that the above BURKE C. PRAY did appear before me this 10th day of July, 1979, and after being first duly sworn, did depose and state that the above Plaintiffs' Answers to Defendant Lockheed's Supplemental Written Interrogatories are true and correct to the best of his knowledge, information and belief.

SUBSCRIBED and SWORN TO before me this 10th day of July, 1979.

Irene A. Churchill
Notary Public

IRENE A. CHURCHILL
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires January 27, 1980

My commission expires:
January 27, 1980

LEWIS, WILSON, LEWIS & JONES, LTD.
2054 North Fourteenth Street
Arlington, Virginia 22201
703/527-8800

Oren R. Lewis, Jr.
Richard H. Jones
John E. Fricker
Michael S. Marcus
Attorneys for Plaintiffs

CERTIFICATE OF SERVICE

I hereby certify that I have caused a true copy of the foregoing Plaintiffs' Answers to Defendant Lockheed's Supplemental Written Interrogatories to be mailed, postage prepaid, this 16th day of July, 1979, to the following counsel:

CARROLL E. DUBUC, ESQUIRE
Haight, Gardner, Poor and Havens
Federal Bar Building
1819 H Street, N. W.
Washington, D. C. 20006

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1730 K Street, N. W.
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JAMES P. PIPER, ESQUIRE
Trial Attorney, Aviation Unit
Torts Section, Civil Division
U.S. Department of Justice
550 11th Street, Room 906
Washington, D. C. 20530

Michael S. Marcus
Michael S. Marcus

(1)

JUNE 26, 1979

LEWIS, WILSON, LEWIS + JONES LTD.
2054 NORTH 14 STREET
ARLINGTON, Va 22216
ATTN: MR. MICHAEL S. MARCUS ESQ.

SUBJECT: QUALIFICATION OF EXPERT WITNESS
WILLIAM TIMM, P.E

Dear Mr. Marcus,
The following information was given to ELLEN [illegible] by phone on this date:

The qualification of WILLIAM TIMM, P.E AS AN EXPERT WITNESS IN THE CASE OF THE AIR CRASH OF C-5A AIRCRAFT NEAR SAIGON, SOUTH VIETNAM, ON APRIL 4, 1975

3 5PM → ENGINEERING DEGREES: HOLDS BACHELOR AND MASTERS DEGREE IN CHEMICAL ENGINEERING AND COMPLETED ALL COURSE, EXCEPT FOR WRITING OF THE THESIS FOR A DOCTOR OF ENGINEERING SCIENCE DEGREE, ALL FROM NEW YORK UNIVERSI[TY]

PROFESSIONAL LICENSES: IS A LICENSED PROFESSIONAL ENGINEER IN THE STATES OF NEW YORK, NEW JERSEY, CONNECTICUT, AND THE COMMONWEALTH OF VIRGINIA.

PROFESSIONAL SOCIETIES: IS A MEMBER THE NATIONAL SOCIETY AND THE NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS (NSPE + NYSSPE), WAS A DIRECTOR AND CHAIRMAN OF THE ETHICAL PRACTICE COMMITTEE OF WESTCHESTER CHAPTER AND IS A MEETING OF THE STATE SOCIETIES ETHICAL PRACTICE AND LONG RANGE GOAL COMMITTEE

IS A MEMBER OF THE AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) AND IS A MEMBER OF C-16 (THERMAL INSULATIONS) AND E-5 (FIRE STANDARDS) COMMITTEES.

IS A MEMBER OF THE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) AND A MEMBER OF THE INSTRUMENT

SOCIETY OF AMERICA (ISA).

IS A MEMBER OF THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS (AICHE) AND THE ASSOCIATION OF CONSULTING CHEMISTS AND CHEMICAL ENGINEERS) (ACC&CE),

OTHER EDUCATION: HOLDS THE RANK OF LIEUTENANT COLONEL IN THE ARMY RESERVES AND HAS COMPLETED THE FOLLO[illegible] COURSE OFFERED BY THE MILITARY: COMPLETED BOTH THE ASSOCIATED ENGINEER COMPANY OFFICERS AND THE ADVANCED ENGINEER OFFICERS COURSE GIVEN BY THE ENGINEER SCHOOL AT FORT BELVIOR, VA; COMPLETED THE COMMAND AND GENERAL STAFF OFFICER COURSE FROM THE UNITED STATES ARMY COMMAND AND GENERAL STAFF COLLEGE FORT LEAVENWORTH, KANAS.; COMPLETED THE NATIONAL SECURITY MANAGEMENT COURSE GIVEN BY THE INDUSTRIAL COLLEGE OF THE ARMED FORCES; IS CURRENTALLY ENROLLED LOGISTICAL MANAGEMENT COURSE AND HAS COMPLETED SEVERAL PHASES OF THAT COURSE.

RESERVE ASSIGNMENT INCLUDED 10 YEARS WITH A LOGISTICAL COMMAND DURING WHICH TIME HE TAUGHT AND ATTENDED NUMERIOUS ~~COURSE~~ CLASS ON MAINTENANCE POLICIES AND DURING TRAINING AT FORT LEE ATTENDEDD CLASSES AND DEMONSTRATIONS ON AIRCRAFT LOADING AND RIGGING.

OTHER EXPERIENCE

HAS WORKED IN THE AIRCRAFT INDUSTRY AND WAS EMPLOYED BY CURTIS WRIGHT CORP IN WOODRIDGE, N.J. WAS ALSO ASSIGNED AS A TECHNICAL REPRESENTATIVE FOR THE U.S. AIR FORCE WHILE EMPLOYED WITH ANOTHER COMPANY.

WHILE IN MILITARY SERVICE, HE PREPARED AN INTERIM OPERATING ~~MANUALS~~ AND SPARE PARTS MANUALS

FOR ~~THE OPER~~ GAS GENERATING EQUIPMENT. ALSO SUPERVISED THE MILITARY PERSONNEL WHO TOOK PART IN THE PREPARATION OF OPERATING, MAINTENANCE AND SPARE PARTS MANUALS FOR GAS GENERATING EQUIPMENT.

IN THE COURSE OF HIS ENGINEERING WORK HE HAS PREPARED SEVERAL MANUALS FOR THE OPERATION AND MAINTENANCE FOR SPECIAL PIECES OF EQUIPMENT AND LARGE CHEMICAL COMPLEXES. HE HAS ALSO BEEN REQUIRED TO WRITE SPECIFICATION FOR NUMERIAL DIFFERENT TYPE PROJECT RANGING FROM BUILDING TO COMPLEX MACHINER AND HAS PREPARED TEST PROCEDURE TO VERIFY THE SAFETY OF COMPONENTS.

HIS DESIGN WORK HAS INCLUDED THE PREPARATION TO CORROSION TEST PROCEDURES AND STUDIES OF CORROSION PROBLEMS; WORK INCLUDE STRESS CALCULATIONS AND THE CHANGE IN CORROSION RESISTANT PROPERTIES FOR THE STRESSED CONDITION; CONSULTED FOR THE SELECTION OF THE PROPER MATERIAL FOR HIGH STRESS POINTS OR CORROSIVE ENVIRONM

HAS MADE STRESS ANALYSIS ON PIPING SYSTEM, STRUCTURAL MEMBER, EQUIPMENT, AND SUPPORTS. AS DEVISED TEST TO DETERMINE THE STRUCTURAL INTEGRITY OF SYSTEM WHICH WERE TOO COMPLEX TO CALCULATE.

HAVE DESIGNED HYDRAULIC AND PNEUMATIC SYSTEM AS WELL AS SAFETY LACTCHES AND INTERLOCKS FOR SPECIAL EQUIPMENT. HAVE MADE SAFETY INSPECTIONS TO ELIMINATE POTENTIAL HAZARDS AND COMPLY WITH ~~US~~ OSHA AND VARIOUS LOCAL RULES AND REGULATIONS

← I hope you will find this information complete; I will see you Thursday July 5, 1979

CAUSES OF ACCIDENT

1- MANUAL EXH 7 + 153 (MANUAL CHANGES)

A- IMPROPELY ORGANIZED

1- FIGURES NOT GROUPED IN LOGICAL SEQUENCE

2- MAINTENANCE TASKS NOT GIVEN IN THE SMALLEST SINGLE OPERATION

3- COMPONENTS NOT CLEARLY IDENTIFIED

B- TO COMPLEX FOR AIRMEN SKILL LEVEL TO EFFECTIVELY USE

C- UNCLEAR AND CONFUSING INSTRUCTION

D- IMPROPERLY REFERENCED

E MISLEADING IN INTEND

F INTERNALLY INCONSISTANT

G- LACKS EXPLICIT WARNING AGAINST MISRIGGING + SAFETY INDICATORS + SAFETY DEVICES

H- CONTAINS NO SECTION FOR INSPECTION OR PREVENTATIVE MAINTENANCE

I LACKED POSITIVE TEST AND VERIFICATION OF WORK PERFORMED

J - NOT FOR SKILL LEVEL OF AIRMEN AND ASSUMED A DEGREE OF TRAINING NOT AVAILABLE OR REASONABLE

K MISLEAD TITLE FOR VERIFICATION SECTION AND NOT REFERENCE

2- HYDRAULIC/LINES AND FLIGHT CONTROL CABLE

A - IMPROPERLY LOCATED FOR ADEQUATE REDUNDANCY

B - NOT STUDIED FOR FAILURE OF AFT RAMP

C - CABLES + HYDAULIC LINES NOT STRONGE ENOUGH OR ADEQUATELY PROTECTED AGAINST DAMAGE

3 - RIGGING AND TESTING EXH 104, 106

A - ALL TESTING ON RAMP IS NEGATIVE + WOULD DISRUPT ITEM TO BE VERIFIE

B - SYSTEM COULD NOT BE VERIFIED

C - UNREASONABLE MAINTENANCE EFFOR STILL WOULD NOT VERIFY RIGGING VERIFICATION

C - POSITIVE TEST OF PROGRAM LINKS DELETED FROM SYSTEM

D - INDICATOR + WARNING LIGHTS COULD GIVE FALSE SIGNAL

E - FATIGUE TEST SHOW SYSTEM CAN NOT FUNCTION UP TO OVER 100,000 CYCLES

4- SYSTEM DESIGN - AFT RAMP EXH 98

A- NO POSITIVE SAFETY DEVICES LIKE RIGGING + LOCKING PINS EXH 43

B- SYSTEM NOT MAINTENAINABLE - RIGGING PINS EXH 43

C- TOLERANCE NOT CONSISTANCE WITH USE CONDITIONS

D- TO SENSITIVE TO TEMPERATURE EFFECTS EXH 70

E- TOO SENSITIVE TO ENVIRONMENTAL CONDITIONS

F- DESIGN CRITERIA - MORE THAN ONE LOCK FAILURE

G- IMPROPER SAFETY ANALYSIS

H- NO POSITIVE INDICATORS

I MATERIAL SUBJECT TO STRESS CORROSION EXH 22 + ___

CHECK

5- SAFETY (EXH 58)

A-DEPARTMENT WAS NOT MANED BY
COMPENTENT ENGINEERS EXH 95

B- DID NOT CHECK ENGINEERING DEPARTMENT
FOR SAFETY EXH 129, 130, 131, 132

C DID NOT CONDUCT FMEA + FMCEA ADEQUATELY
1-~~A~~ - ON LOCKING SYSTEM
2-~~B~~- HYDRAULIC LINES + FLIGHT CONTROLS
3 ~~C~~- TEST OF SYSTEM + COMPONENTS
4 - USED ONLY SINGLE FAULT CRITERIA
5- MAINTENANCE ERROR NOT CONSIDERED

D- DID NOT CONSIDER EXPLOSIVE DECOMPRESSION

E - SHOULD HAVE CONSIDERED RIGGING + LOCKING
F [illegible] PINS

F - DEVELOPED SYSTEM THAT WAS NOT
MAINTENAINABLE

G - DETERMINE POTENTIAL DANAGER OF
MISRIGGING

H - DEVELOPE -CHECK METHOD FOR MAINTENANC
INSPECTION + CHECK FOR CORROSION

I ALLOWED MANAGEMENT POLICIES TO
REDUCE SAFETY

J- DID NOT EVALUATE INCIDENCE OF
DOOR SYSTEM FAILURES

K- DID NOT APPLY SAFETY ENGINEERING
PLAN AND USE ASSET EXH 48-95

~~K~~- 1-DID NOT APPLY C130, C140, + C141
SYSTEM ANALYSIS

6- TESTING EXH 99, 104, 105, 106, 113

A- DID NOT CONDUCT ADEQUATE STATIC
+ FATIQUE TESTING ON DOOR
SYSTEM & HYDRAULIC LINES

B- DID NOT CONDUCT TEST FOR CREEP

C- SHOULD HAVE DETERMINE MAX STRESS
+ IMPACT LOADS ON COMPONENTS
AND IDENTIFED PARTS NEEDING
SPECIAL MAINTENANCE

D- TEST FOR STRESS CORROSION EXH 99

E- TESTING FOR QUALITY CONTROL OF LOCK
COMPONENTS

F- CHECK INDICATION ARE POSITIVE
+ NOT SUBJECT TO FALSE
READINS

7- CANNIBILIZATION EXH CC

A - PART SUBJECT TO STRESS CORROSION SHOULD NOT BE CANNIBILIZED

B - WARNING FOR SPECIAL INSPECTION AND PROHIBITIONS OF CANNIBILIZATION

8. RIGGING COULD NOT BE VERIFIED

9- SYSTEM - UNMAINTENAINABLE

A - NEEDED PEROID FOR RERIGGIN

10- FAILURE MODE + EFFECTS ANALYSIS

EXH 99 PAGE 32

EXH. 112

EXH. 149

WILLIAM TIMM, PE, Consulting Engineer 12 Laurel Hill Pl, Armonk, NY 10504

List of Articles & Publications

1. Section 3, 11, C. Hydraulic Performance High Temperature Water by Paul L. Geiringer

2. Fire Susceptibility Test of UFC Foam "Type K" Insulation - furnished U. F. Chemical Corp. April 1969

3. Education Law in New York Professional Engineer March 1975

4. Paese Versus Tarrytown Round 3 Begins in New York Professional Engineer March 1977

5. Engineers - Public Servants - Political Pawns in New York Professional Engineer March 1977

6. Advice to Engineers in Private Practice & Government in New York Professional Engineer July/August 1977

7. The Real Issues in the North Tarrytown Paving & Drainage Work in New York Professional Engineer July/August 1977

8. Energy Conservation in presentation at seminar in White Plains, New York on April 2, 1976

9. "Comparison of Insulation Materials for Buildings" presented to Westchester Chapter NYSSPE May 17, 1976

10. Westchester County Dilemma, The Westchester Engineer September 1978

11. Cause and Effects of Shrinkage in Urea Based Foam in ASTM STP to be Published Fall 1979

12. Operator's Manual for Hydrogen and Carbon Dioxide Generator (Methanol - Water Type) published by Engineer School 1953

13. Operator's Manual - Valdosta, Georgia - Rosin Treating Facility

14. Operator Manual CAP Camphor Plant

708

WILLIAM TIMM, PE, *Consulting Engineer* 12 Laurel Hill Pl, Armonk, NY 10504

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10- WESTCHESTER COUNTY DILEMMA, THE WESTCHESTER ENGINEER SEPT 1978

11- CAUSE AND EFFECTS OF SHRINKAGE IN UREA BASED FOAM IN ASTM STP TO BE PUBLISHED FALL 1979

12- OPERATOR'S MANUAL FOR HYDROGEN AND CARBON DIOXIDE GENERATOR (METHANOL-WATER TYPE) PUBLISHED BY ENGINEER SCHOOL 1953

13. OPERATORS MANUAL - VALDOSTA, Georgia ROSIN TREATING FACILITY

14 OPERATOR MANUAL CAP CAMPHOR PLANT

WILLIAM TIMM, PE, *Consulting Engineer* 12 Laurel Hill Pl, Armonk, NY 10504

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8. Energy Conservation in presentation at seminar in White Plains, New York on April 2, 1976.

9. "Comparison of Insulation Materials for Buildings" presented to Westchester Chapter NYSSPE May 17, 1976.

List of Court Testimony

1.	Mark Ruff	Incinerator Accident
2.	Anaconda Copper International Smelting & Refining Company	Air Pollution Case
3.	Paul Mucci	Structural Damage for Explosives
4.		Pile Driving Damage
5.	Donald Wall	Well Contamination
6.	David Michales	Drug Case (Criminal)
7.	Fuchsberg & Fuchsberg	Draino Case
8.	Lombardi & DeCarlo	Personal Injury Case (2 TIMES)
9 -	BOWER & GARDNER -	- EXPLOSION OF SOLVENT

List of Court Testimony

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8.	Lombardi & DeCarlo	Personal Injury Case

DUPLICATE

Metallurgical GROUP	DATE 14 February 1969
PREPARED BY: J. A. Cox, 72-14	CHECKED BY: W. P. Whiton, 72-14
APPROVALS: W. L. Jensen, 72-14	J. F. Cotton, 72-14
	SSR 72A168-7207
REQUESTED BY: Component Fatigue Test Group, 72-43	LAB REF. NO. ISR 7221-116B-67

TITLE: MODEL C-5A. RAMP LATCH FATIGUE TEST INVESTIGATION OF FAILED YOKE. (STEEL-4340)

INTRODUCTION:

One yoke, P/N 4F53671-101A, which fractured prematurely during a ramp latch fatigue test, was received in the Metallurgical Group, 72-14, with a request for an investigation. The fracture had occurred through a bushing hole.

OBJECT:

To determine the cause of failure.

SUMMARY OF RESULTS:

It was concluded from this investigation that fatigue cracks began at opposite sides of the I.D. of the bushing hole wall and progressed outward. The rough surface and machining tears contributed to the fatigue crack initiation. The corrosion found could have contributed to the crack initiation; however, this condition appeared to be less serious than the machining tears.

TEST PROCEDURE AND RESULTS:

Figure 1 shows the yoke, the two fractures and part of the inside surface of the hole through which the fracture passed.

Visual examination of the yoke showed no surface anomalies except in the bushing hole. Two detrimental surface conditions were discovered on the hole wall, Figures 2 and 3. First, the hole surface appeared to be unusually rough with deep grooves and machining tears present. The second condition was light surface corrosion.

Macroscopic examination of the fracture surfaces, Figures 4 and 5, shows one had several origins, while the opposite fracture surface had two obvious origins.

Electron fractographic studies of these origins all showed striations which are indicative of a fatigue mode of cracking.

A metallographic examination of the fracture origin showed what appeared to be a transgranular fracture. The fracture appeared normal for a 4340 steel in the quenched and tempered condition.

TEST PROCEDURE AND RESULTS: (CONTINUED)

A chemical analysis and hardness measurements made on the part showed it to be 4340 steel with an average hardness of 45 "Rockwell C." Engineering Drawing 4F53671 specifies the material as 4340 steel, heat treated to 200-220 ksi. A "Rockwell C" hardness of 45 corresponds to 211 ksi.

DISCUSSION:

The yoke fractured by means of a fatigue mode. It is felt that the machining tears acted as stress raisers and subsequent points for crack initiation. From the nature of the failure, it was concluded that the corrosion, although potentially dangerous, was not a major factor in the failure.

RECOMMENDATIONS:

Due to the surface condition of this bushing hole, it is felt that two steps should be taken. The first, check the required design surface condition and determine if it is adequate. Second, some method for inspection before installation should be employed.

It is further recommended that more adequate corrosion protection be applied to the bushing hole I.D.

REFERENCES:

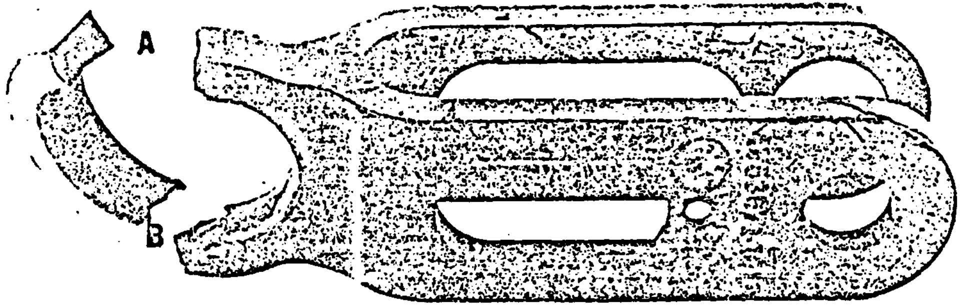
1. Shop Service Request No. 72A168-7207, "Ramp Latch Fatigue Test Investigation of Failed Yoke", dated 23 October 1968.

2. Laboratory Data Record Sheets;
   Metallurgical Group, 72-14,
   Sheet Nos. A283026 through A283030, by J. A. Cox, dated 14 December 1968 through 2 January 1969.
   Sheet No. A283431, by R. A. Runyan, dated 25 November 1968.

   Chemical Group, 72-14,
   Sheet No. A285187, by J. Hunter, dated 19 December 1968.

DISTRIBUTION:

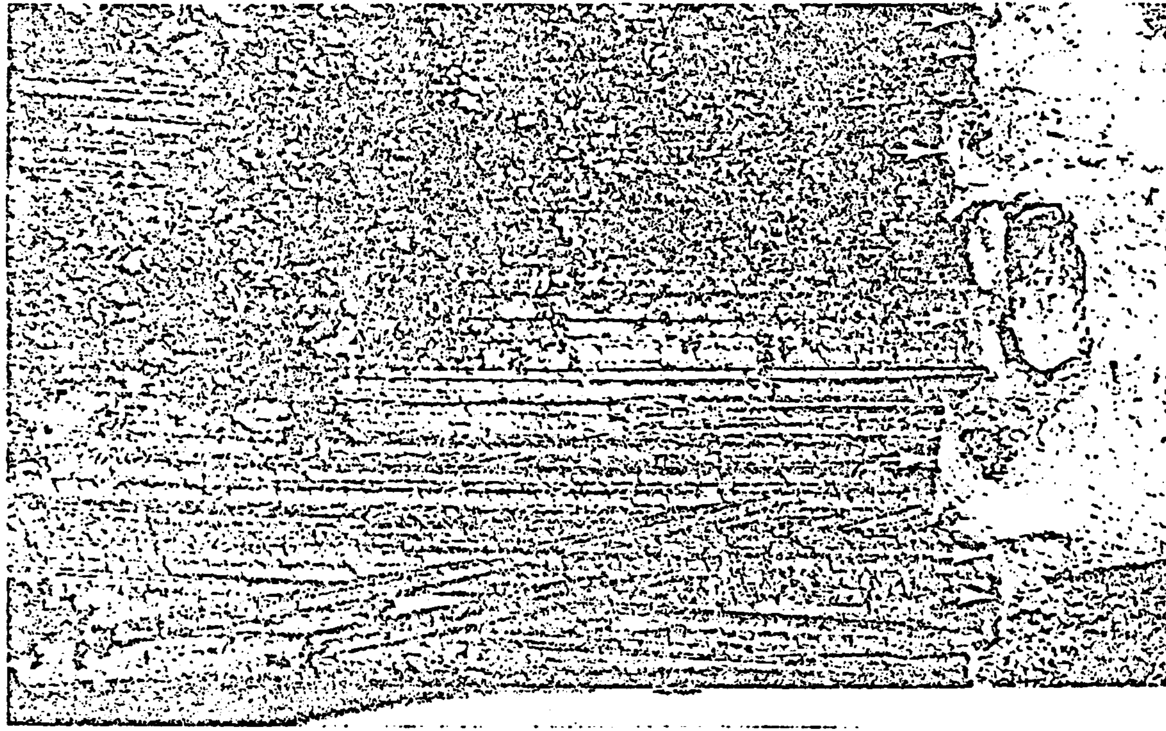
H. H. Davis/P. J. Petrecca, 72-43, Z.407
Metallurgical Group, 72-14, Z.317
TLIC, 72-14, Z.317



Approximately 2/3X.

FIGURE 1 - PHOTOGRAPH OF THE BROKEN YOKE, P/N 4F53671-101A.

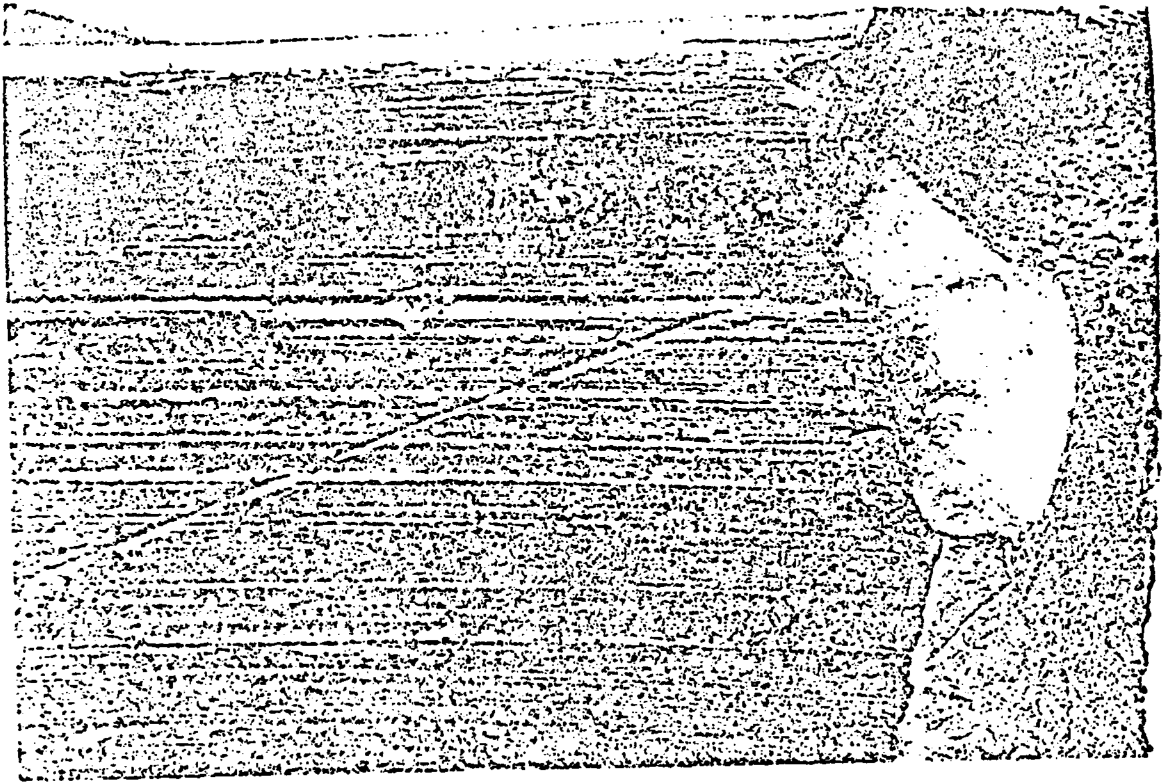
The two fractures are identified as fractures "A" and "B".



Approximately 10X.

<u>FIGURE 3</u> - PHOTOMACROGRAPH OF THE WALL OF THE BEARING HOLE ADJACENT TO FRACTURE "B" AND ITS ORIGINS (ARROWS).

Note the rough surface and the presence of machining tears. Corrosion on the surface is also noted.



Approximately 10X.

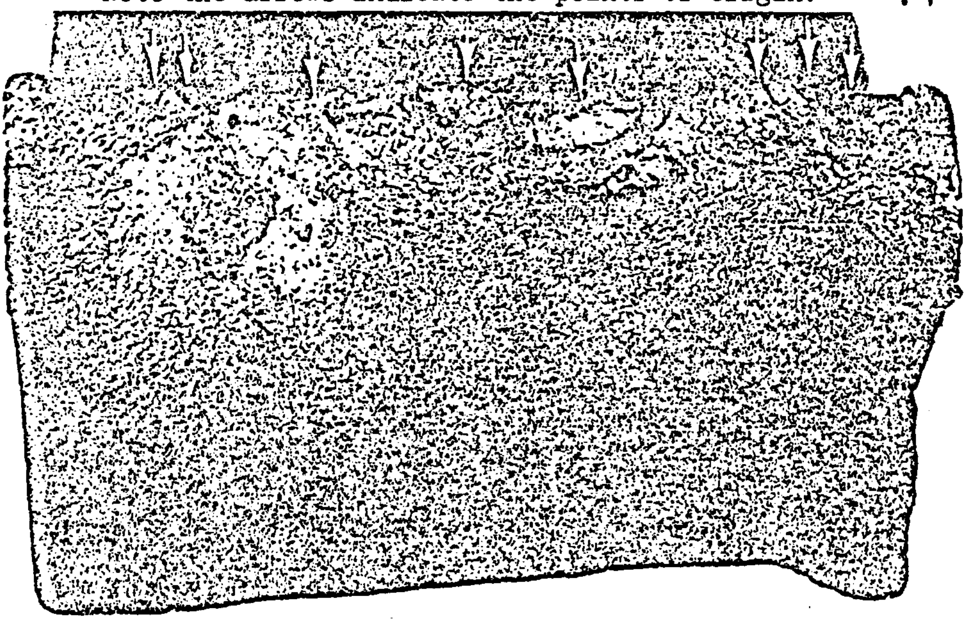
FIGURE 2 - PHOTOMACROGRAPH OF THE BEARING HOLE WALL ADJACENT TO FRACTURE "A" AND ITS TWO ORIGINS (ARROWS).

The rough surface and machining tears are visible.

Approximately 8X.

FIGURE 4 - PHOTOMACROGRAPH OF THE FRACTURE SURFACE OF FRACTURE "A."

Note the arrows indicate the points of origin.



Approximately 8X.

FIGURE 5 - PHOTOMACROGRAPH OF THE FRACTURE SURFACE OF FRACTURE "B."

MANUAL

SECTION 3-80. Page 3-202

1) NEED REFER BACK TO FIG 3-24 (SHEET 1 TO 14) PAGE 3-188

2- REFERS TO OPENING CYCLE FOR CENTER AND SIDE DOORS WITHOUT GIVEN PAR REFERENCE

3- REFER TO FIG. 3-37 WHICH IS 4 SHEET SHOULD BE SHEET (Page 3-292

4- REFER TO Figure 3-16 - MORE SKIPPING ARROUND

5- No call out 'bypass actuator control

6- NO REFERENCE FOR STEP M

7- DID NOT STATE WHEN WHEN MANUAL OVERRIDE BUTTON (10) FIGURE 3-37 SHEET 2 WAS RELEASED

SECTION 3-81 Page 3-205

1) STEP A STATE INSTALL IN REVERSE PROCEDURE DOES NOT GIVE ADJUSTMENT OR SPECIAL WARNING OR NOTES

2- STATES TO RIG IN ACCORDANCE WITH FIG 3-44 DOES NOT STATE ONLY STEPS 1-4, 35-53, 123-
SHOULD REFER TO PAGE 3-336

3- FIGURE 3-44 STEP 1 NEED ELECTRICAL & HYDRAULIC POWER

4- MUST CONTINUE ON PAGE 3-346 FOR STEP 35 WHICH IS DELETED

5- CONTINUATION OF STEP 35A TO 35B TO GET PROPER DISTANCE NOT CLEARLY INDICATED

6- NOTE SHOULD BE IN STEP 36 OR 37 TO PREVENT OMISSION.

7- STEP 37 - TO REMOVE LOCKWASHER WILL HAVE TO REMOVE LOCK NUTS.

8- PARTS IN STEP 37 NOT ILLUSTRATED + STEPS MISSING, TOTALLY UNCLEAR.

9- STEP 40C AGAIN REMOVING LOCK WASHER WITHOUT REMOVING LOCK NUT - STEP 40B INSTALLED LOCK WASHER + STEP 40C REMOVES LOCK WASHER.

10- STEP 42C UNLOCKS EACH LOCK WITHOUT ASSURING RELOCKING - ONLY ASSUME LOCKED POSITION

11- STEP-42 DOES NOT STATE HOW TO INCREASE UNLOCKING FORCE - ASSUME MORE PRESSURE ON UPPER ECCENTRIC SHAFT

12- STEP 4Q - WHAT IS S00 INCH DIMENSION

13- STEP 53 AMOUNT TO A DROP FIT ADJUSTMENT

14- STEP 123 (PAGE 3-371) - DOES NOT APPEAR TO BE NECESSARY FOR AFT RAMP LOCK SUBSYSTEM

15- STEP 124 SHOULD REFERENCE FIGURE FROM PREVIOUS STEP

16- STEP 125 SHOULD REFERENCE PAR 3-28

17- STEP 126 SHOULD REFERENCE 3-60

18- STEP C + d MAY BE FORGOTTEN WITHOUT REFERENCE BACK TO PAGE 3-205 - LAST INSTRUCTIONS WERE ON PAGE 3-371

19- STEP C should refer to fig 3-27 step 2

20- STEP d Should refer to PAR 3-48 and 3-60

NOTE: 3-60 WAS INCLUDE IN STEP 126 FIG-3-44 AB

SECTION 3-168 PAGE ~~[illegible]~~

1. CAUTION STATEMENT IS IN NEGATIVE TERMS STATEMENT SHOULD BE REVERSED TO BE IN POSITIVE TERMS, "BE SURE CENTER AND SIDE CARGO DOORS ARE FULLY OPEN BEFORE OPERATING AFT CARGO RAMP USING MANUAL OVER RIDES

2- SAME POSITIVE REWORDING IN WARNING NOTE & CAUTION NOTES FOLLOWING

3- STEP A + B NEED EXACT REFERENCE AND WORD OBSERVE IS UNCLEAR. CAN'T FIND REFER "SAFETY PRECAUTIONS IN SECTION I OR RIGGING PRECAUTIONS AND RESTRICTIONS IN SECTION I

4. STEP d SHOULD HAVE CAUTION OR NOTE TO ~~CONTINUE ON PAGE~~ TO INDICATE END OF SECTION. COULD CONTINUE ON d PAGE 3-43?

SECTION 3-172 PAGE 3-439

WHERE IS THE PROCEDURE AND WHY IS IT NOT LISTED IN THE TABLE OF CONTENTS

SECTION 3-173 PAGE 4-439

✓ 1) AFT RAMP MECHANICAL RIGGING VERIFICATION PROCEDURE IS NOT LISTED IN TABLE OF CONTENTS

2- STEP A REFERS TO FIGURE 3-44 STEP 8 BUT IS ONLY FOR GAINING ACCESS BUT DOES NOT GIVE CHECK PROCEDURE. - STEP (9) IS PROCEDURE FOR FILLING WITH HYDRAULIC FLUID.

3- WARNING NOTE IS NEGATIVE - SHOULD BE REVERSED TO INDICATE A POSITIVE ACTION

4- AFTER STEP a (2) PROCEDURE APPEARS TO END AND COULD BE FORGOTTEN, HOWEVER IT DOES CONTINUE ON PAGE 3-485

5- STEP b (2) REFERS TO FIGURE 3-44 - STEP 24

A - IS RAMP UP AND UNLOCK, ARM A TWO OR THREE BUTTONS ?

B - WHICH OF THE TWO OR THREE BUTTON IS THE MANUAL OVER-RIDE ?

6- STEP C (STATES: "RAMP LOCKING SYSTEM SHALL BE <u>VERIFIED</u> AS FOLLOW:"

7- FIGURE 3-44 STEP 43 VIEW "S" ILLUSTRATES CLEARANCE POORLY

8 STEP C (2) (IS FORWARD AND AFT HOOK MOVEMENT NECESSARY (STEP 44 FIG 3-44 INCLUDE IT

9- NOTE SHOULD BE INCLUDED IN STEP 2 (C) OR NOTE MUST BE ON SAME PAGE AS INSTRUCTIONAL STEP

10- NOTE ON PAGE 3-486 SHOULD BE PLACE ON FIGURE 3-44 STEP 44

IV PROCEDURE FOR INSTALLING ONE TIE ROD

A. ASSUME ALL OTHER LOCKS ARE IN PROPER RIGGED POSITION

1- START WITH STEP 39 FIGURE 3-44 DISCONNECTING ALL 14 AFT RAMP LOCKS WILL ALLOW ALL LOCKS TO FLOAT AND POSSIBLY BE COME UNLOCK IF ACCIDENTLY TOUCHED

2- STEP 40 WILL LOCK ONE LOCK.

3- STEP 40A MAY ONLY BE NECESSARY IF STEP 42D DOES NOT OBTAIN 30 POUND UNLOCKING FORCE

4- STEP 40B + 40C MAY NOT BE NECESSARY

5- STEP 41 MAY NOT BE NECESSARY BUT STEP 41A WILL BE NECESSARY IF ALL 14 LOCK WHERE DISCONNECTED AND ALLOW TO FLOAT. STEP 41 IS NOT NECESSARY IF OTHER LOCKS WHERE PROPERLY RIGGED AND HELD IN THAT POSITION BY TIE ROD.

6- STEP 42 IS NOT POSSIBLE TO INSURE BOTH AFT LOCKS ARE COMPLETELY OVER CENTER EXCEPT IF IT IS DONE MANUALLY (BY FEEL)

IF THIS PROCEDURE IS GOOD FOR ONE LOCK; WHY NOT FOR ALL?

(13)

7- STEP 42A ALSO APPEAR TO BE A MANUAL LOCKING

8- STEP 42B APPLIES AS MANUAL LOCKING OF REMAINING LOCK.

NOTE THIS POSITION IS SAME AS ALL LOCKS WHERE ASSUME TO BE IN BEFORE TIE RODS WERE DISCONNECTED IF ONLY ONE TIE ROD WAS REMOVED ALL LOCK SHOULD BE IN PROPER RIGGED POSITIO WITHOUT ANY ADJUSTMENT

9 - NEXT STEP IS 49 BUT IS STATING SAME OPERATION AS STEP 42C

10 - STEP 52 IS NECESSARY IF ACTUATOR WAS DISCONNECTED

11- STEP 53 WILL THEN CONNECT ALL TIE ROD AS NECESSARY.

63 a (1)

c- AS JUST SHOWN PARAGRAPH 3-80 + 3-81 LACK + COMPLETE DIRECTION

d- INSTRUCTION IN PAR 3-81 (a) is unclear, vague and misleading, "INSTALL THE COMPONENTS OF THE AFT RAMP IN REVERSE ORDER OF REMOVAL" RATHER THAN GIVING A STEP BY STEP PROCEDURE WITH ALL NECESSARY ADJUSTMENTS WITH ANY APPLICABLE WARNINGS, CAUTIONS OR NOTES.

e. USE IN PAR. 3-81 (B). IS VAGUE, UNCLEAR, AND MISLEADING IN TO REFER TO COMPLETE FIGURE 3-44 INSTEAD OF REFERENCING STEPS 1 THRU 4, 35-53, AND 123-126

f USE OF FIGURE 3-44 IS UNCLEAR, CONFUSING, INCONSISTENT AND NEEDLESSLY COMPLEX. FOR RIGGING LOCKING MECHANISM STEP 5 IS NOT INCLUDED, BUT IS INCLUDED IN STEP 123 MECHANIC IS NOT INSTRUCTED TO REMOVE FAIRING PANELS IN STEP 5, BUT IS INSTRUCTED TO INSTALL THEM IN STEP 123

STEP 12 IS SEPARATED BY REFERENCE FIGURE WHICH DOES NOT SEEM NECESSARY FOR OPERATION .

NOTE ON PAGE 3-343 STATES, "REMOVE THE YOKES THAT REQUIRE RIGGING", THE REVERSE IS CLAIMED FOR THE LOCKS.

OTHER EXAMPLES HAVE BEEN GIVEN UNDER DISCUSSION OF PAR 3-81 AND PAR 3-173 DISCUSSED IN DETAIL PREVIOUSLY

G- ILLUSTRATION ON PAGE 3-348 IS BACKWARD, OTHER FIGURES ARE UNCLEAR AS TO MEANING OR INTENDED USE (PAGE 3-340)

LIMIT SWITCH VIEW A E PAGE 3-357 UNCLEARS SHOWN

THERE ARE OTHER WHICH WILL BE GIVEN LATER AS REVIEW CONTINUES

H- TIE ROD HAS BEEN REFERED TO IN G ABOVE

I - FAILURE TO REFER BACK TO STEP C, D, + E HAS BE GIVE UNDER DISCUSSION OF PAR 3-81

J- PAR 3-168 (D) LACK COMPLETE + CLEAR INSTRUCTION OF USE OF TABLE AND IT IS NOT CLEAR THIS SECTION END AT THIS POINT

K- PAR 3-168 DOES NOT INDICATE EXACT INSTRUCTION FOR ~~[illegible]~~ INSTALLATION OF THE ROD, BELLCRANK, HOOK, YOKE, ETC

L- USE OF PAR 3-168 FOR [illegible] INSTRUCTIONS OVERLY COMPLICATED AND EXPENDS TO MANY MAINTENANCE HOURS PREVIOUSLY ONLY 62 STEPS WERE USED (EXP 171) NOW IT REQUIRE 142

M- TITLE OF SECTION 3-173, "RIGGING VERIFICATION IMPLIES THE DETECTION OF ANY AND ALL OUT OF RIG CONDITIONS. - MR. DOBSON CLAIM ALL OUT OF RIG CONDITIONS NOT DETECT BY THIS PROCEDURE WHICH IS CORRECT IF NEGATIVE TESTS ARE EMPLOYED

(N-) THE LACK CLEAR & COMPLETE DIRECTION IN PAR 3-173 WERE GIVE IN DETAIL AS GIVEN UP THAT PARAGRAPH

O- PAR 3-173 (C) USE FALSE, UNCLEAR AND MISLEADING LANGUAGE WHEN

IT STATES "RAMP LOCKS SHALL BE VERIFIED AS FOLLOWS"

P- SECTION 3-173 FAILS TO WARN THAT THE PROCEDURES, IF FOLLOWED EXACTLY WILL NOT VERIFY THE RIGGING OF THE AFT RAMP LOCKING SYSTEM, AND COULD CONFIRM IF THE RIGGING OF THE RIGGING OF THE AFT RAMP LOCKING SYSTEM WAS COMPLETED 100% CORRECT.

Q- WARNING IS LACKING IN PAR 3-80, 3-81, 3-168, AND 3-173 THAT FAILURE TO INSTALL NEW COTTER PIN COULD RESULT IN A HAZARDOUS CONDITION

R- FIGURE 3-44 STEP 42C USE A 30 # UNLOCKING FORCE WHICH IS MISLEADING, AND A UNNECESSARY NEGATIVE TEST WHICH WILL ONLY SHOW LOCK WAS PREVIOUSLY IN PROPER POSITION BUT CAN NOT ASSURE WHAT POSITION IT WILL BE IN WHEN AGAIN CLOSE TO OVER CENTER POSITION [illegible]

S- BAR 3-81, 3-168, AND 3-173 AS WELL AS FIG 3-9A DO NOT GIVE WARNING OF SPECIAL TOLERANCES AND WHEN PARTS MUST BE REPLACE FOR EXCESSIVE WEAR. ALSO HAS NO INSPECTION OF PART FOR CRACK, STRESS CORROSION INDICATION OR POTENTIAL FAILURE

t. THE MANUAL IS DEFICIENT IN THE AREA OF TROUBLE SHOOTING PROCEDURE REQUIRED PERIODIC MAINTENANCE + INSPECTION OF SYSTEM + COMPONENTS

Exhibit #1 mis-rigging verses out of rigging
manual
no verification

APEC study group - Lockheed <
Air Force
General — General Kirk
Engineering Specialist General Marshal Exhibit #9
Maintenance General Spillie
Safety — General Merklin Exhibit #98

original Contract #1553 in 1972
from developement to production

→ Question: Inspection of aft ramp
before takeoff.
Saftey Engineering Program. Exhibit 95

Exhibit #2 1) need appendix to fully understand report.

2) Cases I thru IV are variation of some case

Exhibit 149 - Failure Mode and effect Analysis
- Generally incomplete - Fox watching the Chickens

Par 2.2.1. Check valve periodically - preventative maintenance - where in manual and how frequently?

Exhibit 114 - Failure Mode + effect Analysis - Manual

INTRODUCTION:1 - State Removal + Replacement should be expanded

Appendix I-B - additional steps for Rigging Verification Procedure

Read

APEX - AIRFORCE

~~17~~, ~~27~~, ~~32~~, ~~43~~, ~~72~~, ~~87~~, 95, ~~98~~, ~~99~~ PAR 6 Page 70, ~~104~~, ~~108~~

~~110~~, ~~112~~, ~~114~~, ~~115~~, ~~120~~, ~~123~~ 129, 130, 131, 132, 149, 153, 158

14

RIGGING PINS

3/ 43

~~50~~

Check

22 EXTRACT STRESS CORROSION

68-69-71 FORWARD RAMP FAILURES

Read 72 - 83 - 88 - 129. 130, 131, 132, 153, 158

22- STRESS CORROSIO

23- TRIP REPORT CANT RIG

EXH 70. PULL TEST VARATION - TEMPERATURE + ENVIRONMENTAL SENSITIVE

EXH 68-69- PRE ACCIDENT FAILURE

EXH 98- PAR 9-10 page 89 - STRESS CORROSION

EXH 99- FMEA Page 32

1) manual < Exhibit #150 . McLaughlin
2) Rigging verification
3) Failure modes + effect analysis
4) Improper design inadequate of lock
5) Location of hydraulic line Exhibit 144
6) Safety Engineering — < Mr. Currans / Mr. Arnold

7) Static + Fatigue tests
8) Corrosion

Previous Accidents

Copies
Failure modes + effect
Dobson trips
Statement of work
(Possibly 14 / 67, 69 6)

Corrosion in 160's
#43 + #150
Lockheed apex study < Minor improvements / Location Hydraulic
#95 , #98, 99
(manual) Apex study which came in with 150
1, 4, 6, (7) / 12 \ 13 , 14, | 20 | 21 | 22 | 23 | 24, 25, 26 | 27*) 32
TEFLIN BOBBI ... leak DOBSON EPC
733 GAO

CAUSES OF ACCIDENT

1- MANUAL - **EXHIBIT 7**

A- improperly organized

1- Figures not group in logical sequence

2- Maintenance tasks not given to smallest single operation

3- Component not clearly identified

B- To complex for personnel to effectively use

C- unclear and confusing instruction

D- improperly referenced

E- misledding in intent

F internally inconsistent

G Lacks explicit warning against misrigging + safety indicators + devices

H- Contained no section for inspection or preventative maintenance

I lacked positive test and verification of worked performed

J - NOT FOR SKILL LEVEL OF MAINTENANCE PERSONNEL AND ASSUMED A DEGREE OF TRAINING NOT AVAILABLE OR REASONABLE

K MISLEAD TITLE FOR VERIFICATION SECTIO

2- HYDRAULIC LINES + CONTROL CABLE

1- IMPROPERLY LOCATED TO PROVIDE REDUNC

2- NOT STUDIED FOR FAILURE OF AFT RAMP SYSTEM. FAILURE MODE AND CRITICAL EFFECT AN

3- CABLE + HYDRAULIC LINES NOT STRONGER ENOUGH OR ADEQUATELY PROTECTED AGAINST DA

~~3- FLIGHT CONTROL~~

~~1- REDUNDENCY~~

~~2- LOCATION~~

~~3- IMPROPER SAFETY ANALYSIS~~

3 ~~A~~. Rigging and testing

A- ALL TESTING NEGATIVE + WOULD DISRUPT ITEM TO BE VERIFIED

B - SYSTEN COULD NOT BE VERIFIED

UN REASONABLE MAINTENANCE EFFORT STILL WOULD NOT VERIFY RIGGING POSITIVELY.

C- POSITIVE TEST OF PROGRAM LINK DELETED FROM SYSTEM

D- INDICATOR + WARNING LIGHTS COULD GIVE FALSE SIGNAL

4 SYSTEM DESIGN - AFT RAMP - EXH 98

EXH-A

1- NO POSITIVE SAFETY DEVICE LIKE LOCKING PIN. A

EXH-A

2- SYSTEM NOT MAINTENAINABLE - RIGGING PINS

3- TOLERANCE NOT CONSISTANCE WITH USE CONDITIONS

4- SYSTEM SUBJECTED TO TEMPERATURE EFFECTS

5- TO SENSITIVE TO ENVIRONMENTAL CONDITIONS

6- DESIGN CRITERIEA - MORE THAN ONE LOCK FAILU

7- IMPROPER SAFETY ANALYSIS

8- NO POSITIVE INDICATORS

9- MATERIAL - SUBJECT TO STRESS CORROSION

5 SAFETY - EXH 58, 129, 130, 131, 132

1- DEPARTMENT WAS NOT MANNED BY COMPETENT ENGINEER -

2- DID NOT CHECK ENGINEER DEPARTMENT FOR SAFETY,

3- DID NOT CONDUCT FMEA + FMCEA ADEQUATELY

A - ON LOCKING SYSTEM

B - HYDRAULIC LINE + FLIGHT CONTROL

C - TEST OF SYSTEMS + COMPONENTS

D - USED ONLY SINGLE FAULT CRITERIA

E - MAINTENANCE ERROR

4- DID NOT CONSIDER EXPLOSIVE DECOMPRESSION EXH. 43

5- WOULD HAVE CONSIDERED RIGGING + LOCKING PINS

6- DEVELOPED SYSTEM THAT WAS NOT MAINTENANDBLE

7- DETERMINE POTENTIAL DANAGER OF MISRIGGING

8- DEVELOPED CHECK METHOD FOR MAINTENANCE INSP...

9- ALLOWED MANAGEMENT POLICY TO REDUCE SAFETY

10- DID NOT EVALUATE INCIDENCE OF DOOR SYSTEM FAILURES
11. DID NOT APPLY WITH SAFETY ENGINEER PLAN AND USE ASSET (EXH. 98+95)
A - DID NOT APPLY C-130 + C141 SYSTEM TO ANALYSIS.

6 TESTING EXH 99- EXH 104, 105, 106, 113

1- DID NOT CONDUCT ADEQUATE STATIC + FATIQUE TESTIN ON DOOR SYSTEM AND HYDRAULIC LINE

2- DID NOT CONDUCT TEST FOR CREEP

3- WOULD HAVE DETERMINE MAX STRESS + IMPACT LOADS ON COMPONENT AND IDENTIFY PARTS NEEDING SPECIAL MAINTENANCE AND SPARE PART SUPPORT

4- TEST FOR STRESS CORROSION - EXH 99

5- TESTING FOR QUALITY CONTROL OF LOCK COMPON.

6- CHECK INDICATION ARE POSITIVE + NOT SUBJECT TO FALSE READING

7- CANNIBILIZATION DEXH CC

~~1- EXTRA OPERATION INCREASE CHANCE OF HUMAN ERROR~~

2- PART SUBJECT TO STRESS CORROSION SHOULD NOT BE CANNIBILIZED

3- WARNING FOR SPECIAL INSPECTION AND PROHIBISIONS OF CANNIBILIZATION

8- RIGGING COULD NOT BE VERIFIED

9. SYSTEM - UNMANTAINABLE
1- NEEDED PERIOD FOR RERIGGING.

10- FAIL TO TRAIN, AIR FORCE MECHANICS

1- INSTRUCT IN POTENTIAL HAZARD

2- INSTRUCT IN PROPER PROCEDURE

3- INSTRUCT ON PROPER INSPECTION + TEST AFTER MAINTENANCE

11- TECH. REPRESENT

1- DID NOT SUPPORT SYSTEM

2- DID NOT REPORT DANGER OF CANNIBILIZATION

3- DID NOT REPORT DOOR INCIDENTS

4- DID NOT REPORT LEVEL OF TRAINING

5- DID NOT INDICATE DEFECTS IN SYSTEM

6- DID NOT TEST ADEQUACY OF MANUAL

10- FAILURE MODE + EFFECTS ANALYSIS

EXH - 99 PAGE 32

EXH - 112, EXH 149

1- Failure Mode + Effect Analysis
2- Cotter pins no warning against reuse

63a- (1) Manual
2- Correct defect in Manual - no preventative maintenance
35- 3- Hydraulic lines + Control Cables routed together - external failure will knockout system
4- Hydraulic system failure of structure not considered
5--9- Flight control
MANUAL 10- Rigging verification
a- system not maintainable
(23-25 26) 11-12- Rigging in system design
51-63 13- Cargo compartment ⟵ not a factor
14-17 14- Failure Mode + effects Analyses
29 15- Static + Fatigue tests
16-17 Explosive decompression
19- Safety system Analyses
59, 60, 20 Safety assurance department
28- Maintain. Alt. ramps
58 30- Weight policy
62 30- Management

32. Quality Control
33- fabrication
34- Compatibility
35-36- Hydraulic line
37-38- design review
39- Pressurization
40 Warning
41 - 44 Design ?
45- Maintainability
46 Unlocking
47-48- Manual
49- Instruction - Failure to Warn
50- wedge in rigging errors
63, 51- rigging verification
52- Contract
53- Failure to Train
54- Test manual
55- TRAINING
56- TECH REP
57-58 Incompetent Manual Dept
[SPILLER] DOBSON CHANG
Read 12-21, (27) 32

Aug 7 week end of week
[THURS OR FRIDAY]

Manual - Vaclean
drawing vaclean
Cont follow.

{ look at
Forward
ramp

~~examples.~~

---

look at section Aft Ramp

* 3-81 install of component part atl

3-168 - General Rigging with

3-173 mechanical verification without

1 - agreement li

Fig 44

verify all or
part characteristics

<u>section C</u>

general instruction table - part refer to Fig 44

Install part a tie rod

reg Fig 44

NOTES: LEWIS WILSON LEWIS & JONES

1) HAROLD HOWARD DEPOSITION (175 – 184

CLAIMS MANUAL NOT ADEQUATE

TO. 2-12

Page 181 MANUAL PAGE 3-336

(not much help.

2) MARLIN MARTAN DEPOSITION (485 – 492

MISRIGGING & COTTER PIN

(519 – 533)

not much help

3) GORDON DOBSON (1043 - 1054)

IMPORTANT FOR SEQUENCE OF FAILURES

4 - COL ROBERT C INGRAM

Page 22 – TWO TIE RODS CANNIBALIZED

Page 23 TWO TIE RODS INSTALLED 27 MAR 75

RIG CHECK 29 MAR 75

5) SGT NOAK FIELDS

NUMBER OF COMMENT ON MANUAL.

PLAINTIFF EXH

21-22

1 - 33
43
44
45
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DEFENSE EXH

A	AUG-28	A
B		
C		
D		
F		
J		
L		
M		
N Q		
R		
W		
CC		
LL		

SHOULD GET COPY OF MIL-H-25098 TECHNICAL MANUAL SPECIFICATION

MIL M-38800 A JOB GUIDE

C-5 AIR CRASH

ILLUSTRATIONS -

1) C-5 FORWARD AND AFT RAMP LOCK SYSTEM
REVIEW OF ECP 7027 AND ECP 7028

2) AIRCRAFT INCIDENT REPORT C-5A SHIP 0008
AF 67-169 NEAR LIBERTY, NORTH CAROLINA
8 OCT 1970.
ATTACHMENT 9 - TORQUE DECK DAMAGE VIEWED
FROM TOP SIDE OF DECK INSIDE ACFT
POSSIBLE HYDRAULIC LINE DAMAGE SHOULD BE EVIDENT

A C-5A PROGRAM SYSTEM SAFETY ENGINEERING PLAN

DOCUMENT NO. 3-7 REVISED 22 DEC 1972

PAR 4.2A.1 The Aerospace Engineering Department serves as the control point for all design, operation, and maintenance problems involving safety; and provides guidance in the solution of such problems. Accurate documentation and positive follow-up are prime responsibilities of this department.

PAR 10.1.1 Safety analyses and studies of the C-5A design are strengthened by use of test, manufacturing and engineering reports produced within the company. Use of published C-141 fault analyses is particularly helpful to safety engineer involved in the specification and design review of the C-5A

1) AIR FORCE MEMO REPLY LAMA (TSGT STEVENS, 57181)
DATE 6 MAR 75, SUBJECT: POSITIVE LOCKING OF PRESSURE DOOR HINGE SELECT LINKAGE ON C-5A AIRCRAFT

BOLT PREVENTED FULL TRAVEL OF PRESSURE DOOR HINGE SELECT LINKAGE - REPLACE WITH ROUND HEAD SCREW
WAS THIS MODIFICATION ACCOMPLISHED ON SUBJECT AIRCRAFT?

2) C-5 MAINTENANCE REVIEW PROGRAM (MMRP) AND SYSTEM SAFETY REVIEW 26-30 APRIL 1976
218 ACCIDENT FINDING 3, 4, AND 9
a) Problem Finding #3 AND #4 BOTH FINDING AND RECOMMENDATIONS DEAL WITH PROBLEMS FOUND WITH TECHNICAL DATA 1-C-5A-2-12 AND 1C-5A-6.
Rewrite TO 1C-5A-2-12 on all rigging procedures for fwd and aft complex and to include wear tolerances for components such as hooks, yokes, and links in the 2-12
b Problem: Finding #9 - The flight deck entrance door came off its hinges during rapid decompression and struck a crew member at the foot of the ladder
Needs new door design

3) SERVICE TROUBLE REPORT BY DEXTER RILEY
DATED 21 JUN 1971
1) HEAVY SURFACE CORROSION ON NINE(9) RAMP TO PRESSURE DOOR HINGE FITTINGS AND SIX (6) HINGE FITTINGS
CAUSE: OPEN TO ELEMENTS DURING LOADING OPERATI[illegible]

RECOMMENDATION SPRAY WITH CHROMATE PAINT

GETTING COPY

B) C-5 PROGRAM SUBSYSTEM SAFETY ANALYSIS REPO[illegible]
LGIUS 287-1-13 31 DEC 1971
11.0 CARGO DOOR SUBSYSTEM
1- Complete FMEA ARE NOT AVAILABLE
2- FUNCTIONAL COMPONENT FMEA UTILIZED TO EXAMINE FAILURE MODES
3- SIMULATOR TEST NOT BEGUN
4- CRITICAL COMPONENT REDESIGN NECESSARY
5- RESTRICTED USE OF TEST AIRCRAFT CARGO DOOR SYSTEM
30 JUN 1969

AT THE INITIAL MEETING, THE BOARD REVIEWED THE STRUCTURAL DESIGN OF THE AFT PRESSURE DOOR AND AFT PRESSURE BULKHEAD TO INSURE COMPLETE ADHERENCE TO THE FAILSAFE CRITERIA

4) COLONEL SPILLER

C-5 CATEGORY III JOINT TEST FORCE

SPECIAL REPORT 3-20-71, Evaluation of C-5 loading system maintenance

"NO PRACTICAL TRAINING IN RIGGING AND REPAIR OF THIS HIGHLY SOPHISTICATED SYSTEM EXISTS AT PRESENT."

5) FIELD SERVICE ACTIVITY REPORT FROM T.J. SCHAFFER INDICATE NUMEROUS PROBLEM WITH AFT RAMP SYSTEM.

6) AIRFORCE LTR. 12 APR 75 SUBJECT C-5 Problem Areas TO S.F. FROM ROGER G. CREWSE CHIEF REPORTS + ANALYSIS DIV. DIRECTORATE OF AEROSPACE SAF.

1 JAN 70 TO 9 APR 75 — 724 INCIDENCE

SINCE 1 JAN 70 — 26 DECOMPRESSIONS OR PARTIAL DECOMPRESSIONS

SINCE 1 JAN 75 — FOUR (4) UMR'S HAVE BEEN SUBMITTED ON AFT RAMP PROBLEMS

7) AFTO 22 FORM DATED 10 APR 73 RIGGING

PAGE 2-193 PAR 2+127 - Proper rigging of forward loading system can not be accomplished with aircraft parked on an unlevel surface TO 1C-5A-2-12 does not reflect this condition

AIRCRAFT INCIDENT

C-5A 70-0447

9FEB75 at 27,000 ft RIGHT SIDE

LOCK 5, 6, 7 unlocked

Program link pins pushed out of position

Push rod between locks 5 + 6 damaged

Fatigue Testing #6 + #7 right side

yokes failed after 10,924 cycles

Progressive failure to #4 lock

Ramp location

FS 2006.00 to FS ~~2054~~ 2110.00 ± (RS 10.40 TO 155.55

NOT IMPORTANT VIEW MAY BE MIRROR IMAGE OF ASSEMBLY DWG.

NOTE: DWG ANL 31/1 TIE ROD BETWEEN 4+5 show Backward and does not agree with DWG A~~H~~HL 34/3 + AHL 34/2

SENT TO LEWIS WILSON LEWIS JONE

1- CASE HAVE CONSULTED OR TESTIFIED — CLAIMS MADE - ON LEGAL ACTION

2- Copy of report - tie rod length [illegible]

14
14
56
14
196
144
784
784
196
14
3 20
280
144
1120
1120
280
40320
20,160

2 | 27,224
13,612#

Route to everyone (EN)

Viet Orphans' C5 Crash Trial Starts

By Kenneth R. Walker
Washington Star Staff Writer

The first trial resulting from the 1975 crash in Saigon of a C-5A airplane carrying Vietnamese orphans to the United States in the waning days of the war began in federal court here yesterday.

Lockheed Aircraft Corp., the builder of the C-5A, has settled some suits resulting from the crash, in which 155 persons were killed. But the trial before U.S. District Judge Louis F. Oberdorfer is the first airing of the case in open court.

The trial will weigh the claims of three Vietnamese orphans who survived and were adopted by American families. Suits filed by a group representing those killed in the crash as well as claims filed by 50 other survivors are pending in federal courts here and in New York.

President Ford ordered the evacuation of the orphans.

The C-5A is the largest aircraft ever built and was designed to serve as a military cargo and troop carrier. It has been the subject of controversies involving safety and cost overruns.

The aircraft company agreed not to contest its liability for the crash, which Air Force investigators have concluded was caused by a faulty ramp locking mechanism.

The six-member jury chosen yesterday will consider only whether the crash was responsible for injuries claimed by the three surviving orphans and what damages Lockheed should pay.

The jury, which will hear each of the three claims separately, began yesterday considering evidence in the case of 6-year-old Michael Moses Schneider, who was a 19-month-old orphan named Nguyen Phi Khanh at the time of the crash.

Oren Lewis Jr., Schneider's attorney, told the jury in his opening statement that there were not enough seats in th C-5A plane to carry all 226 orphans.

"Some were strapped to the floor of the cargo hold," he said. "That plane was crammed full of babies when it left Saigon in good weather. When it reached an altitude of about 24,000 feet, where the air is 27 degrees below zero . . . the whole back end of the plane blew off.

"Because the cargo door struck the controls when it blew off," Lewis said, "the plan couldn't do make" a quick dive and "It took that plane 15 minutes to descend to a level where the air was safe to breathe." It plane broke into pieces in a rice paddy.

Lewis claimed Schneider suffered a head injury which resulted in an epileptic condition.

Carroll Dubuc, the attorney for Lockheed, told the jury he would try to prove that any disabilities the youth has were the result of "his abandonment at such an early age, Vietnamese life, the diseases and parasites that flourished in that country, and the ultimate relocation to a new culture in this counrty."

Decompression Signaled Tragedy

SAIGON, South Vietnam (AP) — The pages of a Donald Duck comic book flipped in the wind.

A baby's bottle, a flight manual, cushions, clothing, and molten pieces of metal were scattered around in the burning grass.

Headless bodies were buried in the mud.

It was the crash site of a U.S. Air Force C5A Galaxy transport that was to have carried 243 Vietnamese orphans to the United States.

It crashed on takeoff from Saigon today.

The sudden whoosh of air out of the cabin of the plane, the largest in the world, was the first sign of the imminent tragedy.

Air Force Sgt. Jim Hadley, a Sacramento, Calif., medical technician topping his two weeks of reserve training with what he thought would be just a weekend flight to Saigon, knew right away the plane was in a decompression condition.

"You could see it," he said at Seventh Day Adventist Hospital, where he had been brought, muddied but unhurt after the crash.

"You could see the hole in the back of the plane, you could see the sunlight streaming in.

"Things started flying around. Eyeglasses. Pens. Pieces of insulation tore off the ceiling. The pillows exploded. They were plastic lined.

"That went off for a little while until the air stopped. By then the oxygen masks had dropped down.

"There weren't enough oxygen masks. We had to keep moving them from kid to kid. We kept on our own because otherwise you get drowsy and then you go out."

An injured flight nurse said from a litter in the hospital corridor, "I think the kids were quiet because they were getting dopey from an absence of oxygen.

"I don't know how long we were in the air. We were losing altitude. But we had plenty of time. We had to discuss what we were going to do.

"We talked about what doors we were going out of when we impacted. We didn't stand by the doors. We were feeding oxygen to the kids."

The kids were wonderful," she added, asking that her name not be used.

"My folks didn't know I was on this flight," she said.

"The children were beautiful. They were noisy when we took off. They were scared, and they didn't like the straps holding them down.

"They were sitting two to a seat, six seats across, 12 to a row.

"Once the decompression condition hit, the kids didn't say a word. They quieted down right away."

Hadley and the flight nurse were on the second level of the huge plane, sandwiched between the top deck and the cargo hold 65 feet below. All levels held orphans and their mainly American women escorts.

916 555 1212

916-944-1111

Col. (Carmichael)

THE REPORTER DISPATCH
WED. JAN 30, 1980

Explosives dropped from plane are lost

SYRACUSE (AP) — Somewhere under a blanket of snow covering the Syracuse area, say U.S. Air Force officials, is 25 pounds of explosives. But just where remains a mystery.

The explosives were dropped near this city of 180,000 on Jan. 18 when a civilian cargo plane lost a door as the result of a "violent decompression" while flying at 22,000-feet.

Along with the explosives, two Teletype machines and the plane's 8-by-10 foot cargo door blew off the craft. No injuries were reported in the accident.

Since then, Air Force officials have found no trace of the debris which could give them a clue to where the "Class B" military explosives landed. The explosives will ignite only if exposed to an electrical charge or an open flame.

"We didn't get snow for so long here, and then when the explosives fell we've had snow ever since," said Air Force Capt. Mil Gutridge. "We've had to suspend our aerial searches because of it. Even a little snow makes seeing projectiles impossible."

Gutridge says the six to eight inches of accumulated snow could make the explosives less potent if the three foot by six inch box the explosives were packaged in was damaged in its fall.

After the cargo door blew out of the four-engine, Lockheed-Electra turboprop, the plane made an emergency landing at Hancock International Airport. It was en route to Dayton, Ohio, from Portsmouth, N.H., when the accident occurred.

"We have been able to narrow our search down to an area of about 10 miles to the north and northeast of the airport," Gutridge said. "We are tracking down the last lead we have, but right now there isn't much we can do."

patrol is part of program by department to get more cops on street.

End DC10 hearing, but who's to blame?

Chicago (AP)—Two weeks of public hearings to try to determine the cause of the crash of an American Airlines DC-10 ended without a clear indication of who was to blame for this country's worst air disaster.

After the National Transportation Safety Board hearings concluded Friday, federal investigators said it will be another three months before they can determine the "probable cause" for the May 25 crash in Chicago that snuffed out 273 lives.

The hearings, at which 42 persons testified, generated piles of evidence indicating several factors may have been involved in the tragedy, but did not affix the blame.

"I don't think we learned too much we didn't already know," said NTSB investigator Rudy Kapustin. "We got some details we didn't have before — precise details about some of the procedures."

A member of the Air Line Pilots Association who did not want to be identified expressed skeptimism about what,if any positive industry changes may result.

"You hear a lot about reports

"Don't think that all these reports and studies mean anything," he said. "You hear a lot about reports and studies now, but you never know what happens to the reports."

Elwood T. Driver, the vice chairman of the NTSB who conducted the hearings, said, "That whole stack of data will have to be thoroughly analyzed.

"This investigation will remain open to receive at any time new and pertinent information."

Much of the discussion among those involved — McDonnell Douglas Corp., American Airlines and the Federal Aviation Administration — was designed to show who should have done what and why they didn't do it.

And many of the questions asked at the hearing seemed to be laying the groundwork for lawsuits.

But the hearings indicated a variety of factors — not just one — may have been responsible for the disaster.

Among them:

—American maintenance procedures that apparently produced a crack in the support of the plane's pylon that caused the port pylon and engine to fall off upon takeoff.

—The design of the DC-10 pylon that allegedly made maintenance difficult to perform regardless of how the engine and pylon were removed.

—Testing of the DC-10 that did not consider the possibility that more than one major problem would occur at one time on the plane. Officials of Douglas Aircraft Co., a subsidiary of McDonnell Douglas, acknowledged that pre-production tests never considered the long shot that electrical, hydraulic and engine problems would occur at the same time.

—Flight manual instructions that told the pilot to lower airspeed when an engine is out. Flight 191 Capt. Walter Lux followed the manual instructions when the left engine dropped on takeoff, but lowering the speed contributed to a developing stall on the left side of the aircraft. The flight manual instructions have since been changed.

—The presence of a wafer-thin metal filler in the pylon attachment that American officials claim reduced clearance between the support bolt and metal fasteners below it. The filler was installed by the manufacturer to fill a tiny gap in the pylon, but American says it made the pylon support more vulnerable to deep cracking.

Inspections under fire

Meanwhile, the certification and inspection procedures of the FAA also have come under fire.

The hearings also focused on a longstanding complaint about the use of designated engineering representatives who work for manufacturers but are certified as FAA agents to review and approve design plans. Critics say the engineers serve two masters — their company and the FAA — but are paid and can be fired by their employers. Sometimes, they even inspect and approve their own work.

A final report on the investigation is due in about three months. Then the five-member NTSB will vote on the probable cause, and officially end one of the most intensive air disaster inquiries.

DAILY NEWS, SUNDAY, AUGUST 12, 1979

NEW YORK, NY 101
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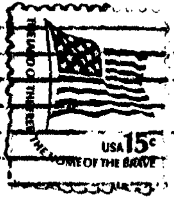

TOPART INC.
119 WEST 57 STREET
NEW YORK, N.Y. 10019
JOHN SEKELSKY

Bill Tim
12 Fair Hill Lane.
Armonk, N.Y., 10504

JOHN SEKELSKY / CROTON DAM RD., CROTON ON HUDSON, N. Y. • CRoton 1-3838

JOHN SEKELSKY / 316 Grand St., Croton-On-Hudson, N.Y. 10520
914 CRoton 1-3834

TO Charles R. Work and Peabody, Rivlin, Lambert, and Meyer.

CLIENT
DATE 6/23/80
ORDER NO.
JOB NO.

1150 Conneccticut Ave. N.W.
Washington, D.C. 20036

Vietnam Orphan Litigation
AD Liten Special Account

This is a statement of a bill sent to Lewis, Wilson, and Jones Ltd.
2054 North 14th Street
Arlington, Virginia

An interest charge of 12% will be added to the previous total.

PREVIOUS BILL....................................1379.49
+ 12% interest charge............................ 165.54

TOTAL 1545.03

John Sekelsky

JOHN SEKELSKY / 316 Grand St., Croton - On - Hudson, N.Y. 10520
914 CRoton 1-3834

TO Lewis, Wilson, Lewis & Jones, Ltd.
2054 North 14th Street
Arlington, Virginia 22216

CLIENT ______
DATE 2/27/80
ORDER NO. ______
JOB NO. ______

Illustrations of artist conception of sequence series of Lockheed C-5 Cargo Jet crash in Vietnam in 1975, on 30 x 30 board.

Five technical illustrations showing locks and ramp and pressure door unit. Show five steps showing failure of units to final explosion of aft units of plane..................$ 500.00

Four illustrations of air view showing sequence of crash from start to finish....................................$ 650.00

Two charts showing altitude in feet and minutes in the air
$ 125.00

Chart showing G-Forces times minutes.
Art Supplies..$ 70.50
Shipping and handling.....................................$ 51.99

TOTAL $1379.49

An interest charge of 12% will be added...................165.54
REVISED TOTAL 1545.03

Bill this is what I sent both organizations.

Johnny

Code Of Ethics

of

ASSOCIATION OF CONSULTING CHEMISTS AND CHEMICAL ENGINEERS, INC.

The Association expects that the following Code of Ethics shall guide the acts of its members:

Section 1. In his relations with the public, a member should

(a) Aid and support all worthwhile efforts to increase knowledge and technology in chemistry and chemical engineering.

(b) Expose and oppose all quackery and frauds.

(c) Refuse to permit his name to be used to support misleading statements in advertisements or reports, or in support of questionable enterprises.

(d) Refuse to be connected with or to perform any illegal work.

(e) Refrain from associating with any enterprise of questionable character.

(f) Be diligent in exposing and opposing such errors and frauds as his special knowledge enables him to recognize.

(g) Refrain from advertising in a self-laudatory manner and avoid any practice likely to do injury to the dignity of his profession.

Section 2. In his relations with his clients, a member should

(a) Protect his client's interest in every legitimate way.

(b) Refuse work for which he knows he is not qualified and, before accepting work he believes futile, so advise his client and make certain that his client nevertheless wishes him to proceed.

(c) Inform his client of other connections which might affect his relation to his client.

(d) Accept no commission on anything purchased by his client without the client's knowledge and permission.

(e) Give honest advice even if it is unpalatable.

(f) Demand just compensation for his services.

(g) See that his fees include overhead and all proper charges for laboratory and other facilities used, whether he has to pay for such facilities or not. In setting fees, it is proper to consider:

1. The time and labor involved, the novelty and difficulty of the matter and the experience and skill necessary.
2. Whether the employment precludes other employment in similar lines or will involve the loss of other business while engaging in the particular work
3. Customary charges of others for similar work
4. The magnitude of the matter involved and the benefits resulting to the client from the services.
5. The character of the employment, whether casual or for an established and constant client.

(i) Resist efforts to scale down bills after the rate of compensation has been agreed to.

(h) Refuse to lower fees originally set because of a competitive figure from another consultant.

(j) When undertaking work for a client a member should enter into an agreement. In the absence of a written agreement, the following principles apply:

1. If he uses information obtained from the client, any results in the form of designs, plans, inventions, processes, etc., shall be regarded as the property of the client.
2. If he uses his own knowledge, then the results remain his property and the client is entitled to their use only in the case for which the member was retained.

(k) Disclose no information concerning the business affairs or technical processes of clients without their consent.

Section 3. In his relations with other consultants, a member should

(a) Support all legitimate efforts to improve the consulting profession.

(b) Refrain from injuring directly or indirectly the reputation of other consultants.

(c) Refuse to accept work or assignments from clients who, to his knowledge, have treated other consultants unfairly.

(d) Report any infractions of these principles to the Professional Welfare and Ethics Committee of this Association.

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of

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TABLE **3b**

Typical Physical Properties—*Concluded*

CASTING ALLOYS

Alloy	Weight, Lb per Cu In.	Modulus of Elasticity, Kips per Sq In.		Coefficient of Thermal Expansion per Degree F[1], 68° to 212°F	Electrical Conductivity, Per Cent of International Annealed Copper Standard	Thermal Conductivity at 25°C, CGS Units
		Tension and Compression	Shear			
333-F[1]	0.100	......	.....	0.0000115	26	0.25
333-T5[3]	0.100	......	.....	0.0000114	29	0.29
333-T6[3]	0.100	......	.....	0.0000115	29	0.28
333-T7[1]	0.100	......	.....	0.0000115	35	0.34
355-T51	0.098	10,200	3,800	0.0000124	43	0.40
355-T6	0.098	10,200	3,800	0.0000124	36	0.34
355-T6[3]	0.098	10,200	3,800	0.0000124	39	0.36
355-T61	0.098	10,200	3,800	0.0000124	37	0.34
355-T7	0.098	10,200	3,800	0.0000124	42	0.39
C355-T61	0.098	10,200	3,800	0.0000124	37	0.34
356-T51	0.097	10,500	3,950	0.0000119	43	0.40
356-T6	0.097	10,500	3,950	0.0000119	39	0.36
356-T6[3]	0.097	10,500	3,950	0.0000119	41	0.38
356-T7	0.097	10,500	3,950	0.0000119	40	0.37
A356-T61	0.097	10,500	3,950	0.0000119	41	0.38
360-F[3]	0.095	10,300	3,850	0.0000116	28	0.27
380-F[3]	0.098	10,300	3,850	0.0000116	23	0.23
384-F	0.098	10,300	3,850	0.0000113	23	0.23
A612-F	0.102	9,700	3,650	0.0000134	35	0.33
C612-F[3]	0.103	......	.....	0.0000131	40	0.38
750-F[3]	0.104	10,300	3,850	0.0000130	46	0.43
A750-T5	0.103	10,300	3,850	0.0000126	43	0.40
B750-T5	0.104	10,300	3,850	0.0000129	45	0.42

[1] Values of coefficient of thermal expansion for "F" and "T" tempers may vary slightly from one casting to another.

[2] While castings are not commonly annealed, similar effects on conductivities may result from the slower rate of cooling of thick sections as compared with thin ones and other variables in foundry practices. Comparison of the values for as-cast and annealed specimens will show the extent to which variations may be expected, depending upon differences in thermal conditions in the production of different types of castings.

[3] Chill cast samples; all other samples cast in green sand molds.

EXPLANATION OF TABLE 4

Units

All strength values in Table 4 are expressed in kips per square inch. One kip is equal to one thousand pounds.

Dimensions

In many cases in Table 4 it is necessary to show thickness ranges or other dimensional classifications, since the minimum properties of the products vary with these factors. The dimensional ranges shown do not necessarily mean that items outside these ranges are not available. The nearest Alcoa sales office should be consulted for information on limiting sizes of products.

Minimum Values

Most of the tensile properties listed in Table 4 are guaranteed minimum values. The rest of the tensile properties, and also the other quantities in the table, are corresponding minimum expected values but are not guaranteed. Tables of minimum mechanical properties guaranteed by Alcoa are available in another publication, the *Alcoa Aluminum Handbook*.

In all cases the values in Table 4 are for metal at room temperature but may be considered applicable to temperatures from 0° to 150° F. For effects of temperature on properties, see Tables 8a, 8b and 8c, pages 76 to 82.

Wrought Products

Guaranteed minimum tensile properties of wrought products are based on test specimens taken from a specified location and direction in the part and do not necessarily represent the absolute minimum values that could be found anywhere in the part. However, for most design purposes, the guaranteed minimum tensile properties and the other corresponding minimum properties in Table 4 are satisfactory for use as over-all minimum values.

For all wrought products, the minimum tensile properties in Table 4 apply to the direction in which specified mechanical properties are determined. This is the principal direction of working (longitudinal direction) for all products except heat-treated sheet and plate. For heat-treated sheet and plate, specifications require that tensile properties be measured in the transverse direction, since these values are generally lower than the longitudinal properties.

Compressive yield strength values in Table 4 apply to the principal direction of working for all wrought products since compressive yield strength is generally lowest in this direction.

Die Forgings

It is customary to conduct quality control tensile tests for die forgings on separately forged coupons. Except for elongations, the properties so determined are applicable not only to the separately forged coupons but also to specimens that might be cut from the forgings themselves in a direction

TABLE 4a

Minimum Mechanical Properties and Buckling Formula Constants—*Concluded*

SHEET AND PLATE

See page 39 for explanation of "minimum" properties.
US=ultimate strength in kips per sq in., YS=yield strength in kips per sq in., El=elongation in per cent in 2 in. or 4 dia.
See pages 39 to 41 for definitions, methods of determination and notes.

Alloy and Temper	Thickness, In.	Minimum Mechanical Properties								Buckling Formula Constants					
		Tension			Compression	Shear		Bearing		Compression			Shear		
		US	YS	El	YS	US	YS	US	YS	B	D	C	B_t	D_t	C_t
5456-O	0.051-2.000	42	19	16	19	26	11	84	38	21.6	0.120	111	13.0	0.056	143
5456-H24	0.051-0.249	51	39	9	38	30	22	97	62	45.4	0.368	79	27.2	0.170	100
5456-H321	0.126-0.249	46	33	12	31	27	19	84	53	36.5	0.265	88	21.9	0.123	112
5456-H321	0.250-1.250	46	33	12	32	27	19	84	56	37.7	0.278	86	22.6	0.129	111
5456-H321	1.251-2.000	44	31	12	30	26	18	80	53	35.2	0.251	89	21.1	0.116	113
5456-H323 or H32	0.126-0.249	48	36	8	34	28	21	91	58	40.3	0.308	85	24.2	0.143	107
5456-H343 or H34	0.051-0.249	53	41	*	39	31	24	101	66	46.7	0.384	78	28.0	0.178	100
6061-O	0.010-3.000	16	6	*	6	11	3.5	33	15	6.5	0.019	185	3.9	0.009	246
6061-T4	0.010-3.000	30	16	*	16	20	9	63	26	18.0	0.092	128	10.8	0.042	152
6061-T6	0.010-3.000	42	35	*	35	27	20	88	58	39.9	0.263	68	23.9	0.122	88
Alclad 6061-O	0.010-0.500	16	6	*	6	11	3.5	33	15	6.5	0.019	185	3.9	0.009	246
Alclad 6061-T4	0.010-3.000	27	14	*	14	18	8	57	22	15.7	0.074	128	9.4	0.034	162
Alclad 6061-T6	0.010-3.000	38	32	*	32	24	14	80	51	36.3	0.228	71	21.8	0.106	92
7075-O	0.015-2.000	29	12	*	13	19	7	61	29	14.5	0.066	135	8.7	0.030	165
7075-T6	0.008-0.011	74	63	5	65	45	36	140	103	77.4	0.711	49	46.4	0.330	63
7075-T6	0.012-0.039	76	65	7	67	46	37	144	106	80.0	0.747	48	48.0	0.347	62
7075-T6	0.040-0.249	77	66	8	68	46	38	146	107	81.3	0.765	48	48.8	0.356	62
7075-T6	0.250-0.499	77	66	8	69	46	38	139	100	82.6	0.784	47	49.6	0.365	61
7075-T6	0.500-1.000	77	66	6	69	47	38	142	104	82.6	0.784	47	49.6	0.365	61
7075-T6	1.001-2.000	77	66	4	68	46	38	140	102	81.3	0.765	48	48.8	0.356	62
7075-T6	2.001-2.500	73	62	3	65	44	36	131	93	77.4	0.711	49	46.4	0.330	63
7075-T6	2.501-3.000	70	60	3	63	42	35	126	90	74.9	0.677	50	44.9	0.314	64
7075-T6	3.001-3.500	68	58	3	62	41	33	122	87	73.6	0.659	50	44.2	0.307	65
7075-T6	3.501-4.000	66	56	2	60	40	32	119	84	71.0	0.624	51	42.6	0.290	66

Alloy and Temper	Thickness, In.	Minimum Mechanical Properties								Buckling Formula Constants					
		Tension			Compression	Shear		Bearing		Compression			Shear		
		US	YS	El	YS	US	YS	US	YS	B	D	C	B_t	D_t	C_t
Alclad 7075-O	0.008-0.062	27	11	*	12	18	6.5	57	26	13.3	0.058	142	8.0	0.027	181
Alclad 7075-O	0.063-1.000	28	12	10	13	18	7	59	29	14.5	0.066	135	8.7	0.030	165
Alclad 7075-T6	0.008-0.011	68	58	5	60	41	34	129	95	71.0	0.624	51	42.6	0.290	66
Alclad 7075-T6	0.012-0.039	70	60	7	62	42	35	133	98	73.6	0.659	50	44.2	0.307	65
Alclad 7075-T6	0.040-0.062	72	62	8	64	43	36	137	101	76.1	0.693	49	45.7	0.322	64
Alclad 7075-T6	0.063-0.187	73	63	8	65	44	36	139	102	77.4	0.711	49	46.4	0.330	63
Alclad 7075-T6	0.188-0.249	75	64	8	66	45	37	142	104	78.7	0.729	49	47.2	0.338	63
Alclad 7075-T6	0.250-0.499	75	64	8	66	45	37	135	98	78.7	0.729	49	47.2	0.338	63
Alclad 7075-T6	0.500-1.000	75	64	6	66	46	37	139	99	78.7	0.729	49	47.2	0.338	63
Alclad 7075-T6	1.001-2.000	75	64	4	66	45	37	137	99	78.7	0.729	49	47.2	0.338	63
Alclad 7075-T6	2.001-2.500	71	60	3	62	42	35	128	90	73.6	0.659	50	44.2	0.307	65
Alclad 7075-T6	2.501-3.000	68	58	3	61	40	33	122	87	72.3	0.642	51	43.4	0.298	65
Alclad 7075-T6	3.001-3.500	66	56	3	60	39	32	119	84	71.0	0.624	51	42.6	0.290	66
Alclad 7075-T6	3.501-4.000	64	54	2	58	38	31	115	81	68.5	0.592	52	41.1	0.275	67
7178-T6	0.015-0.044	83	72	7	73	50	41	158	117	87.8	0.859	46	52.7	0.399	59
7178-T6	0.045-0.249	84	73	8	74	50	42	160	118	89.1	0.878	46	53.5	0.408	59
7178-T6	0.250-0.499	84	73	8	74	50	42	151	111	89.1	0.878	46	53.5	0.408	59
7178-T6	0.500-1.500	84	73	*	74	50	42	151	112	89.1	0.878	46	53.5	0.408	59
7178-T6	1.501-2.000	80	70	3	71	48	40	144	106	85.2	0.821	47	51.1	0.381	60
Alclad 7178-T6	0.015-0.044	76	66	7	67	46	38	144	107	80.0	0.747	48	48.0	0.347	62
Alclad 7178-T6	0.045-0.249	78	68	8	69	47	39	148	110	82.6	0.784	47	49.6	0.365	61
Alclad 7178-T6	0.250-0.499	78	68	8	69	47	39	140	104	82.6	0.784	47	49.6	0.365	61
Alclad 7178-T6	0.500-1.500	78	68	*	69	47	39	140	105	82.6	0.784	47	49.6	0.365	61
Alclad 7178-T6	1.501-2.000	75	65	3	66	45	37	135	99	78.7	0.729	49	47.2	0.338	63

TABLE 4b

Minimum Mechanical Properties and Buckling Formula Constants

EXTRUDED ROD, BAR AND SHAPES

See page 39 for explanation of "minimum" properties.
US=ultimate strength in kips per sq in., YS=yield strength in kips per sq in., El=elongation in per cent in 2 in. or 4 dia.
See pages 39 to 41 for definitions, methods of determination and notes.

Alloy and Temper	Thickness, In.	Minimum Mechanical Properties								Buckling Formula Constants					
		Tension			Compression	Shear		Bearing		Compression			Shear		
		US	YS	El	YS	US	YS	US	YS	B	D	C	B_t	D_t	C_t
2014–O	All	24	9	12	9	15	5	50	21	9.9	0.037	160	5.9	0.017	207
2014–T4	All	50	35	12	30	31	20	90	55	35.2	0.251	89	21.1	0.116	113
2014–T6	Up thru 0.499	60	53	7	55	35	31	114	85	61.4	0.410	50	36.8	0.190	64
2014–T6	0.500–0.749	64	58	7	60	37	33	122	93	67.3	0.471	48	40.4	0.219	62
2014–T6	0.750 and over														
	Area 25 sq in. max.	68	60	7	62	39	35	109	84	69.7	0.496	47	41.8	0.230	61
	Area 25 to 32 sq in.	68	58	6	60	39	33	109	81	67.3	0.471	48	40.4	0.219	62
2024–O	All	25	9	12	9	15	5	52	21	9.9	0.037	160	5.9	0.017	207
2024–T4	Up thru 0.249	57	42	12	38	30	24	108	67	43.6	0.300	65	26.2	0.140	84
2024–T4	0.250–0.749	60	44	12	39	32	25	108	69	44.8	0.313	64	26.9	0.146	83
2024–T4	0.750–1.499	65	46	10	44	34	27	108	71	50.9	0.379	60	30.5	0.176	78
2024–T4	1.500–2.999														
	Area 25 sq in. max.	70	52	10	50	38	30	108	73	58.4	0.466	56	35.0	0.216	73
2024–T4	3.000 and over														
	Area 25 sq in. max.	70	52	10	50	37	30	108	73	58.4	0.466	56	35.0	0.216	73
2024–T4	1.500 and over														
	Area 25 thru 32 sq in.	68	48	8	46	36	28	108	72	53.4	0.407	59	32.0	0.189	76
3003–O	All	14	5	25	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
3003–H112	All	14	5	..	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
5083–O	All	38	16	16	..	..	..	...	..	....	.....	...	....	.....	...
5083–H112	All	40	24	12	..	..	..	...	..	....	.....	...	....	.....	...
5086–O	All	35	14	14	..	..	..	...	..	....	.....	...	....	.....	...
5086–H112	All	35	18	12	..	..	..	...	..	....	.....	...	....	.....	...

Alloy and Temper	Thickness, In.	Minimum Mechanical Properties								Buckling Formula Constants					
		Tension			Compression	Shear		Bearing		Compression			Shear		
		US	YS	El	YS	US	YS	US	YS	B	D	C	B_t	D_t	C_t
5154–O	All	30	11	14	..	..	..	...	..	....	.....	...	....	.....	...
5154–H112	All	30	11	12	..	..	..	...	..	....	.....	...	....	.....	...
5454–O	Up to 5.000	31	12	14	12	..	..	...	..	13.3	0.058	142	8.0	0.027	181
5454–H111	All	34	21	12	..	..	..	...	..	....	.....	...	....	.....	...
5454–H112	Up to 5.000	31	12	12	12	..	..	...	..	13.3	0.058	142	8.0	0.027	181
5454–H311	Up to 5.000	33	20	12	18	19	11	59	34	20.4	0.111	121	12.2	0.051	148
5456–O	Up to 5.000③	42	19	16	19	..	..	...	..	21.0	0.120	111	13.0	0.056	143
5456–H111	Up to 5.000③	44	26	12	..	..	..	79	44	....	.....	...	....	.....	...
5456–H112	Up to 5.000③	42	19	12	19	..	..	...	..	21.0	0.120	111	13.0	0.056	143
5456–H311	Up to 5.000③	42	25	12	22	26	14	79	42	25.3	0.153	106	15.2	0.071	134
6061–O	All	14	5	16	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
6061–T4	All	26	16	16	14	16	9	55	26	15.7	0.074	128	9.4	0.034	162
6061–T6	All	38	35	10	35	24	20	80	56	38.3	0.202	63	23.0	0.094	82
6061–T62	All	35	26	10	26	22	15	74	42	28.1	0.127	74	16.9	0.059	95
6062–O	All	14	5	16	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
6062–T4	All	26	16	16	14	16	9	55	26	15.7	0.074	128	9.4	0.034	162
6062–T6	All	38	35	10	35	24	20	80	56	38.3	0.202	63	23.0	0.094	82
6062–T62	All	35	26	10	26	22	15	74	42	28.1	0.127	74	16.9	0.059	95
6063–T42	Up thru 0.500	17	10	12	10	11	6	36	16	11.0	0.043	149	6.6	0.020	193
6063–T5	Up thru 0.500	22	16	8	16	13	9	46	25	17.5	0.076	103	10.5	0.036	134
6063–T6	Up thru 0.124	30	25	8	25	19	14	63	40	28.0	0.155	81	16.8	0.072	105
6063–T6	0.125–0.500	30	25	10	25	19	14	63	40	28.0	0.155	81	16.8	0.072	105
7075–O	All	29	11	10	12	19	6.5	61	26	13.3	0.058	142	8.0	0.027	181
7075–T6	Up thru 0.249	78	70	7	70	43	40	125	98	79.3	0.602	44	47.6	0.280	57
7075–T6	0.250–0.499	81	73	7	73	45	42	130	102	87.8	0.859	46	52.7	0.399	59
7075–T6	0.500–1.499	82	73	7	73	45	42	131	102	87.8	0.859	46	52.7	0.399	59
7075–T6	1.500–2.999	81	72	7	72	45	42	130	101	81.7	0.629	43	49.0	0.292	56
7075–T6	3.000–4.499①	81	71	7	71	45	41	130	99	85.2	0.821	47	51.1	0.381	60
7075–T6	3.000–4.499②	78	70	6	70	43	40	125	98	79.3	0.602	44	47.6	0.280	57
7075–T6	4.500–5.000③	78	68	6	68	43	39	125	95	76.9	0.575	45	46.1	0.267	55
7178–T6	Up thru 0.249	84	76	5	76	45	44	134	106	86.5	0.686	42	51.9	0.319	51
7178–T6	0.250–2.999③	86	78	5	78	46	45	138	109	88.9	0.714	42	53.3	0.332	54

①Area up thru 20 sq. in. ②Area 20 thru 32 sq. in. ③Area up thru 32 sq. in.

TABLE 4d

Minimum Mechanical Properties and Buckling Formula Constants—*Concluded*

ROLLED AND COLD-FINISHED ROD AND BAR

See page 39 for explanation of "minimum" properties.
US=ultimate strength in kips per sq in., YS=yield strength in kips per sq in., El=elongation in per cent in 2 in. or 4 dia.
See pages 39 to 41 for definitions, methods of determination and notes.

Alloy and Temper	Diameter or Thickness, In.	Minimum Mechanical Properties								Buckling Formula Constants					
		Tension			Compression	Shear		Bearing		Compression			Shear		
		US	YS	El	YS	US	YS	US	YS	B	D	C	B_t	D_t	C_t
2024-O	Up thru 8.000	25	9	16	9	17	5	52	21	9.9	0.037	160	5.9	0.017	207
2024-T4	Up thru 6.500	62	40	14	40	37	23	118	64	48.0	0.400	77	28.8	0.186	100
3003-O	All	14	5	25	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
3003-H12	Up thru 0.374	17	12	10	11	11	7	33	19	12.2	0.051	148	7.3	0.023	179
3003-H14	Up thru 0.313	20	17	10	15	13	10	35	28	16.8	0.082	124	10.1	0.038	157
3003-H16	Up thru 0.250	24	21	..	20	14	12	40	33	22.8	0.131	112	13.7	0.061	144
3003-H18	Up thru 0.204	27	25	..	23	15	14	43	38	26.5	0.164	103	15.9	0.076	131
5052-O	All	25	9.5	25	10	16	5.5	53	20	11.0	0.043	149	6.6	0.020	193
5052-F	0.375 and over	26	11	....	11	17	6.5	55	22	12.2	0.051	148	7.3	0.023	179
6061-O	Up thru 8.000	16	5	18	5	11	3	33	12	5.4	0.015	222	3.2	0.006	241
6061-T4	Up thru 8.000	30	16	18	16	20	9	63	26	18.0	0.092	128	10.8	0.042	152
6061-T6	Up thru 8.000	42	35	10	35	25	20	88	56	38.3	0.202	63	23.0	0.094	82
7075-O	Up thru 8.000	28	11	10	11	18	6.5	59	26	12.2	0.051	148	7.3	0.023	179
7075-T6	Up thru 4.000	77	66	7	66	46	38	123	92	78.7	0.729	49	47.2	0.338	63

TABLE 4e

Minimum Mechanical Properties and Buckling Formula Constants

PIPE

See page 39 for explanation of "minimum" properties.
US=ultimate strength in kips per sq in., YS=yield strength in kips per sq in., El=elongation in per cent in 2 in. or 4 dia.
See pages 39 to 41 for definitions, methods of determination and notes.

Alloy and Temper	Size or Thickness, In.	Minimum Mechanical Properties								Buckling Formula Constants					
		Tension			Compression	Shear		Bearing		Compression			Shear		
		US	YS	El	YS	US	YS	US	YS	B	D	C	B_t	D_t	C_t
3003-O	All	14	5	....	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
3003-H112	1 in. and over	14.5	6	....	6	10	3.5	31	14	6.5	0.019	185	3.9	0.009	246
3003-H18	Under 1 in. size	27	24	....	23	15	14	43	38	26.5	0.164	103	15.9	0.076	131
3003-F	1 in. and over	14	5	....	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
6061-T6	Under 1 in. size	42	35	12	35	27	20	88	56	38.3	0.202	63	23.0	0.094	82
6061-T6	1 in. and over	38	35	10	35	24	20	80	56	38.3	0.202	63	23.0	0.094	82
6063-T5	All	22	16	10	16	13	9	46	25	17.5	0.076	103	10.5	0.036	134
6063-T6	All	30	25	8	25	19	14	63	40	28.0	0.155	81	16.8	0.072	105
6063-T832	All	38	35	5	35	23	20	80	56	38.3	0.202	63	23.0	0.094	82

TABLE 4f

Minimum Mechanical Properties and Buckling Formula Constants

EXTRUDED TUBE

See page 39 for explanation of "minimum" properties.

US=ultimate strength in kips per sq in., YS=yield strength in kips per sq in., El=elongation in per cent in 2 in. or 4 dia.

See pages 39 to 41 for definitions, methods of determination and notes.

Alloy and Temper	Wall Thickness, In.	Minimum Mechanical Properties								Buckling Formula Constants					
		Tension			Compression	Shear		Bearing		Compression			Shear		
		US	YS	El	YS	US	YS	US	YS	B	D	C	B_t	D_t	C_t
2014–O	All	24	9	12	9	15	5	50	21	9.9	0.037	160	5.9	0.017	207
2014–T4	0.125–0.499	50	30	12	26	31	17	90	47	30.2	0.200	100	18.1	0.092	121
2014–T4	0.500 and over	55	35	12	30	34	20	99	55	35.2	0.251	89	21.1	0.116	113
2014–T6	0.125–0.499	60	53	7	55	35	31	114	85	61.4	0.410	50	36.8	0.190	61
2014–T6	0.500–0.749	64	58	7	60	37	33	122	93	67.3	0.471	48	40.4	0.219	62
2014–T6	0.750 and over—														
	Area 25 sq in. max.	68	60	7	62	39	35	114	84	69.7	0.496	47	41.8	0.230	61
	Area 25 to 32 sq in.	68	58	6	60	39	33	114	81	67.3	0.471	48	40.4	0.219	62
2024–O	All	25	9	12	9	15	5	52	21	9.9	0.037	160	5.9	0.017	207
2024–T4	0.499 and less	60	40	10	36	32	23	108	62	41.1	0.275	67	24.7	0.128	87
2024–T4	0.500–1.499	65	46	10	44	34	27	108	71	50.9	0.379	60	30.5	0.176	78
2024–T4	1.500 and over—														
	Area 25 sq in. max.	70	48	10	46	37	28	108	72	53.4	0.407	59	32.0	0.189	76
	Area 25 to 32 sq in.	68	46	6	44	36	27	108	71	50.9	0.379	60	30.5	0.176	78
3003–O	All	14	5	25	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
3003–F	All	14	5	....	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241

Alloy and Temper	Wall Thickness, In.	Minimum Mechanical Properties								Buckling Formula Constants					
		Tension			Compression	Shear		Bearing		Compression			Shear		
		US	YS	El	YS	US	YS	US	YS	B	D	C	B_t	D_t	C_t
5154–O	All	30	11	14	11	19	6.5	63	23	12.2	0.051	148	7.3	0.023	179
6061–O	All	14	5	16	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
6061–T4	All	26	16	16	14	16	9	54	25	15.7	0.074	128	9.4	0.034	162
6061–T6	All	38	35	10	35	24	20	80	56	38.3	0.202	63	23.0	0.094	82
6062–O	All	14	5	16	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
6062–T4	All	26	16	16	14	16	9	54	25	15.7	0.074	128	9.4	0.034	162
6062–T6	All	38	35	10	35	24	20	80	56	38.3	0.202	63	23.0	0.094	82
6063–T42	Up to 0.500	17	10	12	10	11	6	36	16	11.0	0.043	149	6.6	0.020	193
6063–T5	Up to 0.500	22	16	10	16	13	9	46	25	17.5	0.076	103	10.5	0.036	134
6063–T6	Up to 0.500	30	25	8	25	19	14	63	40	28.0	0.155	81	16.8	0.072	105
7075–O	All	29	11	10	12	19	6.5	61	26	13.3	0.058	142	8.0	0.027	181
7075–T6	Up to 0.249	78	70	7	70	43	40	125	98	79.3	0.602	44	47.6	0.280	57
7075–T6	0.250–2.999	80	72	7	72	44	42	128	101	81.7	0.629	43	49.0	0.292	56
7178–T6	Up to 0.249	84	76	5	76	45	44	134	106	86.5	0.686	42	51.9	0.319	54
7178–T6	0.250–2.999	86	78	5	78	46	45	138	109	88.9	0.714	42	53.3	0.332	51

TABLE 4h

Minimum Mechanical Properties and Buckling Formula Constants

DIE FORGINGS

See page 39 for explanation of "minimum" properties.
US=ultimate strength in kips per sq in., YS=yield strength in kips per sq in., El=elongation in per cent in 2 in. or 4 dia.
See pages 39 to 41 for definitions, methods of determination and notes.

Alloy and Temper	Thickness, In.	Minimum Mechanical Properties								Buckling Formula Constants					
		Tension			Compression	Shear		Bearing		Compression			Shear		
		US	YS	El	YS	US	YS	US	YS	B	D	C	B_t	D_t	C_t
1100–F	Up to 4 in.	11	4	25	4	8	2.5	...	...	4.3	0.010	221	2.6	0.005	517
2014–T4	Up to 4 in.	55	30	11	30	34	17	105	48	35.2	0.251	89	21.1	0.116	113
2014–T6	Up to 4 in.	65	55	7	55	39	32	117	88	61.4	0.410	50	36.8	0.190	64
2018–T61	Up to 4 in.	55	40	7	40	35	23	105	64	48.0	0.400	77	28.8	0.186	100
2218–T61	Up to 4 in.	55	40	7	40	35	23	105	64	48.0	0.400	77	28.8	0.186	100
2218–T72	Up to 4 in.	38	29	6	29	24	17	72	46	33.9	0.237	91	20.3	0.110	118
3003–O	All	14	5	25	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
3003–F	All	14	5	..	5	10	3	30	12	5.4	0.015	222	3.2	0.006	241
4032–T6	Up to 4 in.	52	42	3	42	36	24	...	...	50.6	0.433	75	30.4	0.202	100
6061–T6	Up to 4 in.	38	35	7	35	25	20	80	56	38.3	0.202	63	23.0	0.094	82
6151–T6	Up to 4 in.	44	37	10	37	28	21	92	59	40.6	0.220	61	24.4	0.103	79
7075–T6	Up to 3 in.	75	65	7	65	45	37	120	97	73.3	0.535	46	44.0	0.249	59
7079–T6	Up to 6 in.	74	64	7	64	43	37	119	96	72.1	0.522	46	43.3	0.243	59

TABLE 4i

Minimum Mechanical Properties and Buckling Formula Constants

SAND CASTINGS

See page 39 for explanation of "minimum" properties.
US=ultimate strength in kips per sq in., YS=yield strength in kips per sq in., El=elongation in per cent in 2 in. or 4 dia.
See pages 39 to 41 for definitions, methods of determination and notes.

Alloy and Temper	Thickness, In.	Minimum Mechanical Properties								Buckling Formula Constants					
		Tension			Compression	Shear		Bearing		Compression			Shear		
		US	YS	El	YS	US	YS	US	YS	B	D	C	B_t	D_t	C_t
43–F	The values to the right are based on tests of standard specimens individually cast. See page 41.	17	7	3	7	12	....	...	...	7.6	0.025	186	4.6	0.011	212
122–T61		30	28	+	30	22	....	...	...	35.2	0.251	89	21.1	0.116	113
142–T21		23	14	+	14	17	....	...	...	15.7	0.074	128	9.4	0.034	162
142–T571		29	26	+	30	23	....	...	...	35.2	0.251	89	21.1	0.116	113
142–T77		21.5	15	+	16	16	....	...	...	18.0	0.092	128	10.8	0.042	152
195–T4		29	13	6	14	22	....	61	26	15.7	0.074	128	9.4	0.034	162
195–T6		32	20	3	21	24	....	67	40	24.0	0.141	107	14.4	0.065	134
195–T62		36	28	+	29	28	....	76	56	33.9	0.237	91	20.3	0.110	118
195–T7		29	16	3	17	21	....	61	32	19.2	0.101	120	11.5	0.047	163
214–F		22	9	6	10	17	....	...	...	11.0	0.043	149	6.6	0.020	193
B214–F		17	10	+	11	13	....	...	...	12.2	0.051	148	7.3	0.023	179
F214–F		17	9	+	10	13	....	...	...	11.0	0.043	149	6.6	0.020	193

Continued on next page

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EDWARD H. MAHLA
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OF COUNSEL
RALPH E. CASEY *
JOHN W. McCONNELL, JR. *

* ADMITTED TO D.C. BAR

LEWIS, WILSON,
APR 1_ 1980
LEWIS & JONES, LTD.

April 18, 1980

BY HAND

Oren R. Lewis, Jr., Esq.
Lewis, Wilson, Lewis & Jones
2054 North 14th Street
Arlington, Virginia 22216

FFAC v. Lockheed Aircraft Corporation
Our file 2041-1278-2S

Zimmerly v. Lockheed Aircraft Corporation
Our file 2041-1278-5B

Dear Oren:

Pursuant to plaintiffs' Notice to Produce Physical Evidence at Trial and subpoena thereon and defendant's Motion to Quash that subpoena and notice, we appeared before the Court on Tuesday, April 15, 1980 to move to quash that subpoena. The judge extended the subpoena through the end of this week and asked that a report be given by Friday of this week on the documents requested in the Notice to Produce.

With respect to those categories, the judge has already ruled in the negative denying requests as to categories (6) and (8). As to the following categories we make the following production:

(1) We hereby provide seven black-and-white slides not pertaining to the crash scene and therefore they are not within your request for production in the surviving orphans cases. These slides appear to have to do with the ramp portion and ramp locking system of the aircraft and do not appear to be taken at the scene of the crash. Nevertheless, we are making them available to you for your review in Court so that if you

wish copies made of them you should advise us and we will do so.

(2) Lockheed has no such documents pertaining to autopsies, death certificates, etc. except those produced by the government.

(3) The Collateral Investigation was conducted solely by the Air Force and Lockheed has no documents relating thereto except the Collateral Report itself, which has previously been produced to plaintiffs' counsel.

(4) Except for the document prepared by Lockeed with respect to G-forces which has previously been listed as within attorney work product and except as to G-forces information contained in MADAR data already produced or produced today and John Edwards' formula for G-forces as to which Mr. Edwards was prepared to testify at trial but was not requested to do so, defendant knows of no other documents relating to G-forces generated on or in C-5A 68-218.

(5) Defendant is making available to plaintiff a magnetic tape copy of the MADAR tape from AF 68-218; a total "dumpout" in octal form prepared at the request of trial counsel last week in light of plaintiffs' inquiries concerning MADAR data; and eight pages of computation made by Lockheed from MADAR data on AF 68-218 on April 4, 1975 which we may have already given to you. All other documentation in defendant's possession with respect to MADAR on the April 4, 1975 AF 68-218 flight in issue herein has been produced to defendant's knowledge.

(7) Defendant is making available for inspection at our offices or use in Court only a model of the C-5A aircraft and the model of the C-5A used in the wind-tunnel test conducted by Professor Harper as previously agreed in Court on April 15, 1980.

(9) Other than documents already produced, defendant knows of no documents pertaining to

(a) the manner in which C-5A 68-218 broke apart after the second impact on April 4, 1975 near Saigon, South Vietnam;

(b) the nature of the forces and the expenditure of energy associated with such break-up of C-5A 68-218;

(c) the manner in which a C-5A would break up upon a crash landing; and

(d) the nature of the forces in the expenditure of energy associated with the break-up of a C-5A upon a crash landing.

As to categories (c) and (d) defendant knows of no Lockheed documents pertaining to same but is continuing its inquiry.

Sincerely yours,

Carroll E. Dubuc

Enclosures

cc: Honorable Louis F. Oberdorfer
James P. Piper, Esq.

TIME	VA/CG	LAT/CG
5:28:49.55	0.52	-0.37 * MIN
.60	0.16 * (.54) MIN	0.01
.65	1.01	0.38
.70	NR	0.03 ~~0.02~~
.75	0.40	0.18
.80	0.61 MAX	-0.04
.85	1.37 * (.37)	0.13
.90	NR	0.23
.95	0.99	0.28
5:28:50.00	0.55	0.45* MAX
.05	NR	0.40
.10	0.39	0.27
.15	0.54	0.12 ~~0.23~~
.20	0.77	0.15
.25	1.18	NR
.30	NR	0.25
.35	0.85	0.12
.40	0.53	0.05
.45	0.70	0.23
.50	0.98	0.29
.55	1.17	0.13
.60	1.21	0.10
.65	NR	0.26
.70	1.17	0.30
.75	1.03	0.24
.80	0.96	0.30
.85	1.25	0.27
.90		NOT SHOWN [illegible] +0.16

TIME	VA/CG	LAT/CG
.95	1.13	NR
5:28:51.00	1.05	0.09
.05	0.95	0.18
.10	1.03 ~~1.35~~	0.15 ~~0.13~~
.15	NR	NR
.20	NR	0.20
.25	0.98 ~~1.01~~	0.16
.30	1.05	NR
.35	0.91	0.08
.40	NR	0.14
.45	1.02	0.24
.50	NR	0.17
.55	1.06	NR
.60	NR	0.13
.65	0.96	NR
.70	0.92	NR
.75	0.96	NR
.80	NR	NR
.85	1.07	0.10
.90	NR	NR
	NOT SHOWN	ON [illegible]
.95	0.95	NR
5:28:52.00	NR	NR

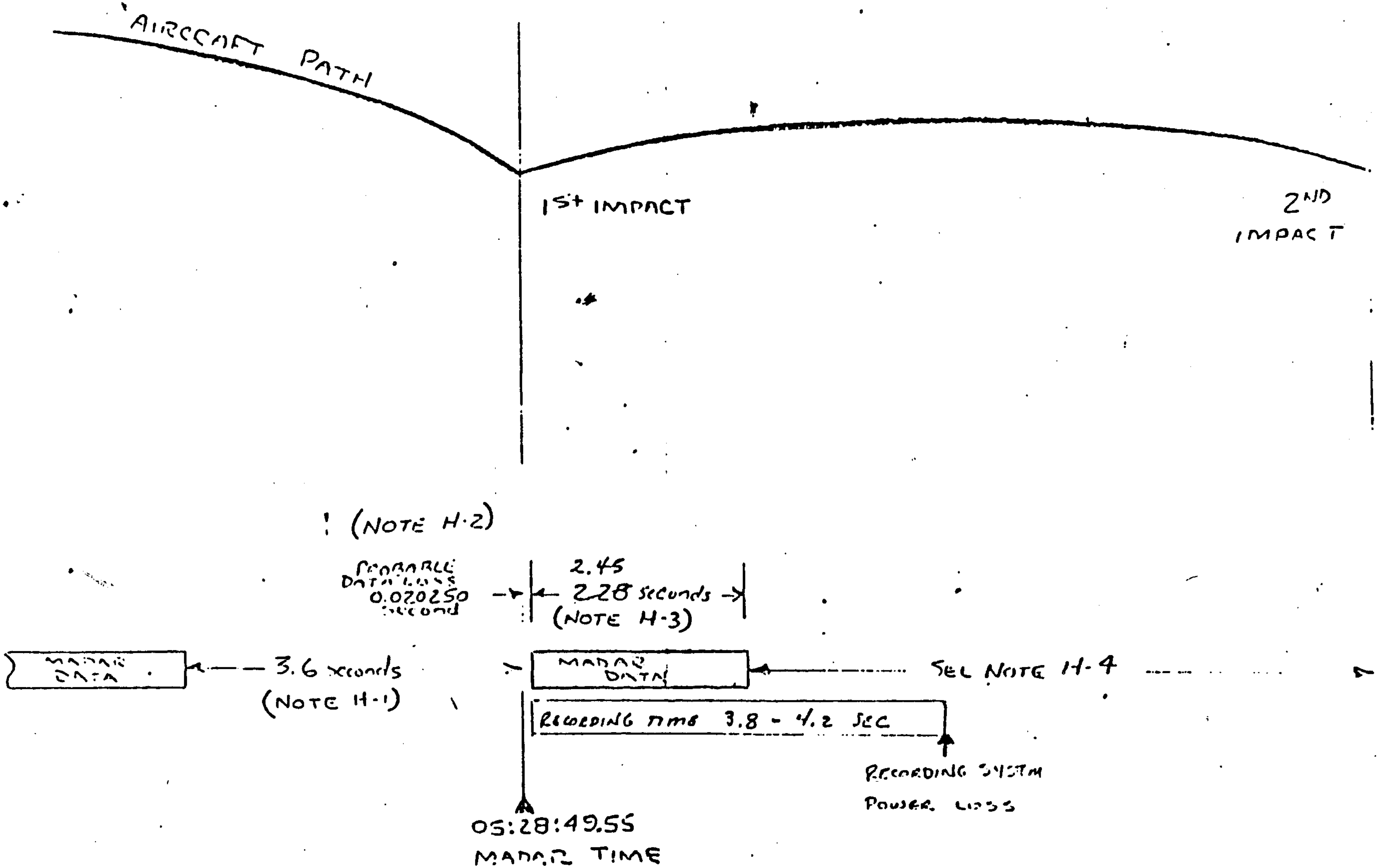
DECODING OF SLRP (05) MESSAGES ON RECORD 11977

LOCKHEED-GEORGIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

OCTAL x_1x_2 x_3x_4 x_5x_6 x_7x_8 x_9x_{10}	(x_3x_4) HEX	CONV DEC	SEC/20	(x_5x_6) HEX	CONV DEC	x_7 HEX	PCODE	x_8 HEX	DEC	(x_9x_{10}) HEX	CONV DEC	COUNTS	ENGINEERING INTERPRETATION		PARAMETER
05 34 54 16 24	1C	14	14	2C	22	0	44	E	14	14	10	-22	22, DISENGAGED		INFLIGHT REFUEL
05 34 42 56 12	1C	14	14	22	17	2	35	E	14	0A	5	-27	-0.027	RAD/SEC²	PITCH ACCELERAT
05 36 14 16 22	1E	15	15	0C	6	0	12	E	14	12	9	-23✓	1.03	G'S	VA/CG
05 36 12 24 34	1E	15	15	0A	5	1	10	4	4	1C	14	78✓	0.24	G'S	LAT/CG
05 36 42 62 04	1E	15	15	22	17	3	35	2	2	04	2	34	0.034	RAD/SEC²	PITCH ACCELERATIO
05 40 14 16 02	20	16	16	0C	6	0	12	E	14	02	1	-31✓	0.96	G'S	VA/CG
05 40 12 26 17	20	16	16	0A	5	1	10	6	6	0F	0	96✓	0.30	G'S	LAT/CG
05 40 06 02 40	20	16	16	06	3	0	6	2	2	20	16	-208	537	FT	PRESS ALTITUDE
05 40 42 62 34	20	16	16	22	17	3	35	2	2	1C	14	46	0.046	RAD/SEC²	PITCH ACCELERA
05 42 14 20 17	22	17	17	0C	6	1	12	0	0	0E	0	0✓	1.25	G'S	VA/CG
05 42 12 24 14	22	17	17	0A	5	1	10	4	4	0C	6	70✓	0.22	G'S	LAT/CG
05 42 56 20 64	22	17	17	2E	23	1	46	0	0	34	26	26	-26, NOT DEPLOY		AIR DROP
05 42 42 56 66	22	17	17	22	17	2	35	E	14	36	27	-5	-0.005	RAD/SEC²	PITCH ACCELERAT
05 44 12 72 (22) 50	24	18	18	0A	5	0 (1)	10	A (2)	10 (2)	28	20	-76 (52)	-0.24 (+0.16)	G'S	LAT/CG
05 44 60 16 74	24	18	18	30	24	0	48	E	14	3C	30	-2	+2, UNKNEELED		FORWARD KNEEL
05 44 42 52 32	24	18	18	22	17	2	35	A	10	1A	13	-103	-0.103	RAD/SEC²	PITCH ACCELERA
05 46 14 16 46	26	19	19	0C	6	0	12	E	14	26	19	-13✓	1.13	G'S	VA/CG
05 46 10 14 12	26	19	19	08	4	0	8	C	12	0A	5	-59	0.41		MACH NO.
05 46 42 46 56	26	19	19	22	17	2	34	6	6	2E	23	-137	137, RETRACTED		GROUND SPOILER
05 50 14 16 26	28	20	20	0C	6	0	12	E	14	16	11	-21✓	1.05	G'S	VA/CG
05 50 12 20 74	28	20	20	0A	5	1	10	0	0	3C	30	30✓	0.09	G'S	LAT/CG
05 50 62 16 74	28	20	20	32	25	0	50	E	14	3C	30	-2	2, UNKNEELED		LEVEL KNEEL
CLOCK MESSAGE	27175	26246	SKIP TO NEXT SLRP MESSAGE (05 FLAG).												
05 02 14 16 17	02	1	1	0C	6	0	12	E	14	0F	0	-32✓	0.95	G'S	VA/CG
05 02 12 22 62	02	1	1	0A	5	1	10	2	2	32	25	57✓	0.18	G'S	LAT/CG
05 02 42 50 70	02	1	1	22	17	2	35	8	8	38	28	-100	-0.100	RAD/SEC²	PITCH ACCELERAT
05 04 14 16 22	04	2	2	0C	6	0	12	E	14	12	9	-23 (9)	1.03 (1.33)	G'S	VA/CG
05 04 12 22 21 (49)	04	2	2	0A	5	1	10	2	2	14	10	48 (42)	0.13	G'S	LAT/CG
05 04 42 54 46	04	2	2	22	17	2	35	C	12	26	19	-45	-0.045	RAD/SEC²	PITCH ACCELERATI
05 06 42 56 66	06	3	3	22	17	2	35	E	14	36	27	-5	-0.005	RAD/SEC²	PITCH ACCELERA
05 10 12 20 04	08	4	4	0A	5	1	10	4	4	04	2	66	0.20	G'S	LAT/CG
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	20	6	6	32	25	121	-15.[illegible]	DEG	[illegible] AILERON [illegible]

LOCKHEED-GEORGIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

OCTAL X_1X_2 X_3X_4 X_5X_6 X_7X_8 X_9X_{10}	(X_3X_4) HEX	CON DEC	SEC/20	(X_5X_6) HEX	CON DEC	X_7 HEX	P CODE	X_8 HEX	DEC	(X_9X_{10}) HEX	CON DEC	COUNTS	ENGINEERING INTERPRETATION		PARAMETER
05 10 42 60 30	08	4	4	22	17	3	35	0	0	18	12	12	0.018	RAD/SEC²	PITCH ACCELERAT
05 12 14 16 06	0A	5	5	0C	6	0	12	E	14	3 ~~26~~	6	~~-26~~ -27	~~1.04~~	G'S	VA/CG
05 12 12 22 52	0A	5	5	0A	5	1	10	2	2	2A	21	53✓	0.16	G'S	LAT/CG
05 14 14 16 26	0C	6	6	0C	6	0	12	E	14	16	11	-21✓	1.05	G'S	VA/CG
05 14 30 26 44	0C	6	6	18	12	1	24	6	6	24	18	114	-14.7	DEG	RT AILERON POS
05 16 14 14 70	0E	7	7	0C	6	0	12	C	12	38	28	-36✓	0.91	G'S	VA/CG
05 16 12 20 62	0E	7	7	0A	5	1	10	0	0	32	25	25✓	0.08	G'S	LAT/CG
05 20 12 22 30	10	8	8	0A	5	1	10	2	2	18	12	44✓	0.14	G'S	LAT/CG
05 22 14 16 16	12	9	9	0C	6	0	12	E	14	0E	7	-25✓	1.02	G'S	VA/CG
05 22 12 24 34	12	9	9	0A	5	1	10	4	4	1C	14	78✓	0.24	G'S	LAT/CG
05 22 42 60 54	12	9	9	22	17	3	35	0	0	2C	22	22	0.022	RAD/SEC²	PITCH ACCELERA
05 24 12 22 60	14	10	10	0A	5	1	10	2	2	30	24	56✓	0.17	G'S	LAT/CG
05 26 14 16 30	16	11	11	0C	6	0	12	E	14	18	12	-20	1.06	G'S	VA/CG
05 26 42 56 74	16	11	11	22	17	2	35	E	14	3C	30	-2	-0.002	RAD/SEC²	PITCH ACCELERA
05 30 14 16 16	18	12	12	0C	6	0	12	E	14	0E	7	-25✓	1.02	G'S	VA/CG
05 30 12 22 24	18	12	12	0A	5	1	10	2	2	14	10	42✓	0.13	G'S	LAT/CG
05 30 42 56 42	18	12	12	22	17	2	35	E	14	22	17	-15	-0.015	RAD/SEC²	PITCH ACCELERA
05 32 14 16 02	1A	13	13	0C	6	0	12	E	14	02	1	-31✓	0.96	G'S	VA/CG
05 34 14 14 72	1C	14	14	0C	6	0	12	C	12	3A	29	-35✓	0.92	G'S	VA/CG
05 36 14 16 02	1E	15	15	0C	6	0	12	E	14	02	1	-31✓	0.96	G'S	VA/CG
05 40 30 26 60	20	16	16	18	12	1	24	6	6	30	24	120	-15.2	DEG	RT AILERON PO
05 40 06 20 44	20	16	16	06	3	1	6	0	0	24	18	18	25616	FT	PRESS ALTITU
05 42 14 16 32	22	17	17	0C	6	0	12	E	14	1A	13	-19✓	1.07	G'S	VA/CG
05 42 12 22 17	22	17	17	0A	5	1	10	2	2	0F	0	32✓	0.10	G'S	LAT/CG
05 42 42 56 06	22	17	17	22	17	2	35	E	14	06	3	-29	-0.029	RAD/SEC²	PITCH ACCELERA
05 46 14 16 17	26	19	19	0C	6	0	12	E	14	0F	0	-32	0.95	G'S	VA/CG
CLOCK MESSAGE	27 17 52 62 50														


AIRCRAFT PATH
1st IMPACT
2ND IMPACT
(NOTE H-2)
PROBABLE DATA LOSS 0.020250 second
2.45
2.28 seconds
(NOTE H-3)
RADAR DATA
3.6 seconds
(NOTE H-1)
RADAR DATA
SEE NOTE H-4
RECORDING TIME 3.8 - 4.2 SEC
RECORDING SYSTEM POWER LOSS
05:28:49.55
RADAR TIME

4-28-8C
Edwards DE

1. $D = VT$ D = distance
V = Velocity (when V is Cons.
t = Time.

2. $D = \frac{V_1 + V_2}{2} T$ for a Velocity that change

3. $D = \frac{V_1}{2} \cdot T$ If V_2 is 0 as was the case

4. $T = \frac{2D}{V}$

Also $D = \frac{1}{2} AT^2$

5. Or $A = \frac{2D}{T^2}$

substituting #4 into #5

6. $A = \frac{2D}{\left(\frac{2D}{V}\right)^2} = \frac{2D}{\frac{4D^2}{V^2}}$

$A = \frac{2D}{4D^2} \times V^2$

$A = \frac{V^2}{2D}$

7. If g's are desired you devide A by 32.2

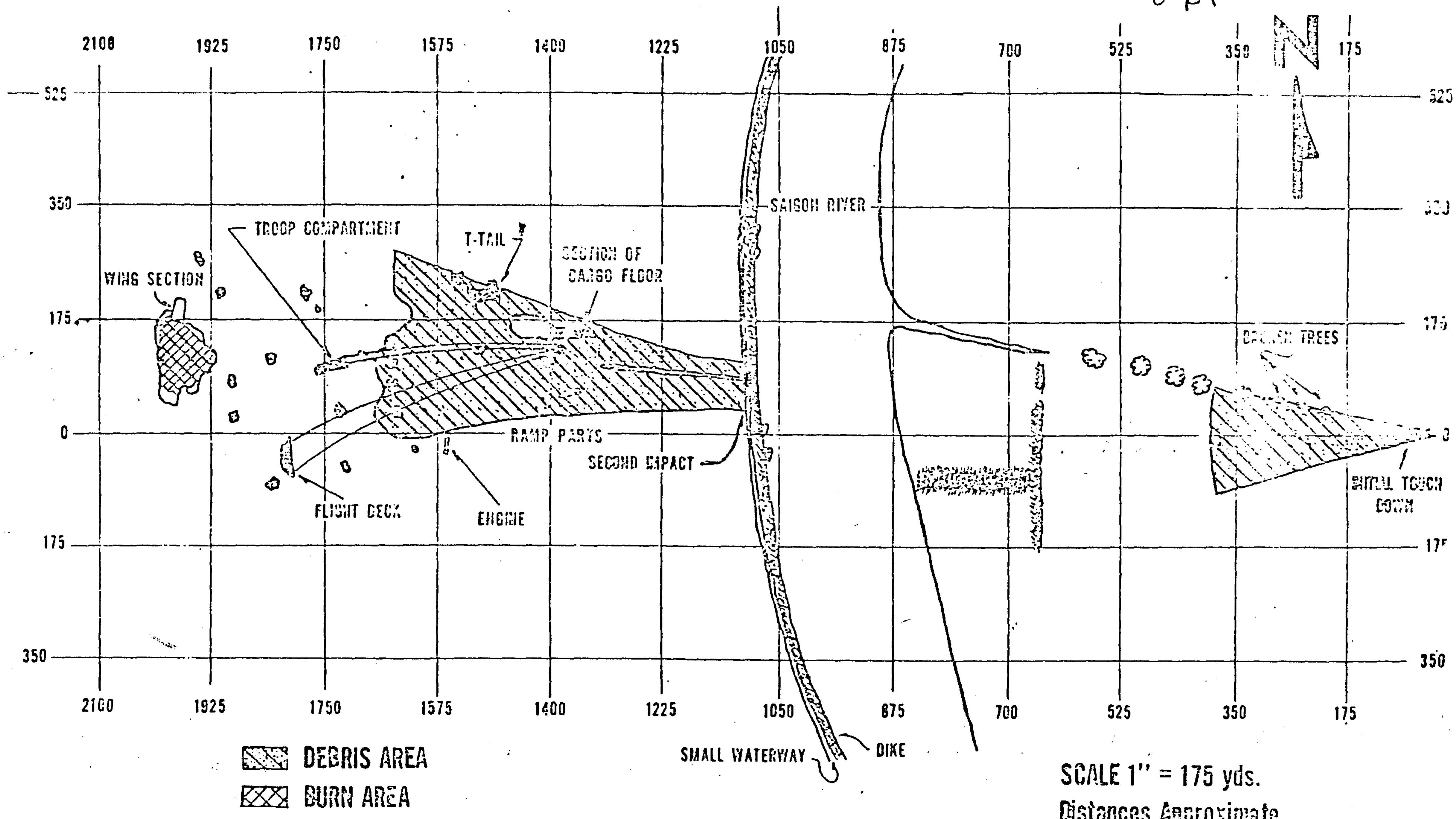
$\left(\frac{A}{32.2}\right) = \frac{V^2}{2D \times 32.2}$

$g's = \frac{V^2}{2D \times 32.2}$

WRECKAGE DIAGRAM

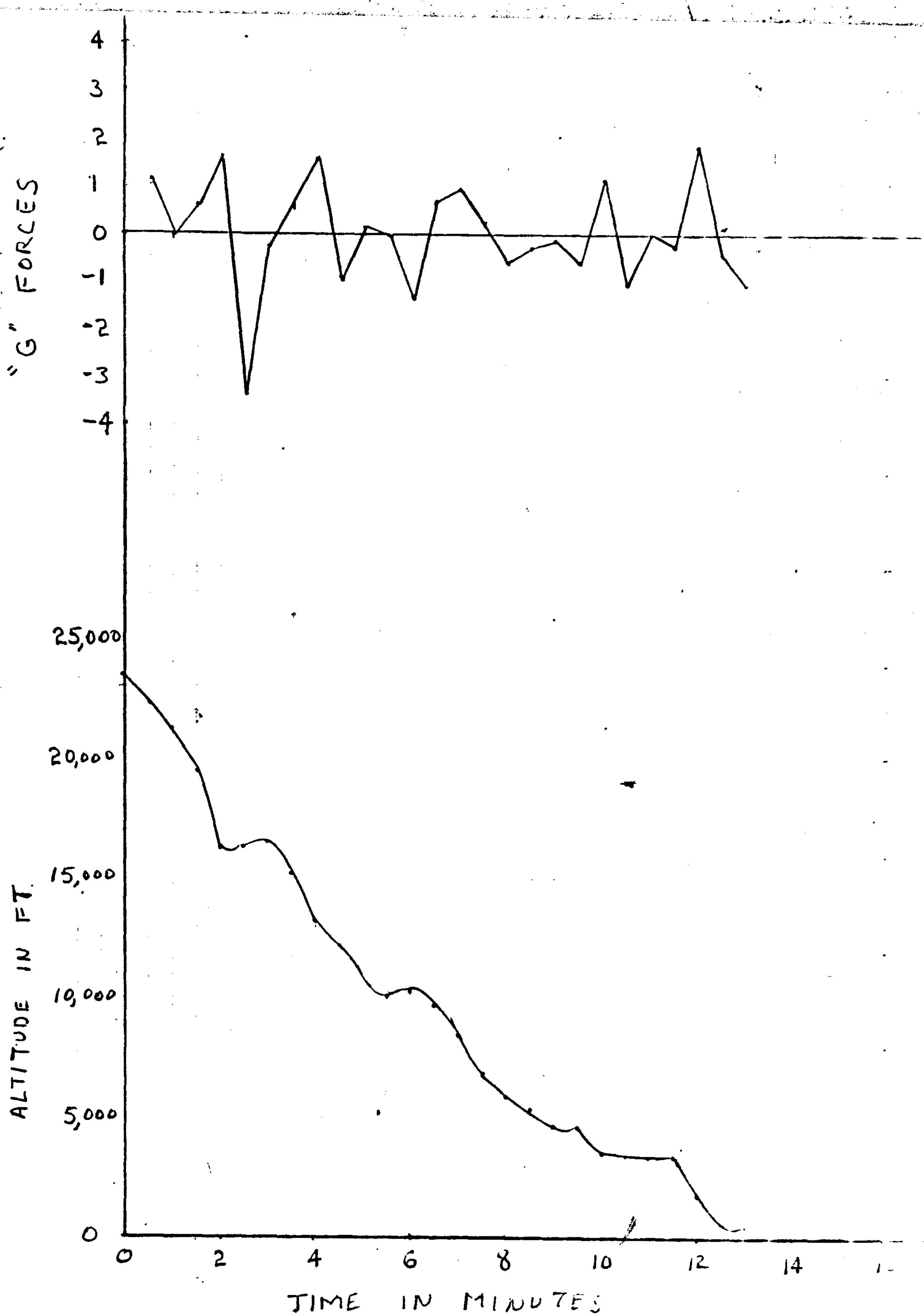
C-5A SN 68-218 4 APRIL 1975

Cole Rip.



SCALE 1" = 175 yds.
Distances Approximate

593



ZERO TIME IS INITIAL DECENT AFTER DECOMPRESSION

FIRST ALTITUDE DATA

TIME (MIN)	ALTITUDE FT	ΔH FT	$\frac{\Delta H}{\Delta t}$	$\frac{\Delta^2 H}{\Delta t^2}$	CALCULATED VERTICAL g FORCE
0	23,424	0.0	0		
0.5	22,313	-1111.0	-37.03	+37.03	1.15
1.0	21,202	-1111.0	-37.03	0.0	[illegible]
1.5	19,535	-1667.0	-55.57	+18.54	0.58
2.0	16,313	-3222.0	-107.40	+51.83	1.61
2.5	16,313	0.0	0	-107.4	-3.[illegible]4
3.0	16,536	+223.0	+7.43	-7.43	-[illegible]3
3.5	15,202	-1334.0	-11.13	+18.56	0.58
4.0	13,314	-1888.0	-62.93	+51.80	1.61
4.5	12,314	-1000.0	-33.33	-29.60	-0.92
5.0	—	-1107.5	-36.92	+3.59	0.11
5.5	10,099	-1107.5	-36.92	0	0.[illegible]
6.0	10,314	+215.0	+7.17	-44.09	-1.37
6.5	9,870	-444.0	-14.80	+21.97	0.66
7.0	8,536	-1334.0	-44.47	+29.67	0.92
7.5	6,981	-1555.0	-51.83	+7.36	0.23
8.0	5,981	-1000.0	-33.33	-18.50	-0.58
8.5	5,315	-660.0	-22.00	-11.33	-0.35
9.0	4,759	-555.0	-18.50	-3.50	-0.1[illegible]
9.5	4,759	0.0	0.0	-18.50	-0.58
10.0	3,648	-1111.0	-37.03	+37.03	1.15
10.5	3,537	-111.0	-3.70	-33.33	-1.04
11.0	3,426	-111.0	-3.70	0.0	0.0
11.5	3,537	+111.0	+3.70	-7.40	-0.[illegible]
12.0	1,870	1667.0	-55.57	+59.27	1.84
12.5	648	1222.0	-40.73	-14.84	-0.46
13.0	537	111.0	-3.70	-37.03	-1.15

MADAR [illegible]ATA FROM AIR FORCE [illegible]

TIME	ALT.	MACH	TIME INTERVAL IN LOCKHEED MA[illegible]
*051236	22312	0.576	
051239	22423	0.598	5:12:35 TO 5:12:41
*051244	22535	—	
051252	22646	0.602	5:12:42 TO 5:12:52
*051256	22757		
*051300	22868	—	← FUEL OUT
051304	22979	0.604	
051314	23201	0.610	5:13:10 - 5:13:17
051329	23423.297	—	5:13:28 5:13:30 ← ALTITUDE
051348	23313	0.620	5:13:42 5:13:49
051353	22979	0.638	5:13:50 5:13:57
051358	22757	0.648	5:13:57 5:14:12
*051404	22535	0.656	
*051407	22423	0.658	
051411	22313	0.664	5:14:12 5:14:16
*051417	22090	0.672	
051422	21868	0.680	5:14:18 5:11:23
051427	21757	0.682	5:14:24 5:10:29
051433	21646	0.674	5:14:30 5:14:34
051423	21535	0.668	
051443	21424	0.654	5:14:36 5:14:43
051449	21202	0.648	5:14:44: 5:14:51
*051453	21090	0.646	
051459	20868.5	0.640	5:14:52 5:14:59
051504	20646	0.620 (?)	5:15:0 5:15:7
*051508	20313	—	
051512	20091	0.632	5:15:8 5:16:13
051616	19535	0.626	5:15:14 5:15:18
051529	18535	0.634	5:16:25 5:15:31
051534	18313	—	5:15:32 5:15:39
*051540	17646.6	0.630	

051546	173	0.640		15:40	5:15:47
051603	16313	0.660		5:16:2	5:16:5
*051608	16202	—			
051612	16091	0.658		5:16:6	5:16:12
051629	16313	0.582		5:16:29	5:16:33
*051635	16758	0.550			
051640	16980	0.528		5:16:34	5:16:41
051645	17091	0.514	←	5:16:43	5:16:51
*051716	16757.8	0.510			
051721	16536	0.518		5:17:15	5:17:22
051730	16202	0.526		5:17:23	5:17:30
*051734	16091	0.528			
051739	15980	0.530		5:17:31	5:17:40
*051743	15869	0.532		8	
051748	15647	0.536		5:17:41	5:17:50
051758	15313.5	0.530		5:17:51	5:17:58
051804	15202	—		5:17:59	5:18:6
051810	14980	0.526		5:18:7	5:18:14
*051815	14869	0.518			
051820	14758	0.508		5:18:15	5:18:24
051830	14313.6	0.502		31:23:46	5:18:34
*051834	14091	—			
051851	13314	0.498		21:20:46	5:18:52
051857	12980	0.504		5:18:53	5:19:0
051904	12758	0.508		5:19:1	5:19:9
*051910	12536	0.510			
051914	12424	—		5:19:10	5:19:16
051925	12314	0.496		5:19:25	5:19:31
051935	12203	0.488		5:19:32	5:19:41
*051944	12092	0.478			
051948	11980.5	0.476		5:19:42	5:19:49
051952	11869	0.474		5:19:51	5:19:57

052000	11647	—		5:20:0	5:20:?
*052008	(18313)	0.470			
052030	10758	0.474		5:20:27	5:20:34
*052305	10536	0.480			
052092	10314	0.486		5:20:38	5:20:42
052053	10092	0.490		5:20:52	5:21:0
*052111	9980.7	0.466			
052117	9869.6	0.468		5:21:10	5:21:17
052129	10091.8	0.460	←	5:21:26	5:21:32
052135	10314	0.452		5:21:34	5:21:39
052149	10758	0.438		5:21:46	5:21:52
052156	10869.5	0.414		5:21:53	5:21:59
052207	10758	0.406		5:22:0	5:22:7
052212	10314	0.410		5:22:8	5:22:16
052219	9869.6	0.442		5:22:17	5:22:24
*052225	9425	0.468			
052231	9092	0.476		5:22:25	5:22:32
052237	8870	0.472		5:22:33	5:22:38
052243	8758.6	0.462		5:22:39	5:22:43
*052250	8536.4	0.446			

~~05 22 50~~
68 13 60
―――――
9 50

TIME			
FROM	TO	ALT.	MACH
5:1:15	5:1:18	—	0.146
5:1:19	5:1:22	—	0.146
5:1:23	5:1:25	—	0.172
5:1:26	5:1:28	—	0.172
5:1:29	5:1:32	—	0.204
5:1:33	5:1:35	537.20	0.216
5:1:36	5:1:39	537.20	0.234
5:1:40	5:1:44	648.30	0.246
5:1:45	5:1:49	648.30	0.246
5:1:50	5:1:53	870.50	0.256
5:1:54	5:1:59	981.60	0.258
5:2:0	5:2:5	1203.80	0.264
5:2:7	5:2:9	1426.00	0.266
5:2:10	5:2:13	1648.20	0.272
5:2:14	5:2:20	1870.40	0.272
5:2:21	5:2:27	2426.90	0.276
5:2:28	5:2:35	2759.20	0.276
5:2:36	5:2:43	3203.60	0.284
5:2:44	5:2:52	3536.90	0.296
5:2:53	5:3:1	3870.20	0.314
5:3:8	5:3:11	4314.60	0.326
5:3:12	5:3:20	4647.90	0.332
5:3:21	5:3:30	5092.30	0.330
5:3:31	5:3:38	5536.70	0.340
5:3:39	5:3:45	5647.80	0.342
5:3:46	5:3:52	5981.10	0.350
5:3:53	5:4:2	6425.50	0.360
5:4:3	5:4:13	7092.10	0.364
5:4:14	5:4:22	7647.60	0.372
5:4:23	5:4:32	7980.90	0.378
5:4:33	5:4:43	8314.20	0.378
5:6:2	5:6:5	8314.20	0.378
5:5:6	5:5:16	9869.60	0.390
5:5:17	5:5:27	10091.80	0.406
5:5:28	5:5:37	10536.20	0.422

TIME FROM	TO	ALT	MACH
5:5:38	5:5:49	10969.50	0.430
5:5:50	5:6:0	11536.10	0.434
5:6:1	5:6:11	11869.40	0.432
5:6:12	5:6:22	12313.80	0.438
5:6:23	5:6:33	12758.20	0.446
5:6:34	5:6:43	12980.40	0.456
5:6:55	5:6:57	13535.90	0.452
5:7:38	5:7:48	15091.30	0.478
5:7:50	5:7:59	15202.40	0.484
5:8:0	5:8:13	15646.80	0.494
5:8:14	5:8:23	15980.10	0.502
5:8:24	5:8:35	16535.60	0.502
5:8:36	5:8:48	16868.90	0.502
5:8:49	5:8:59	17091.10	0.506
5:9:1	5:9:10	17535.50	0.506
5:9:11	5:9:21	17979.90	0.506
5:9:22	5:9:27	18202.10	0.506
6:9:34	6:9:45	18535.40	0.512
5:9:46	5:9:57	18868.70	0.522
5:9:58	5:10:8	19090.90	0.530
5:90:9	5:10:21	19424.20	0 536
5:10:22	5:10:31	19757.50	0.540
5:10:33	5:10:42	20090.80	0.542
5:10:43	5:10:54	20424.10	0.542
5:11:7	5:11:14	20424.10	0.542
5:11:15	5:11:25	20979.60	0.544
6:11:26	5:11:36	21312.90	0.564
*9:30:11	4:62:40	21312.90	0.554
5:12 7	5:12:17	21979.50	0.590
5:12:18	5:12:22	22090.60	0.590
5:12:23	5:12:26	22201.70	0.594
5:12:27	5:12:34	22261.70	0.594
6:12:35	5:12:41	22423.90	0.598
5:12:42	5:12:52	22646.10	0.602
5:12:53	5:13:0	22868.30	0.602

TIME FROM	TO	ALT	MACH
5:13:1	5:13:9	22979.40	0.608
5:13:10	5:13:17	23201.60	0.610
5:13:18	5:13:19	23201.60	0.610
* 5:13:20	7:63:63	23201.60	0.610
* 2:16:22	5:13:27	23201.60	0.610
5:13:28	5:13:34	23423.80	0.606
5:13:35	5:13:41	23423.80	0.610
5:13:42	5:13:49	23312.70	0.620
5:13:50	5:13:56	22979.40	0.638
5:13:57	5:14:2	22757.20	0.648
5:14:3	5:14:11	22312.80	0.664
5:14:12	5:14:16	22312.80	0.664
5:14:18	5:14:23	21868.40	0.680
5:14:24	5:14:29	21757.30	0.682
5:14:30	5:14:34	21646.20	0.674
5:14:36	5:14:43	21424.00	0.654
5:14:44	5:14:51	21201.80	0.648
5:14:52	5:14:59	20868.50	0.640
5:15:0	5:15:7	20646.30	0.634
5:15:8	5:15:13	20090.80	0.632
5:15:14	5:15:18	19535.30	0.626
5:15:19	5:15:24	18979.80	0.630
5:15:25	5:15:31	18535.40	0.634
5:15:32	5:15:39	18313.20	0.634
5:15:40	5:15:47	17313.20	0.640
* 5:15:48	17:32:31	17313.20	0.640
5:15:56	5:16:1	16646.70	.656
5:16:2	5:16:5	16313.40	0.660
5:16:6	5:16:12	16091.20	0.658
5:16:13	5:16:18	16091.20	0.648
5:16:19	5:16:23	16091.20	0.648
5:16:24	5:16:28	16091.20	0.620
5:16:29	5:16:33	16313.40	0.582
5:16:34	5:16:41	16980.00	0.528
5:16:43	5:16:51	17091.10	0.514

TIME FROM	TO	ALT	MACH
5:16:52	5:16:58	17091.10	0.500
*5:17:2	5:17:2	17091.10	0.500
5:17:15	5:17:22	16635.60	0.518
5:17:23	5:17:30	16202.30	0.526
5:17:31	5:17:40	15980.10	0.530
5:17:41	5:17:50	15646.80	0.536
5:17:51	5:17:58	15313.50	0.530
5:17:59	5:18:6	15202.40	0.530
5:18:7	5:18:14	14980.20	0.526
5:18:15	5:18:24	14758.00	0.508
*31:23:46	5:18:34	14313.60	0.502
5:18:35	5:18:40	13980.30	0.502
*21:20:46	5:18:52	13313.70	0.498
5:18:53	5:19:0	12980.40	0.504
5:19:1	5:19:9	12758.20	0.508
5:19:10	5:19:16	12424.90	0.510
5:19:17	5:19:24	12424.90	0.504
5:19:25	5:19:31	12313.80	0.494
5:19:32	5:19:41	12202.70	0.482
5:19:42	5:19:49	11980.50	0.476
5:19:51	5:19:57	11869.40	0.472
5:20:0	5:20:8	11647.20	0.472
5:20:10	5:20:16	11647.20	0.472
5:20:20	5:20:26	10980.60	0.472
5:20:27	5:20:34	10758.40	0.474
5:20:35	5:20:42	10314.00	0.486
5:20:43	5:20:51	10314.00	0.490
5:20:52	5:21:0	10091.80	0.480
5:21:1	5:21:8	10091.80	0.470
5:21:10	5:21:17	9869.60	0.468
5:21:18	5:21:25	9869.60	0.470
5:21:26	5:21:32	10091.80	0.460
5:21:34	5:21:39	10314.00	0.452
*7:43:46	5:21:43	10314.00	0.452
5:21:46	5:21:52	10758.40	0.438

TIME FROM	TO	ALT	MACH
5:21:53	5:21:59	10869.50	0.414
5:22:0	5:22:7	10758.40	0.406
5:22:8	5:22:16	10314.00	0.410
5:22:17	5:22:24	9869.60	0.442
5:22:25	5:22:32	9091.90	0.476
5:22:33	5:22:38	8869.70	0.476
5:22:39	5:22:43	8758.60	0.462
5:22:44	5:22:49	8758.60	0.462
5:22:50	5:22:56	8425.30	0.434
5:22:58	5:22:59	8425.30	0.434
5:23:9	5:23:11	8425.30	0.434
5:23:12	5:23:18	7647.60	0.434
5:23:19	5:23:25	7203.20	0.442
5:23:26	5:23:32	7092.10	0.442
5:23:33	5:23:38	6981.00	0.438
5:23:39	5:23:43	6758.80	0.426
5:23:44	5:23:50	6758.80	0.422
5:23:51	5:23:56	6425.50	0.414
5:23:57	5:24:6	6092.20	0.410
5:24:7	5:24:14	5981.10	0.412
5:24:15	5:24:19	5870.00	0.416
5:24:22	5:24:30	5536.70	0.442
5:24:31	5:24:38	5425.60	0.438
5:24:39	5:24:45	5425.60	0.426
5:24:46	5:24:52	5314.50	0.414
5:24:53	5:24:58	5314.50	0.418
5:25:0	5:25:3	5314.50	0.418
5:25:4	5:25:9	5203.40	0.384
5:25:10	5:25:15	5092.30	0.380
5:25:16	5:25:23	4759.00	0.418
* 5:25:24	30:64:41	4425.70	0.446
5:25:34	5:25:37	4314.60	0.452
5:25:38	5:25:42	4314.60	0.442
5:25:43	5:25:47	4314.60	0.426
5:25:48	5:25:53	4314.60	0.400

TIME FROM	TO	ALT	MACH
5:25:54	5:26:2	4203.50	0.380
5:26:3	5:26:9	4092.40	0.384
5:26:10	5:26:14	3759.10	0.416
5:26:15	5:26:21	3648.00	0.434
5:26:22	5:26:25	3648.00	0.434
5:26:26	5:26:31	3648.00	0.412
30:27:63	5:26:35	3648.00	0.412
5:26:36	5:26:35	3648.00	0.412
5:26:42	5:26:46	3648.00	0.388
5:26:47	5:26:49	3536.90	0.382
5:26:50	5:26:54	3536.90	0.384
5:26:55	5:26:58	3536.90	0.384
5:26:59	5:27:4	3536.90	0.384
5:27:5	5:27:8	3648.00	0.384
5:27:9	5:27:13	3536.90	0.378
5:27:14	5:27:17	3425.80	0.378
5:27:19	5:27:23	3425.80	0.382
30:7:47	0:16:0	3425.80	0.382
5:27:30	5:27:34	3648.00	0.384
5:27:35	5:27:39	3648.00	0.384
5:27:39	5:27:43	3536.90	0.356
5:27:44	5:27:49	3425.80	0.340
5:27:50	5:27:55	3203.60	0.344
5:27:56	5:27:59	2870.30	0.390
5:28:0	5:28:2	2870.30	0.390
5:28:3	5:28:6	2537.00	0.412
5:28:7	5:28:10	2537.00	0.412
5:28:11	5:28:14	2314.80	0.444
* 31:59:61	31:59:61	2314.80	0.444
5:28:20	5:28:23	2314.80	0.444
5:28:24	5:28:27	1870.40	0.416
5:28:28	5:28:31	1426.00	0.420
5:28:32	5:28:34	1426.00	0.420
5:28:35	5:28:37	981.60	0.432
5:28:39	5:28:42	981.60	0.432

TIME			
FROM	TO	ALT	MACH
6:28:43	5:28:45	648.30	0.424
5:28:49	5:28:50	537.20	0.410
5:28:51	5:28:52	537.70	0.410

HAIGHT, GARDNER, POOR & HAVENS
FEDERAL BAR BUILDING
1819 H STREET, N. W.
WASHINGTON, D. C. 20006
CABLE: MOTOR WASHINGTON
WU: TELEX 892598
TELEPHONE (202) 737-7847

April 18, 1980

BY HAND

Oren R. Lewis, Jr., Esq.
Lewis, Wilson, Lewis & Jones
2054 North 14th Street
Arlington, Virginia 22216

FFAC v. Lockheed Aircraft Corporation
Our file 2041-1278-2S

Zimmerly v. Lockheed Aircraft Corporation
Our file 2041-1278-5B

Dear Oren:

Pursuant to plaintiffs' Notice to Produce Physical Evidence at Trial and subpoena thereon and defendant's Motion to Quash that subpoena and notice, we appeared before the Court on Tuesday, April 15, 1980 to move to quash that subpoena. The judge extended the subpoena through the end of this week and asked that a report be given by Friday of this week on the documents requested in the Notice to Produce.

With respect to those categories, the judge has already ruled in the negative denying requests as to categories (6) and (8). As to the following categories we make the following production:

(1) We hereby provide seven black-and-white slides not pertaining to the crash scene and therefore they are not within your request for production in the surviving orphans cases. These slides appear to have to do with the ramp portion and ramp locking system of the aircraft and do not appear to be taken at the scene of the crash. Nevertheless, we are making them available to you for your review in Court so that if you

wish copies made of them you should advise us and we will do so.

(2) Lockheed has no such documents pertaining to autopsies, death certificates, etc. except those produced by the government.

(3) The Collateral Investigation was conducted solely by the Air Force and Lockheed has no documents relating thereto except the Collateral Report itself, which has previously been produced to plaintiffs' counsel.

(4) Except for the document prepared by Lockeed with respect to G-forces which has previously been listed as within attorney work product and except as to G-forces information contained in MADAR data already produced or produced today and John Edwards' formula for G-forces as to which Mr. Edwards was prepared to testify at trial but was not requested to do so, defendant knows of no other documents relating to G-forces generated on or in C-5A 68-218.

(5) Defendant is making available to plaintiff a magnetic tape copy of the MADAR tape from AF 68-218; a total "dumpout" in octal form prepared at the request of trial counsel last week in light of plaintiffs' inquiries concerning MADAR data; and eight pages of computation made by Lockheed from MADAR data on AF 68-218 on April 4, 1975 which we may have already given to you. All other documentation in defendant's possession with respect to MADAR on the April 4, 1975 AF 68-218 flight in issue herein has been produced to defendant's knowledge.

(7) Defendant is making available for inspection at our offices or use in Court only a model of the C-5A aircraft and the model of the C-5A used in the wind-tunnel test conducted by Professor Harper as previously agreed in Court on April 15, 1980.

(9) Other than documents already produced, defendant knows of no documents pertaining to

(a) the manner in which C-5A 68-218 broke apart after the second impact on April 4, 1975 near Saigon, South Vietnam;

(b) the nature of the forces and the expenditure of energy associated with such break-up of C-5A 68-218;

(c) the manner in which a C-5A would break up upon a crash landing; and

(d) the nature of the forces in the expenditure of energy associated with the break-up of a C-5A upon a crash landing.

As to categories (c) and (d) defendant knows of no Lockheed documents pertaining to same but is continuing its inquiry.

Sincerely yours,

Carroll E. Dubuc

Enclosures

cc: Honorable Louis F. Oberdorfer
James P. Piper, Esq.

TIME	VA/CG	LAT/CG
5:28:49.55	0.52	-0.37 * MIN
.60	0.16 * (.54) MIN	0.01
.65	1.01	0.38
.70	NR	0.03 ~~0.02~~
.75	0.40	0.18
.80	0.61 MAX	-0.04
.85	1.37 * (.37)	0.13
.90	NR	0.23
.95	0.99	0.28
5:28:50.00	0.55	0.45* MAX
.05	NR	0.40
.10	0.39	0.27
.15	0.54	0.12 ~~0.23~~
.20	0.77	0.15
.25	1.18	NR
.30	NR	0.25
.35	0.85	0.12
.40	0.53	0.05
.45	0.70	0.23
.50	0.98	0.29
.55	1.17	0.13
.60	1.21	0.10
.65	NR	0.26
.70	1.17	0.30
.75	1.03	0.24
.80	0.96	0.30
.85	1.25	0.27 NOT SHOWN
.90		~~[illegible]~~ +0.16

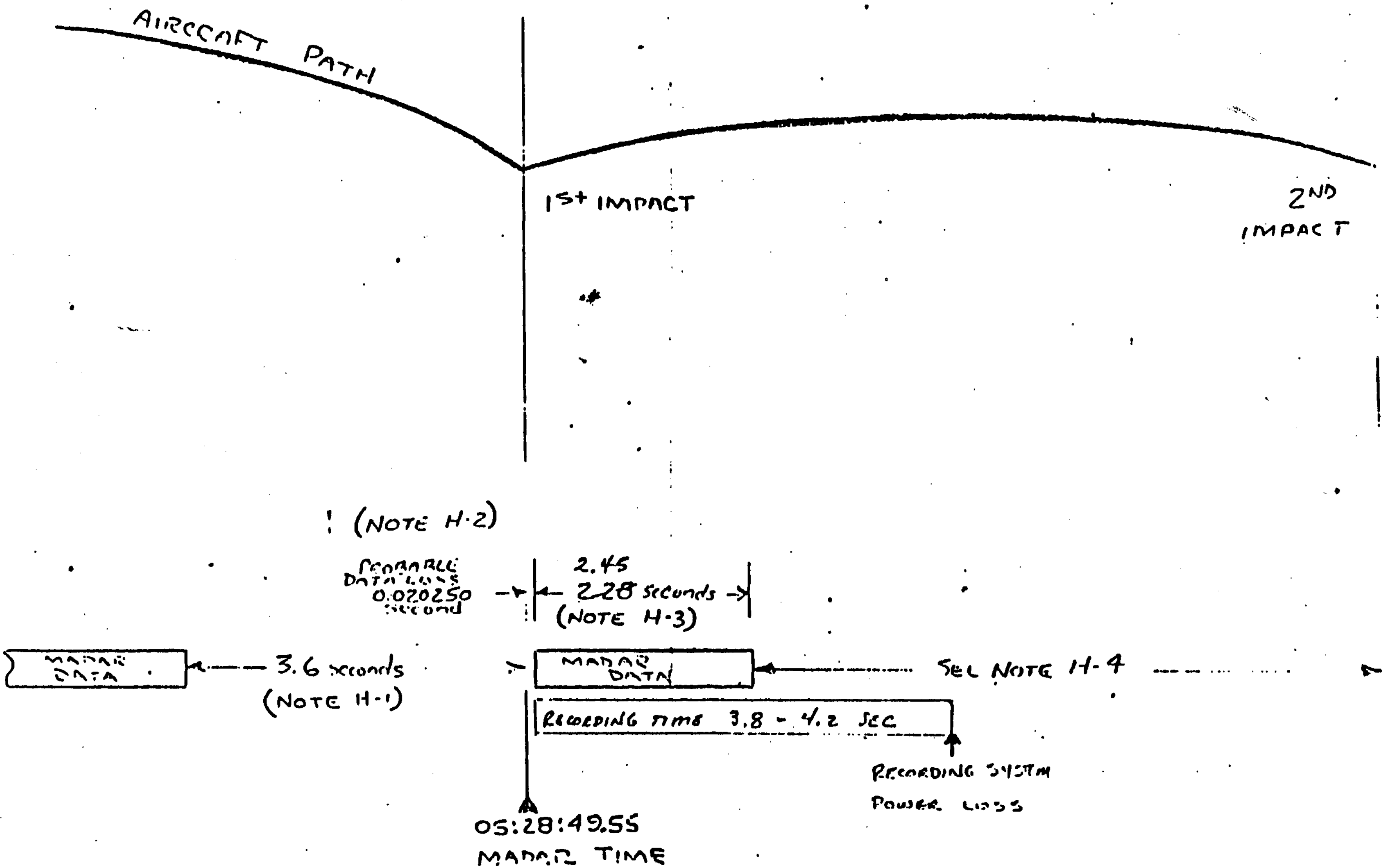
TIME	VA/CG	LAT/CG
.95	1.13	NR
5:28:51.00	1.05	0.09
.05	0.95	0.18
.10	1.03 ~~1.33~~	0.15 ~~0.13~~
.15	NR	NR
.20	NR	0.20
.25	0.98 ~~1.01~~	0.16
.30	1.05	NR
.35	0.91	0.08
.40	NR	0.14
.45	1.02	0.24
.50	NR	0.17
.55	1.06	NR
.60	NR	0.13
.65	0.96	NR
.70	0.92	NR
.75	0.96	NR
.80	NR	NR
.85	1.07	0.10
.90	NR NOT SHOWN	NR ON TCL
.95	0.95	NR
5:28:52.00	NR	NR

LOCKHEED-GEORGIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

OCTAL X_1X_2 X_3X_4 X_5X_6 X_7X_8 X_9X_{10}	(X_3X_4) HEX	CON DEC	SEC/20	(X_5X_6) HEX	CON DEC	X_7 HEX	PCODE	X_8 HEX	DEC	(X_9X_{10}) HEX	CON DEC	COUNTS	ENGINEERING INTERPRETATION	PARAMETER
05 34 54 16 24	1C	14	14	2C	22	0	44	E	14	14	10	-22	22, DISENGAGED	INFLIGHT REFUEL
05 34 42 56 12	1C	14	14	22	17	2	35	E	14	0A	5	-27	-0.027 RAD/SEC²	PITCH ACCELERAT
05 36 14 16 22	1E	15	15	0C	6	0	12	E	14	12	9	-23✓	1.03 G'S	VA/CG
05 36 12 24 34	1E	15	15	0A	5	1	10	4	4	1C	14	78✓	0.24 G'S	LAT/CG
05 36 42 62 04	1E	15	15	22	17	3	35	2	2	04	2	34	0.034 RAD/SEC²	PITCH ACCELERATIO
05 40 14 16 02	20	16	16	0C	6	0	12	E	14	02	1	-31✓	0.96 G'S	VA/CG
05 40 12 26 17	20	16	16	0A	5	1	10	6	6	0F	0	96✓	0.30 G'S	LAT/CG
05 40 06 02 40	20	16	16	06	3	0	6	2	2	20	16	-208	537 FT	PRESS ALTITUDE
05 40 42 62 34	20	16	16	22	17	3	35	2	2	1C	14	46	0.046 RAD/SEC²	PITCH ACCELERAT
05 42 14 20 17	22	17	17	0C	6	1	12	0	0	0E	0	0✓	1.25 G'S	VA/CG
05 42 12 24 14	22	17	17	0A	5	1	10	4	4	0C	6	70✓	0.22 G'S	LAT/CG
05 42 56 20 64	22	17	17	2E	23	1	46	0	0	34	26	-26	-26, NOT DEPLOY	AIR DROP
05 42 42 56 66	22	17	17	22	17	2	35	E	14	36	27	-5	-0.005 RAD/SEC²	PITCH ACCELERAT
05 44 12 72 (22) 50	24	18	18	0A	5	0 (1)	10	A (2)	10 (2)	28	20	-76 (52)	-0.24 (+.16) G'S	LAT/CG
05 44 60 16 74	24	18	18	30	24	0	48	E	14	3C	30	-2	+2, UNKNEELED	FORWARD KNEEL
05 44 42 52 32	24	18	18	22	17	2	35	A	10	1A	13	-103	-0.103 RAD/SEC²	PITCH ACCELERAT
05 46 14 16 46	26	19	19	0C	6	0	12	E	14	26	19	-13✓	1.13 G'S	VA/CG
05 46 10 14 12	26	19	19	08	4	0	8	C	12	0A	5	-59	0.41	MACH NO.
05 46 42 46 56	26	19	19	22	17	2	34	6	6	2E	23	-137	137, RETRACTED	GROUND SPOILER
05 50 14 16 26	28	20	20	0C	6	0	12	E	14	16	11	-21✓	1.05 G'S	VA/CG
05 50 12 20 74	28	20	20	0A	5	1	10	0	0	3C	30	30✓	0.09 G'S	LAT/CG
05 50 62 16 74	28	20	20	32	25	0	50	E	14	3C	30	-2	2, UNKNEELED	LEVEL KNEEL
CLOCK MESSAGE	27	175	262 46	SKIP TO NEXT SLRP MESSAGE (05 FLAG).										
05 02 14 16 17	02	1	1	0C	6	0	12	E	14	0F	0	-32✓	0.95 G'S	VA/CG
05 02 12 22 62	02	1	1	0A	5	1	10	2	2	32	25	57✓	0.18 G'S	LAT/CG
05 02 42 50 70	02	1	1	22	17	2	35	8	8	38	28	-100	-0.100 RAD/SEC²	PITCH ACCELERATIO
05 04 14 16 22	04	2	2	0C	6	0	12	E	14	12	9	-23 9	1.33 (1.03) G'S	VA/CG
05 04 12 22 27 (40)	04	2	2	0A	5	1	10	2	2	17 (20)	10 (16)	48 42	0.73 (0.13) G'S	LAT/CG
05 04 42 34 46	04	2	2	22	17	2	35	C	12	26	19	-45	-0.045 RAD/SEC²	PITCH ACCELERATIO
05 06 42 56 66	06	3	3	22	17	2	35	E	14	36	27	-5	-0.005 RAD/SEC²	PITCH ACCELERA
05 10 12 24 04	08	4	4	0A	5	1	10	4	4	04	2	66	0.20 G'S	LAT/CG
[illegible]														

LOCKHEED-GEORGIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

OCTAL X_1X_2	X_3X_4	X_5X_6	X_7X_8	X_9X_{10}	(X_3X_4) HEX	CON DEC	SEC/20	(X_5X_6) HEX	CON DEC	X_7 HEX	P CODE	X_8 HEX	DEC	(X_9X_{10}) HEX	CON DEC	COUNTS	ENGINEERING INTERPRETATION		PARAMETER
05	10	42	60	30	08	4	4	22	17	3	35	0	0	18	12	12	0.018	RAD/SEC²	PITCH ACCELERAT
05	12	14	16	06	0A	5	5	0C	6	0	12	E	14	06 (3)	6	-26 (-27)	1.01 (0.98)	G'S	VA/CG
05	12	12	22	52	0A	5	5	0A	5	1	10	2	2	2A	21	53✓	0.16	G'S	LAT/CG
05	14	14	16	26	0C	6	6	0C	6	0	12	E	14	16	11	-21✓	1.05	G'S	VA/CG
05	14	30	26	44	0C	6	6	18	12	1	24	6	6	24	18	114	-14.7	DEG	RT AILERON POS.
05	16	14	14	70	0E	7	7	0C	6	0	12	C	12	38	28	-36✓	0.91	G'S	VA/CG
05	16	12	20	62	0E	7	7	0A	5	1	10	0	0	32	25	25✓	0.08	G'S	LAT/CG
05	20	12	22	30	10	8	8	0A	5	1	10	2	2	18	12	44✓	0.14	G'S	LAT/CG
05	22	14	16	16	12	9	9	0C	6	0	12	E	14	0E	7	-25✓	1.02	G'S	VA/CG
05	22	12	24	34	12	9	9	0A	5	1	10	4	4	1C	14	78✓	0.24	G'S	LAT/CG
05	22	42	60	54	12	9	9	22	17	3	35	0	0	2C	22	22	0.022	RAD/SEC²	PITCH ACCELERA
05	24	12	22	60	14	10	10	0A	5	1	10	2	2	30	24	56✓	0.17	G'S	LAT/CG
05	26	14	16	30	16	11	11	0C	6	0	12	E	14	18	12	-20	1.06	G'S	VA/CG
05	26	42	56	74	16	11	11	22	17	2	35	E	14	3C	30	-2	-0.002	RAD/SEC²	PITCH ACCELERA
05	30	14	16	16	18	12	12	0C	6	0	12	E	14	0E	7	-25✓	1.02	G'S	VA/CG
05	30	12	22	24	18	12	12	0A	5	1	10	2	2	14	10	42✓	0.13	G'S	LAT/CG
05	30	42	56	42	18	12	12	22	17	2	35	E	14	22	17	-15	-0.015	RAD/SEC²	PITCH ACCELERA
05	32	14	16	02	1A	13	13	0C	6	0	12	E	14	02	1	-31✓	0.96	G'S	VA/CG
05	34	14	14	72	1C	14	14	0C	6	0	12	C	12	3A	29	-35✓	0.92	G'S	VA/CG
05	36	14	16	02	1E	15	15	0C	6	0	12	E	14	02	1	-31✓	0.96	G'S	VA/CG
05	40	30	26	60	20	16	16	18	12	1	24	6	6	30	24	120	-15.2	DEG	RT AILERON PO
05	40	06	20	44	20	16	16	06	3	1	6	0	0	24	18	18	25646	FT	PRESS ALTITU
05	42	14	16	32	22	17	17	0C	6	0	12	E	14	1A	13	-19✓	1.07	G'S	VA/CG
05	42	12	22	17	22	17	17	0A	5	1	10	2	2	0F	0	32✓	0.10	G'S	LAT/CG
05	42	42	56	06	22	17	17	22	17	2	35	E	14	06	3	-29	-0.029	RAD/SEC²	PITCH ACCELERA
05	46	14	16	17	26	19	19	0C	6	0	12	E	14	0F	0	-32	0.95	G'S	VA/CG
CLOCK MESSAGE					27	17	52 62 50												


AIRCRAFT PATH
1st IMPACT
2ND IMPACT
(NOTE H-2)
PROBABLE DATA LOSS 0.020250 second
2.45
2.28 seconds
(NOTE H-3)
RADAR DATA
3.6 seconds
(NOTE H-1)
RADAR DATA
SEE NOTE H-4
RECORDING TIME 3.8 - 4.2 SEC
RECORDING SYSTEM POWER LOSS
05:28:49.55
RADAR TIME

WILLIAM TIMM & ASSOCIATES
Consulting Engineers
12 LAUREL HILL PLACE
ARMONK, N. Y. 10504

Peabody, Rivlin, Lambert & Meyer
1150 Connecticut Avenue, N. W.
Washington, D. C. 20036

ATTENTION: MR. CHARLES R. WORK

Mr. Irvin,

I am personally very sorry this has been so long getting to you.

Please have a nice Holiday Season!

Margaret Booth

[illegible]

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LEWIS, WILSON, LEWIS AND JONES, LTD.

OREN R. LEWIS, JR.*
ALEXANDER L. WILSON (1926-1977)
ROBERT W. LEWIS
RICHARD H. JONES*
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2054 NORTH FOURTEENTH STREET
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ARLINGTON, VIRGINIA 22216

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DISTRICT OF COLUMBIA OFFICE
SUITE 520
1629 K STREET, N. W.
WASHINGTON, D. C. 20006

CABLE: JETLAW AGTN

TELEX: 899142

TELECOPIER: 527-2807

June 27, 1980

William Timm, P.E.
12 Laurel Hill Place
Armonk, New York 10504

Dear Mr. Timm:

In accordance with your telephone conversation with John Fricker earlier today, enclosed herewith you will find our Interrogatories to the United States (identical Interrogatories were served on Lockheed) together with their Answer and AF Message 231936Z, which is referenced in Answer No. 2.

Sincerely,

Ellen

Ellen Mintz
Paralegal

EM/jan
Enclosures

LAW OFFICES

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TELECOPIER: 527-2807

August 4, 1980

William E. Timm
William Timm & Associates
12 Laurel Hill Place
Armonk, New Jersey 10504

Dear Bill:

Enclosed please find your personal copy of "Mach Number Functions and Altitude Tables" which you were kind enough to provide the Court. Thank you for your cooperation though be advised it is possible we may request its return for use in the upcoming appeals process or future trials.

Sincerely,

Marsha

Marsha Hoover

Enclosure

MMH/kgl

LAW OFFICES

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WASHINGTON, D.C. 20036

CABLE: JETLAW
TELEX: 899142

July 11, 1980

William Timm, P.E.
12 Laurel Hill Place
Armonk, New York 10504

Dear Bill:

In accordance with our telephone conversation, enclosed herewith you will find Lockheed's Response to our G-Force Interrogatories, together with documents referenced therein provided by Lockheed.

Other documents which are referenced but not attached are:

1. Telex 23 19362 APR 75, which I sent to you together with the United States' Response to these Interrogatories;

2. Tab T Summary to the Aircraft Accident Report, which you should already have. It is Liability Deposition Exhibit No. 1; and

3. CEI Spec. CP 40002-2B, which I spoke to you about on the phone.

As I indicated to you, these are original documents and we have no other copies, so we would appreciate having you return them as soon as you have completed your review.

Sincerely,

Ellen Mintz

Ellen Mintz

Enclosures

EM/kgl

LEWIS WILSON LEWIS JONES

1) Figure not located properly - example
Figure 3-26 mentioned on Page 3-3 + 3-4
is located on page 3-194 to 3-198 with A-B [illegible]

2- See Cautions on page 3-38

Go over section 3-81 - 3-82, 3-168
to 3-172

Review of Exhibits

Exhibit P.L #35 MEMO D.J. HOUGHTON 31 MAY 1972

Answer charges of mismanagement (?)

Copy Exhibit PL #36 MEMO J.W. EDWARDS TO D.O. GUNSON 4/15/7

Exhibit PL #37 Letter to San Antonio 12 JAN 76

LOCKHEED APEX STUDY

Page 50 Design Criteria

Exhibit PL #38 Lockheed Apex Study 8 OCT 75

Additional Redundancy + protection for flight Control power source

Exhibit PL #39 Lockheed Apex Study 21 JUL 75

Improvement and Protection of Flight Control System

Exhibit PL #40 C-5 management Realignment 2 MAY 1972

~~Copy~~ Exhibit PL #41 - M+R IN THE APEX STUDY FORWARD + AFT LOCKING SYSTEM
BRIEFING NOTE ON LOCKING SYSTEM

Exhibit PL #42 Aircraft 0021 (68-0218) Action Plan

Copy Exhibit PL #43 LOCKHEED APEX STUDY 15 JUL 75

Can't understand Basis of Conclusion Pg 41

Copy Exhibit PL #44 G. DOBSON TO D. O. GUNSON 4/11/75

Copy Exhibit PL #45 G. DOBSON TO D. O GUNSON 27 MAY 75

Copy Exhibit PL #46 G. A DOBSON TRIP REPORT 4 APR 75 TO 29 MAY 75

Copy Exhibit PL #47 TRIP REPORT W.R. GREENWOOD 21 APR 75

Copy Exhibit PL #48 Excerpts from bid proposal re safety

Safety evaluated by Computer - GOCO

Exhibit PL #49 TSAF No. R-2-17.0 MAINTAINABILITY PROGRAM PLAN.

Copy Exhibit PL #50 TECHNICAL DISCUSSION DOBSON.

Exhibit PL #51 Escape Descent Reels

Copy Exhibit PL 52 Cargo Door Subsystem

PL 53 Landing Gear Extension

PL 54 Flight Controls

PL 55 Nose Landing Gear

PL 56 Manually Operable Pressure Door [illegible]

PL 57 Aft Ramps and Safety Valve Installation

PL 58 FAA - STRUCTURAL TESTS 23OCT68

Item 4A - Has LOCKHEED considered all failure modes in the rudder system

answer No, not yet, but the failure analysis is being watched

PL 59 - FAA LTR - CERTIFICATION TEST 30 SEP 68

Item 3A - Plug type door only failsafe PAGE 2

PL 60 FAA LTR 12 SEP 68

PL 61 FAA LTR 30 JAN 68

PL 62 LTR TO A.F. FAA DEVIATION REPORT 22JAN6

PL 63 LTR TO FAA - LANDING GEAR 9JAN68

PL 64 G.A. DOBSON TRIP REPORT - ALTUS AFB 1FEB7[illegible] ON SIX STUDENTS - LITTLE VALUE

Copy PL 65 G.A. DOBSON TRAINING COURSE A DOVER, ETC 13FEB7[illegible]

Copy PL 66 Investigation of Aft Ramp Locking Mech. 3[illegible]

Copy PL 67 LTR. VERN HANNUM 8AUG74

~~Copy~~ Copy Notes from 64 are same as 69 PL 68 SUMMARY OF LOCKING SYSTEM FAILURES

Copy PL 69A Study to make locking system more foolproof

PL 69B Status of Program - locking system.

Copy PL 69E LOCKING SYSTEM FWD RAMP

Copy PL 70 W.M. PERRY TRIP REPORT TO KELLY AFB 3JUL75 LOCKS TEMPERATURE SENSITIVE.

PL 71 Excerpt of DOBSON NOTES

Copy Exhibit PL-72 APEX STUDY GROUP Failure Mode Analysis
Copy Exhibit PL-73 Summary Report of C-5A Accident
Exhibit PL-79- ship 21 - Delivered 09-04-70
PL 80- Simulation Study of C-5A Control system Failure
Copy PL-82 W.M PERRY TRIP REPORT AFT RAMP LATCH
Copy PL-82 AFT RAMP FAILURE ANALYSIS
Copy PL 85 TIE ROD FAILURES ← Conclusion NO.1 IMPORTANT
Copy PL 86 ASTM GUIDE TO FATIGUE TESTING

Material Received

	88	106
Read	89	109
	90	110
	96	
	97	111
	99	149

+ SYSTEM FAILURE EFFECTS ANALYSIS

(1)

DESCRIPTION OF EVENTS LEADING UP TO THE CRASH OF THE C-5 AIRCRAFT NEAR SIAGON ON APRIL 4, 1975

GENERAL

The C-5 aircraft is the largest aircraft ever built and has a wingspan of one football field in length. This aricraft was built to carry troops in the upper troop compartment and cargo in the lower compartment. (Use illustration of cutaway of aircraft) The lower troop compartment was also built to carry personnel in cases of emergancy. When personnel were to be x carried in the cargo compartment, palletized seats with portable oxygen equipment were to fastened to the floor of the cargo compartment. The aircraft that was utilized to transport the orphans out of Saigon on this ill-fated mission were not equiped with palletized seats in the cargo compartments.

HXXX HISTORY OF EVENTS OCCURRING ON AIRCRAFT 68-218 PRIOR TO LANDING AT SAIGON

The U.S. Air force had a policy in 1975 that all operational aircraft must be flown at least once every 30 days. During this period they were also having a logistical problem of obtaining sufficient spare parts to sufficiently maintain the C-5 aircraft. The policy of cannabalization was instituted to alleveate the spare part problem and enable the Air Force to continue to fly their aircraft every 30 days.

Aircraft 68-218 was in a cannabalized status from March ,3 1975 until April 1, 1975. Parts of the aft ramp x locking assembly had been cannabalized to provide spare parts for other aircraft. On March 24, 1975 these cannabalized tie rods were reinst~~ated~~ ALLED in this aircraft, and the rigging on this aircraft was verified on March 29, 1975.

Aircraft C-5A, Serial number 68-218 departed Travis Air Force Base 0647 Zulu April 1, 1975. to unload 105mm Howitzers at Warner-Robin Air Force base Georgia. The flight then continued to Travis Air Force base and then to Hickham Field Air Base, Anderson Base, and finally Clark Air Base, the Philipenes. Because of the high priority of this mission, this aircraft departed Hickham Field without fixing the co-pilot's windshield but took the part along to have it fixed at Clark Air base; this action avoided incurring another day of maintainence which would have delayed the departure of this aircraft. En route to Clark Air Base number two engine was shut down because it exceeded the vibration parameters on the MADAR; this maintainence work was performed at Clark and delayed the departure for the completion of this work. Number two engine was completely inspected and found that there was no sign of wear, therefore it was supposed that the MADAR was not reading correctly.

While this crew was at Clark Air base, President Ford made a televised announcement that the U.S. would begin an immediate air lift of orphans out of Saigon and named the C-5 aircraft as one of the carriers that would accomplish this mission. Following this announcement General Carlton had directed the next available C-5 aircraft to take the orphans out of Saigon. Aircraft number 68-218 was advised by the 22nd Air Force that they were to take out as many orphans and attendants as were ready to go and to floor load them as necessary. Necessary supplies and medical gear such as blankets, pillows, 500 milks, 500 juices, box lunches, baby bottles, etc. were collected and placed aboard the aircraft. Five members from the combined 9 and 10th Aeromedical Evacuation Group joined this aircraft for the flight to Saigon, Tan Son Nhut Air Base.

The aircraft departed Clark Air Force Base on April 4, 1975 at 0214 Zulu or 10:13 local time and arrived at Saigon on the same day at 0450 Zulu or 12:51 local time. At Saigon they were taxied to a parking spot on the diagonal taxi way heading north just in front of the tower.

STARTING OPERATION BABY LIFT

The crew members provided the security for the aircraft while it was on the ground during the off- and on-loading process. The 105 mm howitzers and recoilless rifles were off-loaded which took about an hour and then the orphans and their escorts, who were waiting on buses and cars near the aircraft, were started to load the aircraft. Initially the orphans were carried two by two by the escorts completely up the ladder near the aft loading ramp and placed in seats in the troop compartment. It was soon realized that this loading procedure was ineffective and the escorts made a ~~change~~ CHAIN to pass the babies up the ladder from one person to another. Most of the small children were loaded aboard the aircraft in the troop compartment.

To make maximum utilization of the space available, the ~~[illegible] [illegible]~~ ARM RESTS between the seats were removed and two babies were placed in each seat; the babies were then held in the seat by placing blankets and pillows over them and strapping them with the seatbelts. (Try to find photographs showing the loading of orphans on the aircraft) Most of the small children were accomodated in the troop compartment and where an older child was available, they were placed next to a young baby to help take care of the infant. One of the flight ~~nurse~~ nurses FROM THE ORIGINAL CREW and two of the medics were assigned to the troop compartment. In addition, members of another Medi Vac Team that arrived on a C-141 that was not going to fly out orphans, had requested and were assigned the C-5 aircraft to help with operation "baby lift." The location and distribution of this Medi Vac team is not known but it is assumed that two medics and one flight nurse were also assigned the troop compartment and one flight nurse and medic were assigned the cargo compartment.

Some of the escorts that were being stationed in the cargo compartment were requested to assist in the caring of the babies in the troop compartment. All the available seats were used to strap infants in the seats, and there were no seats available for the medical team, the escorts, or the crew members.

All the escorts and orphans that could not be accomodated in the troop compartment, were placed on the floor of the cargo compartment. Two layers of blankets were spread on the floor of the cargo compartment near the forward portion of the aircraft. The children were placed on the blankets and strapped down with cargo straps. Escorts were placed next to the smaller infants to help care for them. Some of the larger children and some of the escorts sat on benches on the sides of the cargo compartment. They were also strapped into these benches by straps that held groups of them together on the bench.

It was quite hot on the ground in Saigon during the loading process and many of the children were frightened and crying. The escorts and medical personnel were attempting to give the babies orange juice and water in an attempt to quiet them. This time was quite confusing and no reliable head count was made in the aircraft. Also there this no manifest or list of orphans that were placed aborad this aircraft.

As best as can be determined there were 145 orphans on board in the troop compartment of this aircraft along with 7 attendents; of this number 143 orphans survived the crash and 6 attendants survived the crash that were located in the troop compartment. It is estimated that 102 orphans were located in the cargo compartment along with 47 other people; 96 orphans are estimated to have perished in the cargo compartment along with 45 other people.

These numbers are based on the casualty report submitted by ~~Chief Warrant Officer~~ CWO-4 XXX Scott, and are the most reliable numbers that can be ascertained from this unfortunate incident. Exact numbers cannot be given because: there was no manifest of orphans, there was conflicting testimony of crew and other people in several categories, civilian attendants were moving around the aircraft while head counts was being done and may have been counted twice or not at all, several American children were on board and it could not be ascertained whether they were counted as orphans or civilian attendants. After the crash the exact number of survivors could not be counted because they were immediately taken to a number of hospitals and orphanages throughout Saigon, the counts of attendants in the troop compartment was confused because some of the attendants were going to from and cargo compartment. The exact number of remains of children were estimated at 93 but it was possible that there were more and if was difficult to determine at the time (18 April) because of the status of the remains.

At the arrival at Tan Son Nhut Air Base the cargo door was openned for the first time for off-loading since it was openned for the on loading at Warren-Robins Air Force Base. The takeoff weight 464,000lbs. and fuel weight of 96,200 lbs. was computed at Tan Son Nhut Air Base

At the last minute newsmen arrived on the scene and Lt Col. Mitchell asked if it was possible to take some pictures. One of the crew members escorted each camera crew and one at a time they proceeded up through the left troop door and through the cargo compartment and out the crew door. There are records of the television news film showing the start of this operation which was shown on American television just in time of the crash.

The aircraft took off from Saigon at 0501 Zulu or 16:03 local time on 4 april 1975. Everything proceeded in an orderly manner and the climb proceeded with all engines operating within limits. The aircraft climbed at 200 KIAS until approximately 16,000 feet and then began a slow acceleration to 270 knots indicated air speed. The air crew discussed the possibility of flying at 37,000 feet due to bad weather off the coast of Saigon, but because of the oxygen requirement in the case of rapid decompression it was planned to proceed to Clark Air Force Base at 33,000 feet. It is noted that there was no oxygen available for the personnel traveling in the cargo compartment. The aircraft proceeded on course to Vung Tau radio beacon and approximately three minutes past Vung Tau at 0513 Zulu the aircarft was traveling a .610 Mach at an altitude of 23,424 feet. At this point a rapid decompressuion occurred.

RAPID DECOMPRESSION

The causes and complete sequence of the rapid decompression will be discribed without attempting to define the exact cause and sequence which intiated this failure. Experts reports claim it occurred in the locking system of the aft ramp. Whether it was a failure of locks one and two or any other pairs of locks is unimportant at this time. The failure of the locking system caused the ramp to lower slightly which then caused the pressure door to become disconnected from the ramp. The pressure within the cargo compartment forced the pressure door to rotate about its upper hinge position and crash into the ~~talking~~ TORQUE deck with a violent impact which ruptured the hydraulic systems lines in systems ONE and TWO and ruptured the control cables which control both the elevators and rudders of this aircraft.

Approximately 65,800 cubic feet of air flew out of the rear cargo compartment doorway at sonic velocity in a matter of a few seconds. Normal atmospheric pressure at sea level is 29.92 inches of mercury if the cabins were pressurized to an equavlent altitude of 6,000 feet, the interior atmospheric pressure would have been reduced to 23.98 inches of mercury. This pressure suddenly dropped to 11.88 inches of mercury. The effects of this decompression of quite dramatic and observed in the crews' and other witness' testimony of a fog existing in the cabin immediately upon decompressiom. They also described the floating particles which appearred to be like exploding diapers in the atmosphere. This description can be quite accurate because any material which could entrap and hold air and was not completely permeable would tend to expand rapidly and possibly explode upon the sudden reduction in pressure. Materials like cellular insulation, which contains closed cells would explode on this rapid decompression.

The sequence would start with what would appear to be an explosion or a loud bang or report at the point of time which the pressure door was forced from its hinges connecting the aft ramp and forced back into the ~~talk~~ TORQUE deck. It is possible that there could have been a hissing similar to a hole in a tire which is reflating rapidedly, just prior to the actual decompression. This hissing sound would initially occur from the leakage of air from around the seals of the aft ramp as it tends to deform and break away from the aircraft because of the lcoking mechanism failure. Personnel in the aircraft during sudden decompression could experience extremely painful ears because of the unequalization of pressure exerted from the inside of the body out. An experience similar to this but in reverse is the pain that some individuals can experience when a aircraft descends rapidly during an approach for a landing. During this sudden decompression there would be no opportunity to equalize the pressure inside the ear drums with the pressure that was being lowered to in the environment.

When the rapid decompression occurred there was a complete loss of oxygen in the cabin and if personnel were not supplied with oxygen promptly, they would slowly pass out in time periods as short as 20 seconds. Upon loss of cabin pressure the oxygen masks were deployed out of the cabinets in the troop compartments, unfortunately there was no oxygen supply for the personnel in the cargo compartment. So it is obvious that all these individuals would lose concesness during the subsequent decent of the aircraft. The discription of what occurred, from one of the surviving witnesses in the cargo compartment. Sgt. Philip R. Wise, it is apparant that personnel in the cargo compartment did not regain conscesness during the decent of this aircraft. They were all suffering Hypoxia and Sgt. Wise's testimony did not recall any impact or anything further after he hit the deck and grabbed on to a cargo tie down strap.

It should be remembered that the large volume of air which was flowing out the openning the aircraft would carry any particles or personnel within the vincinty out the openning. It is reported that Donald Dionne was thrown from the aircraft at the rapid compopression from his location in the cargo compartment. Most of the luggage, which was stored on the off-ramp also blew out of tha aircraft at the decompression. It is not known whether any of the orphans were lost at this time. Because of the lack of an exact count of the number of orphans or personnel, besides the crew, on this aricraft, it is impossible to ascertain if any of the passangers where lost during decompression. Sgt. Howard Perkins, load master, was on the air ramp ladder leading to the troop compartment at the time of decompression. The lower portion of this ladder was torn away and Sgt. Perkins was only saved by crew members holding on to him and pulling him up into the troop compartment.

All the personnel in the cargo compartment would slowly become unconscious from hypoxia. Personnel in the troop would also become unconscious from hypoxia unless they donned oxygen maskes. It should be remembered that there were twice as many orphans sitting in the seats as there were oxygen masks. Each group of seats had only three oxygen masks and there were 6 orphans sitting in the seats. The oxygen masks would not fit on the infants and the infants would tend to push the mask off their face. The escorts and crew had to don some of these oxygen masks so that they would remain concious and would be able to assist the infants. The oxygen masks the crew and escorts used further reduced the oxygen masks to the infants strapped in the seats. It is reported that the oxygen masks did not reach the level of the infants strapped in the seats, and it was necessary for the medical crew and escorts to lift the babies up to the oxygen masks to give them oxygen. It was not possible to provide the infants with oxygen during this period of decompression and many of the escorts and medical personnel stated that they just gave oxygen to the infants that appeared to need it most. It is noted that all the infants became very quiet during this panic period which is contrary to what would be expected. The only reasoning for this lack of crying and general commotion would be that the infants were suffering from hypoxia and drifting off into ~~unconsecciousness.~~ unconsciousness The testimony of all the crew members that were in the troop compartment, stated that the infants were quiet even after impact.

The aircraft had to descend from 23,424 feet to 10,000 before oxygen would no longer be required.

CONTROL OF THE AIRCRAFT AFTER DECOMPRESSION

Upon the rapid decompression the pilot turned left and made a slow descending left turn back to Saigon. Immediately after the turn the pilot realized that he had lost control of the elevators and rudders of the aircraft, the engineer had immediately reported the loss of number two hydraulic pressure after the rapid decompression and the loss of number one hydraulic system while he was trying to pressurize from the other systems. The loss of number two and number one hydraulic systems caused the lose of all trim controls that provide power for the elevator and rudders and also losing power to the left aileron and half the power of the right aileron and flight ~~psielers~~ spoilers on each wing and one of the two systems that powers the flaps and slats. The aircraft had lost all control to control its attitude and rate of descent. His only control was the control surfaces of the right aileron and the left spoiler. The pilot was descending rapidly and had to apply power to reduce the rate of descent. And the aircraft was controlled by controlling the throttle to the engines as well as using the right aileron and left spoiler to maintain the aircraft level. The prime source of hydraulic power to the landing gears were also lost and the emergancy extension of the landing gears was necessary. The landing gears were initially attempted to be lower when the aircraft was at 10,000 feet and was only completed a few seconds before impact. In the turn to the final 7 or 8 miles from the end of the runway, the nose pitched down rapidly and the addition of maximum throttle would not bring the nose back up. The pilot then decided to take the aircraft straigth ahead towards an open area and was expecting to recover from the nose low attitude as he had done before. The aircraft initially impacted on the east side of the Saigon river and strue a path of debris approximately 400 yards long. The aircraft then became airborne and traveled approximatley 1,100 yards from the point of the first touchdown over the bank and onto the west side of the Saigon river. Upon the second impact the aircraft started to break up and sections of the aircraft were covered over another 1,000 yards area. The cargo section floor stuck in the mud approximately 1,400 yards from the point of initial impact. The troop compartment traveled a distance of 750 yards from the point initial impact and the flight deck traveled approximately 800 yards from the point of initial impact. The section that traveled the furthest was the wing section and that section started to burn. These distances are shown on the pictorial sketch showing the crash diagram.

It should be remembered that the personnel in the cargo section were probably ~~concensioud~~ unconscious from hypoxia and never knew the plane impacted at all. Most of the deaths occurred from personnel located in the cargo compartment. The troop compartment separated from the cargo compartment and traveled an additional 350 yards. Some of the infants were thrown free from the seats in which they were bound and some seats were overturned. There were injuries to personel who were not properly braced for the impact but the number of casualties in this section were minimum. From the description of the crew members and escorts most of the babies appeared to come through the impact with only minor injuries. This assumption can also be based on the fact that many of the infants may also still been unconscious from hypoxia because oxygen masks could not be lowered down to them during the period of lack of oxygen after the rapid decompression. The medical experts will describe the individuals injuries of the orphans and relate the actual causes of these injuries.

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August 27, 1980

Mr. William Timm, P.E.
12 Laurel Hill Place
Armonk, New York 10504

Dear Mr. Timm:

The C5A litigation is still moving along and there have been some recent developments about which we feel you should be informed. There has been a sum of three trials which have been completed as of this date: Schneider, Zimmerly and Marchetti. The Schneider and Marchetti cases are on appeal. The Zimmerly case was granted a retrial when the judge granted our motion for a new trial on July 8. This was a tremendous achievement in light of the fact of the zero verdict in the case. The importance of this new trial is underscored by the fact that the verdict in the original trial was so grossly out of line with what we believe should be a fair resolution of James Zimmerly's claim.

Because we have another chance to go to bat for James, it is imperative that his case be retried with an effort no less than that of the original C5A trials. Accordingly, we must ask for your assistance in this cause. The purpose of this letter is two-fold: firstly, we request that you testify on James' behalf; secondly, we hope to give you as much prior notice as possible, in order to ease the burden upon you in terms of your personal schedule.

The retrial is tentatively scheduled for September 22nd. If this date remains true, then jury selection will begin on that date. If past is prologue, there will be change in this schedule. Nevertheless, we feel an obligation to give you as much information as we have available to us as soon as we become informed.

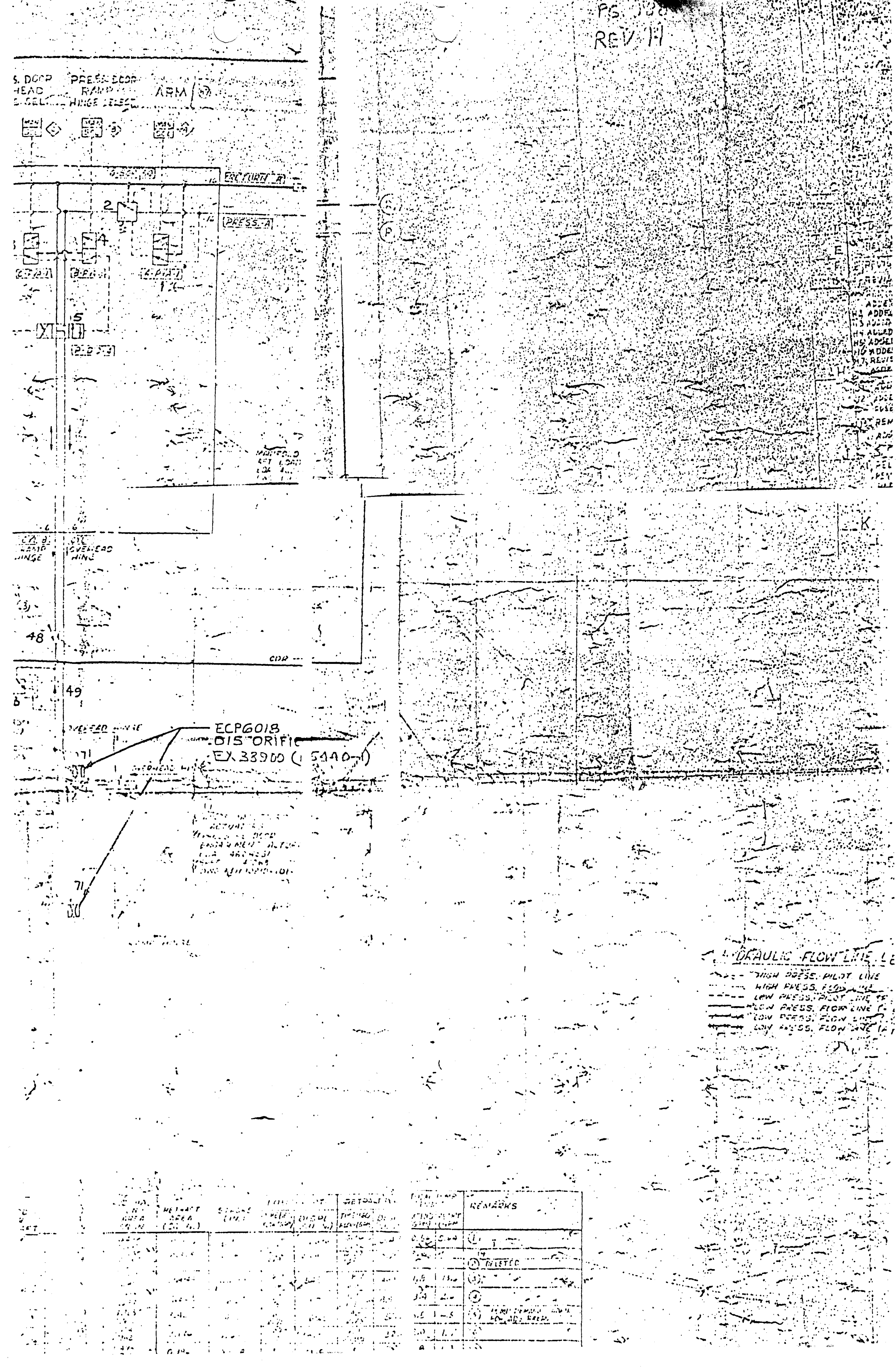
In order to assist me in ensuring that witnesses will be handled as effectively and courteously as possible, I have the aid of two assistants. Lena Natale, my medical assistant, and Peter Butt, my legal associate on this case, are both assigned to help us work together to complete our task of achieving a positive result in this case. Please feel free to contact Ms. Natale, Mr. Butt or myself should you have any questions.

Looking forward to seeing you in September, I remain,

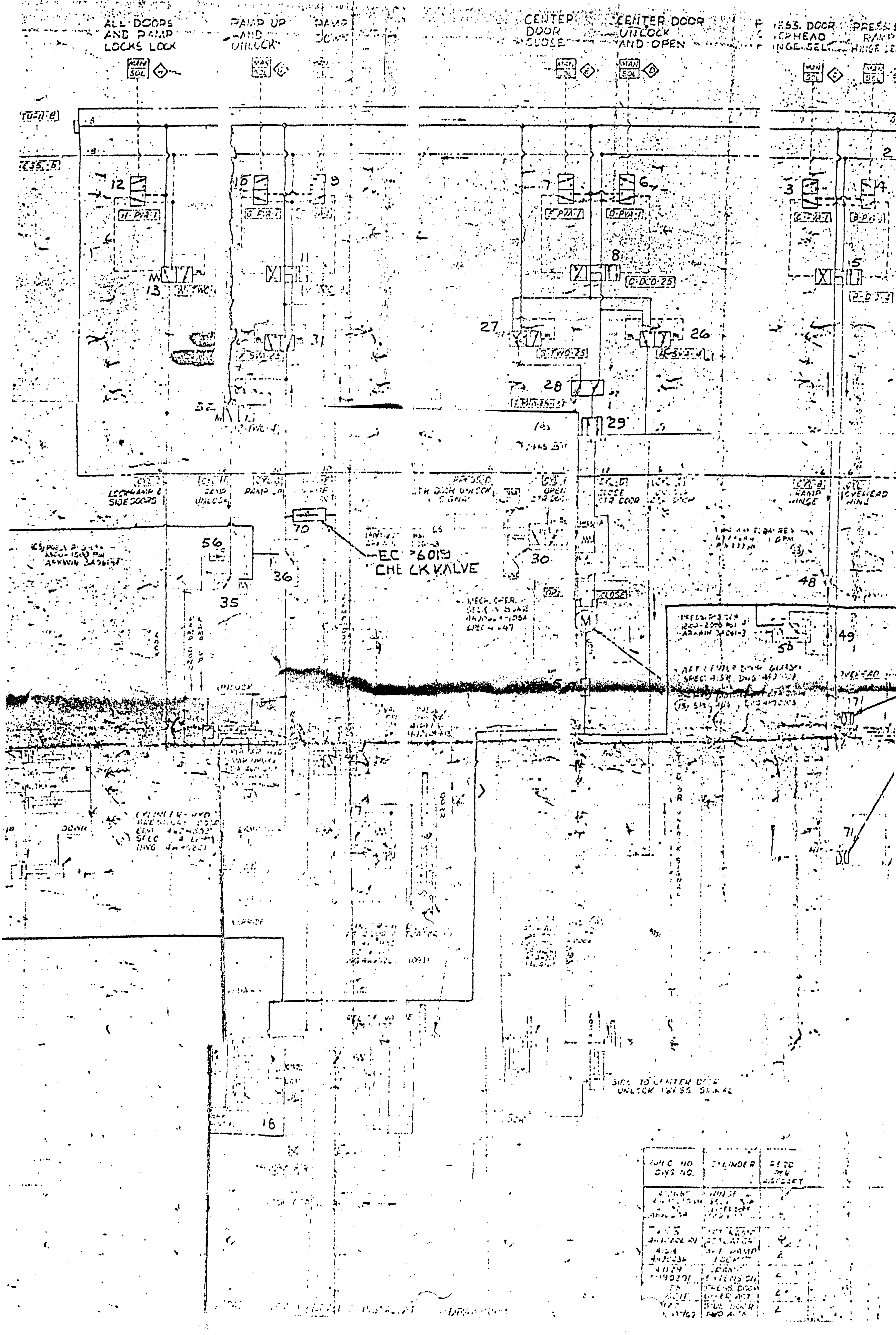
Very truly yours,

Michael Cohen / LN

Michael Cohen, M.D., Ph.D.



PS 038
REV H
S. DOOR HEAD SELECT
PRESS. DOOR RAMP HINGE SELECT
ARM
RETURN
PRESS.
ECP6018
DIS ORIFIC
EX 33900 (5440-1)
48
49
71
REMARKS
DELETED
HYDRAULIC FLOW LINE
HIGH PRESS. PILOT LINE
HIGH PRESS. FLOW LINE
LOW PRESS. PILOT LINE
LOW PRESS. FLOW LINE


ALL DOORS AND RAMP LOCKS LOCK
RAMP UP AND UNLOCK
CENTER DOOR CLOSE
CENTER DOOR UNLOCK AND OPEN
MAN SOL
12
13
10
9
31
7
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52
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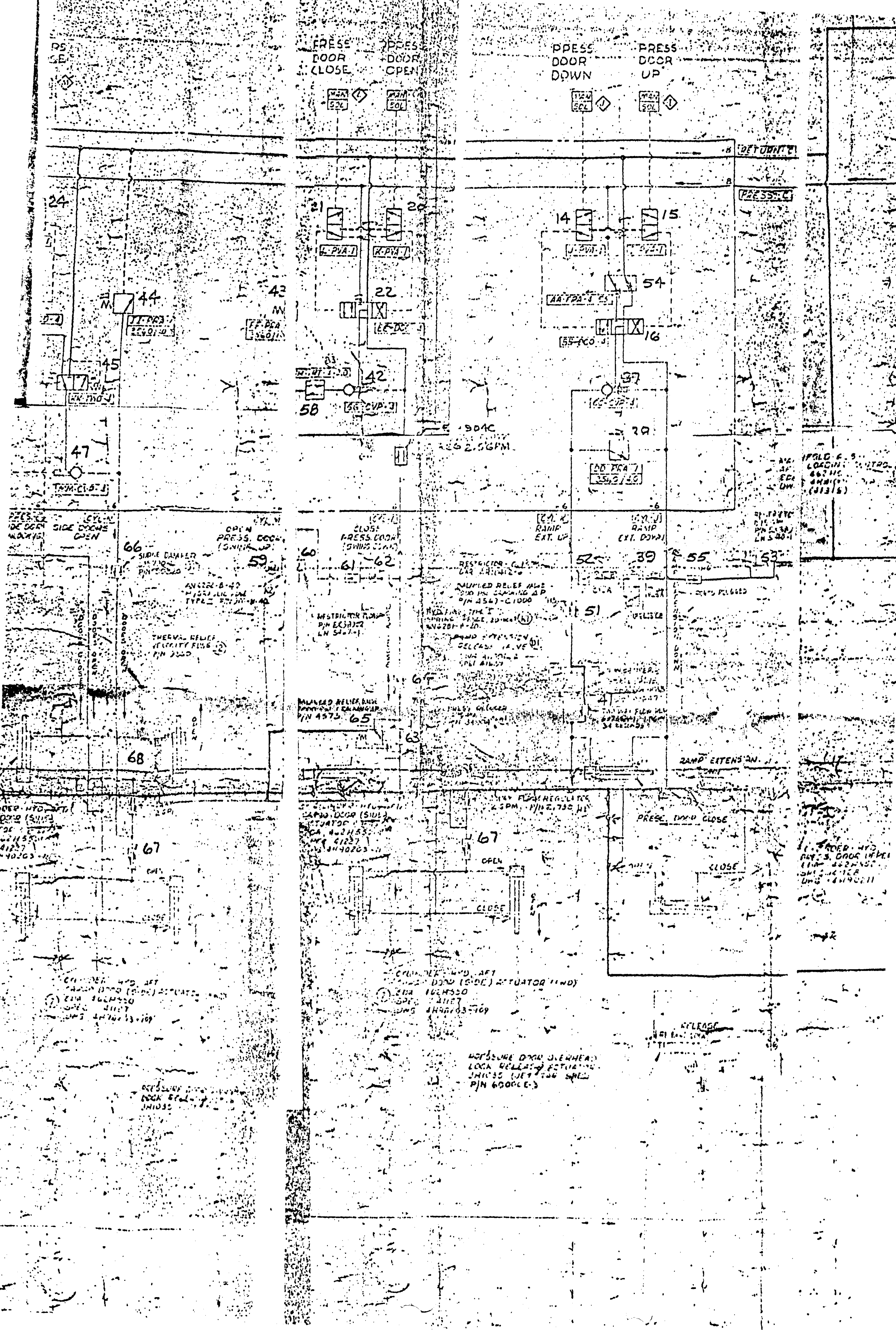
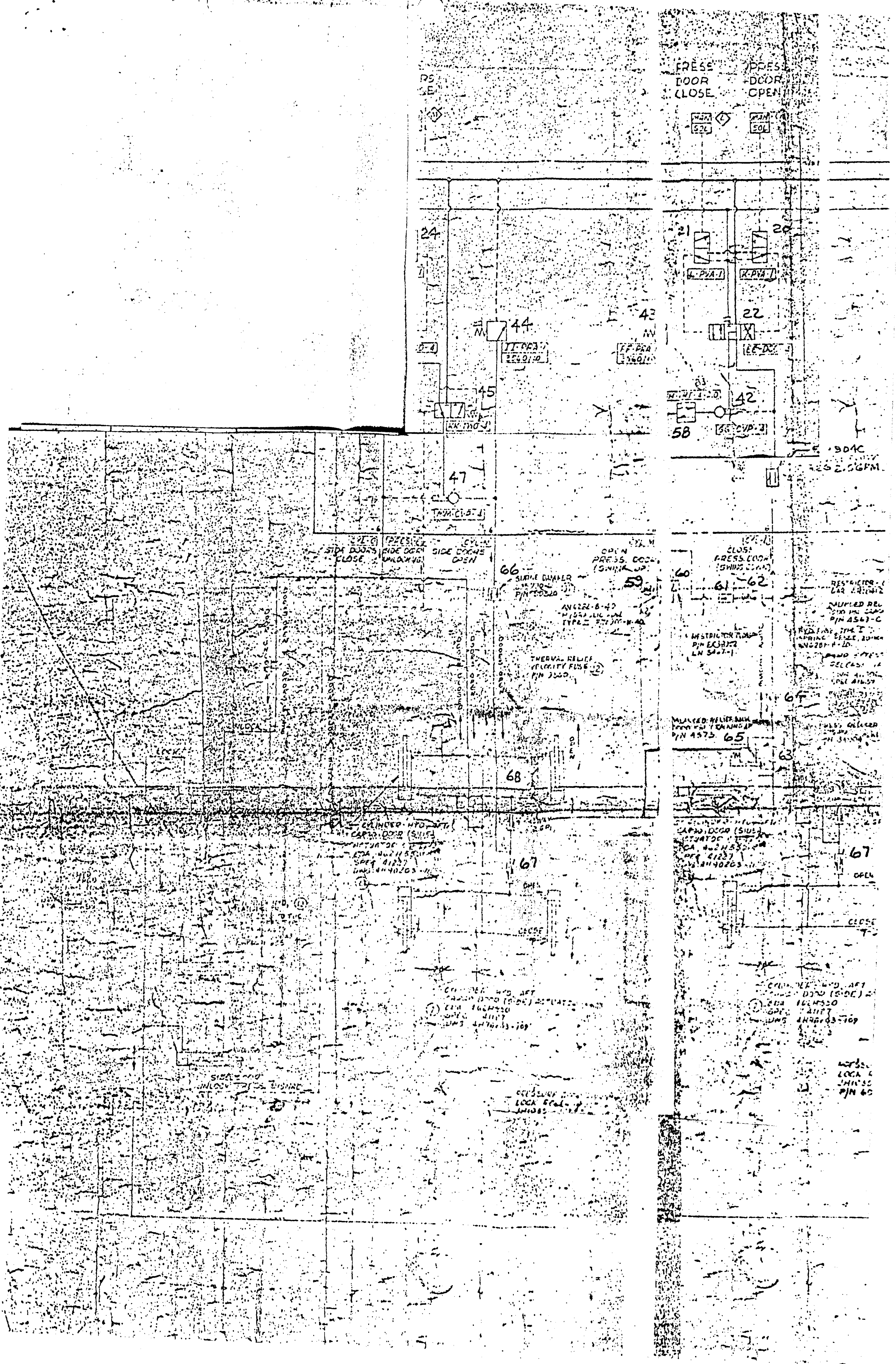
CHECK VALVE
71
16



PRESS DOOR CLOSE
PRESS DOOR OPEN
PRESS DOOR DOWN
PRESS DOOR UP
RETURN
PRESS
CYL. K RAMP EXT. UP
CYL. J RAMP EXT. DOWN
CLOSE PRESS. DOOR (SWING CONN)
OPEN PRESS. DOOR (SWING UP)
RAMP EXTENSION
PRESS. DOOR CLOSE
OPEN
CLOSE
RELEASE



PRESS DOOR CLOSE
PRESS DOOR OPEN
24
21
20
44
43
22
45
42
58
47
SIDE DOORS CLOSE
SIDE DOORS OPEN
66
OPEN PRESS. DOOR
CLOSE PRESS. DOOR
59
60
61
62
THERMAL RELIEF VELOCITY FUSE
65
63
68
67

This goes at The End

of Exhibit No. 112

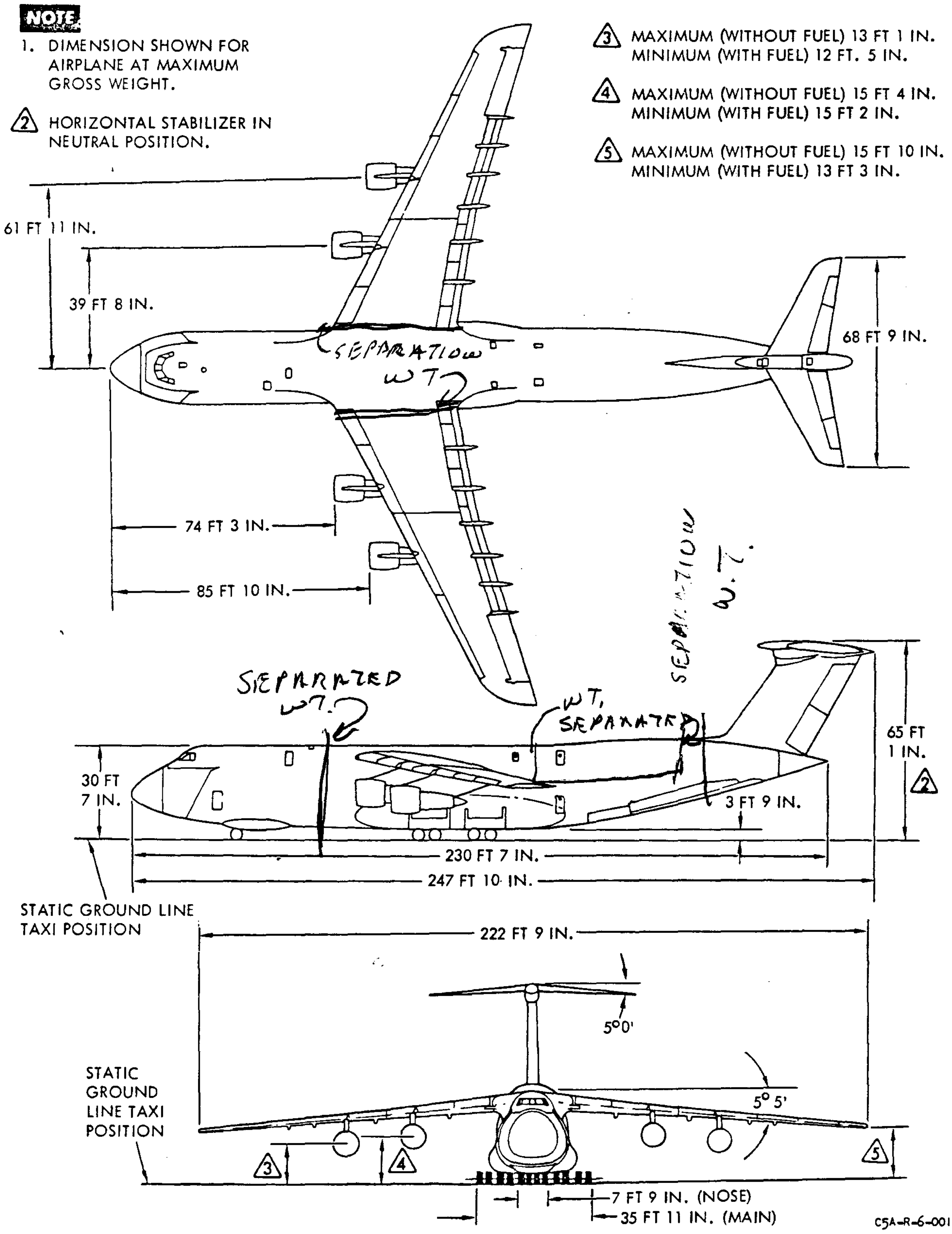
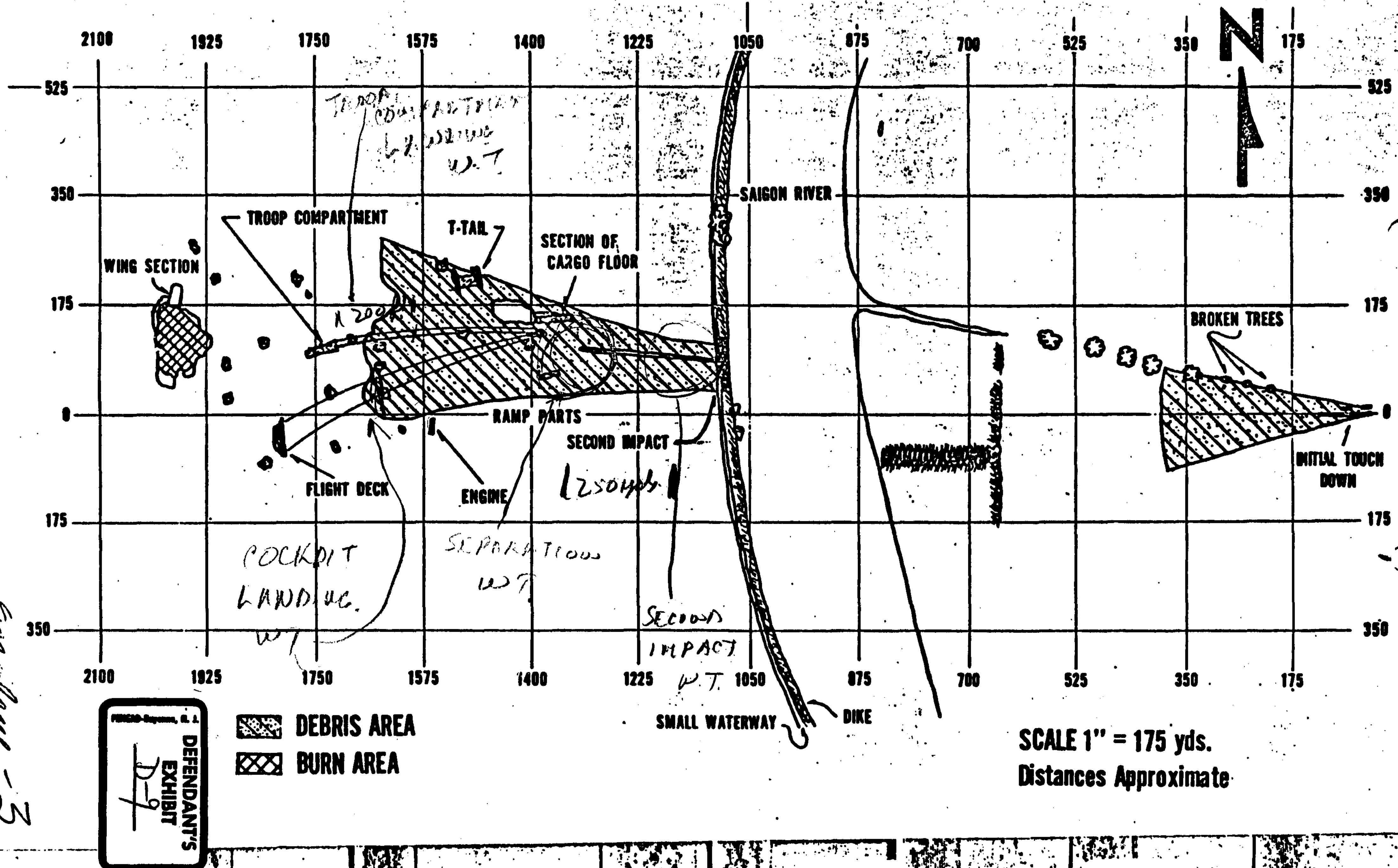


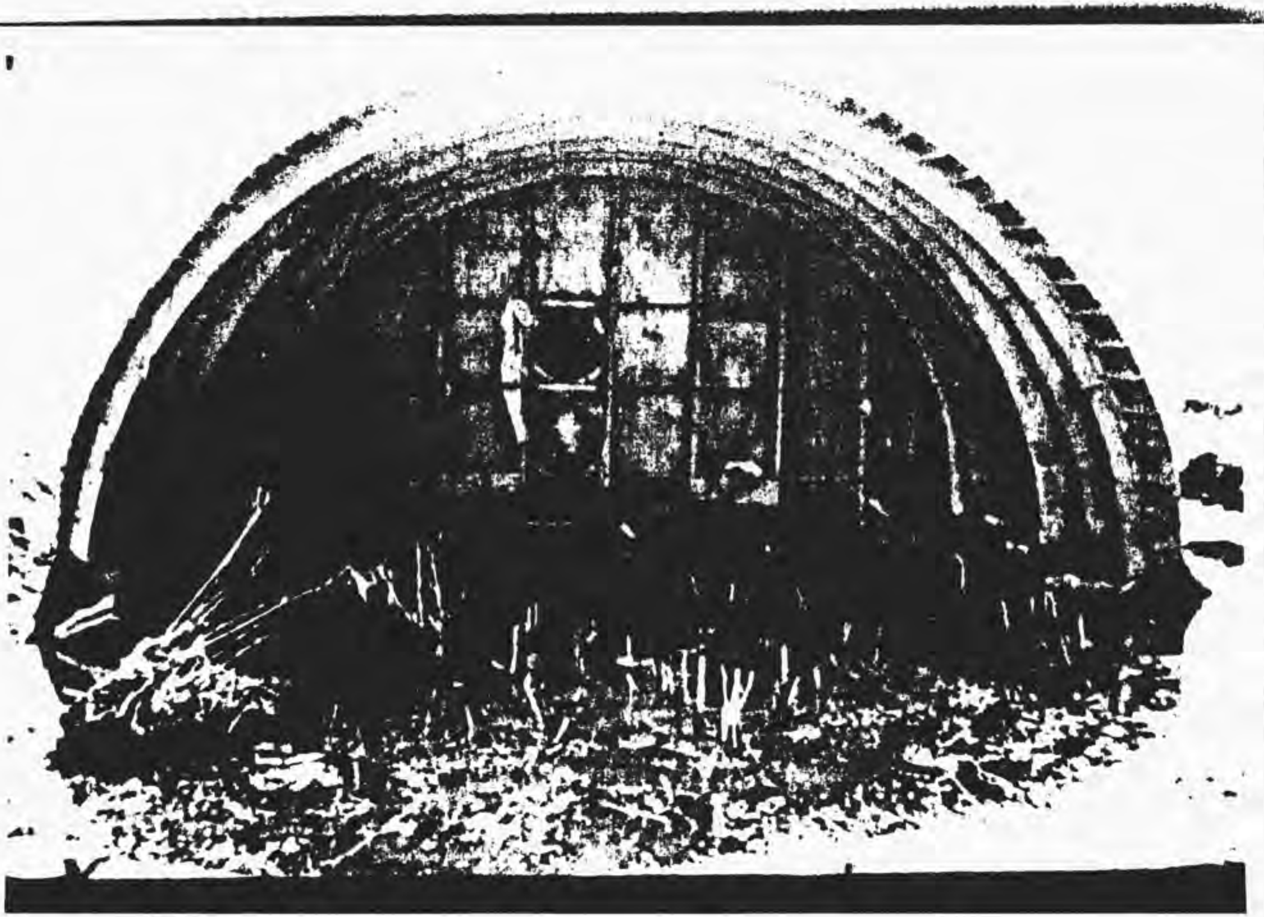
Figure 1-1. Airplane Dimensions

WRECKAGE DIAGRAM
C-5A SN 68-218 4 APRIL 1975



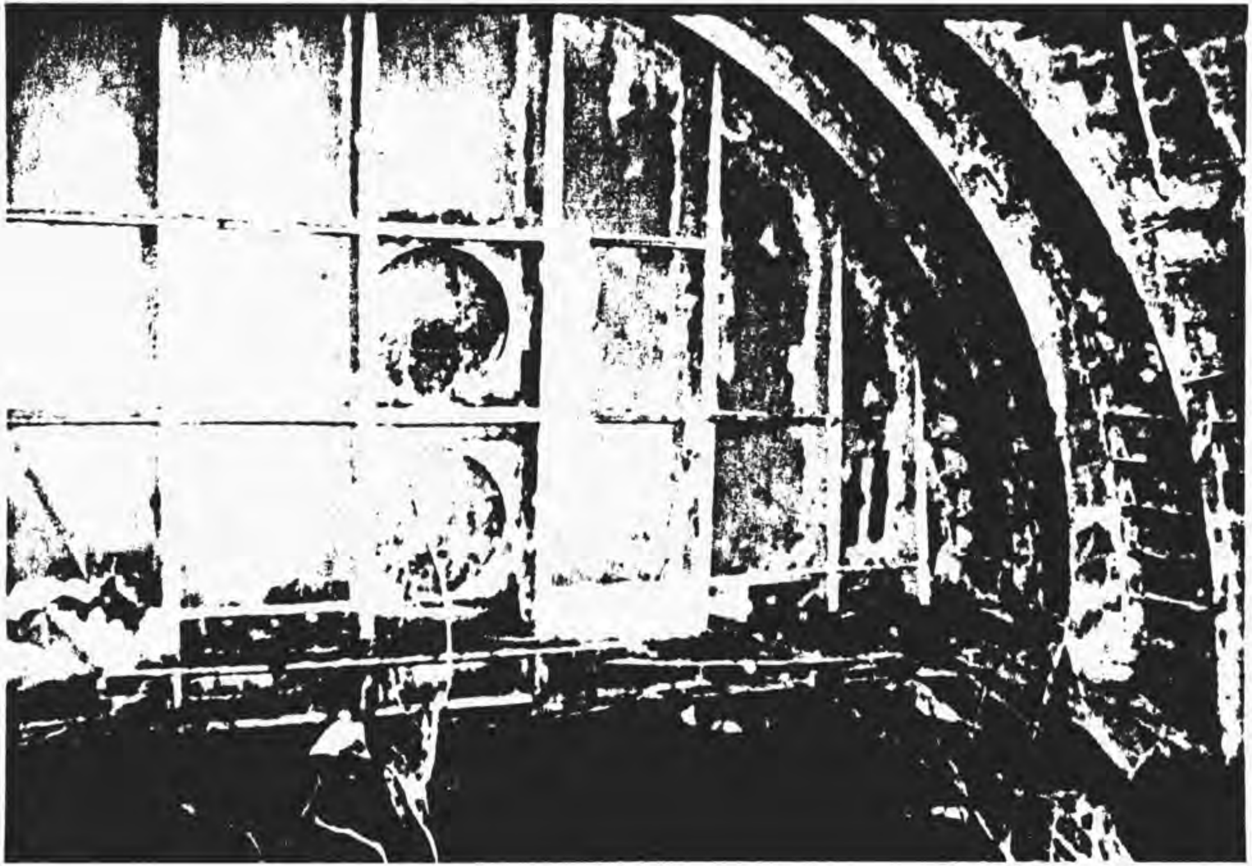
DEFT. EX. B- TIMM #7
DATE: 10/22/81
REPORTER: ALBERT J. GASDOR
593

L-1



L-1-A (Jimmie)

10/22/81



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