Outline of the Risks associated with the Long Term Storage of EEE Parts intended for the future production of satellite equipment.
As a result of customers requirement for mass or repeated production (H-IIA, HTV and potentially future repeat satellites), the risk of obsolescence and the high cost of repeated procurement, are combining to make the business case for large single procurements, resulting in the need to place kitted parts into Long Term Storage (LTS) for future satellite production. While a LTS approach may initially seem attractive and relatively easy to provide, LTS is not without risks. Alter-UK (AUK) experience has shown that it is necessary to employ many safeguards in order to prevent deterioration of parts, loss of traceability or loss of capability, any of which would render the stock as not suitable for future use and result in the loss of customer investment. AUK has been successfully storing parts for satellite production and maintenance for more than 25 years, over this time AUK has developed a LTS service which has been repeatedly contracted in support of many customer projects, world wide. This paper outlines the risks and preventative measures employed by AUK to assure a successful conclusion to its LTS Service, including:- procurement controls, spares philosophy, documentation controls, traceability, screening, testing, retention of capability, preparation for storage, packaging, kitting, store conditions, monitoring, accountability and Watch Dog Testing.
Presentation Objectives

• To highlight the RISKS associated with Long Term Storage (LTS)
• To provide an insight into the potential problems and propose possible mitigating actions to eliminate or reduce the risk to the parts
• The procurement and storage represents a major investment by the Customer,
• Parts are an asset to the OEMs product’s future production.
• Ultimately to assure that parts subjected to LTS can be withdrawn and used in their intended application
• ALTER-uk’s experience with LTS suggests that the objective must be to understand all the risks associated with LTS, to understand those risks and to employ the best practices available
Experience

• AUK experience began with Spacelab Maintenance in 1982 which resulted in EEE parts being stored for a minimum of 15 years

• More recently AUK has stored parts for ESA Projects stock maintenance which has various stocks many of which have been in store in excess of 10 years

• AUK has also stored parts for H-IIA for more than 6 years

• HTV Long Term Storage is planned for a minimum of 6 years

• Over this time AUK has developed and modified a Long Term Storage Service based upon the experience of AUK and OEMs who have suffered the loss of critical stocks and who now contract Alter to provide this described LTS Service.
Reasons for Long Term Storage

- To plan for the effects of Obsolescence on future production or design
- Last Time Buy
- Parts remaining from Minimum Order Quantity or Value (MOQ/MOV)
- Increasing buy quantity to fix future parts cost
- Lower OEM Equipment price or assure on demand production
- To gain cost advantage or cost discount through increased quantities
  - Achieve next price break
  - Amortise cost of LAT or Qualification
  - Amortise cost of Documentation
  - Amortise cost of DPA, Upscreening
- Avoid future Long Lead delivery and secure future short term availability
- Achieve and maintain consistent parts Quality Level
- Avoid Multiple Procurements
- Maintain stock for equipment maintenance and support
- Maintain stock for off-the-shelf production
Overall Risk

• Many companies consider that Long Term Storage is not a difficult service to offer and that there is little difference between storing parts for 1 year 2 years 5 years or more...........

• OEMs have successfully stored parts for many years but have failed to recognise the differing issues of Long Term Storage

• Many of these OEMs have come to AUK with parts which have been poorly stored, these have exhibited many differing issues which has led to very serious parts reliability problems

• These problems have in some cases resulted in loss of stock, delayed production, re-designs and expensive re-qualification

• Long Term Storage has many obvious risks and some not so obvious risks, any of which may render your stock unsuitable, this paper is intended to identify the risks associated with Long Term Storage and to point to AUK’s mitigating experience
Overall risk.....continued

- When OEMs consider Long Term Storage as a possible solution, then a Risk Assessment should be performed
- The top down risks include:-
  - Assuring continuous parts supply
  - Long term safety and security of the parts
  - Quality of the parts following LTS
  - Cost of the initial Investment and the running cost of LTS
  - Ensuring full traceability of the relating Documentation

- OEMs should take LTS seriously and look upon LTS as a long term investment, where the loss of the stock will not only result in loss of investment, but will incur the additional costs associated with the unplanned actions and delays which will certainly be necessary following any loss of stock.
Introduction to Risk Assessment

• The following slides present a short introduction to a number of perceived Risks associated with each step of the LTS process
• Each of these Risks should be considered when subjecting parts to LTS
• OEM’s should consider the how the service provider will provide mitigating actions to reduce or eliminate these Risks
• AUK has developed a LTS Service which encompasses the experience gained with many successful Projects and which we believe is the basis of a LTS Best Practice
• There are however no guarantees and while AUK LTS Service includes many mitigating actions, it also builds in a number of monitoring points designed to provide better vision of future events, to discover the early signs of potential problems and to provide as much time and available resources to implement the necessary recovery actions
Elements of LTS Service

- Procurement
- Documentation
- Receiving Inspection, Test & DPA
- Screening & Verification Review
- Packing, Kitting & Storage
- Documentation Traceability, Storage, Accessibility & Retrieval
- Quality Monitoring, Relife, Watch-dog & Failure Analysis
- Obsolescence Monitoring
Procurement

- Procurement Route
- Qualification
- Procurement Quality
- SOW requirements
- Inspection requirement
- LTS requirement

- Customs
- Export Licence
- Duty Payable
- LTB Notification Record
- PCN Notification record

LTS -> Pre-Procurement -> Procurement -> LTS Preparation

- Purchase Ordering
- Packing requirement
- Alert Records
- Documentation requirements
- Quantity Requirements
  - Need, Test, DPA, RGA, WD, Fallout, Spares, LTB…..

- Invoke LTS Process
- Filing Records
- Indexes
- Security
- Confidentiality

STREAM OF BUBBLES ORIGINATED WITHIN THE CAVITY CASE
Documentation

- Procurement Specification
- Generic Specification
- Detail Specification
- QML Listing
- Product Change Notice
- Supplier Data & Records
- Inspection Standards

- Conversion to recognised standards, RTF/PDF/HTML/DOC/XLS/PPT
- Verification of Document transfer
- Future of PDF/A archiving Standard
- Manufacturer Media
- Software incompatibility

External → Internal → Media → Access

- Customer Communication
- Supplier Communication records
- Internal Records & Reports
- Process & Procedures
- Test & Inspection Records
- Software files

- Read, Record & Playback
- WWW Access
- Archiving
- Back-up copies
- Upgrades
- Audits
Incoming, Receiving Inspection, Test & DPA

- Source Control
- Documentation
  - Traceability
  - Summary Information
- Packing Inspection
  - Suitability for LTS

- RI
- Physical Testing
  - Physical Testing
  - Microsection
  - RGA internal
  - Water Vapour

- Test
  - Travel Visual
  - Visual Inspection
    - Exposed base metal
    - Damaged Seals
  - Electrical Measurement

- DPA
  - PIND
  - X-ray
  - CSAM
  - Humidity testing
  - Surge Testing
  - Screening

CONDUCTIVE MATERIAL
Screening & Verification Review

- Procurement Quality Level
- SOW requirement
- Test Specification
- Procedures
- Establishing Part Grade
- Screening Sequence

- Lead free
- Moisture Sensitive Parts
  - High Temp Bake
- Corrosion sensitivity
- Spares
- Watch-dog sample frequency

Baseline ➔ Records ➔ Critical ➔ Processes

- Screening
- Test Equipment
- Software
- Calibration
- Accuracy & Repeatability

- Storing of finished parts
- Incomplete Testing
- Processing of Spares, correlation samples

VOID ON THE GLASS SEAL AREA
Packing, Kitting, Preservation & Storage

**Packing**
- Manufacturer Standard Packing
- Transit & Handling Damage
- Sources of Chlorine, Fluorine and Ammonia
- Also formic/acetic acid from silicone sealants
- Label legibility

**Kitting**
- Corrosion & Oxidation
- Avoid Bio-degradable Packing
- Avoid high Vacuum packing
- Use of Faraday cage packing
- Seal cables
- Galvanic Corrosion

**Preservation**
- Bonded Store, Ring-Fenced
- Security, Segregation & Safety
- Building Risks
  - Environmental control
  - Fire, Criminal damage, etc
  - Meteorological, extreme conditions
  - Geophysical, earthquake, volcano
- Disaster Recovery

**Storage**
- Temperature
- Humidity
- N2 purging
- Desiccant pouches
- Moisture Indicator
- Hermetic Seal
Documentation Traceability, Storage, Accessibility & Retrieval

- Documentation Index
- Communications
- Media monitoring
- Inventory Control
- Procurement Records
- Test & Inspection Records

- Printed documents
- Loss of Media
- Software upgrades
- Transfer/Verification
- Adoption of PDF/A
- Standard HTML, DOC, XLS, PPT, JPG

Traceability → Storage → Accessibility → Retrieval

- Tape Back-up
- Mirror Copies
- Original Document Storage
- Digital Media Life
- Software backward compatibility
- Conversion of Custom Software

- On-line WWW
- Security
- Access Rights
- Retrieval Rights
- Off-line backup
- Recovery Process
Quality Monitoring, Relife, Watch-dog & Failure Analysis

- Part Availability
- Obsolescence Monitoring Alerts, NCRs & PCN
- Usage Rates
- Allocation of Spares

- Shelf Life
- Relife
  - EM, Visual, Solderability, seal & RGA
- High Risk materials include
  - Tin/Lead solder, Silver, Copper, Kovar

Watchdog
- Identification of signs of Degradation
- DPA Bench Mark
- Packing condition, RGA
- Solderability, Microsection, Material Analysis

Emergency Response
- Reporting Failures
- Investigation of Field Failures
- Handling, Test or Storage related
- Emergency Response
Obsolescence Monitoring

- Part Availability
- Alerts
- Obsolescence Notice
  - LTB
  - PCN
  - Package changes

- Media
- Software updates
- Data format updates
- Transfer & Verification

Source → Test → Records → LTS

- Ability to Test
  - Equipment
  - Software
  - Jigs
  - Test Programs
  - Experience

- Maintaining Stocks
- Monitoring Usage
- Monitor Watch-dog
- Initiate Additional Procurement
For Long-Term Storage (LTS) to be effective it must provide suitable protection for the parts and traceability of the Customer’s investment.

The requirement is that when the part is withdrawn from Long Term Storage (LTS) the part will perform the required function.

The prime objective is therefore to ensure that all parts taken from storage are in good condition.

To do so parts must enter the store in good condition and the storage must not promote any degradation.

It is imperative to “Ring Fence” the components in storage against all perceived Risks in order to secure the OEM Investment.
ALTER TECHNOLOGY GROUP

Introduction

HELPING YOU TO CHOOSE AND TO BE SURE
ALTER Technology Group was established in January 2007.

The ALTER Group was formed by the merger of the following companies:

- TECNOLOGICA Spain (Seville/Madrid)
- IGG UK and US (Fareham/Valley Forge)
- TOP-REL in Italy (Rome)
- HIREX Engineering in France (Toulouse)

ALTER Group is an European leading company specialised in the field of part engineering, testing, quality and procurement for Aerospace and Defence and other industrial applications.

ALTER Group is also the European market leader for EEE parts for high reliability applications.

The individual ALTER companies will continue operating in their geographical locations within an integrated organisation structure to implement the group synergies.

Maintain laboratories in UK, Spain, Italy and France.

Our highly specialised services range from the electronic part evaluation, procurement and acceptance, to equipment certification (EC marking) and electromagnetic compatibility engineering.

A solid specialised technology base, permanent innovation and quality assured to ISO 9001, more than 189 professionals and revenues in excess in 2007 of 50 M€ are the pillars sustaining our company.
ALTER is an European leading company specialised in the field of part engineering, testing, quality and procurement for Space, Aerospace & Defence and other industrial applications certified to ISO-9000-2000. Our highly specialised service range from the electronic part evaluation, procurement and acceptance, to the equipment certification (EC marking) and electromagnetic compatibility engineering. A solid specialised technology base, permanent innovation and quality, more than 189 professionals are the pillars sustaining our company.

Tecnologica is based in Seville and Madrid in Spain, was established in 1986. In 1993 the headquarters and laboratories were moved to Seville. Expansion of service portfolio to include the engineering and certification of industrial equipment. Operating in space, defence, telecommunications and industrial markets employing 87 highly trained and qualified staff in Seville and Madrid offices.

IGG, a UK based independent, private company, established in 1978 and dedicated to supporting OEMs needs in 19 countries. IGG employs 44 highly trained and qualified staff in UK and USA offices, specialists in all types and every aspect of hi-reliability parts. Innovators in the use of all part Quality levels for all applications operating in space, aerospace and defence & industrial markets and a service provider for part users & manufacturers.

Toprel is based in Rome, Italy and was established in 1988, with the main objective of supplying services to space industries in the field of EEE high reliability parts. Employing 24 highly qualified staff including part engineers specialised in the field of Hi-Rel parts with large experience in space projects and technical experts in the field of parts testing, semiconductor physics, radiation, failure analysis.

Hirex is based in France, was established in 1993 employs 34 highly skilled and trained engineers and technicians with cumulative expertise in high-reliability space parts, experts in semiconductors physics, parts manufacturing, board and test systems design, technology and device construction, radiation effects and testing, within a new facility of 1700 m².
WHAT WE DO

The core of our activities is represented by the services related to high reliability electronic components,

- Components engineering
- Obsolescence management
- Quality requirements compliance
- Technological evaluations
- Purchasing
- Acceptance
- Special testing
- Storage
- Logistics
- Consultancy

ALTER has extended its activities to other complementary and synergic fields such as quality verification and certification of equipment including EC marking and ground systems integration,

- Safety
- Mechanical and environmental
- EMC testing and engineering
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