

**F. Funds Expended**

Total expenditures to date: \$105,196

**G. Data Utility**

We have just received the CCTs for 20 August of the Powder River Basin (AA0116-09050-3, AA0116-20010-1,2, AA0116-20020-1,2). We are in the process of registering these scenes.

Also we have received NASA produced thermal-inertia and temperature-difference images for Cabeza Prieta (AA0342-09130-4,5,6,7,8) and for Powder River (AA0410-08430-4,5,6,7,8). These data are being reformatted and will be compared to our products.

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NASA CR-  
160720

JSC-14579

PROJECT DEVELOPMENT PLAN  
FOR THE  
LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)

JOB ORDER 63-1767-1485

(E80-10238) PROJECT DEVELOPMENT PLAN FOR  
THE LANDSAT IMAGERY VERIFICATION AND  
EXTRACTION SYSTEM (LIVES) (Lockheed  
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Prepared By

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Systems and Services Division

Houston, Texas

Contract NAS 9-15200

For

EARTH OBSERVATIONS DIVISION



*National Aeronautics and Space Administration*  
**LYNDON B. JOHNSON SPACE CENTER**

*Houston, Texas*

October 1978

LEC-12856

PROJECT DEVELOPMENT PLAN  
FOR THE  
LANDSAT IMAGERY VERIFICATION & EXTRACTION SYSTEM (LIVES)


PREPARED BY:

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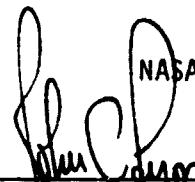
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For

EARTH OBSERVATIONS DIVISION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

LYNDON B. JOHNSON SPACE CENTER

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## FORWARD

This Program Development Plan (PDP) is in response to the Earth Observations Division direction to proceed with the development of a High Density Tape (HDT) processing capability and pertains to the applications software to be delivered April 1, 1979.

The plan delineates results of the HDT processing requirements investigation and provides the overall management tool for the control of system design, implementation, and testing.

It is expected that this PDP will be updated to reflect status and schedule adjustments and to provide working level interfaces.

## ACRONYMS

CCT	-- Computer Compatible Tape
CDR	-- Critical Design Review
CPU	-- Central Processing Unit
DTL	-- Data Techniques Laboratory
EOD	-- Earth Observations Division
GSFC	-- Goddard Space Flight Center
HDT	-- High Density Tape
I/O	-- Input/Output
LIVES	-- Landsat Imagery Verification and Extraction System
NASA	-- National Aeronautics and Space Administration
PDP	-- Project Development Plan
PDP 11/XX	-- Digital Equipment Corporation Series 11 Computer Processor
PDR	-- Preliminary Design Review
RSX-11	-- PDP 11/45 Operating System Software

## 1.0 DESIGN CONCEPTS

1.1 General--The LIVES software is to be implemented on two existing hardware configurations in the Data Techniques Laboratory (DTL); the PDP 11/45 Support Processor and the PDP 11/45: I-100 Imagery System. LIVES will utilize the Calcomp disc storage data base generated by the HDT reformatting subsystem. (Ford Aerospace Project)

1.2 Recommended Design Approach--The LIVES is comprised of the following software modules:

- o Preprocessing.
- o Data Management
- o Screening and Translation
- o Data Extraction
- o Computer Compatible Tape (CCT) Generation

The interactions that exist between these software modules are depicted in Figure 1-1.

A structured software design, aimed at single function modularity will be adhered to throughout the LIVES system design. Deviations from this policy will be considered only for the sake of functional efficiency or to insure simplicity of use. In order to insure system integrity and to facilitate software implementation and testing, a carefully controlled and coordinated program of software development, integration and testing will follow system design. This program will be executed in three phases: (1) unit construction, (2) module assembly and (3) system integration.

The first development phase of LIVES will be devoted to the actual construction of solidly designed software units with explanatory comments. Ideally, all such units will be functionally singular, but occasionally, when warranted, these units may perform a combination of functions. All units will be commented to the extent necessary to generally describe their function and to explain each major logic decision where it occurs in the code. Only meaningful variable names will be employed in the structure of these units. This phase of LIVES development will end with the testing of all such units (unit testing).

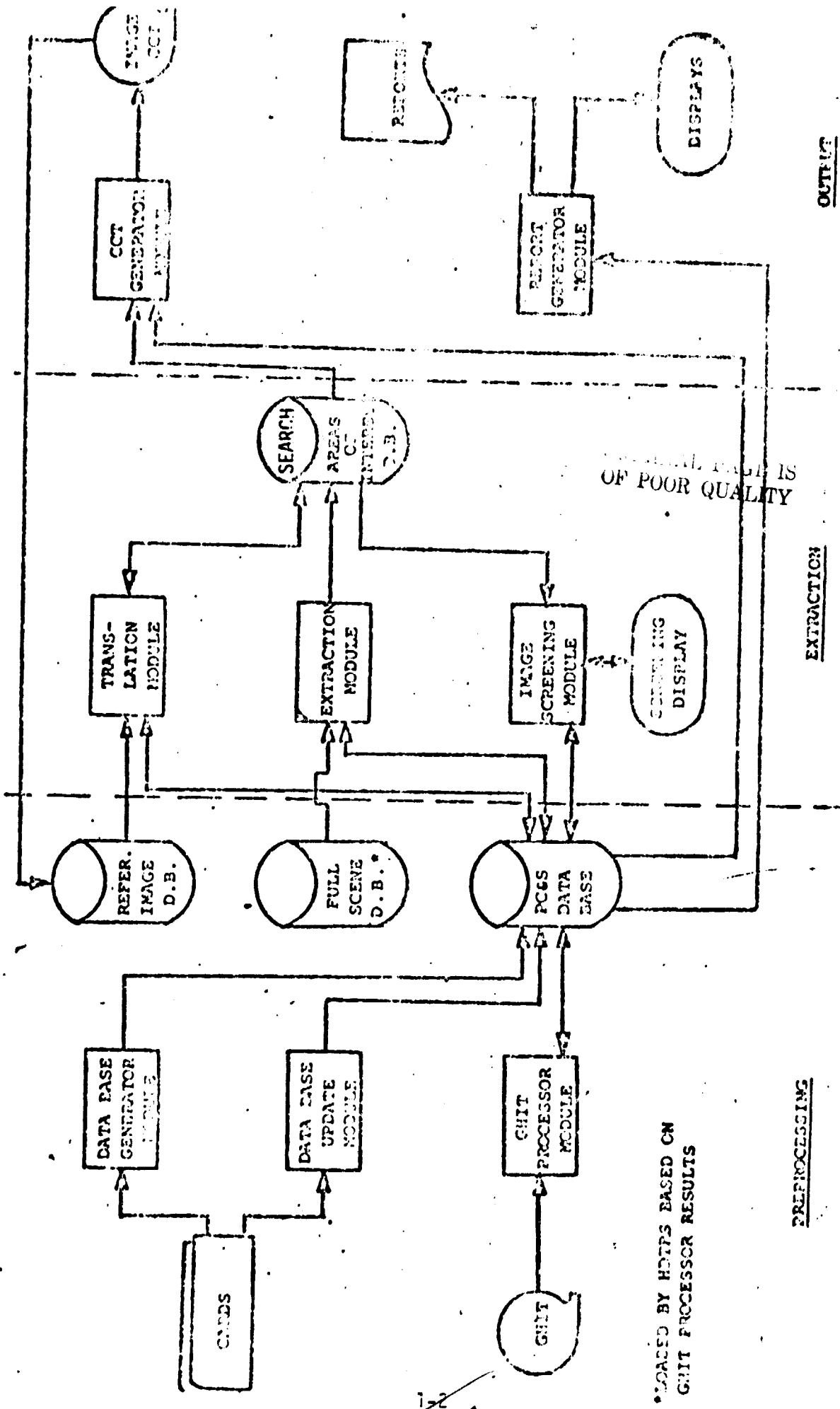


Figure 1 -- Software Module Interfaces



The second development phase of LIVES is that of integrating the individually tested software units into their respective functional modules through appropriate linkage. Each such module will be tested to insure that the integration is proper and complete.

In phase three, the modules will be integrated into a complete LIVES system. Thorough testing of the total integrated system is the major objective of this phase.

1.3 Alternate Concept--None

1.4 Rationale for the Selected Design Concept--Budget constraints dictated utilization of existing equipment wherever possible and acquiring only those resources required to achieve HDT processing capability. The functional capabilities defined for the April 1, 1979, LIVES were limited to a specified subset of the total user requirements.

1.5 Pacing Items--Beginning October 1979, Goddard Space Flight Center (GSFC) will provide only HDT's to JSC. Therefore, the LIVES capability must be operational by that time.

## 2.0 SCHEDULING

2.1 General--The following schedule information (Figure 2-1) for the Landsat Imagery Verification and Extraction System is current as of August 29, 1978.

2.2 Design--As shown in the schedule, a Preliminary Design Review (PDR) of the LIVES system will be conducted on October 17, 1978, followed by a Critical Design Review (CDR) on November 28, 1978. Design completion of the LIVES software modules will be accomplished by December 6, 1978.

2.3 Development--Following software design completion, LIVES software modules will be developed with all unit testing to be completed by mid-February, 1979.

2.4 Implementation--Integration and integration testing of software modules will begin early January 1979 and continue through the last week in February 1979.

2.5 Testing--Internal LEC unit, module and LIVES system integration testing will be performed in the DTL and/or the Ford Aerospace Co. Facility beginning December 1978 and continue in that facility through mid-March 1979.

2.6 Installation--The HDT subsystem hardware will be assembled, checked out, and confirmed operable in the Ford Aerospace Facility. The LIVES software will be internal LEC tested and confirmed operable on the hardware configured at the Ford Aerospace Facility.

The HDT subsystem hardware will then be disassembled (on or about the 15th of March, 1979), reassembled in the DTL, Building 17, with scheduled operational readiness on the 17th of March 1978.

At that time, LIVES system integration testing will be repeated and NASA acceptance tests will be performed on the total HDT hardware and software system.

# LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)

AUGUST 29, 1978

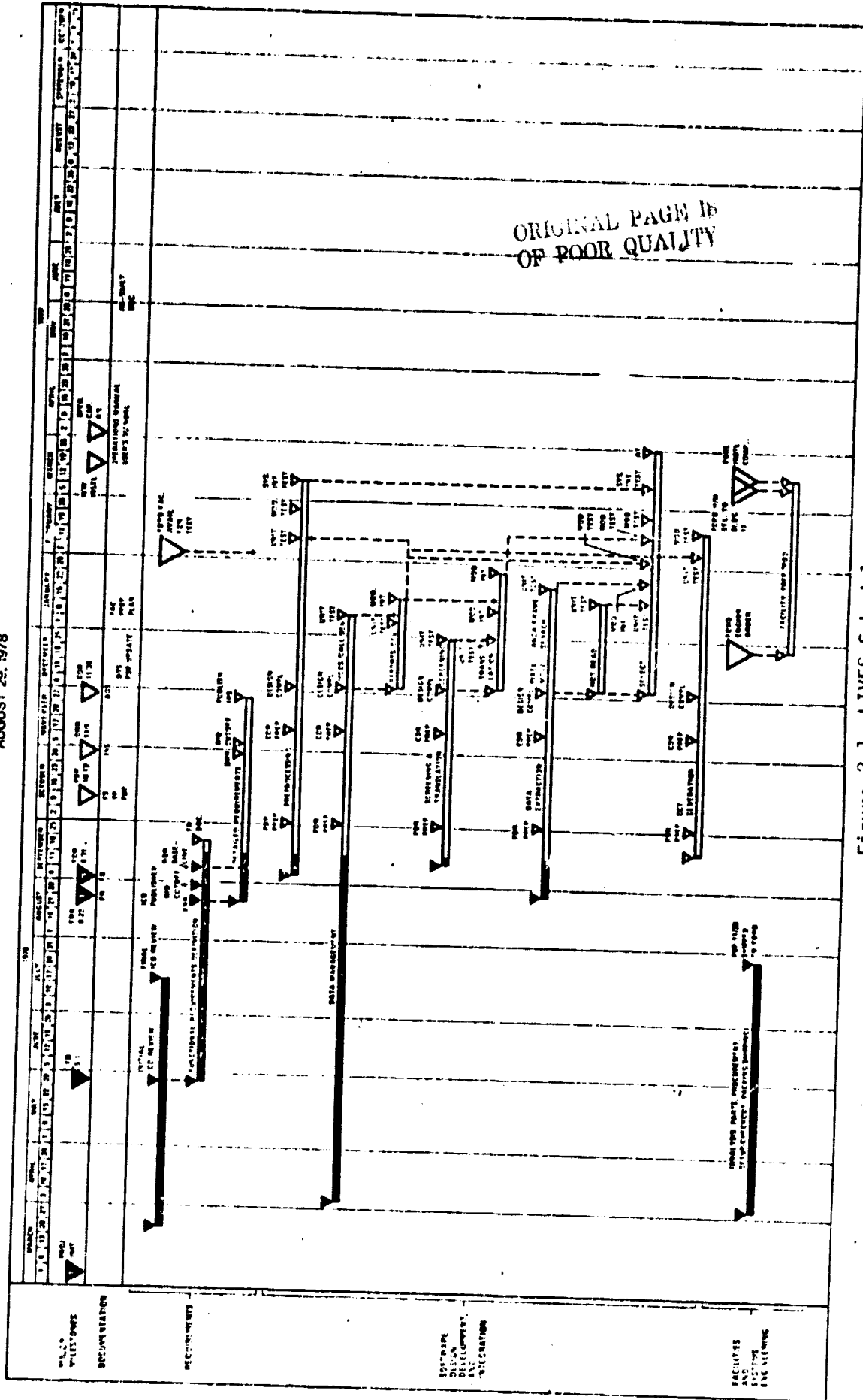


Figure 2-1--LIVES Schedule

DEC

22  
5

### 3.0 DECISION POINTS

3.1 General--As of the date of this document a decision has been made to include software capability to perform 'cloud cover detection' in the April 1979 system. A decision is pending on one other software capability currently under investigation, whether to include imagery production gains and bias (gray scale).

3.2 Procurement Cycles--Not applicable.

3.3 State-of-the-art Cutoff Dates--Not applicable.

3.4 Project Specification Deliveries--The following documents are deliverable items:

- Functional Requirements Document
- Preliminary Functional Design Document
- Functional Specification Document
- Test Plan
- Project Development Plan
- Implementation Requirements Specification
- Detailed Design Specification
- Detailed Test Specifications
- Facility Preparation Plan
- Users Manual
- Operations Manual
- As-Built Document

3.5 Requirement Trade-Off Decisions--See Section 3.1

3.6 Major Project Milestones--The following are the major milestones for the LIVES software:

- Project Initiation March 1, 1978
- Functional Description June 1, 1978
- Functional Requirements Review, August 23, 1978
- Functional Design Review, August 31, 1978

- o Preliminary Design Review, October 17, 1978
- o Detailed Requirements Review, November 1, 1978
- o Critical Design Review, November 28, 1978
- o Hardware Installation, March 17, 1979
- o Operation Capability, April 1, 1979

## 4.0 SYSTEM TESTING

### 4.1 General--See Figure 2-1

4.2 Test Support Constraints--Unit and module checkout and testing will be accomplished utilizing simulated HDT data base.

Disc I/O handlers utilized during DTL testing and checkout will not be the same as will exist for the Calcomp discs in the final system. A Calcomp disc will become available at the Ford Aerospace Facility beginning the first week in February. LIVES testing on a PDP 11/70 with the Calcomp I/O handlers will be possible at that time. Allocation and turn-around times for LIVES testing may be adversely impacted by DTL production commitments and scheduling.

Communication interface between the PDP 11/20 and the PDP 11/45 cannot be exercised until installation and interface of the HDT hardware subsystem to the PDP 11/45 in the DTL. (Scheduled for March 17, 1979).

5.0 INTEGRATION -The schedule for the delivery of the HDT subsystem hardware to the DTL (See Figure 2-1) in conjunction with the unavailability of disc I/O handler on the PDP 11/45 (See Section 4.2) dictate the repeat of system integration tests after relocation of the hardware in the DTL.

6.0 TRAINING PLANS--Not applicable

7.0 PERTINENT GUIDELINES--LIVES software will be written in standard RSX-11 Fortran and constructed such that it will not be machine dependent wherever possible.

- o The April 1, 1979, system will be designed and constructed to accommodate known follow-on user requirements not within the capabilities being developed for this April 1979 system.
- o CPU execution time of the software developed should not be a major factor to system throughput times.

8.0 CONTINGENCY PLANS--During the time period April-October 1979, both CCT's and HDT's containing the same data will be available from GSFC. The intent is to verify the HDT operation using processed CCT data. The CCT's will satisfy any contingency data requirements of the user community.

9.0 PRELIMINARY MANMONTHS AND COMPUTER TIME ESTIMATES--The following manmonths and computer time estimates for the LIVES software are current as of September 29, 1978.

<u>MANMONTHS</u>							
1978			1979				
O	N	D	J	F	M	A	M
10	13	14	14	14	14	6	5

Background processing (low priority tasks) time on the two PDP 11/45 systems in the DTL will provide adequate computer resources for program development and checkout.

Computer resources configured with the HDT hardware subsystem will be available at the Ford Aerospace Facility beginning the first week in February 1979.