NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHN F. KENNEDY SPACE CENTER
KENNEDY SPACE CENTER, FLORIDA 32899

APR 3 1972

REPLY TO
ATTN OF: AA-GSO-2/72-3-7

MEMORANDUM

TO: Distribution

FROM: AA/Manager, Apollo-Skylab Programs

SUBJECT: Skylab Program Directive #17, "Skylab Design Certification Review"

The attached SLPD #17 is provided for your information. A copy of the briefing note to the Center Director is attached to provide you with a summary of the general impact on the center.

As you know through previous correspondence on this subject, a new KSC Program Directive entitled "Skylab Delta Design Certification Review Implementation Plan" is being prepared and will be coordinated with appropriate Center elements.

for William H. Rock
Robert C. Hock

2 Enclosures
SLPD #17
Briefing Note

Distribution:
Apollo-Skylab Dist. M

#3
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MAR 2 0 1972

Dr. Debus

Subject: Skylab Program Directive No. 17

The directive, entitled "Skylab Design Certification Reviews", dated March 7, 1972, was developed to define the requirements and procedures for Skylab Program Design Certification Reviews (DCRs) and to identify the organizations and documentation necessary to support the reviews. This directive is the Skylab counterpart to Apollo Program Directive #7, "Apollo Design Certification Reviews". For the most part, the Skylab and Apollo directives are similar except for the following:

a. The Skylab DCRs at KSC will be a delta review of significant changes from the Apollo usage configuration.

b. Certain Skylab unique facilities will be reviewed in the Operations and Checkout Building prior to the arrival of the Skylab hardware at KSC (i.e., the ATM Clean Room and the West Integrated Test Stand and unique applications of ACE).

c. LC-39 hardware unique to the Skylab Program will be completely reviewed.

The intent of this directive is to assess and certify the design and performance adequacy of certain critical checkout areas and the launch complex.

Implementation of Skylab Program Directive #17 will be via Kennedy Program Directive 8040.X (TBD) "Skylab Delta Design Certification Review Implementation Plan", which is being developed at this time.

The new directive will be given the usual distribution to the first and second level directorates, and those individuals having primary interest in the reviews.

The directive assigns responsibility for launch complex/GSE review at KSC to the Skylab Program Manager.

Robert C. Hock

Robert C. Hock

OFFICE OF MANNED SPACE FLIGHT PROGRAM DIRECTIVE	M-D ML 3200.143 (Project)	DATE MAR 7 1972

SKYLAB
PROGRAM DIRECTIVE NO. 17

TO: Distribution

FROM: DIRECTOR, SKYLAB PROGRAM

SUBJECT: Skylab Design Certification Reviews

REF: a) Skylab Program Directive No. 11A dated October 14, 1970

I. Directive Purpose

A. The purpose of this directive is to define the requirements and procedures for Skylab Program Design Certification Reviews (DCR's) and to identify the organizations and documentation necessary to support the reviews.

II. Scope and Applicability

A. This directive amplifies the basic requirements in Ref. (a) for the planning and implementation of DCR's for the Skylab modules and cluster systems, launch vehicles, experiments, ground support equipment (GSE), launch complex, and mission operational support systems.

B. The DCR's are applicable to Skylab mission SL-1/SL-2 which includes the Workshop and the first manned visit and the CSM rescue mission. DCR's will not be planned for subsequent Skylab missions unless major design changes occur between missions.

III. Background

A. The DCR's are supported by the normal Center design review processes. They involve examining the design performance and verification of the major contract end items, the integrated cluster systems, the significant crew and experiment interfaces and mission operations activity to assess and certify that the equipment and operational elements can accomplish the planned Skylab missions. Specifically the Skylab DCR's are conducted to:

1. Assess and certify the adequacy of the performance design requirements and verification programs of the major Skylab end items and their interfaces as a complete space vehicle system for flight worthiness and manned flight safety.

2. Assess and certify the design adequacy of the Launch Complex, Mission Control Center and the Spaceflight Tracking and Data Network; and

3. Assess and certify compliance with established Safety and Program Reliability goals. (Numerical reliability goals are excluded.)

IV. Organization

A. The DCR's will be organized by the Skylab Program Director and conducted by the Management Council acting as the Design Certification Board. The Skylab Engineering Directorate (MLE) will provide planning and coordination for the DCR's including agenda preparation, meeting organization, DCR minutes and the follow-up control of action items.

B. The DCR's will be planned as a series of reviews scheduled to utilize results obtained from the development, qualification and acceptance test programs, and all pertinent information obtained from other Skylab Program activities such as mission simulations, software verification, coordination and interface reviews, and crew training.

C. Each DCR will be a formal review conducted on the basis of oral summary presentations, supported by documented submissions which form a part of the record of the DCR. The presentations shall be made by cognizant NASA officials and contractor personnel as appropriate.

D. At the completion of each Skylab DCR, if the design of the subject of the review is judged by the board to adequately meet the Skylab mission requirements, the board will execute a Skylab Design Certification Document. The document will identify the specific Skylab areas being certified and any actions upon which certification is contingent and will include by reference all of the supporting documentation prepared for the DCR.

E. All open actions identified in the Skylab Design Certification Documents shall be accomplished and a report submitted to the Design Certification Board by the cognizant NASA program manager at a subsequent DCR but specifically prior to or at the Flight Readiness Review for the mission.

F. The following types of DCR's will be conducted:

1. Delta DCR's - These reviews are for equipment previously developed and utilized in the Apollo program. They will concentrate on an assessment of the Skylab unique performance requirements, design modification and verification adequacy. The Saturn IB and Saturn V launch vehicles, the Skylab CSM and the Launch Complex modifications are specific Skylab DCR's that will be reviewed using this delta approach.

2. Experiment DCR's - Experiment and experiment support systems reviews will address the major related experiment groups managed by the cognizant experiment development centers, or proxy development centers. The reviews will focus on experiment performance adequacy and where appropriate, the experiment interfaces with experiment support equipment. Module to experiment interfaces will be included in subsequent Mission/ Cluster Systems DCR.

3. Mission/Cluster Systems DCR - This review will cover the major Saturn Workshop hardware and software systems. (The Saturn Workshop is defined as the integrated combination of the OWS, IU, AM/MDA and ATM modules.) It will also include the Payload Shroud and the interfaces with experiments and the CSM. The Skylab missions, flight crew operations, mission operations and mission facilities shall be included in this review.

G. The planning dates for all Skylab DCR's will be established by the Skylab Program Director at least six months prior to the first proposed DCR. Approximately two or three months prior to a specific DCR, a preliminary guideline letter will be transmitted to the Centers for coordination of specific DCR support requirements, backup reference documentation and agenda items. The final DCR agenda identifying topics and time allotments will be issued by the Skylab Program Director three weeks prior to the DCR.

V. DCR Requirements

A. General - For all Skylab DCR's, the reviews of Skylab flight hardware elements require an examination of performance capability, interface compatibility and development maturity against specific mission requirements and flight environment, with emphasis on manned safety. Accordingly, the review shall include:

1. A summary which relates equipment performance and support capability to specific mission objectives, requirements, and applicable specifications.

2. A brief description of the form and function of the principal elements and subsystems, including interfaces.

3. A summary of those factors which are significant to an assessment of performance capability and design maturity. Topics to be considered shall include:

a. Development, qualification and acceptance test results.

b. Configuration differences between qualification and flight articles.

c. Failure history and identification of items experiencing repeated failure.

d. Corrective actions resulting from prior design reviews and where applicable, feedback of prior mission experience.

e. Factors imposing mission constraints.

f. Contamination control factors.

4. An assessment of the systems capability to withstand the effects of required long duration operations where applicable.

5. An assessment of reliability and crew safety based on the identification and formal disposition of Category I and II Single Failure Points (SFP).

6. A summary of unresolved problems and plans for corrective actions.

B. Delta DCR's

1. For Launch Vehicle propulsion stages, IU's, CSM (and their GSE), DCR emphasis will be concentrated on systems for which there are configuration differences and/or mission requirement differences from Apollo missions. The review requirements stipulated in Section V-A are applicable for the modified systems.

These delta DCR's will include: 1) Assessment of hardware involved in long term ground storage; and 2) Assessment of the Rescue Mission CM modifications.

2. The Launch Complex 39 review will emphasize the differences between Apollo and Skylab KSC launch facilities required to support test, checkout and launch of Skylab space vehicles and will include:

a. A brief description of the significant changes including interfaces.

b. A summary of topics that verify performance capability and design maturity that cover checkout test results, failure histories, corrective actions and factors imposing mission constraints.

c. Assessment of prior Apollo and potential Skylab failure modes, hazards and risks related to ground and launch safety and the design and procedures efforts to minimize or eliminate them for Skylab. This will include disposition of new Category I and II SFP's (if any) resulting from Skylab configuration and/or mission differences from Apollo.

d. A summary of unresolved problems and corrective actions.

C. Experiment DCR's

1. All of the requirements of Section V-A will be applicable to Experiment DCR's. Additional specific areas of interest to be covered for experiment reviews include:

a. Design assessments indicating the scientific and technical integrity of the experiment.

b. Assessment of experiment interface compatibility and performance with applicable experiment support systems.

c. Crew participation experience that provides confidence in the man/experiment interfaces.

D. Mission/Cluster Systems DCR

1. This review will cover the Saturn Workshop systems hardware and software, the SL-1/SL-2 Mission design, flight crew and mission operations in a manner that will facilitate an examination of the capabilities of the Workshop and Orbital assembly systems to meet specified performance criteria, and that will permit an assessment of the flight and ground hardware and software to support the successful conduct of the Skylab mission.

a. The Saturn Workshop hardware and software systems including experiment and CSM interfaces and the Payload Shroud shall be reviewed by a systematic examination of the principal module systems and their integration as complete systems throughout the Skylab cluster and orbital assembly. Flight crew equipment for Skylab missions shall be included in this review. The requirements identified in Section V-A are applicable and will be required for the review of the cluster and orbital assembly systems.

b. The review of prelaunch and launch operations will provide an assessment of the design verification of the KSC new and/or modified industrial facilities and GSE, to accept and perform the Skylab Test and Checkout Operations. This review shall be restricted to major items such as the ATM clean room, the West End Test Stand and unique Skylab ACE usage and shall be completed prior to initial use with flight hardware.

c. The review of the SL-1/SL-2 Mission will include an assessment of the capability to meet all Skylab mission objectives giving due considerations to both systems capabilities and operational constraints. A summary of mission trajectory profiles and mission sequences which relate key events to performance capabilities and margins will be included. The mission review will cover that period commencing with the final countdown of the Saturn Workshop launch and ending with crew recovery.

d. The review of flight crew operations shall encompass crew related mission and experiment requirements, crew training and crew timelines, crew health requirements before, during and after missions, operational procedures associated with the Caution and Warning Systems, crew safety factors, potential hazards and emergency procedures, and any unresolved problem areas related to crew performance or crew safety. Where appropriate, the astronauts' assessments of the above factors should be presented.

e. The review of mission operations and mission facilities will include performance capabilities and operation of the Mission Control Center, the Huntsville Operations Support Center, the Spaceflight Tracking and Data Network and the recovery facilities as they relate to the Skylab mission. The tracking, data and communications systems coverage and utilization for major mission phases shall be reviewed. The processing, flow and use of commands, telemetry, voice and television shall be addressed. The major elements of mission management shall be reviewed, including the flow of mission data and its use in real time mission planning, and the major decision paths.

VI. Documentation

A. Documentation in support of the presentations shall be submitted in accordance with Attachment I, and shall be made a part of the official record of the DCR. It is intended that, whenever possible, this documentation shall be derived from progressive requirements and design reviews, and acceptance reviews which have been conducted by the cognizant design and development organizations.

B. The Centers shall schedule completion of supporting reviews and assessments such that the documentation outlined in Attachment I is available for submission to the Design Certification Board no later than two to three weeks prior to the scheduled date for the DCR. Copies of visual aids used during DCR may be submitted at the DCR.

VII. Areas of Responsibility

A. The major areas to be covered by the Skylab DCR's are listed below along with an assignment of responsibilities for the organization of the presentation and preparation of supporting documents. It should be recognized that DCR's are a cooperative effort of all involved Centers and they shall be available to support specific DCR's as requested.

1. Launch Vehicle Design Modifications

a. Review of design modifications of the Skylab Saturn V Launch Vehicle, IU and GSE - Saturn Program Manager (MSFC)

b. Review of design modifications of the Skylab Saturn IB Launch Vehicle, IU and GSE - Saturn Program Manager (MSFC)

2. Command and Service Modules Modifications

a. Review of design modifications of the Skylab CSM modifications, the Spacecraft LEM Adapter (SLA) and the Rescue Mission Mod Kit - Spacecraft Program Manager (MSC)

3. Skylab Experiments

a. Review of experiments and experiment support systems for which MSC is the development center or proxy development center - Skylab Program Manager (MSC)

b. Review of experiments and experiment support systems for which MSFC is the development center or proxy development center - Skylab Program Manager (MSFC)

4. Launch Complex/GSE

a. Review of design differences between Apollo and Skylab Launch facilities - Skylab Program Manager (KSC)

5. Skylab Cluster and Mission

a. Mission objectives and performance requirements - Skylab Program Director (Headquarters)

b. Review of Saturn Workshop and orbital assembly hardware and software systems, experiment support interfaces, Payload Shroud and related GSE - Skylab Program Managers (MSFC - Prime, MSC - Support)

c. Review of KSC industrial area facilities and GSE - Skylab Program Manager (KSC)

d. Review of SL-1/SL-2 Mission profiles, sequences and constraints - Assistant Director for Flight Operations (MSC)

e. Review of Flight Crew Operations for Skylab - Assistant Director for Flight Crew Operations (MSC)

f. Review of Mission Operations and Mission Facilities - Assistant Director for Flight Operations - MSC (with MSFC, KSC and GSFC support)

VIII. Action

This directive shall be implemented immediately to insure timely planning scheduling, preparation and conduct of the required DCR's.

Attachment I

DCR Documentation Requirements

I. Presentation Vugraphs and Paper Copies

A. Vugraphs will be used at each DCR and will be retained by the Skylab Program Office upon completion of the DCR. Fifty copies of the vugraph presentations will be provided immediately prior to the DCR by the Center official responsible for such oral assessment.

II. Assessment Reports

A. Ten copies of a DCR Summary Report containing information identified below will be submitted to the Skylab Program Director (MLE) by the cognizant Center Program Managers two to three weeks prior to the DCR at which the particular topics scheduled (i.e., LV stages, CSM, experiments, launch complex, cluster) will be reviewed.

1. Program Managers Summary assessment and certification on design adequacy of the major Skylab integrated hardware for which he is responsible and other certifications (i.e., contractor, cluster systems, etc.) that he considers appropriate.

2. Applicable Skylab requirements and the system configurations intended to meet these requirements, including a brief description of the major design features.

3. Schematics of subsystems with criticality identification of subsystems.

4. Category I and II Single Failure Point (SFP) summaries including explicit test/checkout requirements, mandatory quality inspection points, and contingency procedures.

5. Verification summaries identifying hardware verified by analysis, similarity or test with rationale and results to support design configuration and perform verification adequacy against appropriate specifications, test plans and safety requirements. (Details of the verification summaries may be included in the backup documentation.)

6. Identification of significant waivers, constraints and problem areas.

III. Backup Documentation

A. Specific backup documentation to be available prior to and during a DCR shall include:

1. Failure histories of critical items and their corrective action results.

2. Prior review RID actions and their resolution.

3. Outstanding Engineering Change Proposals (ECP's) and their resolution.

4. Failure modes and effect analysis.

5. Limited life component operating time/status.

6. Details of verification results (both test and analysis).

7. Certificates of Flight Worthiness (COFW) suitably updated on each module, stage and experiment or experiment group which meet reference (a) and Center COFW requirements.

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