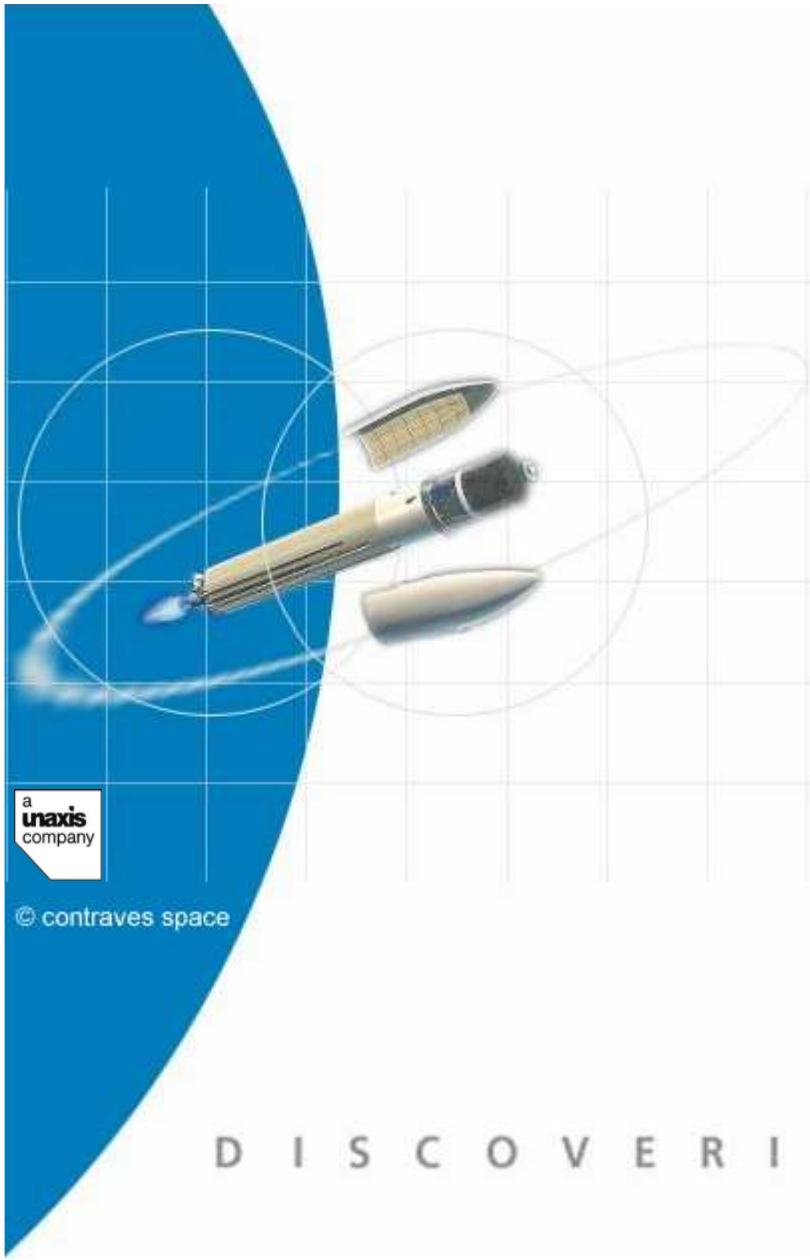
Contraves Space



ESA-NASA Working Meeting on Optoelectronics

COTS Fibre Optic Components in SMOS/MOHA

October 5th and 6th, 2005

DISCOVERING THE UNIVERSE

Outline

SMOS and SMOS/MOHA

- SMOS
- MOHA in SMOS
- COTS Fibre Optic Components in SMOS

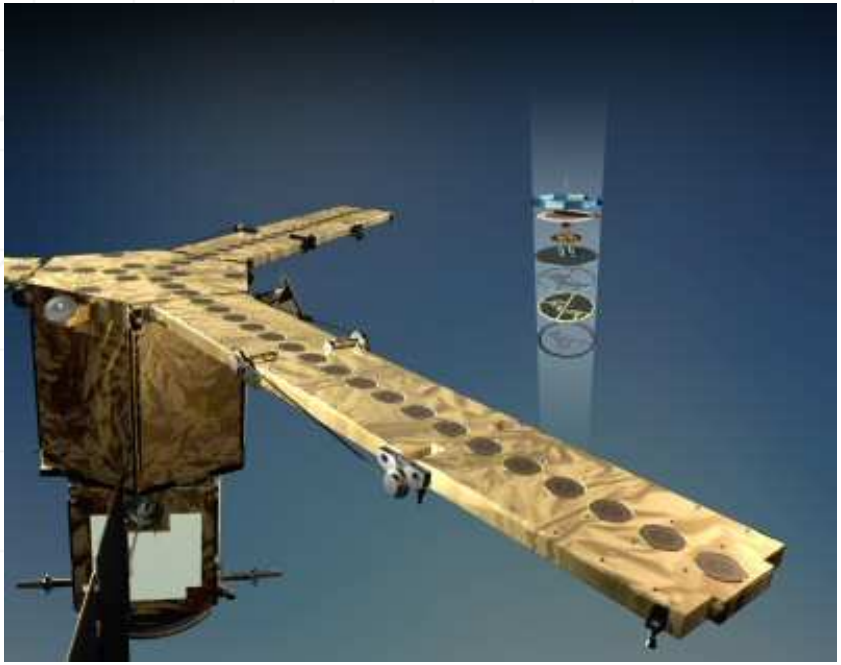
Qualification Approach

- Possible Strategies
- Strategy for SMOS/MOHA
- Evaluation
- Lot Acceptance
- Procurement Baselines

Lessons Learned and Issues

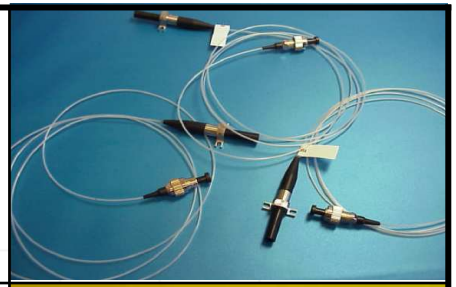
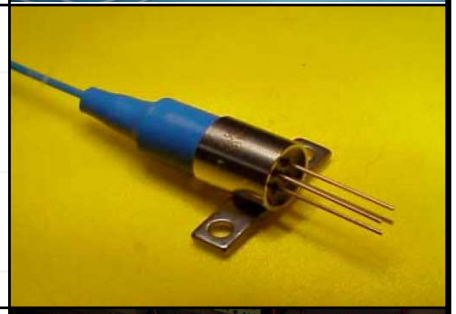
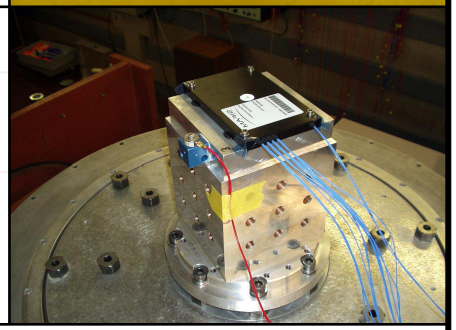
SMOS and SMOS/MOHA

SMOS Mission (Soil Moisture and Ocean Salinity) Payload Module: Microwave Imaging Radiometer with Aperture Synthesis (MIRAS)



MOHA (MIRAS Optical Harness): Connects antennas with the control and correlator unit via a custom optical bus.

COTS Fibre Optic Components in SMOS/MOHA

Fibre Optic Laser Transmitter	
Fibre Optic Receiver	
Fibre Optic Coupler Assembly	
Fibre Optic Cable / Pigtails	

Qualification Approach

- **Highest quality level for commercial off-the-shelf opto-electronic components is according to Telcordia standard or similar**
- **Space qualified components not feasible (power budgets) or simply not existing**
- **A full qualification exercise as per ESCC specification not feasible due to**
  - **time and cost constraints**
  - **industry is too fast moving**

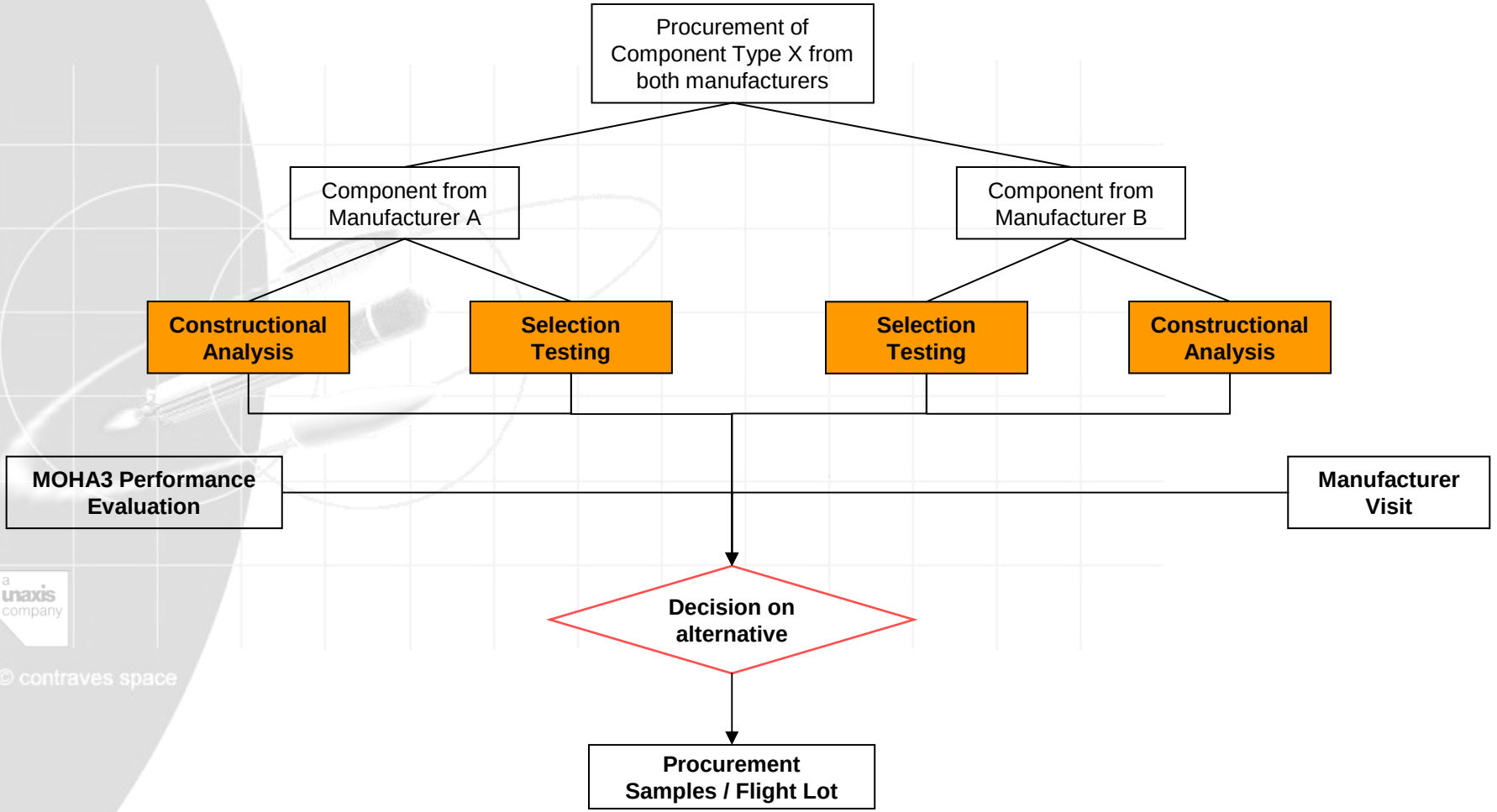
Qualification Approach: Strategies

1	Full qualification of 1 flight lot (FL) plus samples	+ least costs + shortest overall schedule – highest impact on schedule if not successful
2	Full qualification of 2 alternatives of FL plus samples in parallel	+ risk of schedule delay is lowered, high probability that one lot can be successfully qualified + shortest overall schedule – 2 qualification lots to be procured – 2 full qualification campaigns – very high cost impact
3	Partial evaluation of 2 alternatives Full qualification of 1 FL plus samples	+ costs are moderate (only one qualification) + risk of qualification failure low – impact on overall schedule is high as procurement has to be performed for the samples and after successful evaluation for the FL again
4	Partial evaluation of 2 alternatives (reservation of 2 FL plus Samples) Partial qualification of 1 FL plus samples	+ short overall schedule as the FL plus samples are already reserved + lowest risk of schedule delay + Some tests already done during evaluation and need not to be repeated during qualification – Budget is highest as the reservation penalty for the 2nd FL is probably equal to the FL cost
5	Partial evaluation of 1 alternative (if not successful 2nd alternative) Full qualification of 1 FL plus samples	+ high risk of schedule delay – Overall schedule is medium as the procurement of the FL plus samples have to be done after evaluation, but impact if evaluation is not successful

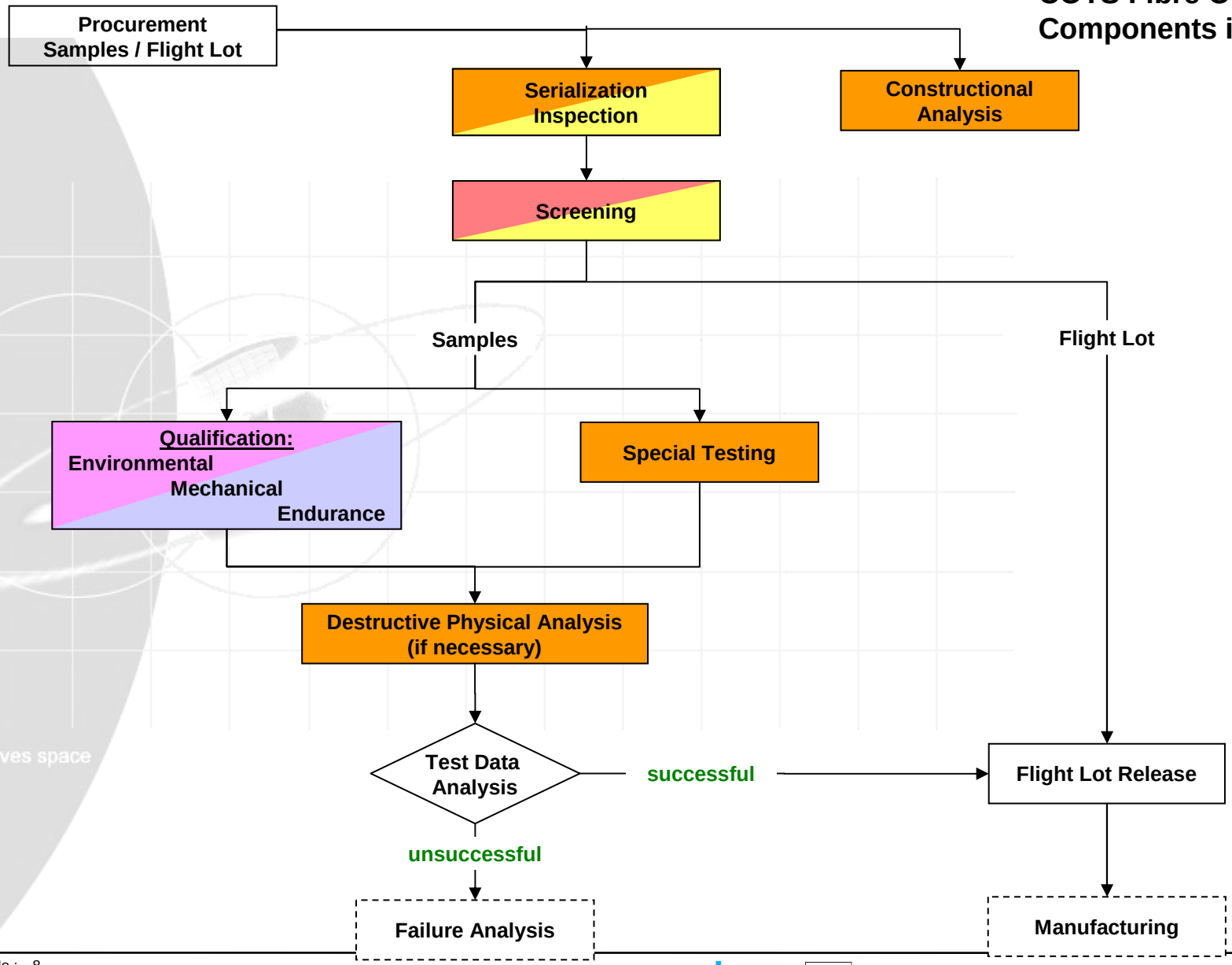
Qualification Approach: Strategy for SMOS/MOHA

- One time Lot Acceptance Testing for this particular mission only
- One flight lot is purchased and tested for its suitability to the particular space application
- In order to reduce risk:
  Evaluation phase with two possible COTS candidates for each component (subjected to most critical tests, constructional analysis, manufacturer assessment)

Qualification Approach: Evaluation Phase



Qualification Approach: Lot Acceptance



Flight Lot Qualification

Qualification Approach: Testing

- **Selection testing (Evaluation phase):**
  - vibration, shock
  - thermal vacuum cycling
  - radiation (gamma & proton)
  - constructional analysis & manufacturer assessment
- **Flight lot screening / qualification**
  - extended burn-in
  - acceptance thermal cycling
  - measurement at high and low temperature
- **Flight lot acceptance testing**
  - thermal cycling, vibration, shock and radiation
  - life test
  - bending, fibre pull, mating, DPA

Tecnologica Componentes Electrónicos, S.A.

Most testing has been outsourced to a dedicated test house, Tecnologica SA in Spain.

Qualification Approach: Procurement Baselines

To reduce qualification effort:

- **Procure different parts with as many similarities as possible:**
  - same optic fibre
  - same pigtail cable
  - same fibre optic connector

- **Assess willingness of manufacturer to cooperate in the proceeding**
  - Willingness to disclose exact processing
  - Willingness to manufacture according to custom requirements (use the supplied fibre, cable, connectors)
  - Willingness to help in failure analysis

Issues I

- **Fibre optic cables: Pay high attention to used cable design and harnessing and ensure its compliance with required temperature range and vibration and shock requirements**

- **Fibre optic cable design:**
  - loose tube good for processing pigtailed parts / couplers
  - tight tube better for temperature performance

- **Fibre optic cable/harnessing**
  - fixation of cable (vibration and shock)
  - connectorising of cable/pigtail (Diamond connector, light throughput required)

- **Temperature behaviour of laser transmitter**

Issues II

- **Analyse used materials (epoxies, strain relief boots) for their suitability in space applications**

- **Electro-optic components:**
  - Humidity content in TO-can
  - Mechanical rigidness of the assembly

Lessons Learned

- Most manufacturers are not willing to customise their process for a small volume order
- Be fast, products change fast
- Smaller manufacturers show greater interest and higher flexibility to customise their manufacturing and/or disclose the exact processing
- Be very accurate in manufacturer assessment (which activities are outsourced, how is the visibility)

Contact Information

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