

VALENCIA PLANT

MAY 9TH, 1986

RELIABILITY ASSURANCE PROGRAM

J. Blanco
3480 Product Eng.
Dept. 9216 Valencia

CONTENTS :

1. Introduction
2. Program Objectives
3. OBR & MDR records
4. 3480 Error recovery categories
5. Reliability Plus basic definitions
6. Reliability Plus algorithms overview
7. R PLUS versus EREP
8. LOGREC analysis methodology.
9. Definition of program parameters.
10. 3480 basic reliability figures.
11. Program Achievements.
12. Appendix ; ERA Codes

INTRODUCTION

During the 3480 Early ship program (ESP) in late 1984, it was decided that selected accounts would send, on a weekly basis, a LOGREC tape containing all 3480 related information in the particular account.

Thus, LOGREC tapes were generated by dumping system SYS1.LOGREC data and then, sending it thru IBTS to Valencia PLant.

Major objectives at the time were:

1. Have a better knowledge of Machine and Media behaviour in a real Customer environment.
2. Provide a close follow-up of Subsystem performance by Engineering functions, assisting, when required, on-site CE's in a fast response to problems resolution.

The strategy proved to be extremely useful, as measured by the level of satisfaction achieved on ESP Customers and the number of problems detected and, thus corrected, on GA machines.

LOGREC data received in Valencia was loaded on individual data bases (one per Customer) and then processed using statistical analysis programs (SAS), common in both Tucson and Valencia. Additional "one shot " programs were developed to solve specific problems.

ESP was over, but necessity for increasing reliability figures still remains, in order to keep the 3480 as the leading Tape Unit in the Market, in terms of reliability and serviciability.

PROGRAM OBJECTIVES

Reliability Assurance program for 3480 Tape Subsystem started in Valencia in September 1985. Led by Valencia Project Office, EMEA Countries were requested to select major accounts and send LOGREC data to Valencia on a regular basis.

Most Customers selected were RELIABILITY PLUS Subscribers, which in turn added additional benefits as describer hereafter.

Reliability Assurance program major objectives are:

1. Identify major detractors to higher reliability figures.
2. Evaluate overall Media performance.

3. Define Subsystem Reliability expectations after extended periods of usage.
4. Improve Reliability figures, as published by R PLUS, in terms of USE/HARD FAIL
5. Identify non device-related failures being flagged as Hard Fails and, subsequently, proposing modifications to R PLUS algorithms.
6. Correlate 3480 reliability, as measured by R PLUS, with expected IBM RAS criteria specifications.
6. Assist CE on resolution of specific problems.

OBR & MDR RECORDS

As in other equipments, OBR and MDR records contain all information related to device errors and statistical data. These records are stored in SYS1.LOGREC data set, usually on DASD, and constitutes the primary source of data for EREP and other analysis programs (R PLUS).

1. OBRfs (Outboard Records) contents:

- o 32 bytes of sense data for failure isolation (FSC, Drive error code, etc). These 32 bytes are presented by the Control Unit to the Channel each time a permanent error occurs (not recovered by the CU) or the CU is in forced logging mode.
- o Date, time, jobid, volser, CCW, OBRSW, etc which are added by the system itself.

2. MDR's (Miscelaneus data records) contents:

- o 32 bytes of environmental data containing....
 - ...number of WTE1s, RTE1s, CWTE's, CRTE1s, ERG's, RBLKS, WBLKS, RMBYTE, WMBYTE, RBLKCORR, WBLKCORR for each JOBID and presented to the Channel each time an overflow condition exists (ERA=2A) or a n Rewind/Unload " cmd (ERA=2B) is issued by the Channel.
- o Date, Time, Volser, CPUSER, etc.

Following is a detailed description of 3480 OBR/MDR records.

MDR RECORD TYPE FOR THE 3480 MAGNETIC TAPE SUBSYSTEM

@1	CLASRC	/* RECORD TYPE - MDR IS 90X AND 91X	*/
@2	SYSREL	/* SYSTEM RELEASE LEVEL	*/
@3	SWITCH0	/* RECORD SWITCH	*/
@4	SWITCH1	/* RECORD SWITCH	*/
@5	SWITCH2	/* RECORD SWITCH. MDR FOR 3480 = 41X	*/
@6	SWITCH3	/* RECORD SWITCH	*/
@7	MRCDCNT	/* SEQ. NO. AND PHYSICAL RECORDS CNT	*/
@9	DATE	/* DATE	*/
@13	TIME	/* TIME	*/
@14	HRS	/* TIME IN HOURS	*/
@15	MIN	/* TIME IN MINUTES WITHIN THE HOUR	*/
@16	SEC	/* TIME IN SECONDS WITHIN THE MINUTE	*/
@17	VERNO	/* MACHINE VERSION CODE	*/
@18	CPUSER	/* CPU SERIAL NUMBER	*/
@21	CPUMOD	/* CPU MODEL NUMBER (0158, 3081, ETC)	*/
@23	SPACE1	/* RESERVED	*/
@25	BUFRECID	/* DEVICE ADDRESS / DEVICE NUMBER	*/
@27	VOLSER	/* VOLUMEN SERIAL	*/
@33	SPACE2	/* RESERVED	*/
@37	BLKLEN	/* BLOCK LENGTH	*/
@39	MDR00	/* UNIT CHECK	*/
@40	MDR01	/* DEVICE STATUS	*/
@41	MDR02	/* DATA PATH & ERROR POSITIONING	*/
@42	MDR03	/* ERP ACTION CODE = ERA (2A OR 2B)	*/
@43	MDR04	/* BLOCK ID	*/
@46	MDR07	/* FORMAT 20 = SENSE. 21 = BFR LOG	*/
@47	MDR08	/* READ FWD DATA CHECKS	*/
@48	MDR09	/* READ BKWD DATA CHECKS	*/
@49	MDR10	/* WRITE DATA CHECKS	*/
@50	MDR11	/* READ BLOCKS CORRECTED ON FLY (WRT ECC)	*/
@51	MDR12	/* WRITE BLOCKS CORRECTED ON FLY (RD ECC)	*/
@52	MDR13	/* CU EQUIPMENT CHECKS	*/
@53	MDR14	/* READ BYTES PROCESSED X 4096	*/
@55	MDR16	/* WRITE BYTES PROCESSED X 4096	*/
@57	MDR18	/* READ BLOCKS PROCESSED X 256	*/
@58	MDR19	/* WRITE BLOCKS PROCESSED X 256	*/
@59	MDR20	/* TRANSIENT DATA CHECKS (ISV)	*/
@60	MDR21	/* RESERVED	*/
@61	MDR22	/* CRITERIA WRITE TEMP. ERRORS	*/
@62	MDR23	/* CRITERIA READ TEMP. ERRORS	*/
@63	MDR24	/* ERASE GAP COUNTS	*/
@64	MDR25	/* DRIVE EQUIPMENT CHECKS	*/
@65	MDR26	/* LOW ORDER POSITION OF RD/WR COUNTER	*/
@66	MDR27	/* IML/HRDWR EC LEVEL/SERIAL NO.	*/
@69	MDR30	/* READ ERROR RETRIES	*/
@70	MDR31	/* BUFFER SEGMENT DEMARKED	*/

OBR RECORD FORMAT FOR THE 3480 MAGNETIC TAPE SUBSYSTEM

@1	CLASRC	/* RECORD TYPE - OBR IS 30X	*/
@2	SYSREL	/* SYSTEM RELEASE LEVEL	*/
@3	SWITCH0	/* RECORD SWITCH	*/
@4	SWITCH1	/* RECORD SWITCH	*/
@5	SWITCH2	/* RECORD SWITCH.	*/
@6	SWITCH3	/* RECORD SWITCH	*/
@9	DATE	/* DATE	*/
@13	TIME	/* TIME	*/
@14	HRS	/* TIME IN HOURS	*/
@15	MIN	/* TIME IN MINUTES WITHIN THE HOUR	*/
@16	SEC	/* TIME IN SECONDS WITHIN THE MINUTE	*/
@17	VERNO	/* MACHINE VERSION CODE	*/
@18	CPUSER	/* CPU SERIAL NUMBER	*/
@21	CPUMOD	/* CPU MODEL NUMBER (0158, 3081, ETC)	*/
@23	SPACE1	/* RESERVED	*/
@25	JOBID	/* JOBID	*/
@50	SECUA	/* SECONDARY CHANNEL AND UNIT ADDRESS	*/
@53	DEVTYPE	/* DEVICE TYPE 8080X FOR 3480	*/
@55	DEPTYPEA	/* DEVICE TYPE (RIGHTHAND ADJUST)	*/
@57	SDRCNT	/* NUMBER OF BYTES IN IN SDR AREA	*/
@58	PCUA	/* PRIMARY CUA OF DEVICE	*/
@61	IORETRY	/* NUMBER OF I/O RETRIES	*/
@63	SENSCNT	/* NUMBER OF BYTES IN SENSE FIELD	*/
@65	VOLSER	/* VOLUMEN SERIAL	*/
@71	BLKLEN	/* BLOCK LENGTH	*/
@73	HDRSER	/* HEADER LABEL SERIAL	*/
@76	SPACE4	/* RESERVED	*/
@81	OBR00	/* UNIT CHECK	*/
@82	OBR01	/* DEVICE STATUS	*/
@83	OBR02	/* DATA PATH & ERROR POSITION	*/
@84	OBR03	/* ERA CODE	*/
@85	OBR04	/* BLKID	*/
@88	OBR07	/* FORMAT 20=SENSE 21=BUFF LOG	*/
@89	OBR08	/* DRIVE ERP CODE	*/
@90	OBR09	/* CU FLAGS	*/
@91	OBR10	/* CU FRU 1, 1ST ERROR CODE	*/
@93	OBR12	/* CU FRU 2, 2ND ERROR CODE	*/
@95	OBR14	/* CU FRU LAST ERROR	*/
@97	OBR16	/* CU HRDWR FRU CODES	*/
@99	OBR18	/* DRIVE FLAGS BYTE 1	*/
@100	OBR19	/* DRIVE FLAGS BYTE 2	*/
@101	OBR20	/* DRIVE FRU CODE 1	*/
@103	OBR22	/* DRIVE FRU CODE 2	*/
@105	OBR24	/* CU CHANNEL INTERFACES	*/
@106	OBR25	/* CU FEATURES	*/
@107	OBR26	/* CU UCODE EC LEVEL	*/
@108	OBR27	/* IML/HRDWR EC LEVEL/SERIAL NO.	*/
@111	OBR30	/* DRIVE ADDRESS LOGICAL/PHYSICAL	*/
@112	OBR31	/* DATA BYTE COUNT IN BUFFER (DR)	*/

3480 ERROR RECOVERY CATEGORIES

Any 3480 error will be categorized as follows:

1. " In fly " errors: Those errors corrected by internal Subsystem hardware without microcode concurrence. There is not real time data check indication nor performance degradation.

MDR record (MDR11, MDR12) will be updated by CU microcode.

It won't be logged as Soft fail.

It will be reported in EREP as ECC error.

2. Error recovery succesful by the Subsystem (Temporary error). Statistical records within the buffered log (MDR's) will be updated. An OBR will be logged in SYS1.LOGREC if Subsystem in forced logging.

They will be logged as SF's or MSF's by R PLUS algorithms.

3. Error retry unsuccesful /not able to be retried by the Subsystem. Actions will be:

A. Log information pertinent to the error on SYS1.LOGREC

B. Perform recovery actions as called by CPU.

If CPU recovery actions are succesful, the OBR will be logged as " Recovered error " on EREP and won't be candidate for Hard Fail since OBR word 4 (SWITCH1) will indicate a temporary error, as will be discussed later on.

If CPU recovery actions are unsuccesful, OBR will be logged as any Hard Fail category.

4. Catastrophic errors ; Error or conditions which cause a loss of communications to the Host system : Microprocessor errors, some Channel Adapter errors, power failures, etc.

This type of errors will be always logged as Hard Fail.

RELIABILITY PLUS BASIC DEFINITIONS

Following is a description of parameters used by RELIABILITY PLUS Inc. to measure 3480 performance:

A. HARD FAIL (HF): Any device permanent error preventing the Customer job's completion as originally scheduled. Note that Hard Fail does not necessarily mean JOB ABEND

Example: A Write permanent error on one drive, where a DDR is called and it is successful.

Although many permanent errors can be associated to a unique JOBID-VOLSER-CUA combination, only the first permanent error will be deemed to be a Hard Fail candidate. Remaining/Subsequent permanent errors will be considered as OTHER HARD FAILS.

B. MEDIA HARD FAIL (MHF): Any permanent error caused by the same VOLID on different drives. First occurrence is classified as MHF, subsequent occurrences are classified as " REPEAT MEDIA HARD FAIL " (RMHF).

C. SOFT FAIL (SF): Any temporary error attributed to hardware failures.

D. MEDIA SOFT FAIL (MSF): Temporary errors attributed to Media failures.

Thus, the total number of temporary errors (TE's):

$$TE's = SF's + MSF's$$

RELIABILITY PLUS ALGORITHMS OVERVIEW

All OBR records logged on SYS1.LOGREC will be analyzed and subsequently classified into one of the four Hard-Fail categories:

- o MEDIA (MHF)
- o REPEAT MEDIA (RMHF)
- o OTHER (OHF)
- o DEVICE (HF)

OTHER is a category used to classified permanent OBR records that are not analyzed to be either MEDIA or DEVICE hard fails.

The Algorithm has several steps:

1. Discard all OBR records where SWITCH1, bit1 is set. This will eliminate those "temporary OBR's", logged when Subsystem in forced error logging mode and those "recovered errors" (Subsystem permanent errors but temporary from CPU standpoint). This should explain why a Subsystem being in forced logging mode (temporary OBR's logged) won't mean any difference to R PLUS algorithms: They simply (temporary OBR's) will be discarded.

2. OBR's records with following ERA codes (OBR record OBR03 content) will be directly assigned to OTHER FAILS :

- ERA 21 (DATA STREAMING ERROR)
- ERA 26 (READ BACKWARD DATA CHECK)
- ERA 36 (DRIVE PATCH LOAD FAILURE)
- ERA 39 (BACKWARD AT BOT)
- ERA 3B (VOLUMEN REMOVED BY OPERATOR)
- ERA 40 (OVERRUN)
- ERA 4B (CONTROL UNIT AND DRIVE UNIT INCOMPATIBLE)

3. OBR's with sns byte 0 (OBR00) = 40 (Intervention required) or sns byte 0 (OBR00) = 80 (Command reject) will be directly assigned to OTHER HARD FAILS

4. Following Subsystem Fault Symptom Codes (FSC's) will be directly assigned to OTHER Hard Fails:

- o FSC 70C2 (Block Id mismatch) and ERA = 41
- o FSC 7161 (Blank Tape) and ERA = 2E
- o FSC 7153 (Tape Void) and ERA = 31
- o FSC CF80 (Serial Itfce Bus disabled) and ERA = 42

5. There are two special JOBID's which are handled in a different way by R PLUS: " EOS EXIT " and "*MASTER*".

R PLUS does not necessarily discard all permanent OBR's with EOS EXIT or *MASTER* as JOBID's. They simply do not consider the existance of either of those JOBID's as a change to the JOBID. This becomes important when

considered that a change in either the JOBID, VOLSER or Drive address is a reason to count another HF.

For example:

JOBID	VOLSER	CUA
ABCDEF	112233	FFF
MASTER	112233	FFF
ABCDEF	112233	FFF

would be counted as 3 HF's because of the change in JOBID's. In fact, R PLUS counts the error as one because *MASTER* is not considered as a change in the JOBID.

If the permanent OBR is logged with a unique combination of VOLSER, JOBID and CUA, being *MASTER* the JOBID, R PLUS will count it as a HF.

Experience shows that all OBR's logged with EOS EXIT being the JOBID, are always temporary OBR's, i.e., OBR SWITCH1 bit1 is always set.

6. All permanent errors not filtered out on above steps will be candidates for Media Hard Fails (MHF's). Their sequence is:

*** VOLSER, CUA, DATE, TIME ***

Any of these OBR records containing one VOLSER spanning at least two CUA's within 15 days will reflect a potential Media problem; hence, the first occurrence of this sequence is classified as a MEDIA hard fail (MHF), and those remaining become REPEAT MEDIA hard fail (RMHF).

Multiple Permanent OBR records with and ERA of 23 or 25, with any combination of unique CUA/VOLSER occurring within one hour also reflects a potential MEDIA problem; hence, the first occurrence of this sequence is classified as a MEDIA hard fail, and the remaining become REPEAT MEDIA hard fails. This handles a swap-to-the-same-drive situation.

7. Permanent OBR records not classified as MEDIA Hard fails on step 6 will be candidates for Device (HF's) or OTHER hard fails. Their sequence is :

*** DATE, TIME, CUA, VOLSER, JOBID ***

8. Those permanent OBR records not isolated in above steps are OTHER hard fails (OHF).

Once completed the analysis of all OBR records logged in SYS1.LOGREC the next step is to analyze the MDR records. All information related to NUM-

BER of temporary errors, usage in Mbytes, etc, is obtained from these records.

MDR records will contain counts of temporary errors that are Read, write and equipment checks. These records also contain usage information in the form of Read/Write bytes processed, number of Read/Write blocks processed and number of Read/Write blocks corrected (ECC errors).

Temporary errors are the sum of control unit temporary equipment checks (MDR13 contents), drive temporary equipment checks (MDR25 contents) and Read and Write temporary errors (MDR08 + MDR09 + MDR10).

Thus; $TE's = CUTEc + DUTEc + WTE + RTE$

and ; $TE's = SF + MSF$

R PLUS algorithms will first identified those temporary errors MEDIA related (MSF); Remaining Temporary errors will be "Drive soft fails" or, simply Soft fails (SF).

$$SF = TE - MSF$$

Algorithm to "isolate" MEDIA soft fails (MSF) is as follows:

"MEDIA soft fails " will be analyzed from daily drive activity, by Volumen-serial. A VOLSER's temporary error count may be deemed to be a " Media soft fail " if either of the following two conditions occur:

(1). If the portion of VOLSER temporary errors versus the drive temporary errors divided by the portion of VOLSER megabytes processed versus the drive megabytes processed exceeds 10

$$\frac{TE_{vol} / TE_{drive}}{MBYTES_{vol} / MBYTES_{drive}} > 10 , \text{ or}$$

(2). When the daily drive activity includes at least two VOLSER's, and for any VOLSER temporary errors that account for more than 75 % of the total Drive's temporary errors.

For either case, the VOLSER is flagged as containing "media soft fails." (i.e., there are no drive Soft fails). For those VOLSER's that have no media soft fails, their temporary error count are the "drive soft fails".

VOLSER's failing algorithm (1) will be considered "MEDIA SOFT FAILS
BASED ON CRITERIA 1"; The same applies for those VOLSER's being detected
on (2) algorithm..."MEDIA SOFT FAILS BASED ON CRITERIA 2".

RELIABILITY PLUS VERSUS EREP

The SYS1.LOGREC data set can be analyzed many ways, and interpretations of permanent OBR records vary. Figure below shows two ways that EREP and Reliability Plus analyze SYS1.LOGREC data. MDR records are not shown because bytes and blocks processed (from MDR only) should be interpreted only one-way; by counting.

ERA	EREP reporting			Reliability Plus	
	candidate for media perm error	Control unit perm error	drive perm error	candidates for media hard fail	candidate for hard fail
22			X	X	X
23	X		X	X	X
25	X		X	X	X
28			X	X	X
2C			X	X	X
2D			X	X	X
2E			X	X	X
31			X	X	X
32			X	X	X
35			X	X	X
36			X		
39			X		
3B	OPERATOR RELATED ERROR				
40		X			
41			X	X	X
47		X		X	X
49		X		X	X
4A			X	X	X
4B		X			
4C		X		X	X

Fig. EREP versus Reliability Plus analysis of permanent OBR records.
ERA codes are defined in the appendix.

8. Soft fail analysis method depending on:

- o Poor RAS performance on IBM terms (KMB-CRTE, KMB-CWTE)
- o Poor performance on R PLUS terms (SF-ratio < 1)

9. Analysis upon degraded RAS performance includes:

- o RD/WR temp. error distribution per CUA and week.
- o RD/WR temp. error distribution per CU (Local-Remote)
- o Load balancing efficiency.
- o MDR's records analysis per CUA exceeding a threshold criteria
- o Blocks corrected vs blocks processed ratio per CUA.
- o Identify major detractors (VOLID's) to degraded performance
- o OBR (FMT 19) records per CUA.
- o Analysis based on Customer specific problems by designing " one-time shot " programs.

9.1. Poor SF-ratio analysis includes:

- o Evaluation of CU, DU temporary equipment checks by CUA.
- o Evaluation of RD/WR temp. errors (all) based on RAS information. This info. is only available if Subsystem is in forced logging mode.

10. Customer Tape Library maintenance (required at least 2 months of history on data base.)

11. Media Soft fail analysis (MSF) as per R PLUS criteria using R + simulation program and NDD criteria

DEFINITION OF PROGRAM PARAMETERS.

As stated before, after reception of each Customer LOGREC tape, a report is generated and sent to each Country R PLUS coordinator/AFSG specialist. The main goals of this report are:

1. To provide responsible persons with a general overview of product performance, both as per R PLUS and IBM RAS criteria.
2. To identify those VOLSERS which do require some action by on-site CE (remove them if the number of TE's is confirmed after an additional test on that VOLSER using OLT C, etc). A good library maintenance policy is the key for a good performing product.
3. To further assist AFSG/HCS teams on identifying those drives with poor performance trend or errors which just took too long to fix.

The feedback report is organized as follows:

A. HARDFAILS DISTRIBUTION BY CUA (& WEEK): This sheet provides the distribution of Hard fails per Drive (CUA) and week. Each Drive address (CUA) is associated, by the program, to a symbol (one letter). This report will highlight those Drives whose performance is poor along the time or which were performing poorly too long, before a corrective action was taken.

B. HARDFAILS DISTRIBUTION BY ERA (&WEEK): Same as before, this report will indicate, by week, what type of Hard fail was it (each Hard fail has an associated ERA code)

C. PERMANENT ERRORS DISTRIBUTION BY CUA (& WEEK): Same as chart in (A), but ALL permanent errors, regardless of whether they are permanent errors or not, will be displayed per Drive (CUA) and week.

D. PERMANENT ERRORS DISTRIBUTION BY ERA : Same as chart (B), but for permanent errors. _

E. OBR (BY DATE, TIME) FOR HARD FAIL ANALYSIS (WITH SENSE) : This report will provide the 32 bytes of sense data for each permanent OBR logged on the reported period. The program will further classify each OBR as one of the possible Hard fail categories (HF, MHF, RMHF, CWHF CRHF) and as per EREP-like parameters.

Note that :

CWHF = Criteria Write Hard Fail= A Hard fail due to a Write perm. error
CRHF = Criteria Read Hard Fail = A Hard fail due to Read perm. error
CWPE = Criteria Write permanent error
CRPE = Criteria Read permanent error
DRPE = Drive permanent error

CUPE = Control Unit permanent error
OPPE = Operator permanent error
OTHPE= Other permanent error
VOLPE= Volumen permanent error

Next chapter will explain in detail what a "criteria" permanent error is.

F. MEDIA SOFT ANALYSIS OF MDR RECORDS (BY VOLSER, BY DATE).

This report will be provide a list with those VOLSERS exceeding a given number of TE's (currently, threshold is set to 30 but previously was on 10). Each of the VOLSERS exceeding the threshold will be analyzed using R PLUS Soft fail algorithms (1) and (2). An ACTION REQUIRED will be posted if the VOLSER is found to be a "Media Soft Fail".

Nomenclature is as follows:

VOLSER = flagged VOLSER
DATE = The julian date in which above VOLSER was flagged.
CUA = Drive address where VOLSER was flagged.
DVOL = Number of volumes used on above CUA on this DATE.
DMBYTE = Total number of Mbytes processed on this CUA on this DATE.
MBYTES = Total number of Mbytes processed on this specific VOLSER.
RMBYTE = Read Mbytes on this VOLSER
WMBYTE = Write Mbytes on this VOLSER
DTE = Total number of temporary errors on this CUA this DATE,
TE = Number of temporary errors on this VOLSER.
CUTEC = Control Unit temporary equipment Checks
DUTEC = Drive Unit temporary equipment checks
RTE = number of read temporary errors on this VOLSER
WTE = number of write temporary errors on this VOLSER
CRTE = number of criteria read temporary errors on this VOLSER
CWTE = number of criteria write temporary errors on this VOLSER
MSF = number of Media soft fails
MSF1 = VOLSER flagged as criteria (1)
MSF2 = VOLSER flagged as criteria (2)

In addition, a new report is being issued, flagging those VOLSERS which fail NDD criteria (more than 18 write temporary errors on two different drives).

F. SOFTFAILS DISTRIBUTION BY CUA (& WEEK) : Distribution of Soft fails by Drive (CUA) and week. This chart is useful to detect performance degradation, in terms of temporary errors, for specific Drive units.

G. RELIABILITY PLUS OVERVIEW (BY WEEK): This report will provide all the basic Performance figures for all 3480 Subsystems installed in the account. Terminology should be already familiar to the reader.

H. RELIABILITY PLUS OVERVIEW (BY DRIVE) : This report will provide basic performance parameters (both, R PLUS and IBM RAS) for each Drive Unit on the reported period.

I. SOFTFAIL OVERVIEW (BY MONTH): This report will provide basic information on Subsystem performance in terms of temporary errors, by month. Some new terms used in here are:

KBLKS = Total number of KBlocks processed.
NVOLS = Total number of different volumes used.
RECC = Total number of read blocks corrected "on the fly".
WECC = Total number of write blocks corrected "on the fly".
NAR = Number of "ACTION REQUIRED", i.e., volumes flagged by MSF algorithms.

J. HARDFAIL OVERVIEW (BY MONTH): Will provide total amounts of permanent errors, by month, classified within each category.

K. OVERALL OVERVIEW (BY MONTH) : This report will provide overall Subsystem performance, both on R PLUS and IBM terms.

Additional reports, still on development process, will allow an easier tracking of Drive Units performance by HCS/AFSG teams. The program will also detect those Drives with poor performance trend, not due to specific volsters, and will flag them as "ACTION REQUIRED", similar to what is currently done with Tapes.

3480 BASIC RELIABILITY FIGURES

There are different ways to define 3480 Reliability figures. Following paragraphs will discuss what current experience is about 3480 performance expectations.

1. **HARDWARE RELIABILITY:** It can be defined in several ways...

A. Repair actions rate (RA), i.e., number of RA's per machine, per month due to hardware failures. Usage is estimated in 700 power-on hours per month. This figure is calculated taking into account the expected failure rate for the technology used in 3480. Current values are

RA's per A22 (Control Unit) per month : 0.110
RA's per B22 (Drive Unit) per month : 0.191

Therefore, the number of "expected hardware failures" on a 2x8 subsystem per month (average figure, on a 3 month rolling..) should be:

RA's TOTAL/MONTH = 1.748

B. From the Customer point of view, hardware reliability is expected to be:

* 250 GBYTE/HF, being a HF any device permanent error which prevents the Customer job completion as originally scheduled

OR

* 65 GBYTE between permanent errors (ANY permanent error)
This is the " MBYTES/PERMANENT ERROR " which appears in EREP.

C. From the temporary errors stand point, field experience shows :

* 1 GBYTE/SF , being a SF any DEVICE related temporary error

OR

* 500 MBytes or higher per temporary write error

Following are, for reference, U.S. Field procedures to monitor 3480 performance. Similar procedures should be desirable to implement in EMEA.

FIELD PROCEDURES

* ACCOUNT CE

- Tracks Performance to 65,000 Megabytes per permanent error.

- Alert Branch specialist when account is below criteria two consecutive weeks.

* BRANCH SPECIALIST

- Alert Region when account is below criteria for second week.

* REGION PRODUCT COORDINATOR

- Notify NSD HQ (FTO) when account is below criteria for third week.

PROGRAM ACHIVEMENTS.

Following Customers are currently following the Valencia 3480 Reliability Assurance program. Most of them report on a regular basis, usually monthly, and are R PLUS Customers. Some of the accounts report due to very specific problems and, usually, over short periods of time and until their specific problems are solved.

DENMARK

HANDELSBANKEN, SDC, DANSKE BANKEN, MULTIDATA, DATACENTRALEN

GERMANY

DATEV, HENKEL, HEW HAMBURG, HAMBURG MANHEIMER, QUELLE, BOSCH, HDV
FIDUCIA, GAD

U.K.

WESTERN GEO, FRIENDS PROVIDENT, COMMERCIAL UNION, AMERICAN EXPRESS

NETHERLANDS

RABO BANK, RABO 2, KLM

FRANCE

ESSO, CREDIT LYONNAIS, SDRM, AGF-GIE, AIR FRANCE

SWITZERLAND

ERZ BV, SWISSAIR, CIBA GEIGY, ERZ PTT, BEDAG

BELGIUM

BOERENBOND

SPAIN

EL CORTE INGLES

SWEDEN

SE BANK

SOUTH AFRICA

SOUTH AFRICAN MUTUAL

APPENDIX : ERA CODES

This appendix supplies the error codes used to analyze SYS1.LOGREC data.

The 3480 Design Control Document specifies at least 45 Error Recovery Action (ERA) codes for the Subsystem microcode Error Recovery Programs. They are logged as both OBR permanent and temporary error records and MDR records. The ERA's expected to be Hard Fail candidates are:

ERA	DESCRIPTION
22	Path equipment Check
23	Data check Read
25	Data Check Write
28	Write ID mark check
2C	Permanent equipment Check
2D	Data security erase fail
2E	Not Capable (EOT error)
31	Tape void
32	Tape tension lost
35	Drive equipment check
36	Drive patch load failure
39	Backward at BOT
3B	Volumen removed by operator
40	Overrun
41	Block ID sequencing
47	Control Unit error
49	Bus out Parity
4A	Control Unit ERP failed
4C	Control Unit error recovered (Check 1)

