

# Alert Workshop

## Experience and Lessons Learned

James Geary

GOCE PA Engineer

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## Background

- **Project-perspective of the alert system, its use and value.**
- **GOCE project milestones:**
  - PDR March 2002
  - CDR June 2005
  - QR July 2007
  - FAR April 2008
  - Shipment July 2008
  - Launch campaign July-September 2008
  - Storage November 2008 to date
  - Launch 16 March 2009 (*keeping our fingers crossed!*)



REMOVE BEFORE FLIGHT

EADS

4507

REAR

Esa

SWL: 1,375 kg  
PL: 2,500 kg

4.900 kg  
2.100 kg

Beta

## Alert Status

- **Alert Status List established by Prime (TAS-I TO) with input by lower levels**
- **List maintained up-to-date by Prime and distributed to ESA for review at system progress meetings (on a regular basis)**
- **Similar exercise at lower level (Platform and Gradiometer)**
- **Alert status addressed by Prime Progress Report**
- **The Industry PA Manager is subscribed to the Alert System and therefore notified of new alerts automatically**



NUMBER	TITLE	APPLICABILITY	CLOSURE REFERENCE	STATUS	REMARKS
EA-2001-01-A	RT54SX32 OBSOLESCENCE	YES	REPLACEMENT PARTS AVAILABLE	CLOSED	CDMU: see fax GOCE-ASG- 0283/02
EA-2001-02-A	AMP01X - PARTS TESTED AT ELECTRICAL LIMITS DIFFERENT FROM THE SMD	N/A	CORRECTIVE ACTIONS IN PLACE BEFORE GOCE PROCUREMENT	CLOSED	USER INFORMED, NO USAGE
EA-2001-07-A	TERMINATION OF SEXTANT PCB MANUFACTURING LINE	N/A	NOT USED ; OTHER PRODUCT AVAILABLE	CLOSED	OBSOLECENCE NOTICE
EA-2002-EEE-08-A	SMCS332 ASIC. LOSS OF 1355 IEEE LINK	N/A	APPLICATION NOTE IN DATA SHEET	CLOSED	LAB answer refers to Cryosat
EA-2003-EEE-03-A	Internal Vapour Content of ICs Products built in National Semiconductor Leadless Chip Carrier	LAB, ALC	Laben Mail 20.1.04: PAD meeting ALC	CLOSED	PROCUREMENT OF AFFECTED LOTS AVOIDED
EA-2003-EEE-04-A	SALE OF ATMEL NANTES MG2/MG2RT Fabrication Facility and Transfer of the	N/A	ORDERS ARE STILL EXECUTED	CLOSED	THERE IS STOCK IN NANTES AND WITH USER (CDMU)
EA-2003-EEE-05-A	RT54SX-S ICCI INRUSH CURRENT	LAB, ALC	START UP PROCEDURE ADOPTED	CLOSED	
EA-2003-EEE-06-A	Incorrect use of insert alignment tool by one operator.	all	Recall by Souriau	CLOSED	Souriau has recalled all defective parts
EA-2003-EEE-07-A	Semicoa UB packages with tin finish	all	THIS PACKAGE HAS NOT BEEN USED BY ANYONE	CLOSED	
EA-2003-SWE-02-A	RECALL OF SILICON SCULPTOR SOFTWARE VERSIONS 3.66 DOS & 4.29 WINDOWS AND	N/A	NOT USED ; OTHER PRODUCT AVAILABLE AND USED ON GOCE	CLOSED	
EA-2005-EEE-10	Low Radiation Tolerance of Microsemi Small Signal Low Power NPN Standard	all	Test condions not reportet	CLOSED	Data available match with the GOCE requirements
EA-2005-EEE-12-A	4 Mbit EEPROMs delivered and not tested property. The programmability of every memory cell in the 4 Mbit EEPROMs has not yet been verified		not used	CLOSED	
NA-GSFC-2005-01	ACTEL SX-A, RTSX-S, AND RTSX-SU FPGAs IN MISSION AND SAFETY-CRITICAL	LAB, ALC,		CLOSED	see EA-2004-EEE-07A
NA-GSFC-2005-04	Hitachi 1 MB die for space applications	LAB	See ASG NCR GO-NR-ASG-0637	OPEN	See ESA 2005 EEE 009
IB7-P-04-01	Semicoa 2N3700U holes in marking area	LAB,AAE,AST, CRISA	User are alerted by E-Mail 3.3.05	OPEN	ASG-TO18
VV-P-05-01	IRC MIL-PRF-55342 Chip Resistors with low lead terminals	CRS	e-mail sent to CRS on the 10.04.2006 to confirm that there is no impact on GOCE	CLOSED	Closed with e-mail from Federico De la Cruz (10-4-06) who confirmed no impact on CRS H/W.
no Ref	Warning on RIC7113E4 from IR	LAB	Used DC have no silicon gel getter inside	CLOSED	E-Mail IR to TOP-REL 9.2.05

## Alert Assessment

- **Before PDR, the design baseline is screened to identify alert applicability and therefore criticalities (e.g. procurement impact)**
- **An initial alert status is thus established**
- **At PDR and before CDR, actions are identified by / agreed with Industry for the applicable alerts**
- **Such actions are then followed on, to verify closure before CDR in order to minimize the impact on the project**
- **The alert status is updated on a regular basis**
- **The ESA PA Manager is responsible to inform Industry on criticality identified through IPN's**

## Alert Evaluation

Example: EA-2004-07-A, Actel RTSX-S programmed antifuse reliability problem

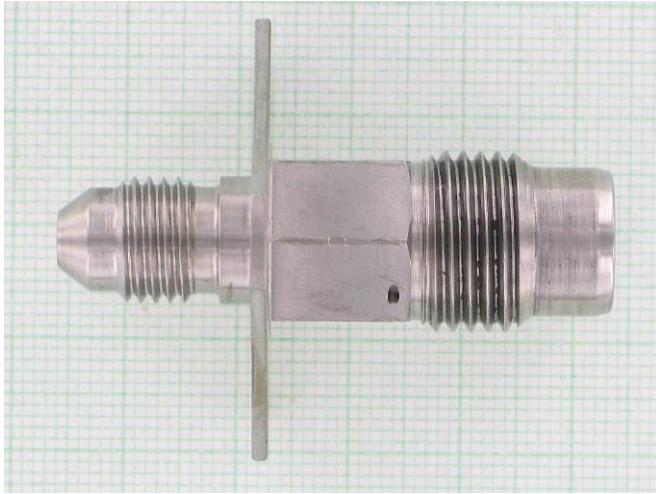
- **Initial recommendations: a) replace MEC-die device with UMC-die device; b) use latest programming SW, c) maximize ground testing, testing coverage and temperature (>600 hrs)**
- **Identification of units using the affected component: Gradiometer control units (GAIEU, FEEU), Transponder, CDMU, SSTI**
- **Criticality assessment by each user (timing analysis, failure tolerance, function criticality, programming algo, schedule impact)**
- **Units design already frozen; many units already under qualification/ acceptance or delivered at higher level**
- **Evolving situation: UMC die testing in progress**
- **Transponder: replacement of MEC dies with UMC dies feasible → implemented**
- **CDMU: FPGA with UMC die procured for spares**
- **Gradiometer units: Industry reluctant to use UMC dies (concern on qualification status)**
- **Risk mitigation for CDMU and Gradiometer units based on additional burn in (however at relatively mild condition due to unit temperature limitations)**
- **No anomaly/ failure detected during subsequent testing at higher levels (cumulated test time approx 1000 hrs)**

## Alert Generation – 1/6

### EA-2008- MPA-13-A: Marotta Fill and Vent Valve leakage

- During the launch campaign, the system leak test showed an excessive leak rate.
- The part had a history of leak problems, also in other projects (Rosetta, MetOp, Integral)
- To eliminate the risk of an unpredictable evolution during mission, the part was replaced with the spare unit.
- IPN # 143 was issued.
- The removed part was brought back and subject to destructive inspection by the Estec QM Labs. Results showed contaminants and damage on the sealing surface. An hypothesis on the failure mechanism was proposed.
- The alert was generated with preventive and corrective actions for the supplier, and recommended actions for the part user.

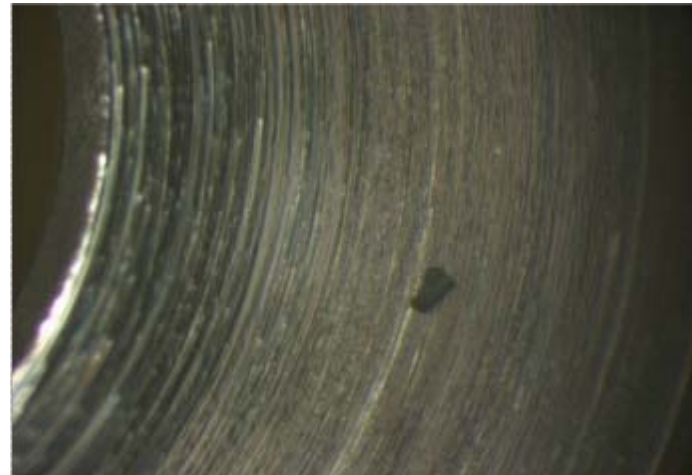
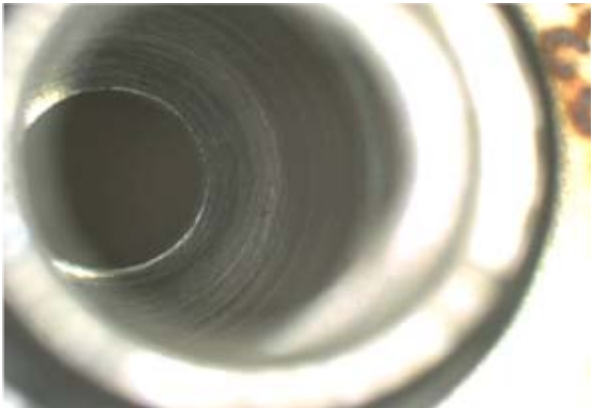
## Alert Generation – 2/6



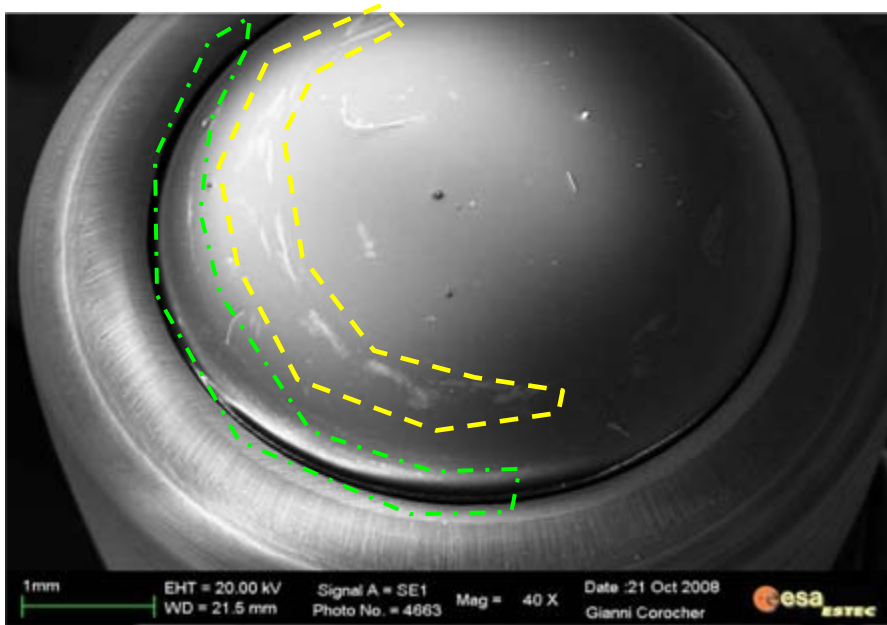
## Alert Generation – 3/6

### Visual inspection:

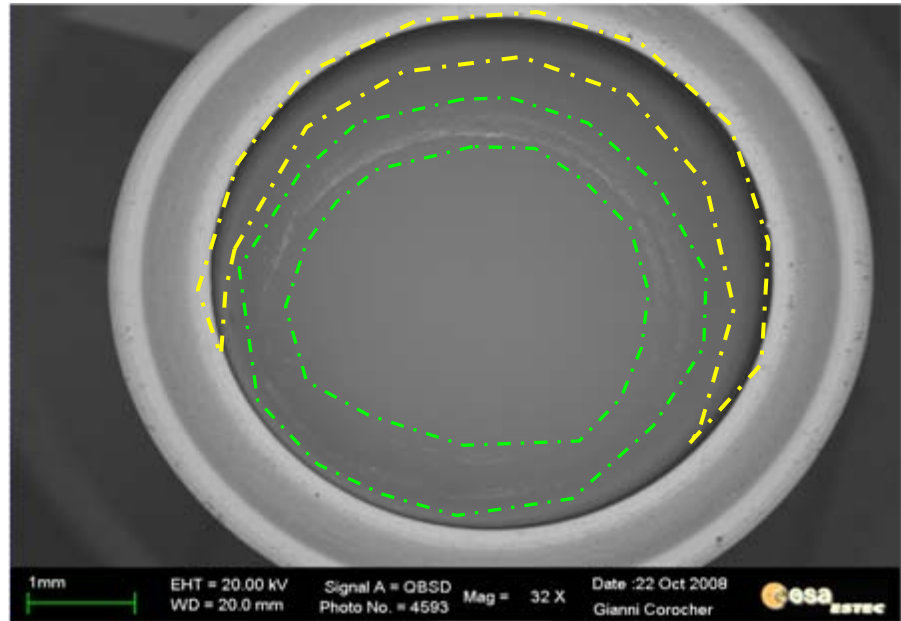
- A particle on the seal area (below)
- Deposit of metallic material on the surface of the ball (next)



## Alert Generation – 4/6



**GOCE SN 004**



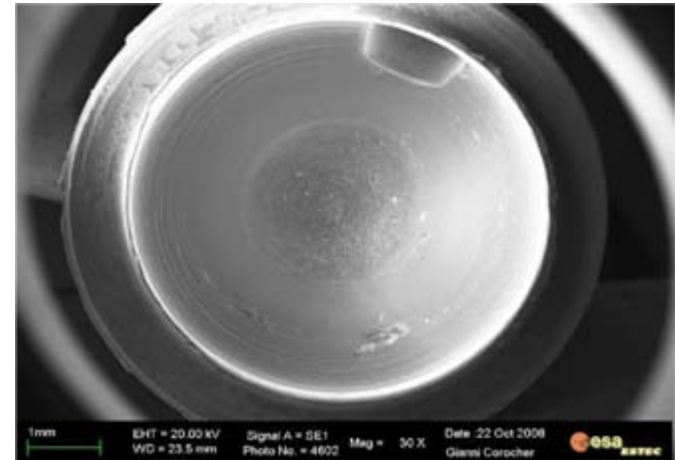
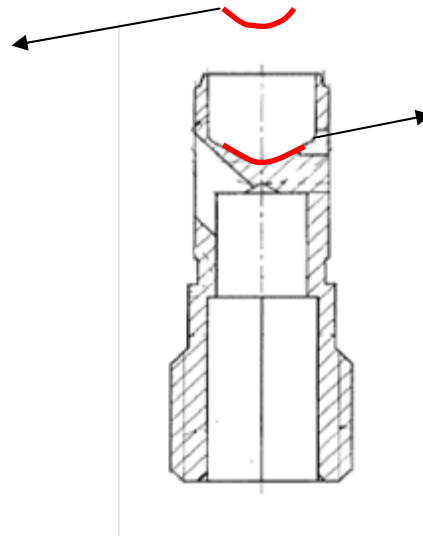
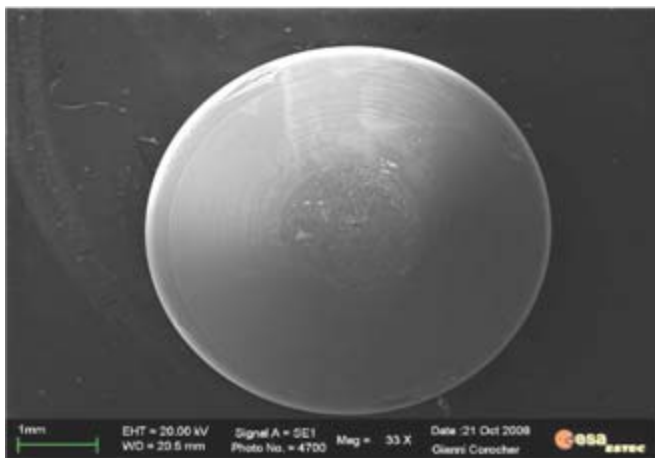
**Metop SN 212**

## Alert Generation – 5/6

Inspection of ball support and screw mechanism mating surfaces:

- Contact surfaces between the two parts clearly visible and showing evidence of wear and deposit of the ball support material on the housing

Goce SN 004



# Alert Generation – 6/6

## Summary

<b>GOCE SN 004</b>	<b>Metop SN 212</b>
Contamination in cap screw mechanism and seal (silicon nitride particles, and greasy substance).	Ball move easily on the screw mechanism
Ti6Al4V and Stainless steel deposits on the ball. Smearing of Ti alloy deposit.	Ti6Al4V and Stainless steel deposits on the ball. Smearing of Ti alloy deposit.
Damage to the seal surface, smearing , flaking of material. Orientation of the smearing resembling the deposit visible on the ball.	Part not available
Wear of the surface of the ball support. Smearing of the material. Deep scratches in “not contact area” and presence of particles of silicon nitride.	Wear of the surface of the ball support. Smearing of the material.
Deposit of Ti6Al4V on the surface of the screw mechanism ball support	Deposit of Ti6Al4V on the surface of the screw mechanism ball support
Damages around the hole of the ball	Deposit of Ti6Al4V on the bottom surface of the ball. Damages near the hole Circumferential scratches.

## Lessons Learned

On the basis of the experiences made vis-à-vis a number of critical alerts affecting the GOCE project, it is concluded that there is the need for:

On the project side:

- **Pro-activeness** in the process of evaluation and alert recommendations and definition of corresponding actions → “regular” project work flow must be adapted at once
- **Adopt conservative margins** for analysis/ testing to have an adequate risk minimization and cover for uncertainties (e.g. those inherent with alert recommendations)

On the Alert System side:

- **Shorter time for alert release**
- **Clear definition of corrective/ preventive actions in alert recommendations. This will reduce interpretation and discussion with Industry.**

## Suggestions

**Main comments made on the “old” system during 2007 survey:**

- **Encourage feedback from users to improve system and tool** 😊
- **Link with other Alert Systems missing**
- **Improve alert distribution by attaching PDF file**
- **Alert release time on average too long** 😊
- **Web site not user friendly (e.g. retrieval and search)** 😊

## Conclusions

- **The Alert System has proven invaluable to prevent / correct problems in projects, especially when actions are taken promptly to minimize (if not eliminate) potential risk**
- **The web-based tool is indispensable to support the Alert System**
- **The IPN system has also proven extremely useful to inform its users (e.g. projects community) of potential problems promptly, and foster communication and exchange of information/ engineering data. Confidentiality however should be stressed.**