

Advanced Software Development Workstation

Knowledge Base Design

Design of Knowledge Base for Flight Planning Application

Michel Izygon

Barrios Technology, Inc.

December 31, 1992

**Cooperative Agreement NCC 9-16
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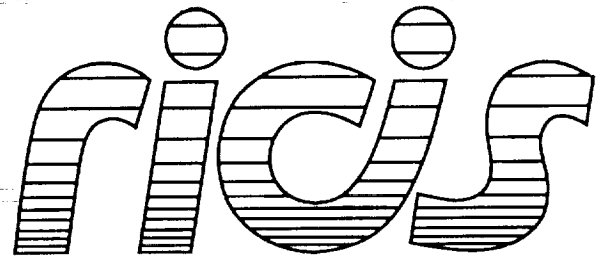
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(NASA-CR-192818) ADVANCED SOFTWARE
DEVELOPMENT WORKSTATION. KNOWLEDGE
BASE DESIGN: DESIGN OF KNOWLEDGE
BASE FOR FLIGHT PLANNING
APPLICATION (Research Inst. for
Computing and Information Systems)
16 p



*Research Institute for Computing and Information Systems
University of Houston-Clear Lake*

RICIS Preface

This research was conducted under auspices of the Research Institute for Computing and Information Systems by Dr. Michel Izygon of Barrios Technology, Inc. Dr. Rodney L. Bown served as the RICIS research coordinator.

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The views and conclusions contained in this report are those of the author and should not be interpreted as representative of the official policies, either express or implied, of UHCL, RICIS, NASA or the United States Government.

Advanced Software Development Workstation

**Knowledge Base Design
Design of Knowledge Base for Flight Planning Application**

**Prepared for
NASA-Johnson Space Center**

December 31, 1992

**Submitted by
Dr. Michel Izygon
Barrios Technology Inc.
1331 Gemini Av.
Houston, TEXAS 77058**

ABSTRACT

This deliverable contains the listing of the INTUIT knowledge base, and hardcopies of some panels developed with TAE+ as entry forms, developed for the Intelligent User Interface of the MOC/COMMAND system Test Library.

Knowledge Base Design
Design of Knowledge Base for Flight Planning Application
RICIS Project
Michel Izygon

Summary

The development process of the knowledge base for the generation of Test Libraries for Mission Operations Computer (MOC) Command Support focused on a series of information gathering interviews with Glen Rieke. These knowledge capture sessions are supporting the development of a prototype for evaluating the capabilities of INTUIT on such an application. The prototype includes functions related to POCC (Payload Operation Control Center) processing. It prompts the end-users for input through a series of panels and then generates the Meds associated with the initialization and the update of hazardous command tables for a POCC Processing TLIB.

This deliverable includes:

- the listing of the file TLIB_KB4.art, which is the knowledge base written in ART-IM,
- sample computer screen panels developed in order for the user to easily enter the needed data.

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TLIB_KB4.art

```
* -----*
(DEFSCHEMA CASES
 (INSTANCE-OF SLOT)
 (CARDINALITY MULTIPLE)
 (INHERITS YES))

(DEFSCHEMA SIGNON
 (INSTANCE-OF SLOT)
 (CARDINALITY MULTIPLE)
 (INHERITS YES))

(DEFSCHEMA CONSOLE_LIST
 (INSTANCE-OF SLOT)
 (CARDINALITY MULTIPLE)
 (INHERITS YES))

(DEFSCHEMA VEHICLE_LIST
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 (CARDINALITY MULTIPLE)
 (INHERITS YES))

(DEFSCHEMA PBI_LIST
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 (CARDINALITY MULTIPLE)
 (INHERITS YES))

(DEFSCHEMA MEDS
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 (CARDINALITY MULTIPLE)
 (INHERITS YES))

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 (CARDINALITY MULTIPLE)
 (INHERITS YES))

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 (COMMENTS)
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* -----*
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 (NAME "COMMAND_TERM_PRTY_ABORT"))

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 (COMMENTS))

* -----*
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* -----*
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* -----*
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* -----*
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* -----*
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* -----*
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 (COMMENTS)
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* -----*
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 (COMMENTS)
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* -----*
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 (COMMENTS)
 (NAME "ORBITER_UPLINK_FORMAT"))

* -----*
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* -----*
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 (SCAN))
```

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```
(PBI_VAL)
(FL_ID)
(DATA_TYPE)
(FIELD_SELECT)
(HAS-FORM-SPECIFICATION)
(NAME_MED_I69))

* -----
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(OPTION)
(TITLE)
(VEHID)
(GROUPID)
(MNEMONIC)
(HAZCMD01)
(HAZCMD02)
(HAZCMD03)
(HAZCMD04)
(HAZCMD05)
(HAZCMD06)
(HAZCMD07)
(HAZCMD08)
(HAZCMD09)
(HAZCMD10)
(HAZCMD11)
(HAZCMD12)
(HAZCMD13)
(HAZCMD14)
(HAZCMD15)
(HAZCMD16)
(HAS-FORM-SPECIFICATION FORM-FOR-MED_C88)
(NAME_MED_C88))

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(FILE-NAME "hazar_cmd.res")
(FORM-FOR-CLASS MED_C88)
(HAS-PANEL-SPECS (PANEL-FOR-CASE_POCC_HAZCMD)))

* -----
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(IS-A MED)
(OPTION)
(DELTA_TIME)
(CMDTYPE)
(SOURCE_NAME)
(NB_CMD_WORDS)
(UPLINK_MODE)
(PLDID)
(NCICNB)
(FL_ID)
(DATA_TYPE)
(HAS-FORM-SPECIFICATION FORM-FOR-MED_N65)
(NAME_MED_N65))

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(FILE-NAME "med_n65.res")
(FORM-FOR-CLASS MED_N65)
(HAS-PANEL-SPECS (PANEL-FOR-MED_N65)))

(DEFSCHEMA PANEL-FOR-MED_N65
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(PANEL-NAME "MED_N65"))
(HAS-ITEM-SPECS OPTION-DELTATIME-SPEC DELTATIME-SPEC CMDTYPE-SPEC SOURCE_NAME-SPEC NB_CMD_WORDS-SPEC
EC UPLINK_MODE-SPEC PLDID-SPEC NCICNB-SPEC FL_ID-SPEC DATA_TYPE-SPEC)
)

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(VALUE-TYPE SYMBOL)
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(VALUE-TYPE FLOAT)
)

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(VALUE-TYPE SYMBOL)
)

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(INSTANCE-OF ITEM-SPECIFICATION)
```

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(VALUE-TYPE SYMBOL)  
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(COMMENTS)  
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* -----  
(DEFSHEMA TLIB  
(IS-A OBJECT)  
(CASES_POCC)  
(CASES_2STAGES)  
(CASES_DELOGS)  
(CASES_SYSTEM_CONFIGURATION)  
(MEDS)  
(FLIGHT_ID)  
(SITE_ID)  
(ORBITER_ID)  
(NAME "TLIB"))  
  
(DEFSHEMA SITE_ID-RESTRICTION  
(INSTANCE-OF ATTRIBUTE-RESTRICTION)  
(HAS-ENUMERATED-SET SITE_ID-SET))  
  
(DEFSHEMA SITE_ID-SET  
(INSTANCE-OF ENUMERATED-SET)  
(ALLOWABLE-VALUES (BDA AGOS BOTS HAW IOS MIL YARS)))  
  
(DEFSHEMA ORBITER_ID-RESTRICTION  
(INSTANCE-OF ATTRIBUTE-RESTRICTION)  
(HAS-ENUMERATED-SET ORBITER_ID-SET))  
  
(DEFSHEMA ORBITER_ID-SET  
(INSTANCE-OF ENUMERATED-SET)  
(ALLOWABLE-VALUES (102 103 104 105)))  
  
(DEFSHEMA TLIB_FORMULA  
(INSTANCE-OF FORMULA)  
(ARGUMENTS (NAME FLIGHT_ID ORBITER_ID SITE_ID)  
(ATTRIBUTE TEXT)  
(FUNCTION TLIB_TEXT))  
  
(DEFSHEMA CASES_POCC-RESTRICTION  
(INSTANCE-OF ATTRIBUTE-RESTRICTION)  
(ALLOWABLE-CLASSES POCC_PROCESSING)  
(ATTRIBUTE CASES_POCC))  
  
(DEFSHEMA CASES_2STAGES-RESTRICTION  
(INSTANCE-OF ATTRIBUTE-RESTRICTION)  
(ALLOWABLE-CLASSES TWO_STAGE_PROCESSING)  
(ATTRIBUTE CASES_2STAGES))  
  
* -----  
(DEFSHEMA CASE POCC_INITIALIZATION  
(IS-A POCC_PROCESSING)  
(SIGNON SWCO NET CMD)  
(PRINT_LOAD_LIST YES)  
(TELEMETRY)  
(CONSOLE_LIST)  
(CONSOLE_1 POI)  
(CONSOLE_2 NIL)  
(CONSOLE_3 NIL)  
(CONSOLE_4 NIL)  
(CONSOLE_5 NIL)  
(VEHICLE_LIST)  
(VEH_1)  
(VEH_2 "NIL")  
(VEH_3 "NIL")  
(VEH_4 "NIL")  
(VEH_5 "NIL")  
(PBI_LIST)  
(PBI_1)  
(PBI_2 "NIL")  
(PBI_3 "NIL")  
(PBI_4 "NIL")  
(PBI_5 "NIL")  
(HAS-FORM-SPECIFICATION FORM-FOR-CASE_POCC_INIT)  
(NAME "CASE_POCC_INITIALIZATION"))  
  
* -----  
(DEFSHEMA CASE POCC_INIT_FORMULA  
(INSTANCE-OF FORMULA)  
(ARGUMENTS (NAME CONSOLE_1 CONSOLE_2 CONSOLE_3 CONSOLE_4 CONSOLE_5)  
(ATTRIBUTE CONSOLE_LIST)  
(CONSTRAINT OF CASE_POCC_INITIALIZATION)  
(FUNCTION CASE_POCC_INIT_FUN))  
  
* -----  
(DEFSHEMA CASE POCC_INIT_2_FORMULA  
(INSTANCE-OF FORMULA)  
(ARGUMENTS (NAME VEH_1 VEH_2 VEH_3 VEH_4 VEH_5)  
(ATTRIBUTE VEHICLE_LIST)  
(CONSTRAINT OF CASE_POCC_INITIALIZATION)  
(FUNCTION CASE_POCC_INIT_FUN))  
  
* -----  
(DEFSHEMA CASE_POCC_INIT_3_FORMULA  
(INSTANCE-OF FORMULA)  
(ARGUMENTS (NAME PBI_1 PBI_2 PBI_3 PBI_4 PBI_5)  
(ATTRIBUTE PBI_LIST)  
(CONSTRAINT OF CASE_POCC_INITIALIZATION)  
(FUNCTION CASE_POCC_INIT_FUN))
```

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```
(DEFSHEMA SIGNON-RESTRICTION
(INSTANCE-OF ATTRIBUTE-RESTRICTION)
(HAS-ENUMERATED-SET SIGNON-SET))
)
(DEFSHEMA SIGNON-SET
(INSTANCE-OF ENUMERATED-SET)
(ALLOWABLE-VALUES (SWCO TLM CMD NET TRAJ)))
)
(DEFSHEMA MEDS-RESTRICTION
(INSTANCE-OF ATTRIBUTE-RESTRICTION)
(ALLOWABLE-CLASSES MED)
(ATTRIBUTE MEDS))
)
* -----
(DEFSHEMA FORM-FOR-CASE_POCC_INIT
(INSTANCE-OF FORM-SPECIFICATION)
(FILE-NAME "case.pocc.init.res")
(FORM-FOR-CLASS CASE_POCC_INITIALIZATION)
(HAS-PANEL-SPECS (PANEL-FOR-CASE_POCC_INIT)))
)
(DEFSHEMA PANEL-FOR-CASE_POCC_INIT
(INSTANCE-OF PANEL-SPEC)
(PANEL-NAME "caseinit")
(HAS-ITEM-SPECS CONSOLE_1-SPEC CONSOLE_2-SPEC CONSOLE_3-SPEC CONSOLE_4-SPEC CONSOLE_5-SPEC
TELEMETRY-SPEC
VEH_1-SPEC VEH_2-SPEC VEH_3-SPEC VEH_4-SPEC VEH_5-SPEC PBI_1-SPEC PBI_2-SPEC PBI_3-SPEC
PBI_4-SPEC PBI_5-SPEC))
)
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)
)
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)
)
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(PARM-NAME "CONSOLE_2")
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)
)
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(CORRESPONDS-TO-ATTRIBUTE CONSOLE_3)
(PARM-NAME "CONSOLE_3")
(VALUE-TYPE SYMBOL)
)
)
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(CORRESPONDS-TO-ATTRIBUTE CONSOLE_4)
(PARM-NAME "CONSOLE_4")
(VALUE-TYPE SYMBOL)
)
)
```

```
(DEFSHEMA CONSOLE_5-SPEC
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(CORRESPONDS-TO-ATTRIBUTE CONSOLE_5)
(PARM-NAME "CONSOLE_5")
(VALUE-TYPE SYMBOL)
)
)
(DEFSHEMA VEH_1-SPEC
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(CORRESPONDS-TO-ATTRIBUTE VEH_1)
(PARM-NAME "VEHICLE_1")
(VALUE-TYPE STRING)
)
)
(DEFSHEMA VEH_2-SPEC
(INSTANCE-OF ITEM-SPECIFICATION)
(CORRESPONDS-TO-ATTRIBUTE VEH_2)
(PARM-NAME "VEHICLE_2")
(VALUE-TYPE STRING)
)
)
(DEFSHEMA VEH_3-SPEC
(INSTANCE-OF ITEM-SPECIFICATION)
(CORRESPONDS-TO-ATTRIBUTE VEH_3)
(PARM-NAME "VEHICLE_3")
(VALUE-TYPE STRING)
)
)
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(INSTANCE-OF ITEM-SPECIFICATION)
(CORRESPONDS-TO-ATTRIBUTE VEH_4)
(PARM-NAME "VEHICLE_4")
(VALUE-TYPE STRING)
)
)
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(INSTANCE-OF ITEM-SPECIFICATION)
(CORRESPONDS-TO-ATTRIBUTE VEH_5)
(PARM-NAME "VEHICLE_5")
(VALUE-TYPE STRING)
)
)
(DEFSHEMA PBI_1-SPEC
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(CORRESPONDS-TO-ATTRIBUTE PBI_1)
(PARM-NAME "PBI_1")
(VALUE-TYPE STRING)
)
)
(DEFSHEMA PBI_2-SPEC
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(PARM-NAME "PBI_2")
(VALUE-TYPE STRING)
)
)
(DEFSHEMA PBI_3-SPEC
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(PARM-NAME "PBI_3")
(VALUE-TYPE STRING)
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)
```


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```
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(CORRESPONDS-TO-ATTRIBUTE PBI_4)  
(PARAM-NAME "PBI_4")  
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```

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(PARAM-NAME "PBI_5")  
(VALUE-TYPE STRING)  
)
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```
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(DEFSHEMA CASE_POCC_HAZARD_CMD_UPD  
(IS-A POCC_PROCESSING)  
(OPTION)  
(TITLE)  
(VEHID)  
(GROUP ID)  
(MNEMONIC)  
(OPENHAZ)  
(ENBHAZ)  
(HAZCMD01)  
(HAZCMD02)  
(HAZCMD03)  
(HAZCMD04)  
(HAZCMD05)  
(HAZCMD06)  
(HAZCMD07)  
(HAZCMD08)  
(HAZCMD09)  
(HAZCMD10)  
(HAZCMD11)  
(HAZCMD12)  
(HAZCMD13)  
(HAZCMD14)  
(HAZCMD15)  
(HAZCMD16)  
(HAS-FORM-SPECIFICATION FORM-FOR-CASE_POCC_HAZ_CMD_UPD)  
(NAME "CASE_POCC_HAZARD_CMD_UPD")
```

```
* ----- *  
(DEFSHEMA FORM-FOR-CASE_POCC_HAZ_CMD_UPD  
(INSTANCE-OF FORM-SPECIFICATION)  
(FILE-NAME "hazar.cmd.res")  
(FORM-FOR-CLASS CASE_POCC_HAZARD_CMD_UPD)  
(HAS-PANEL-SPECS (PANEL-FOR-CASE_POCC_HAZCMD)))  
  
(DEFSHEMA PANEL-FOR-CASE_POCC_HAZCMD  
(INSTANCE-OF PANEL-SPEC)  
(PANEL-NAME "hazcmd")  
(HAS-ITEM-SPECS OPTION-SPEC VEHID-SPEC GROUPID-SPEC TITLE-SPEC MNEMONIC-SPEC OPENHAZ-SPEC  
EC ENBHAZ-SPEC HAZCMD01-SPEC  
C HAZCMD02-SPEC HAZCMD03-SPEC HAZCMD04-SPEC HAZCMD05-SPEC HAZCMD06-SPEC HAZCMD07-SPEC  
C HAZCMD08-SPEC HAZCMD09-SPEC HAZCMD10-SPEC HAZCMD11-SPEC HAZCMD12-SPEC HAZCMD13-SPEC  
C HAZCMD14-SPEC HAZCMD15-SPEC HAZCMD16-SPEC))
```

```
(DEFSHEMA OPTION-SPEC
```

```
(INSTANCE-OF ITEM-SPECIFICATION)  
(CORRESPONDS-TO-ATTRIBUTE OPTION)  
(PARAM-NAME "OPTION")  
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```
(DEFSHEMA VEHID-SPEC  
(INSTANCE-OF ITEM-SPECIFICATION)  
(CORRESPONDS-TO-ATTRIBUTE VEHID)  
(PARAM-NAME "VEHID")  
(VALUE-TYPE INTEGER)  
)
```

```
(DEFSHEMA GROUPID-SPEC  
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(PARAM-NAME "GROUPID")  
(VALUE-TYPE INTEGER)  
)
```

```
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(INSTANCE-OF ITEM-SPECIFICATION)  
(CORRESPONDS-TO-ATTRIBUTE TITLE)  
(PARAM-NAME "TITLE")  
(VALUE-TYPE STRING)  
)
```

```
(DEFSHEMA OPENHAZ-SPEC  
(INSTANCE-OF ITEM-SPECIFICATION)  
(CORRESPONDS-TO-ATTRIBUTE OPENHAZ)  
(PARAM-NAME "OPENHAZ")  
(VALUE-TYPE SYMBOL)  
)
```

```
(DEFSHEMA ENBHAZ-SPEC  
(INSTANCE-OF ITEM-SPECIFICATION)  
(CORRESPONDS-TO-ATTRIBUTE ENBHAZ)  
(PARAM-NAME "ENBHAZ")  
(VALUE-TYPE SYMBOL)  
)
```

```
(DEFSHEMA MNEMONIC-SPEC  
(INSTANCE-OF ITEM-SPECIFICATION)  
(CORRESPONDS-TO-ATTRIBUTE MNEMONIC)  
(PARAM-NAME "MNEMONIC")  
(VALUE-TYPE STRING)  
)
```

```
(DEFSHEMA HAZCMD01-SPEC  
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(CORRESPONDS-TO-ATTRIBUTE HAZCMD01)  
(PARAM-NAME "HAZCMD01")  
(VALUE-TYPE SYMBOL)  
)
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```
(DEFSHEMA HAZCMD02-SPEC  
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(PARAM-NAME "HAZCMD02")  
(VALUE-TYPE SYMBOL)  
)
```

```
(DEFSHEMA HAZCMD03-SPEC
```

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```
(INSTANCE-OF ITEM-SPECIFICATION)
(CORRESPONDS-TO-ATTRIBUTE HAZCMD03)
(PARM-NAME "HAZCMD03")
(VALUE-TYPE SYMBOL)
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 (PARM-NAME "HAZCMD04")
 (VALUE-TYPE SYMBOL)
)

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 (PARM-NAME "HAZCMD05")
 (VALUE-TYPE SYMBOL)
)

(DEFSCHEMA HAZCMD06-SPEC
 (INSTANCE-OF ITEM-SPECIFICATION)
 (CORRESPONDS-TO-ATTRIBUTE HAZCMD06)
 (PARM-NAME "HAZCMD06")
 (VALUE-TYPE SYMBOL)
)

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 (CORRESPONDS-TO-ATTRIBUTE HAZCMD07)
 (PARM-NAME "HAZCMD07")
 (VALUE-TYPE SYMBOL)
)

(DEFSCHEMA HAZCMD08-SPEC
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 (CORRESPONDS-TO-ATTRIBUTE HAZCMD08)
 (PARM-NAME "HAZCMD08")
 (VALUE-TYPE SYMBOL)
)

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 (CORRESPONDS-TO-ATTRIBUTE HAZCMD09)
 (PARM-NAME "HAZCMD09")
 (VALUE-TYPE SYMBOL)
)

(DEFSCHEMA HAZCMD10-SPEC
 (INSTANCE-OF ITEM-SPECIFICATION)
 (CORRESPONDS-TO-ATTRIBUTE HAZCMD10)
 (PARM-NAME "HAZCMD10")
 (VALUE-TYPE SYMBOL)
)

(DEFSCHEMA HAZCMD11-SPEC
 (INSTANCE-OF ITEM-SPECIFICATION)
 (CORRESPONDS-TO-ATTRIBUTE HAZCMD11)
 (PARM-NAME "HAZCMD11")
 (VALUE-TYPE SYMBOL)
)

(DEFSCHEMA HAZCMD12-SPEC
 (INSTANCE-OF ITEM-SPECIFICATION)
```

```
(CORRESPONDS-TO-ATTRIBUTE HAZCMD12)
(PARM-NAME "HAZCMD12")
(VALUE-TYPE SYMBOL)
)

(DEFSCHEMA HAZCMD13-SPEC
 (INSTANCE-OF ITEM-SPECIFICATION)
 (CORRESPONDS-TO-ATTRIBUTE HAZCMD13)
 (PARM-NAME "HAZCMD13")
 (VALUE-TYPE SYMBOL)
)

(DEFSCHEMA HAZCMD14-SPEC
 (INSTANCE-OF ITEM-SPECIFICATION)
 (CORRESPONDS-TO-ATTRIBUTE HAZCMD14)
 (PARM-NAME "HAZCMD14")
 (VALUE-TYPE SYMBOL)
)

(DEFSCHEMA HAZCMD15-SPEC
 (INSTANCE-OF ITEM-SPECIFICATION)
 (CORRESPONDS-TO-ATTRIBUTE HAZCMD15)
 (PARM-NAME "HAZCMD15")
 (VALUE-TYPE SYMBOL)
)

(DEFSCHEMA HAZCMD16-SPEC
 (INSTANCE-OF ITEM-SPECIFICATION)
 (CORRESPONDS-TO-ATTRIBUTE HAZCMD16)
 (PARM-NAME "HAZCMD16")
 (VALUE-TYPE SYMBOL)
)

* -----*
(DEFSCHEMA NASCOM_BLOCK_FORMAT
 (IS-A CASE)
 (COMMENTS)
 (NAME "NASCOM_BLOCK_FORMAT"))
* -----*

(DEFSCHEMA DATA_MANAGEMENT
 (IS-A CASE)
 (COMMENTS)
 (NAME "DATA_MANAGEMENT"))
* -----*

(DEFSCHEMA SERVICE_ROUTINES
 (IS-A CASE)
 (COMMENTS)
 (NAME "SERVICE_ROUTINES"))
* -----*

(DEFSCHEMA NETWORK_STATUS_PROCESSING
 (IS-A CASE)
 (COMMENTS)
 (NAME "NETWORK_STATUS_PROCESSING"))
* -----*

(DEFSCHEMA SUPPORT_PROCESSING
 (IS-A CASE)
 (COMMENTS)
 (NAME "SUPPORT_PROCESSING"))
```


Object: P0CC_02

OK Apply Close

Telemetry

YES NO

Consoles List Payload Vehicle Id Numbers PBI ID Numbers

PO1
PO2
PO3

veh 1:

PBI 1:

RL4
NIL

veh 2: NIL

PBI 2: NIL

RL4
NIL

veh 3: NIL

PBI 3: NIL

RL4
NIL

veh 4: NIL

PBI 4: NIL

RL4
NIL

veh 5: NIL

PBI 5: NIL