CONTRACT NAS10-7308

DEVELOPMENT OF A TEST AND FLIGHT ENGINEERING ORIENTED LANGUAGE

PHASE I ORAL PRESENTATION MATERIAL

W. F. Kamsler
C. W. Case
E. L. Kinney
J. Gyure

Martin Marietta Corporation
Denver Division
Box 179, Denver, Colorado 80201

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Prepared for
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John F. Kennedy Space Center

MARTIN MARIETTA
DENVER DIVISION

DEVELOPMENT OF A TEST AND FLIGHT ENGINEER ORIENTED LANGUAGE

for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

KENNEDY SPACE CENTER, FLORIDA

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PHASE I ORAL PRESENTATION

26 AUGUST 1970

MEMBERS OF THE STUDY TEAM

MARTIN MARIETTA
DENVER DIVISION

WILLIAM F. KAMSLER - PROGRAM MANAGER

C. WILLIAM CASE

J. GYURE

EDMUND L. KINNEY

STUDY OBJECTIVES

MARTIN MARIETTA
DENVER DIVISION

1. PERFORM A STUDY OF THE EFFECTIVITY OF TEST ENGINEER ORIENTED LANGUAGES THAT HAVE BEEN EMPLOYED, OR HAVE BEEN PROPOSED FOR EMPLOYMENT, FOR TEST AND CHECKOUT AUTOMATION OF SPACE VEHICLE, AIRCRAFT, AND OTHER RELATED SYSTEMS.

2. ANALYZE AND DEVELOP THE CHARACTERISTICS REQUIRED FOR A LANGUAGE FOR THE SPACE SHUTTLE APPLICATION.

3. PRODUCE A COMPLETE LIST OF LANGUAGE REQUIREMENTS (SPECIFICATIONS) CONSISTENT WITH THE DESIGN CONCEPTS OF THE SPACE SHUTTLE.

STUDY PHASES

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PHASE I

REVIEW THE PAST AND CURRENT DEVELOPMENT EFFORT RELATED TO SPACE VEHICLE AUTOMATIC CHECKOUT LANGUAGE

PHASE II

DEVELOP THE NEEDED CHARACTERISTICS FOR A SPACE SHUTTLE AND FLIGHT ENGINEER ORIENTED LANGUAGE

PHASE III

PRODUCE A LIST OF LANGUAGE REQUIREMENTS (A SPECIFICATION) FOR THE BASIC DESIGN OF THE LANGUAGE

1. CHECKOUT EQUIPMENT ORIENTED

2. UNIT UNDER TEST ORIENTED

DESIGNED TO PROVIDE MORE DIRECT PATH FROM TEST ENGINEER TO RCA-110A COMPUTER OBJECT PROGRAM USED IN SATURN PROGRAM

```
    1  NAME                                    IBATH
*FLT CONTROL PREPS AS-699 REV3 8/26/0          COMP1
    2  CODE                                    A4
*THE FOLLOWING ARE THE ASSIGNED FLAG      CONDITIONS
*       FLAG 6   THE FCC SPATIAL COMPARATOR DID NOT SET
*       FLAG 10   GYRO OUTPUT WAS NOT WITHIN TOLERANCE
    3  MLSR                                    ILUVV,SCOW
    4  D1SA                                    MDO,378,379,694,1799,
                                               1801,1803,1890
    5  DECL                                    P/SPAT/COMP,DP1AO-12J06-01
                                               P/CSP/POWER/ON,DP1AO-12J01-06
    6  TERM                                    MDO-1790,MDO+378,MDO-1803
                                               MDO-1890,MDO-378
```

ATOLL PROGRAM STATEMENTS

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```
 7  DISO1                          MDO,1801              (PITCH SELECT ON)
 8  DELY1                       5000PP/SPAT/COMP,B001100
 9  SFLG1                          F6
10  DPLY1        *PITCH SPATIAL COMPARATOR DID NOT SET*
11  DISO1                       500MDO,378               (ZERO CMD ON)
12  DISOO                          MDO,1790              (CONTROL RATE GYRO ON)
13  MDSO                           MDO,-1890,-1803
14  TFLGO                          F6,B002500
15  DPLY          *OPTIONS*
                   1CONTINUE
                   2REPEAT COMPARISON SET
                   3TERMINATE
                 ENTER $PR AND OPTION DESIRED
16  SEMIR                          4,B001700,B001900,B002300,
                                   B002400
17  DPLY            *OPTION ENTERED   1*
18  GOTO                           B002500
19  DPLY            *OPTION ENTERED   2*
20  DISO1                       500MDO,379               (COMPARATOR RESET)
2050SFLGO                          F6
21  GOTO                           B000700
22  DPLY              *OPTION ENTERED3*
23  GOTO                           B006100
24  SEMI               PROGRAM HAS LAPSED TO SEMI
                       BY KEYBOARD REQUEST
2450GOTO                           B002400
```

```
 25  SETT                          TCA
 26  RGMT                          SCOV
 27  DISO1                    3000MDO,694                    (I.U.RAMP POS)
 28  TESTW    3.25 0.25 0.25VDC    AV10,PREF/PITCH,B003300
 29  DPLY1     *PITCH REF GYRO     OUTPUT WAS NOT IN 2TO4DEG/*
               *SEC BAND AFTER RAMP FOR 3 SECS
 30  SFLG1                         F10
  .    .          .          .          .
  .    .          .          .          .
  .    .          .          .          .
  .    .          .          .          .
  .    .          .          .          .
  .    .          .          .          .
 61  DPLY      TEST HAS BEEM TERMINATED VIA OPERATOR
               SELECTION OF TERMINATE OPTION
 62  MSFG                          F,-6,-10
999999END
```

ATLAS

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DEVELOPED FOR BLACK-BOX TESTING WITH UNKNOWN TEST SYSTEM.

EACH TEST PROGRAM COMPLETELY AUTONOMOUS.

COMPLETE SPECIFICATION OF EXTERNAL (UUT) INTERFACES, ELECTRICAL, PNEUMATIC, ETC.

ENGINEER AND TECHNICIAN ORIENTED WITH EMPHASIS ON READABILITY WITHOUT SIGNIFICANT TRAINING.

ENGINEERING-LIKE PHRASES IN STATEMENTS, WITH LARGE BUT FAMILIAR VOCABULARY.

SPECIFICATION ORGANIZED FOR RAPID REFERENCING AND GUIDANCE.

ALL IDENTIFIERS ENCLOSED IN QUOTE MARKS.

NO PARALLEL PROGRAM CAPABILITY

NO PROVISIONS FOR "POSTING" SUBROUTINES.

ATLAS - ABBREVIATED TEST LANGUAGE FOR AVIONICS SYSTEMS

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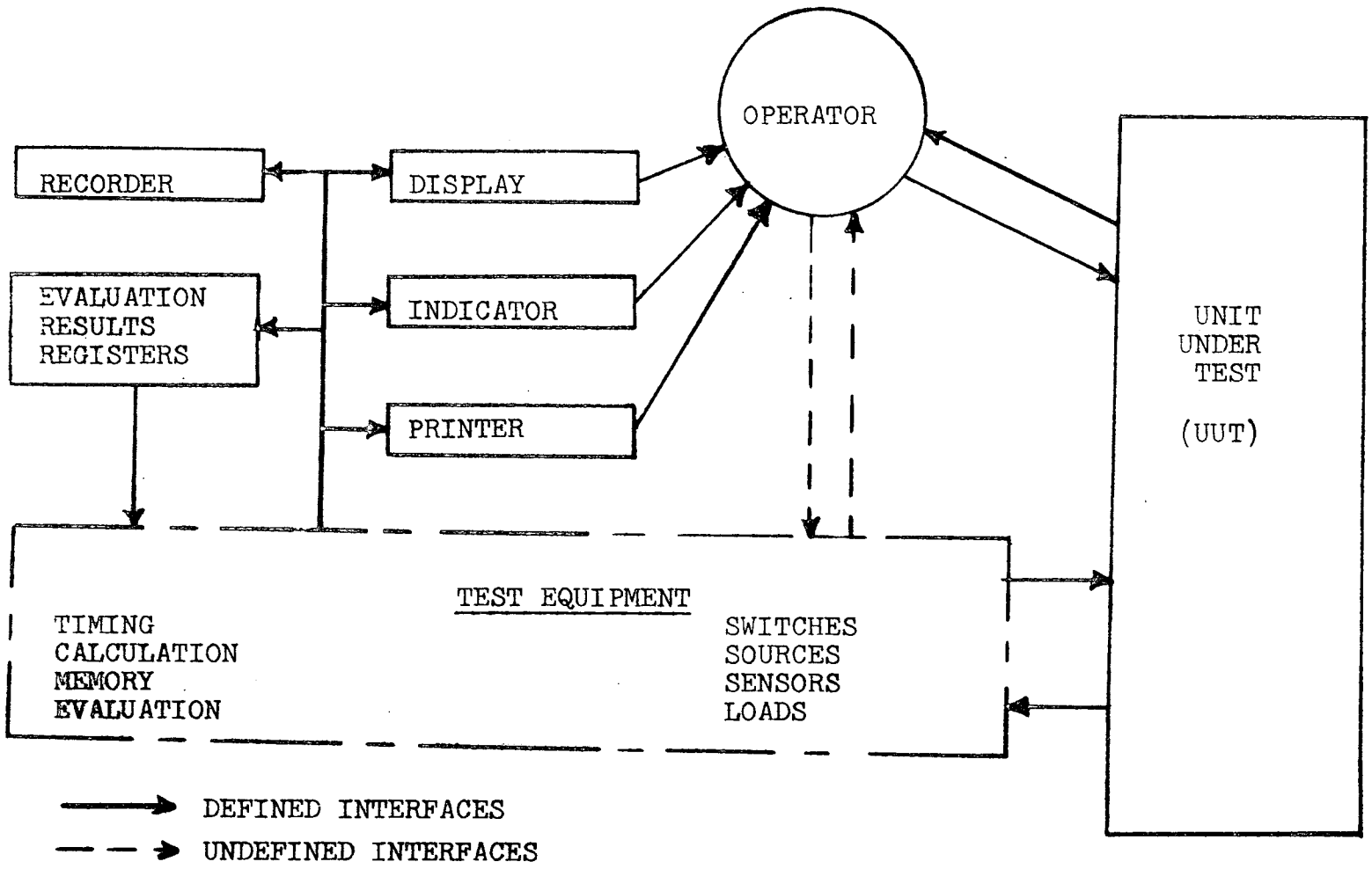

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ATLAS SPECIFICATION SYNTAX DIAGRAM (SIMPLIFIED)

fstatno ✓ APPLY,#noun, #[statement characteristics],#[conn] $

WHERE:

fstatno=FLAG AND STATEMENT NUMBER

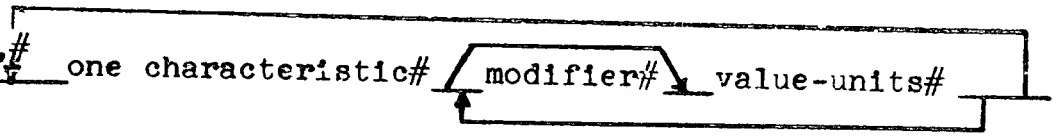
✓ =SINGLE SPACE ONLY

=ONE OR MORE SPACES

noun =DC SIGNAL,AC SIGNAL,HEAT,SYNCHRO,MANOMETRIC,ETC.

[statement characteristics]=VOLTAGE,CURRENT,TEMP,PRESSURE,ETC.
WITH MODIFIERS MAX,MIN,ERRLMT,RANGE,ETC.,
value AND units.

= ,# one characteristic# modifier# value-units#



[conn] = CNX HI J1-2 LO J1-1,CNX PITOT-PORT,
CNX POINT-A, (LOCATIONS ARE UUT NOMENCLATURE)

$ = STATEMENT TERMINATOR

```
C IN ALL STATEMENTS, ERRLMT REFERS TO THE ACCURACY
  REQUIRED OF THE TEST SYSTEM IN PROVIDING OR MEASURING
  THE CHARACTERISTIC $

100101  APPLY, DC SIGNAL,
        VOLTAGE 28.5V ERRLMT + -2.0V,
        CURRENT MAX  300MA,
        CNX  HI  JI - /A  LO  JI - 23  $

100102  VERIFY, (VOLTAGE), DC SIGNAL,
        VOLTAGE ERRLMT  + -.01V,
        TEST -EQUIP-IMP MIN 10KOHMS,
        SAMPLE WIDTH MIN 200MS,
        UL  30.5V
        LL  26.5V,
        CNX  HI  JI - /A
             LO  JI -23  $

100103  REMOVE, STEP 100101  $

100103  GOTO STEP 109901  IF LO, STEP
        100109 IF GO  $
```

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```
C    PREAMBLE STATEMENTS$

     000101   SPECIFY, SOURCE, DC SIGNAL,
              VOLTAGE 28.5V ERRLMT +-2.0V,
              CURRENT MAX 300MA,
              AC COMP MAX 100MV$

     000201   DEFINE, 'DISCRETE 314', SOURCE, DC SIGNAL,
              CNX  HI  J1-/A
                   LO  J1-23$

C    THE FOLLOWING ARE ALTERNATIVES IN PROCEDURES$

     010023   APPLY, 'DISCRETE 314'$

     010023   APPLY, DC SIGNAL, CNX HI J1-/A  LO J1-23$

     010023   APPLY, DC SIGNAL, VOLTAGE 28.5V  ERRLMT +-2.0V
              CURRENT MAX 300MA, AC COMP MAX 100MV,
              CNX HI  J1-/A  LO J1-23$
```

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```
C IN PREAMBLE$

 001090 DEFINE, 'CALCHECK', PROCEDURE,
  ('ENABLE ,  'STIM V ,)  RESULT ('A')$

 001091 APPLY, 'ENABLE'$

 001092 APPLY, DC SIGNAL, VOLTAGE
        'STIM V',  CNX HI J1-1 LO  J1-2$

 001093 MEASURE, (VOLTAGE), DC SIGNAL,
        VOLTAGE MAX 11V ERRLMT +-0.1PC,
        CNX HI J1-14 LO J1-23$

 001094 SAVE, 'MEASUREMENT', 'A'$

 001095 END, 'CALCHECK'$

C LATER IN PROCEDURE$

 100118 PERFORM, 'CALCHECK',
        'DISC 314',  4.0V, 'CAL .8FS'$

 100128 PERFORM, 'CALCHECK', TABLE
      3 VAR 3 TIMES,
      'DISC 314',    0.0V,       'CAL 0'
      'DISC 314',    2.5V,       'CAL .5FS'
      'DISC 314',    5.0V,       'CAL FS'$
C       ENABLE      STIM V          A     $
```

```
102090 CALCULATE, 'DRIFT' = 'V1' - 'V2'$

    92 COMPARE, 'DRIFT', LT 3.1V$

    93 REPEAT, STEP 100080 IF NO GO$

    95 REPEAT, STEP 100046 THRU STEP
       100050, 13 TIMES$

102105 REPEAT, STEP 100046, STEP
       100076, STEP 100104$

102200 MEASURE, TIME INTERVAL$
    01 START WHEN, (VOLTAGE), 'INTEG. OUT',
       EQ 1.0V, MAX TIME 2.0 SEC$
    02 APPLY, DC SIGNAL, 'DISC 315'$
    03 STOP WHEN, (VOLTAGE), 'INTEG. OUT'.
       EQ.3.5V, MAX TIME 15 SEC$
    04 GOTO, STEP 102207 IF NOGO$
    05 COMPARE, 'MEASUREMENT', UL 8.5
       SEC LL 5.5 SEC$
    06 GOTO, STEP 102300 IF GO$
    07 PRINT, MESSAGE,
FAILED  1022 INTEGRATER SLOPE TEST$
```

```
S104400 ADJUST, DC SIGNAL,
        UUT-1MP MIN 35KOHMS, VOLTAGE
        RANGE 0.0V TO 100V ERRLMT +-0.1V
        BY 0.1V
        RATE 1.0V/SEC,
        CNX  HI J3-47
             LO J1-23$

S   01 TO REACH, (VOLTAGE), DC SIGNAL,
        VOLTAGE ERRLMT +-10MV, EQ 400MV,
        CNX  HI J4-13
             LO J1-23$

    02 VERIFY, (VOLTAGE), DC SIGNAL,
        UL 72.5V LL69.4V,
        CNX  HI J3-47  LO J1-23$

110004 WAIT FOR, MANUAL INTERVENTION$

    06 WAIT FOR, 3.0MIN BEFORE STEP
       110100$
```

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```
200129 REMOVE,STEP 100102$


200131 REMOVE,CNX HI J2-47 J1-3
       J2-13 J5-12$

200245 REMOVE,'SIGNAL LIST 12'$

200302 APPLY,AC SIGNAL,VOLTAGE
       +12.0 +J16.0V,FREQ 400HZ,
       DISTORTION MAX 2.0PC,
       CNX HI J4-16
           LO J4-23
       REF HI J4-1
           LO J4-23$

200401 CALCULATE,'F42'=1

200622 COMPARE,'F42',EQ 1$

200623 GOTO,STEP 202206 IF EQ$

200624 PRINT,MESSAGE,

ALTERNATE TEST REQUIRED          REF. F42 OFF $
```

PROCEDURE - ORIENTED LANGUAGE FOR AEROSPACE APPLICATIONS.

A SUBSET OF SPACE PROGRAMMING LANGUAGE (SPL)

PRIMARY APPLICATIONS - GUIDANCE AND NAVIGATION.

ORIENTED TO ARITHMETIC AND LOGICAL MANIPULATIONS.

DESIGNED FOR USE BY A PROFESSIONAL PROGRAMMER.

NOT A TEST-ORIENTED LANGUAGE.

THE CLASP LANGUAGE CONSISTS OF FIVE TYPES OF STATEMENTS

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1) DATA DECLARATION.

2) FORMULAS AND ASSIGNMENT.

3) PROGRAM CONTROL.

4) SUBPROGRAM DEFINITION.

5) COMPILER DIRECTIVES.

CLASP DATA DECLARATION EXAMPLES:

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1) DECLARE FIXED MTP 24 12

2) DECLARE INTEGER = 0, K, L, M = 1, N

3) DECLARE BOOLEAN, UP = TRUE, HIGH = ON, DOWN = FALSE, LOW = 0

4) DECLARE TEXT, MESSAGE 13

5) DECLARE INTEGER, MATRIX (3,4) = (0,-6,-48,3,4,6,4(7),59,11)

6) ABLE. DECLARE INTEGER, A,B,C,D

7) DECLARE HARDWARE I, INDEX1 = 1, INDEX2 = 2

8) OVERLAY A,B,D,C, = K,L,M,N

CLASP FORMULA AND ASSIGNMENT EXAMPLES:

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1) MTP = (ALPHA + 2)/(ZLIK + (PI**3)) -3.14 + BETA

2) A = MTP LSH 1

3) B = A LAND $B^{1}010101^{1}$

4) A, B, C = 4, Q/R, ABS (Y)

5) ALPHA (*,4) = MATRIX (*, 4)

6) A = = N

CLASP PROGRAM CONTROL EXAMPLES:

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1) STAGE. ABLE = X * Y

2) GOTO STAGE

3) GOTO (LOC1,,LOC3,LOC4)INDX

4) IF ALPH LS BETA
   THEN GOTO STAGE
   ELSE ALPHA = BETA
   END

5) FOR I = 1 BY 2 TO N
   STATEMENTS
   END

6) LOCK INAME
   STATEMENTS

7) UNLOCK INAME

8) ON INAME
   STATEMENTS
   EXIT

CLASP SUBPROGRAM DEFINITION EXAMPLES:

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1)
```
PROC .CALC (A, B, C = OUTPUT)
      DATA DECLARATIONS
      STATEMENTS
EXIT
```

2)
```
.CALC (X, Y, Z = W)
```

3)
```
PROC .SIN (X)
DECLARE FIXED 24 12, SIN, X, RESULT
   DATA DECLARATIONS
   STATEMENTS
SIN = RESULT/2
EXIT
```

4)
```
IF X3 -.SIN (2*PI*F) GR 0.5
THEN GOTO L1
END
```

5)
```
CLOSE .GAMMA
  STATEMENTS
EXIT
```

6)
```
.GAMMA
```

CLASP COMPILER DIRECTIVE EXAMPLES:

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1) TRACE TEST, FIND
   STATEMENTS

2) UNTRACE

3) COUNT (3)
   STATEMENTS

4) UNCOUNT (3)

5) OPTIMIZE TIME (5)
   STATEMENTS

6) UNTIME

7) OPTIMIZE SPACE (2)
   STATEMENTS

8) UNSPACE

9) DIRECT
   MACHINE CODE

   END

FLOW CHART FOR SAMPLE CLASP PROGRAM

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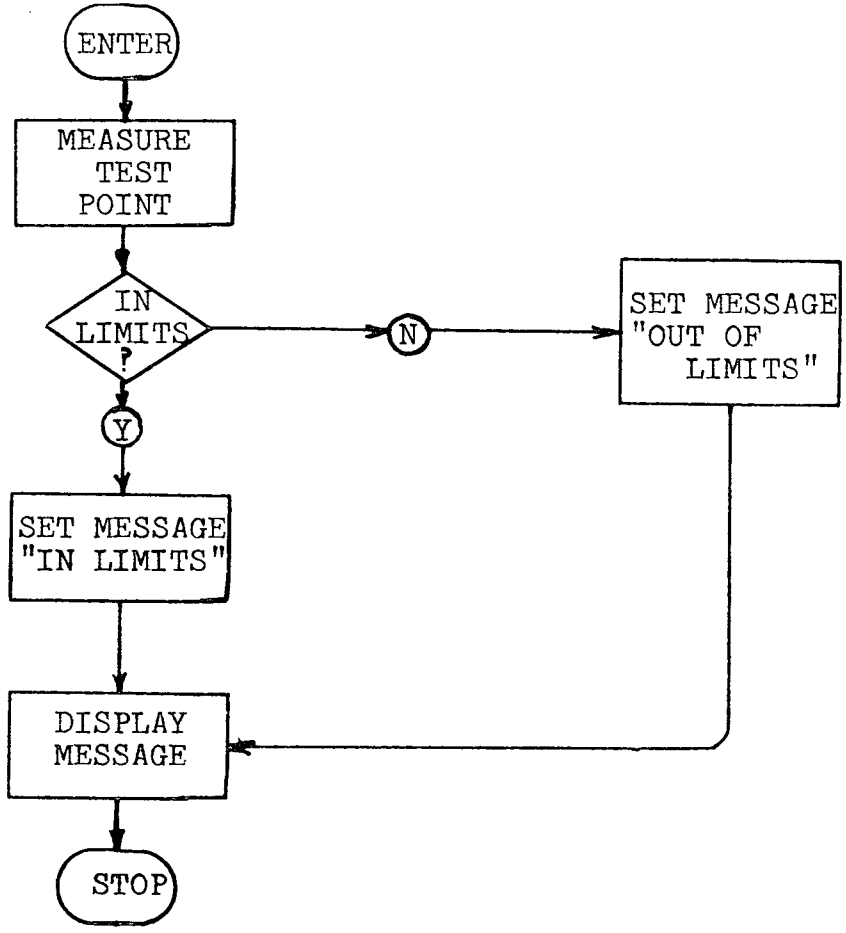

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```
START "SAMPLE CLASP PROGRAM"
    DECLARE FIXED, MTP "MEASUREMENT TEST POINT" 24 12.
    DECLARE TEXT, MESSAGE 13 = '                    '
    DIRECT
    "A DIRECT CODE PROCEDURE WOULD APPEAR HERE TO          *
     PERFORM I/O ASSOCIATED WITH MEASURING THE TEST        *
     POINT AND STORING THE VALUE MEASURED IN MTP."         *
    END
    IF MTP LS 9.9 OR MTP GR 10.1 "VOLTS"
    THEN MESSAGE = 'OUT OF LIMITS'
    ELSE MESSAGE = ' IN LIMITS   '
    END
    DIRECT
    "A DIRECT CODE PROCEDURE WOULD APPEAR HERE TO          *
     PERFORM I/O ASSOCIATED WITH MESSAGE OUTPUT"
    END
    STOP"THIS SAMPLE TEST"
TERM
```

TOOL - TEST ORIENTED ONBOARD LANGUAGE

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SPECIAL PURPOSE, TEST ORIENTED APPLICATION
TEST SYSTEM ORIENTED FIXED FORMAT LANGUAGE
TRANSLATOR-INTERPRETER MODE OF EXECUTION
PART OF AN ON-LINE INTERACTIVE MULTIPROGRAMMED
CHECKOUT SYSTEM FOR SPACECRAFT

- SELF-TEACHING.
- CONCURRENT TEST EXECUTION.
- TEST PRIORITIES AND PROTECTION.
- RESOURCE ALLOCATION.

NAME	PURPOSE
AGAIN	TERMINATE DO LOOP
BEGIN	BEGINNING OF TEST
CALL	CALL A SEQUENCE
CHECK	CHECK CONTENTS OF DATA CELL
CLEAR	CLEAR HARDWARE UNIT
CONNECT	CONNECT STIMULUS SWITCH
DELAY	DELAY ELEMENT EXECUTION
DISCONNECT	DISCONNECT STIMULUS SWITCH
DISPLAY	DISPLAY ON PLASMA OR MICROFILM
DO	START DO LOOP
END	END OF TEST
EVALUATE	EVALUATE DATA
GOTO	UNCONDITIONAL BRANCH
IF	CONDITIONAL BRANCH
INTERRUPT	INTERRUPT EXECUTION ON TIME OUT
MEASURE	MEASUREMENT DEVICE CONTROL
MILESTONE	SPECIAL DISPLAY ON PLASMA
READ	READ DATA
RECORD	RECORD DATA
REPEAT FLAG	REPEATABLE ELEMENTS FLAG
START	START TEST ON CONCURRENT LEVEL
STIMULATE	STIMULUS UNIT CONTROL
STOP	STOP TEST ON CONCURRENT LEVEL
TRANSFER	TRANSMIT DATA

PLASMA DISPLAY WORK AREA:

```
SEQ NASA                BEGIN
PASSWORD:               KSC
     [TO BE COMPLETED BY OPERATOR]
```

MICROFILM CUE FRAME:

```
431 WRITE MODE
    BEGIN ELEMENT -  SELECT PROTECTION KEYS
    ENTER N  NO PROTECTION
          C  CALL EXECUTE INHIBIT
          K  KEYBOARD EXECUTE INHIBIT
          D  DELETE INHIBIT
          R  REVIEW INHIBIT
          M  MODIFY INHIBIT
    MULTIPLE ENTRIES MUST BE IN THE ABOVE
    ORDER AND SEPARATED BY COMMAS.
    EXAMPLE: C, K, R
```

PLASMA DISPLAY WORK AREA:

```
SEQ   NASA        STIMULATE
DC VOLTS  SGU1 AUTO ON
  [TO BE COMPLETED BY OPERATOR]
```

MICROFILM CUE FRAME:

```
554  WRITE MODE - STIMULATE ELEMENT
 DC  VOLTAGE AMPLITUDE
 ENTER VOLTAGE AMPLITUDE IN THE FORM:
    ±XX.XX; -40.00 VOLTS/PEAK ≤±XX.XX≤ +40.00 VOLTS/PEAK
    OR AS A DATA CELL NUMBER, D0 TO D9
```

CAGE TEST LANGUAGE (CTL)

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DENVER DIVISION

1. CHECKOUT EQUIPMENT ORIENTED
2. UNIT UNDER TEST ORIENTED

DESIGNED TO PROVIDE A NEAR ENGLISH TEST ORIENTED LANGUAGE

FOR USE WITH THE TITAN-IIIM CHECKOUT EQUIPMENT

CAGE TEST LANGUAGE --OFF LINE TRANSLATOR

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	ELEMENT																		
	BEGIN	END	SEQUENCE	REP/TEST	APPLY	CONNECT	STIMULATE	MEASURE	CK/ANALOG	CK/DISC	SET/(DMS)(PCM)	DEFER/(KEY)(TIME)	CONTINUE	SYSTEM/TEST	TIME	RESET	REPEAT	DISPLAY	SAVE	RESTORE
MODIFIER	TEST NO.	NONE	SEQ. NAME	RT NAME	CAGE NO.	CAGE NO.	D/A NO.	A/D NO.	A/D NO.	CAGE NO.	CAGE NO.	CAGE NO.	NONE	ST NAME	TIMER NO.	D/A	REP. NO'S	TEXT	TEMP	TEMP
				"P" LIST			B/G NO.	MODE	INTER-VAL	GROUP NO.	GROUP NO.	TIME VALUE		"P" LIST	INTER-VAL	B/G		MILE-STONE		
							SIN	RNG	LIMITS	ON/ OFF	ON/ OFF	ON/ OFF			DELAY	A/D		DATA		
							FREQ	SAMPLE	COM-PUTA-TION	N/M	OPEN/ CLOSE	DEF. ELE-MENTS			C/D VALUE	ALL		STA-TUS		
							LEVEL	LIMITS	RE-TAIN	DEC. TIME	ERON/ EROF				C/D START	ANAL. SW. NO.		PAUSE		
							RNG	INTER-VAL	ADD, SUB DIV	COND. TEST	ALT. ACTION				C/D STOP	ANALOG		NO-GO		
							DURA-TION	SMOOTH	DATA1 DATA9		NULL, AMB, OP.LIM				PAUSE/ SEQ	TIMER NO.		PRINT		
								SPS	COND. TEST							C/D		LCC		
								POINTS								DISC SW. NO.		CAGE NO.		
								COND. TEST								DISC-NO.		DE-VICE NO.		
								DATA RATE										AMB		

1. CHECKOUT EQUIPMENT ORIENTED

2. UNIT UNDER TEST ORIENTED

DESIGNED TO PROVIDE A COMMUNICATION MEDIUM BETWEEN THE TEST ENGINEER AND THE VIKING SYSTEM TEST EQUIPMENT

1. CHECKOUT EQUIPMENT ORIENTED

2. UNIT UNDER TEST ORIENTED

PROVIDE PROCESS INTERCOMMUNICATION BETWEEN UPLINK AND DOWNLINK

ACE-S/C CHECKOUT OPERATIONS INVOLVED WITH APOLLO PROGRAM

1. CHECKOUT EQUIPMENT ORIENTED
2. UNIT UNDER TEST ORIENTED

PROVIDE FOR PARAMETRICALLY CONTROLLED SEQUENCES IN THE SKYLAB TEST PROGRAM (ATM)

ATOLL-II

- DEVELOPED FOR SATURN, BUT NOT IMPLEMENTED.
- WOULD PROBABLY HAVE BEEN MODIFIED IF IMPLEMENTED.
- COULD BE MADE QUITE READABLE BY DILIGENT PROGRAMMER.
- IS SIGNIFICANTLY PROGRAMMER ORIENTED.
- REQUIRES MANY DECLARATIONS.
- EXTENSIVE CAPABILITES FOR ARRAYS, LISTS, PAIR-LISTS, ETC.
- ACCOMMODATES: RCA 110A TO RCA 110A COMMUNICATIONS
  PARALLEL PROGRAMS AND MONITORING
  POSTING OF SUBROUTINES
  ANALOGS
  ARITHMETIC
- DIFFICULT MANUAL, SOME ERRORS AND OMISSIONS.

```
                    PROC INCREMENT,LOAD (A) AMP,EVERY (B) SEC
                    (A PROCEDURE WOULD FOLLOW USING A AND B AS PARAMETERS)
                    DECLARE EXTERNAL DOV (TRANS.SW,1=D214)
                    TURN ON TRANS.SW.1 ELSE GO TO TS1M1
-30/10              PULSE OFF TRANS.SW,1 FOR 2.0 SEC ELSE GO TO TS1M2
-28/00              DISO TRANS.SW.1=OFF ELSE GO TO TS2M2
                    DOMNTR DOV12,FTPL2,EXECUTE BUR2
                      :
                    RELEASE DOMNTR (DOV12)
                    POST MONITOR CHECK.HYDRA.PRESS
                    SAMPLE FWD.BATT.VOLTAGE,ARRAY.3,INDEX.4,FOR 10 SEC.
          DO.3      DO (J)=1,16,1 WHILE FWD.BATT.VOLTAGE GT 26.0 VDC
                    INCREMENT.LOAD 1.0 AMP.EVERY 5 SEC
                    END DO.3
M                   INTERROGATE DOM,$ WHAT IS THE DAY OF THE MONTH?$
                    REQUEST (64) VALUE.LIST.12
                    TRANSMIT (32) SIGNAL.LIST.7
          PT9B      PROC PARALLEL.TEST.9
                    DISO K108=ON,K102-OFF,K304=ON,PS.1=ON,BATT.2=ON
C                   ELSE GO TO PT9S1
                      :
          PT9S1     SYNC (1)
                      :
                    END PT9B

                    START PARALLEL.TEST.9 AT 5 SEC AFTER STEP SPT9
          SPT9      TURN ON VOR.RECEIVER ELSE GO TO D214
                    SYNC (1)
                      :
```

MOLTOL

MARTIN MARIETTA DENVER DIVISION

- DEVELOPED FOR MANNED ORBITING LAB, NOT IMPLEMENTED.
- VERY SIMILAR TO ATOLL-II, INCLUDES ATOLL-II FEATURES.
- PROVIDES FOR CONTROL OF STATEMENT EXECUTION RATE.
- PROVIDES FOR COMMUNICATING WITH ON-BOARD COMPUTER.
- PROVIDES FOR DEFINING NEW TERMS FOR MOLTOL PRIMITIVES,E.G.

  DEFINE TURN ON AS DISO.
- MANUAL SOMEWHAT BETTER THAN ATOLL-II, SOME OMISSIONS.

```
DOPA    APPLY DO.PROF.A,ELSE EXECUTE SEMI.1

        SET PWR.A.ON.COMMAND,ELSE GO TO CMD.CHECK

        APPLY 5.0 VDC TO UR.VDA.INPUT,ELSE GO TO A102

        APPLY VDA.STIM.ARRAY TO VDA.INPUT.LIST,ELSE EXECUTE SEMI.2

        OPEN PRESSURE.RELIEF.VALVE,ELSE RUN

        DISPATCH 23,1,ELSE EXECUTE TEST.OBC

        READ PWR.A.VOLTAGE TO PAV(1,1)

SCAN    SAMPLE AILIST,AIVOLTS.ARRAY,NO.SAMPLES,10 SEC FOR 10 MIN

        IF PWR.B.VOLTAGE LT 26.0 VDC,THEN EXECUTE SEMI.1

        INCREMENT=250

        C=(ARCTAN(Y/X))*0.5
```

1 APPLY A VOLTAGE TO OPERATE A RELAY

2 RELAY IS CALLED "BATTERY TRANSFER"

3 CHECK A RELAY CONTACT TO VERIFY RELAY OPERATION

4 OPERATE TIME MAY BE AS LONG AS 10 MILLISECONDS

5 CONTINUE WITH NEXT TEST IF "GO"

6 DISPLAY ERROR MESSAGE AND HOLD IF "NO GO"

```
000100 NAME                          ILAFF
000200 CODE                          A4
001000 DISA                          MDO,123
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
001400 DISO1                         MDO,123
001500 DELY1                      10 MDI111,B003100
001600 SEMI1          *BATTERY TRANSFER CONTROL NO GO REF 0015*
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
003100 TFLG1                         F14,B999999
   :
999999 END
```

```
000100 BEGIN ATLAS PROGRAM $
000112 DEFINE,'BATT TRANS CONT', SOURCE,DC SIGNAL,VOLTAGE
       28.5V,CURRENT MAX 300MA,CNX HI SIJ4-202 LO COMMON $

000122 DEFINE,"BATT TRANS IND',SENSOR,(VOLTAGE),DC SIGNAL
       VOLTAGE MAX 32V,CURRENT MAX 100MA,GT 25.0V,
       CNX HI SIJ4-303 LO COMMON $
```

```
E100121 APPLY,'BATT TRANS CONT'$

    23 DELAY,10 MS $

    25 VERIFY,'BATT TRANS IND'$

    26 GO TO,STEP 100100 IF GO$

    27 DISPLAY,MESSAGE,
BATTERY TRANSFER NO GO                    REF. 1001 $

    28 WAIT FOR,MANUAL INTERVENTION $
```

```
B$
E100100 GO TO -----$
B999999 TERMINATE ATLAS PROGRAM $
```

```
START "BATTEST"
     DECLARE FIXED,MDI 24 12
     DECLARE TEXT,MSG 5 = 'NO GO'
     DIRECT
A1.  "MACHINE CODE TO CONNECT AND APPLY VOLTAGE    *
      TO BATTERY TRANSFER CONTROL,AND READ         *
      BATTERY TRANSFER INDICATOR AND STORE VALUE,  *
      APPROPRIATELY SCALED,IN MDI."
     END
     IF MDI GR 25.0
        THEN GOTO NEXTEST
     END
     DIRECT
     "MACHINE CODE TO OUTPUT NOGO MESSAGE"
     END
     STOP A1
     NEXTEST.  STATEMENT
                  .
                  .
               STATEMENT
     STOP
TERM
```

```
            BEGIN           BATTEST

            CONNECT         D213

            STIMULATE       DC,VOLTAGE,+28.0V,AS

            DELAY           0:0:10

            MEASURE         DC,D512,D1,+28.0V

            CHECK           LIMITS,+30.0V,+25.0V,D1

            IF              IN,10
            STIMULATE       CLEAR
            DISPLAY         MESSAGE,AMD,ADU,$NO GO$

            END B

      10    STATEMENT
              .
              .
            STATEMENT
            END A
            FIN
```

CTL COMPARISON TEST

MARTIN MARIETTA
DENVER DIVISION

```
*SEQUENCE BATEST
*SEQUENCE ELEMENTS

     10.0 SET/DMS,OPEN,1D747
          APPLY,1D747
          CK/D,1D748,ON,10MS,10.1
          BEGIN 20.0
     10.1 D/NO-GO,DISC,STOP
          RESET,1D747
     20.0 (NEXT TEST)
          .
          .
          .
END
```

```
BGNA    BEGIN BATT.TEST
        DECLARE EXTERNAL DOV(BATT.TRANS.CONT=D213)
        DECLARE EXTERNAL VDI(BATT.TRANS.IND=D512)
        CONSOLE=A4

C102    TURN ON BATT.TRANS.CONT,ELSE GO TO BTNG
        DELAY 10 MS
        IF BATT.TRANS.IND IS ON,THEN GO TO NEXTEST,
C       ELSE CONTINUE
BTNG    HALT $ BATTERY TRANSFER IS NO GO C102 $

NEXTEST ---
ENDA    END BATT.TEST
```

CONCLUSIONS

MARTIN MARIETTA
DENVER DIVISION

- TEST ORIENTED LANGUAGES
  - PROVIDE A LANGUAGE TO ACCOMPLISH AUTOMATIC CHECKOUT TASKS.
  - AID IN ACCOMPLISHING AUTOMATION THROUGH MAN-MACHINE COMMUNICATION.
- WHY A NEW LANGUAGE?
  - TO CORRECT DEFICIENCIES FOUND IN EXISTING TEST ORIENTED LANGUAGES.
  - INCORPORATE WHAT HAS BEEN LEARNED FROM PAST EFFORT.

PROBLEMS

MARTIN MARIETTA
DENVER DIVISION

DIFFICULT TO LEARN TO WRITE

DIFFICULT TO LEARN TO READ

ABSENCE OF ARITHMETIC CAPABILITES

LACK OF SAFEGUARDS

MINIMUM CHECKING FEATURES

CHECKOUT SYSTEM DEPENDENT