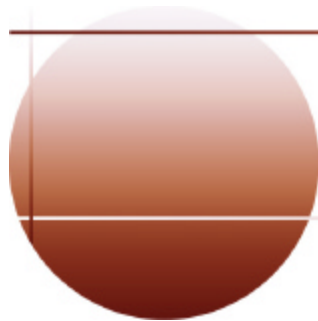# E67

IMS V8 DBRC Enhancements: A Brave New World

Karen Ranson (ranson@us.ibm.com)

IMS

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User Requirements

- **Handle large RECON records**
  - Eliminate planned and unplanned outages that are due to RECON record size growth

- **Provide automatic RECON "loss" notification**
  - All DBRC instances should automatically deallocate the "discarded" RECON without delay after a RECON reconfiguration

- **Support RECON command authorization**
  - Provide support for authorization control for DBRC commands

- **Eliminate specific DBRC/IMS abends**

DBRC Enhancements - Highlights

- **16M RECON Record Size**
  - **RECON records up to 16M are supported**

- **PRILOG Compression Enhancement**
  - **Attempted whenever a data set entry is added to PRILOG**
  - **Overhead reduced to improve performance**

- **Automatic RECON Loss Notification**
  - **A RECON reconfiguration is automatically propagated to other DBRC instances**

DBRC Enhancements - Highlights...

- **RECON Command Authorization Support**
  - **Support is provided that allows users to control RECON access/update via:**
    - **DBRC batch commands (DSPURX00)**
    - **HALDB Partition Definition Utility**
  - **User exit implementation allows user flexibility**
    - **customize security criteria**
    - **maintain audit trail**

- **Eliminate DBRC/IMS Abends**
  - **Several DBRC/IMS abends are eliminated**

16M RECON Record Size

- **DBRC does its own RECON record spanning**

  - **RECON records are written as multiple VSAM records**

  - **A RECON record "segment" fits into a single control interval (CI)**

    - **segment size = MIN(record size, CI size) - some overhead**

    - **VSAM spanning is not used**

  - **Limit is 16M because of move-character-long (MVCL) instruction restriction**
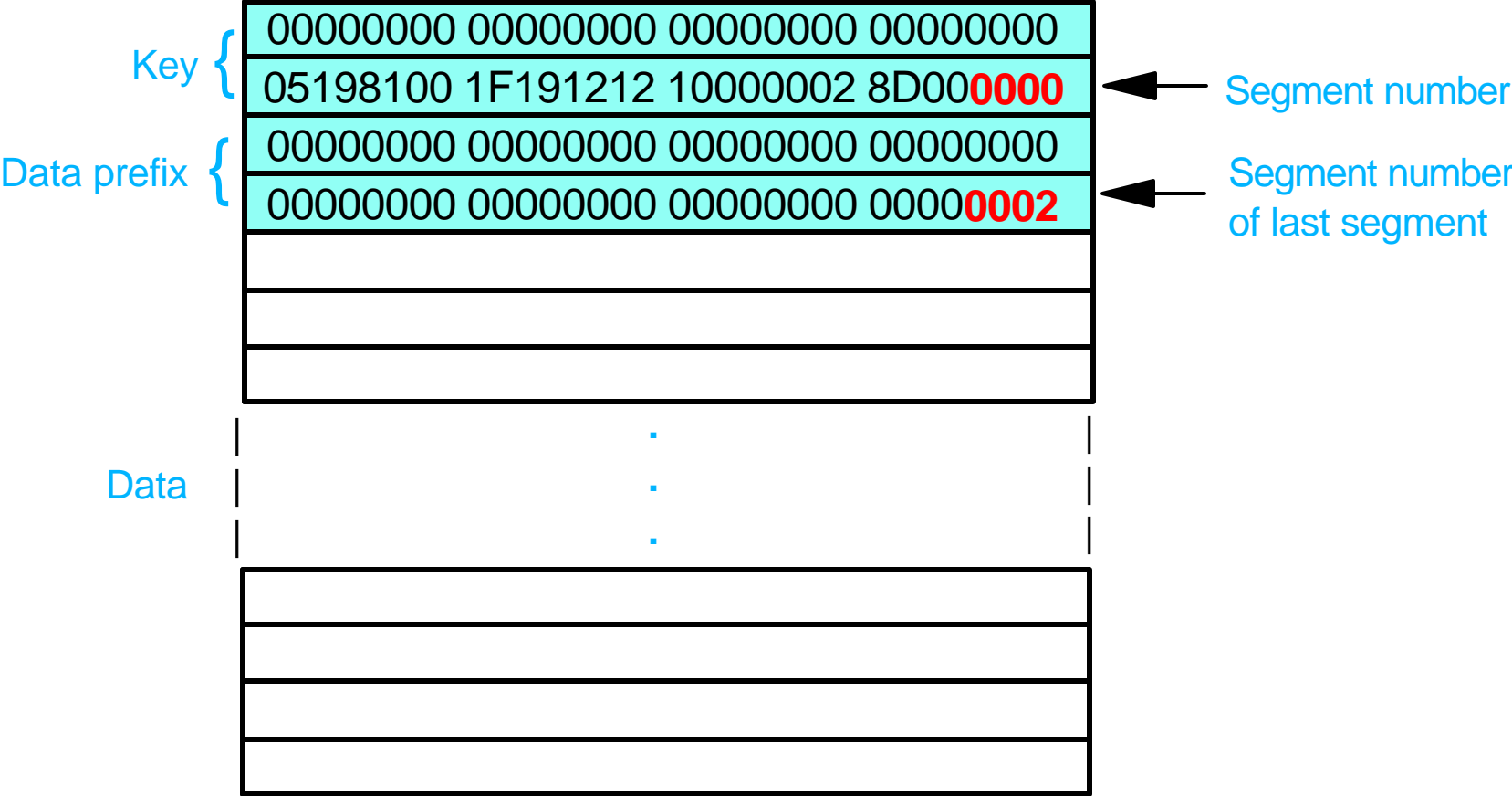
16M RECON Record Size...

- **DBRC spanning of records is automatic**

- **Users may choose to adjust RECON data set attributes (maximum record size, CI size, SPANNED/NONSPANNED)**
  - *After* **all systems have migrated to V8 (or higher)**

- **Unsegmented RECON records are presented to the RECON I/O exit routine (DSPCEXT0)**

16M RECON Record Size...

- **LOGALERT and SIZALERT specifications need to be adjusted**
  - **After all systems have migrated to V8 (or higher)**

- **LOGALERT(dsnum,volnum)**
  - **Triggers DSP0287W warning for PRILOG record size**
    - **no room for *dsnum* data set entries of *volnum* volumes each**
  - **With default values (*dsnum*=3, *volnum*=16), warning not issued until PRILOG size is almost 16M!**

- **SIZALERT(dsnum,volnum,percent)**
  - **Triggers DSP0387W warning for PRILOG-family records**
    - **no room for *dsnum* data set entries of *volnum* volumes each**
  - **Triggers DSP0007I warning for any RECON record**
    - **record size exceeds *percent* percent of 16M maximum**
  - **With defaults (*dsnum*=15, *volnum*=16, *percent*=95), a RECON record will exceed 15M before warning is issued!**

16M RECON Record Size - Segmenting example

Logical RECON record

Key {
| 00000000 00000000 00000000 00000000 |
| 05198100 1F191212 10000002 8D00**0000** | ← Segment number

Data prefix {
| 00000000 00000000 00000000 00000000 |
| 00000000 00000000 00000000 0000**0002** | ← Segment number of last segment

Data
| . |
| . |
| . |

16M RECON Record Size - Segmenting example...

Physical records (segments)

Segment 0
00000000 00000000 00000000 00000000
05198100 1F191212 10000002 8D00**0000**
00000000 00000000 00000000 00000000
00000000 00000000 00000000 0000**0002**

Segment 1
00000000 00000000 00000000 00000000
05198100 1F191212 10000002 8D00**0001**

Segment 2
00000000 00000000 00000000 00000000
05198100 1F191212 10000002 8D00**0002**
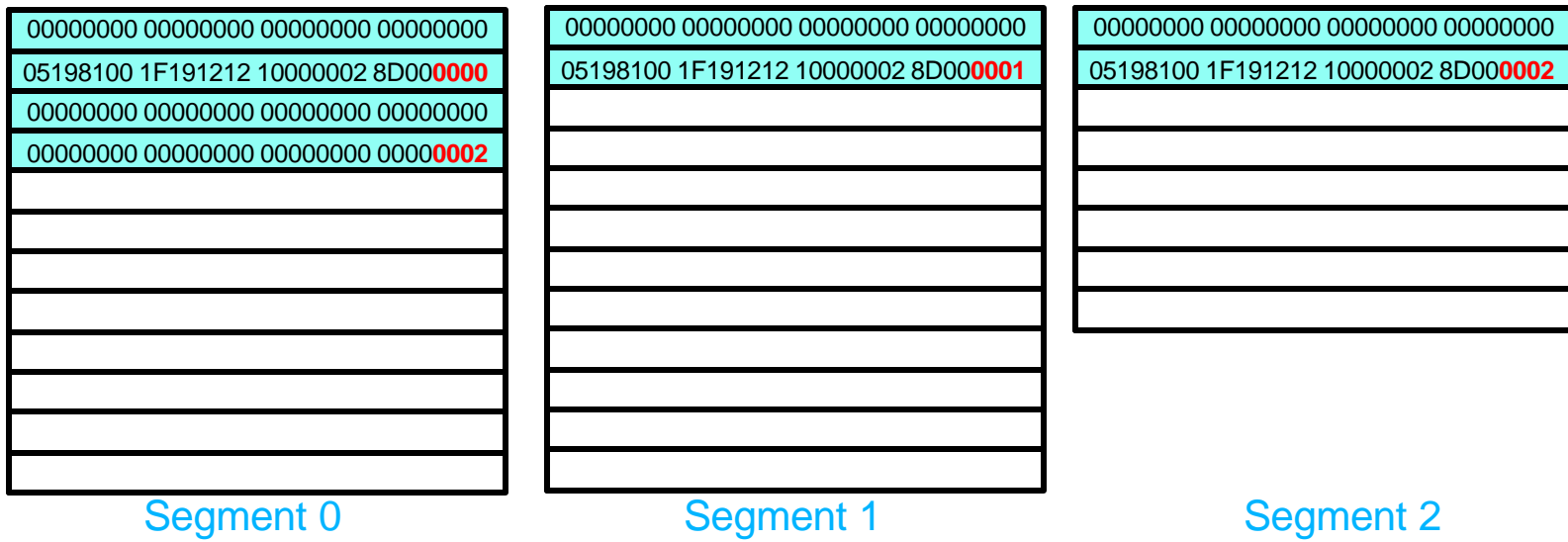
Data prefix only exists in first segment (segment 0)

PRILOG Compression Enhancement

- **PRILOG compression is attempted whenever an OLDS archive job is run**
  - For RSR, Tracking log data set open

- **Oldest allocation information for each DBDS is kept in the LOGALL record**
  - Used to reduce the overhead of compression attempts
  - LIST output:
    - Earliest overall ALLOC on the log
    - DBDSs sorted in order of their earliest ALLOC

- **Indication given if nothing was compressed (DSP1150I)**
  - ALLOC
  - Checkpoint
  - Log retention period

Automatic RECON Loss Notification (ARLN)

- **DBRC automatically deallocates the discarded RECON copy after a reconfiguration**
  - I/O error
  - CHANGE.RECON REPLACE

- **The Structured Call Interface (SCI) is required**
  - Used for intra-DBRC communication
  - There is a one-to-one correspondence between a RECON and an IMSplex
    - All DBRC instances using a given RECON join the same IMSplex
  - A DBRC address space can use SCI even if the IMS control region is not using SCI (i.e., no OM or RM)
  - If the control region and DBRC address spaces both use SCI, they must join the same IMSplex

ARLN - User interfaces

- **Automatic RECON Loss Notification is optional**

- **The IMSplex name for the RECON is specified via**
  - the **DBRC SCI Registration exit** or
  - new EXEC statement keyword parameter, **IMSPLEX=**

- **The exit and/or the parm can be used**
  - if both, exit overrides the parm

- **ARLN is not available if:**
  - the exit indicates that SCI is not to be used
  - the exit returns an invalid IMSplex name
  - the SCI registration request fails

- **If SCI registration fails or could not be attempted because of an exit error, RECON access is denied**

ARLN - User interfaces...

- **DBRC SCI Registration exit (DSPSCIX0)**
  - **Function: Provide the IMSplex name to be used for a RECON**
  - **Standard parameter list: R1-->parm pointer list**
  - **Input:**
    - **DSN of one of the RECON data sets (RECON1, RECON2 or RECON3)**
    - **IMSPLEX parameter value**
  - **Output:**
    - **IMSplex name (1 to 5 characters)**
    - **Return code**

    RC00 - IMSplex name is used to register with SCI
    RC04 - No SCI registration - RECON access fails if the RECON contains an IMSplex name
    RC08 - No SCI registration - any IMSplex name found in RECON is ignored, RECON access is allowed
    RC12 - RECON access fails

ARLN - User interfaces...

- **DBRC SCI Registration exit (DSPSCIX0) ...**

  - **The sample exit supplied by IMS:**
    - **Lookup table matches RECON DSN with an IMSplex name**
    - **Returns the specified IMSPLEX parm (RC00)**
    - **RC04 if IMSPLEX parameter not specified**

  - **If the SCI Registration exit is not found**
    - **IMS behaves as if the IBM supplied exit were used**

  - **DSPSCIX0 must be found in an authorized data set, which can be a member of JOBLIB, STEPLIB, or LINKLIST.**
    - **If the library is concatenated, only the data set containing the exit needs to be authorized**

ARLN - User interfaces...

- **First DBRC instance to join the IMSplex saves the IMSplex name in the RECON**
  - All subsequent V8 DBRC instances using the RECON must specify the same IMSplex name

- **CHANGE.RECON IMSPLEX(*imsplex_name*)|NOPLEX**
  - Used to change or reset the IMSplex name for the RECON
    - Cannot be used to set the initial IMSplex name
    - No other V8 DBRC instances can be active when the command is processed except those active before ARLN was activated (DSP1124I)
  - /RMCHANGE cannot specify these keywords
  - Any subsequent commands in the DBRC command utility (DSPURX00) job step will fail

ARLN - messages

- **DSP1123I DBRC REGISTERED WITH IMSPLEX .....
  [USING EXIT]**

- **DSP1124I DBRC NOT PARTICIPATING IN IMSPLEX .....**

- **DSP1125I IMSPLEX NAME CONFLICT - DBRC IS USING
  ..... BUT IMS IS USING .....**

- **DSP1135I SCI REGISTRATION FAILED, IMSPLEX
  NAME=....., RC=........, RSN=........**

- **DSP1136I RECON ACCESS DENIED, IMSPLEX NAME
  ..... NOT VALID**

- **DSP1137I IMSPLEX MAY NOT BE CHANGED, DBRC
  ACTIVE FOR job1, job2, ...**

ARLN - messages...

- **DSP1139I RECON ACCESS DENIED BY DSPSCIX0**

- **DSP1140I UNEXPECTED RETURN CODE FROM .... REQUEST, RC=........, RSN=........**

- **DSP1141I RECON LOSS NOTIFICATION RECEIVED**

- **DSP1142I EXIT MODULE .... FOUND IN UNAUTHORIZED LIBRARY: ....**

- **DSP1143I RECON ACCESS FORCED BY DSPSCIX0**

- **DSP1144I IMSPLEX PARAMETER NOT ALLOWED**

- **DSP1145I RECON LOSS NOTIFICATION NOT SENT**

ARLN - feature activation

Problem 1
- PLEX1 active, but not yet intended for use
- Job mistakenly submitted with IMSPLEX=PLEX1
  - PLEX1 recorded in RECON
- Existing jobs will issue DSP1124I
- New jobs will not run unless they also use PLEX1

Solution
- DSPURX00 job for CHANGE.RECON NOPLEX with IMSPLEX=PLEX1 on its EXEC statement

ARLN - feature activation...

Problem 2

- PLEX1 active, but not yet intended for use
- DSPURX00 job mistakenly submitted with IMSPLEX=PLEX1, executing a CHANGE.RECON IMSPLEX(PLEX2) command
  - PLEX2 recorded in RECON
  - No PLEX2 for SCI registration
- Existing jobs will issue DSP1124I
- New jobs will not be able to run
  - Even CHANGE.RECON IMSPLEX(PLEX1) !

Solution

- DSPSCIX0 which will yield a return code 8 (No SCI registration, ignore IMSplex name in the RECON)
- Use it with CHANGE.RECON job to fix or reset the PLEXname

ARLN - recommendations

● **Recommendations**

  – **Restrict access to CHANGE.RECON IMSPLEX|NOPLEX**

  – **Use DSPSCIX0 to control IMSPLEX parm usage**

  – **Have a DSPSCIX0 (RC=8) ready for use in emergencies**

RECON Command Authorization support

- **Allows the installation to control the use of DBRC commands**

- **Commands can be authorized at the "command verb" level, the "resource type" level or the "resource" level**
  - **For example--**
    - **PersonX can issue CHANGE.DB for all databases**
    - **PersonY can issue CHANGE.DB only for databases AAA, BBB, and CCC**
    - **PersonZ can issue CHANGE.SUBSYS but not CHANGE.DB**
    - **PersonQ can issue all LIST commands, but cannot issue any other commands**

- **Other RECON security issues are not addressed**
  - **Any jobs using DBRC must have control-level access to the RECON**

RECON Command Authorization support...

- **The HALDB Partition Definition Utility is supported**
  - **DBRC requests from the utility are converted to equivalent DBRC commands for the purpose of command authorization**
    - **Utility requests -- Query, Set, Change, Delete**
    - **DBRC commands -- LIST, INIT, CHANGE, DELETE**

- **/RMxxxxxx commands are not supported**

RECON Command Authorization support...

- **Resource Name Table (DSPRNTBL)**

  - **Contains the list of all protected resources, i.e. DBRC commands**

  - **This table cannot be modified**

  - **Complete list in the** *DBRC Guide and Reference*

  - **A profile, discrete or generic, must be defined (RDEF) covering each resource**

RECON Command Authorization support...

- **Resource Name Table (DSPRNTBL)...**

  In general, protection is provided:
  - for DBs - specified in DBD keyword, specific types (TYPEFP)
  - for log types (OLDS, SLDS, etc.)
  - for specific groups (GSG, DBDSGRP, etc.)
  - for specific or groups of subsystems
  - for commands that act on ALL records of a type
  - for each keyword of the CHANGE.RECON command
    - INIT.RECON only protected at the verb.modifier level

- **Resource name examples:**

  CHANGE.RECON.CMDAUTH

  INIT.DB.*dbname*

RECON Cmd Auth - User interfaces

- **User interfaces**

  - **CHANGE.RECON CMDAUTH(SAF|EXIT|BOTH|NONE,*safhlq*)**

    - **Used to enable/disable command authorization for a RECON**
    - *safhlq* **- specifies the high level qualifier of the resource profiles, required with SAF, EXIT, and BOTH**
    - **NONE - turns command authorization off,** *safhlq* **cannot be specified**
    - **Turning on command authorization uses the specified setting**
    - **The user must be authorized with the current setting to disable command authorization**
    - **Cannot specify CMDAUTH keyword with online command**

  - **INIT.RECON CMDAUTH(SAF|EXIT|BOTH|NONE,*safhlq*)**

    - **CMDAUTH(NONE) is the default**

RECON Cmd Auth - User interfaces...

- **CMDAUTH(SAF,*safhlq*)**
  - DBRC issues RACROUTE FUNC=AUTH to invoke RACF or an equivalent security product

  - Checks if the user is authorized for READ access to resource profiles such as:
    - *safhlq*.CHANGE.PRILOG.OLDS
    - *safhlq*.DELETE.LOG.INACTIVE
    - *safhlq*.GENJCL.ARCHIVE.ssid
    - *safhlq*.INIT.DBDS.dbname
    - *safhlq*.NOTIFY.CA.grpname

    where *safhlq* is the user-defined resource high level qualifier

  - Uses the FACILITY resource class

  - New error message (DSP1157I) if authorization denied

RECON Cmd Auth - User interfaces...

- **CMDAUTH(EXIT,*safhlq*)**

  - The DBRC Command Authorization Exit, DSPDCAX0, is called to perform command authorization

    - User exit - sample provided

  - DSPDCAX0 must be found in an authorized data set, which can be a member of JOBLIB, STEPLIB, or LINKLIST
    - If the library is concatenated, only the data set containing the exit needs to be authorized

  - New error message (DSP1154I) if DSPDCAX0 denies authorization

RECON Cmd Auth - User interfaces...

- **CMDAUTH(BOTH,*safhlq*)**

  - The security product is invoked first, then DSPDCAX0

  - SAF return code and RACF return/reason codes passed to DSPDCAX0
    - from RACROUTE FUNC=AUTH call

  - DSPDCAX0 return code overrides the security product
    - DBRC SAF error message (DSP1157I) suppressed

RECON Cmd Auth - User interfaces...

- **DSPDCABK - DSPDCAX0 parameter block**

  - Resource name address
  - Resource name length
  - Address/length of high-level-qualifier
  - Address/length of Command Verb
  - Address/length of Command Qualifier
  - Address/length of Command Modifier
  - Userid
  - Address of DSPDCAX0
  - SAF return code
  - RACF return code
  - RACF reason code
  - DSPDCAX0 return code
  - Address of user area
  - Size of user area (1024 bytes)

RECON Cmd Auth - 'gotchas'

Scenario 1

- **User permitted to use the LIST.LOG ALL command**

- **This does not automatically permit the user for:**
  - **LIST.LOG ALLOLDS**
  - **LIST.LOG OLDS()**

- **Must remember that these are all separate resources**
  - **No logical relationship between resources!**

Recommendation

- **Define a LIST.LOG.* resource**

RECON Cmd Auth - 'gotchas'...

Scenario 2

- **UserA permitted to the LIST.DB.* resource**
  - **UserA can use LIST.DB to display any DB or combination of DBs**

- **LIST.DB.XYZ resource is then defined, UserB permitted**

  ➡ **UserA is no longer allowed to issue LIST.DB DBD(XYZ)**

  ➡ **LIST.DB ALL can still be used by UserA to display XYZ!**

Recommendation

- **Create RACF groups with different security levels**
  - **use these groups in the appropriate PErmits**

Eliminate DBRC/IMS Abends

- **Deallocation request**
  - **No abend during deallocation processing if:**
    - **the ALLOC record is not found**
    - **the ALLOC record already has a deallocation time**
  - **Error messages are issued**
    - **DSP0153I (new) identifies the DBDS and ALLOC and DEALLOC times**
    - **DSP0300I indicates the specific error**
  - **A dump is taken**
  - **'Prohibit further authorization' status is set for the DB/Area**

- **Authorization request**
  - **No abend if the SUBSYS record becomes larger than the RECON physical record size**
    - **With *16M RECON Record Size*, the SUBSYS record is written as multiple RECON record segments**

Eliminate DBRC/IMS Abends...

● **No abend if recording an EEQE causes the DBDS record to exceed the RECON physical record size**

  – **Abend eliminated by *16M RECON Record Size***

● **Maximum number of EEQEs per DB is 32,767**

  – **DB I/O Error request**

    • **IMS abend U0602 still occurs if the maximum number of EEQEs is exceeded**

    • **DFS0612I message with a new return code of 32**

  – **CHANGE.DBDS ADDEQE()**

    • **New message DSP1146I**

LIST output - RECON record

```
RECON
 RECOVERY CONTROL DATA SET, IMS V8R1
 DMB#=7                                    INIT TOKEN=01225F2206572F
 NOFORCER   LOG DSN CHECK=CHECK17     STARTNEW=NO
 TAPE UNIT=3400       DASD UNIT=3400       TRACEOFF     SSID=IMSA
 LIST DLOG=NO                  CA/IC/LOG DATA SETS CATALOGED=NO
 MINIMUM VERSION = 6.1
 LOG RETENTION PERIOD=00.001 00:00:00.0
 COMMAND AUTH=SAF     HLQ=HLQ70
 SIZALERT DSNUM=15       VOLNUM=16     PERCENT= 95
 LOGALERT DSNUM=3        VOLNUM=16

 TIME STAMP INFORMATION:

   TIMEZIN = %SYS

   OUTPUT FORMAT:  DEFAULT = LOCORG NONE    PUNC YY
                   CURRENT = LOCORG NONE    PUNC YY


 IMSPLEX = ** NONE **

-DDNAME-        -STATUS-        -DATA SET NAME-
 RECON1          COPY1           IMSTESTL.IMS.RECON1
 RECON2          COPY2           IMSTESTL.IMS.RECON2
 RECON3          SPARE           IMSTESTL.IMS.RECON3
```

LIST output - PRILOG record

```
PRILOG                                          RECORD SIZE=       344
 START = 98.254 12:34:56.7          *    SSID=IMS11    VERSION=8.1
 STOP  = 00.000 00:00:00.0               #DSN=1
 GSGNAME=**NULL**
 FIRST RECORD ID= 0000000000000001      PRILOG TOKEN= 0

 DSN=RLDS.LOG1                                    UNIT=3400
 START = 98.254 12:34:56.7             FIRST DS LSN= 0000000000000001
 STOP  = 00.000 00:00:00.0             LAST  DS LSN= 0000000000000000
 FILE SEQ=0001     #VOLUMES=0002

   VOLSER=VOL001 STOPTIME = 99.254 12:34:56.0
     CKPTCT=0     CHKPT ID = 00.000 00:00:00.0
     LOCK SEQUENCE#=   939000000000

   VOLSER=VOL003 STOPTIME = 00.000 00:00:00.0
     CKPTCT=0     CHKPT ID = 00.000 00:00:00.0
     LOCK SEQUENCE#=   000000000000
```

LIST output - LOGALL record

```
LOGALL
 START    = 98.254 12:34:56.7               *
 EARLIEST ALLOC TIME = 98.254 12:34:56.8
 DBDS ALLOC=2                    -DBD-     -DDN-     -ALLOC-
                                 DBVHDJ05 CJVHDG1E  1
                                 DHVNTZ02 HIDAM     1
```

Migration/Coexistence

- **Version 8 Migration/Coexistence supports V6 and V7**

- **Time History Table is deleted**
  - was used for coexistence with V5 format timestamps

- **COEX|NOCOEX keywords removed from INIT.RECON and CHANGE.RECON commands**
  - accepted for compatibility

Migration

- **Use the CHANGE.RECON UPGRADE command to upgrade your RECONs to version 8**
  - **Upgrade utility (DSPURU00) is obsolete**

- **Every RECON record grew by at least 32 bytes (*16M RECON Record Size*)**
  - **most grew even more (other enhancements, reserved space)**

- **DBRC spanning of records is automatic**
  - **Upgrade breaks records into segments as necessary**

Migration...

- **Some recommendations for a V8 RECON...**

- **Primary space allocation should be increased**
  - Avoid 'RECON full' condition
    - Higher high-used RBA values are likely
  - May want to double current allocation
  - Should also allocate secondary extents

- **May need to increase region size for batch jobs**
  - DBRC uses additional buffer space to handle segmenting

Coexistence - 16M RECON Record Size

- **16M RECON record size is supported in coexistence mode**
  - **Down-level releases can read and write segmented RECON records once the RECON has been upgraded to V8**
  - **Down-level releases cannot write RECON records that exceed the maximum VSAM record size**

- **Unsegmented RECON records are presented to the RECON I/O exit routine (DSPCEXT0)**

- **Vendor code may need to be modified to handle segmented records**

Coexistence - MINVERS

- **MINVERS(61|71|81)**

  - New keyword for **INIT.RECON/CHANGE.RECON**
    - MINVERS(61) is the default for INIT.RECON and upgrade
    - Can only be changed using version 8

  - Minimum IMS version allowed to sign on to DBRC

  - Added to support APPC/OTMA SMQ Enablement

Coexistence - Miscellaneous

- Down-level releases cannot participate in Automatic RECON Loss Notification

- RECON Command Authorization support is not available in down-level releases