

ESA-NASA Working Meeting on
Optoelectronics

COTS Fibre Optic Components in SMOS/MOHA

October 5th and 6th, 2005



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D I S C O V E R I N G T H E U N I V E R S E

SMOS and SMOS/MOHA

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

Qualification Approach

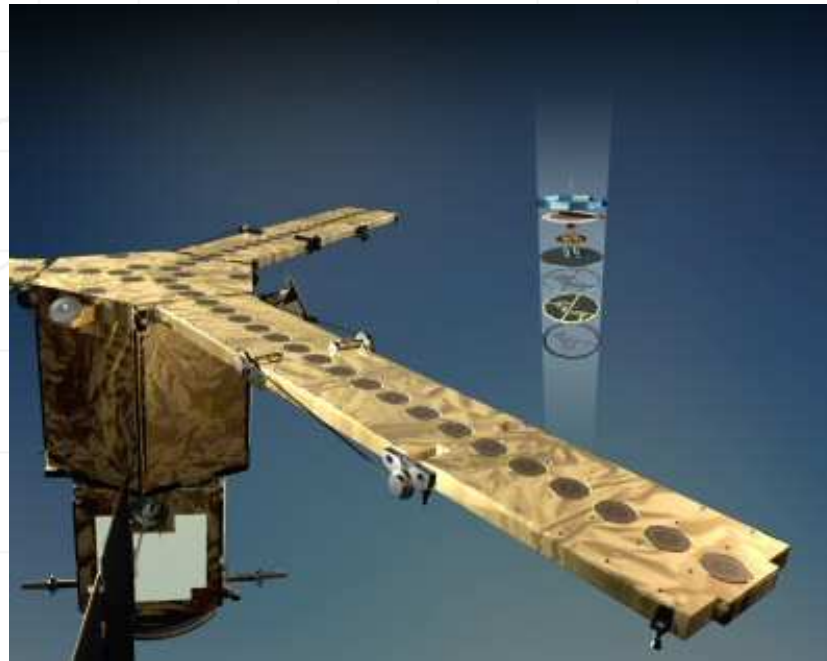
- **Possible Strategies**
- **Strategy for SMOS/MOHA**
- **Evaluation**
- **Lot Acceptance**
- **Procurement Baselines**

Lessons Learned and Issues

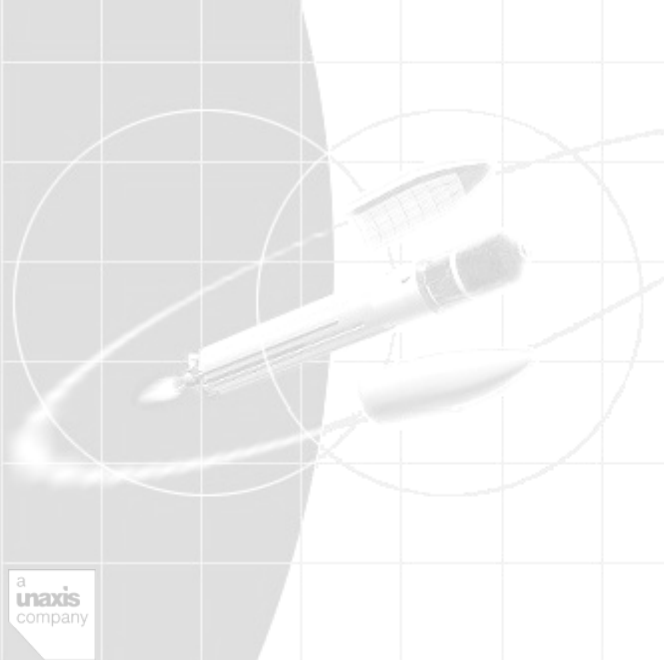
SMOS and SMOS/MOHA

COTS Fibre Optic
Components in SMOS

**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.**

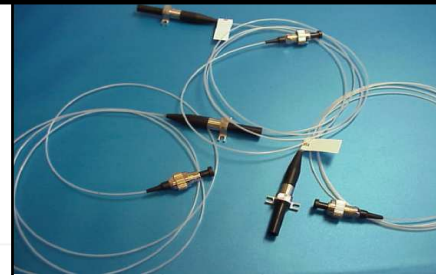


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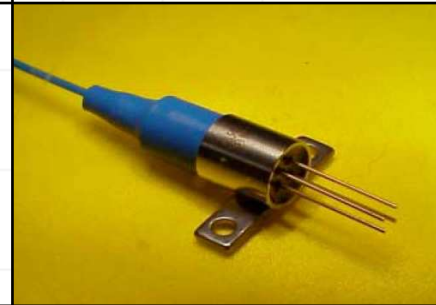
COTS Fibre Optic Components in SMOS/MOHA

COTS Fibre Optic Components in SMOS

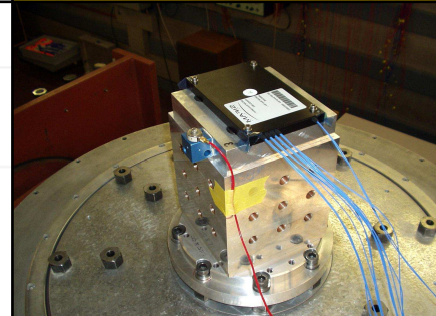
Fibre Optic Laser Transmitter



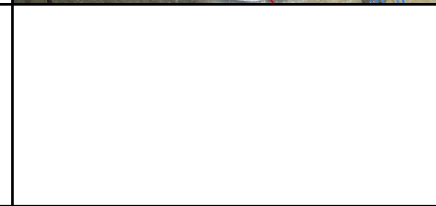
Fibre Optic Receiver



Fibre Optic Coupler Assembly



Fibre Optic Cable / Pigtails



- **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

COTS Fibre Optic Components in SMOS

1	Full qualification of 1 flight lot (FL) plus samples	<ul style="list-style-type: none"> + least costs + shortest overall schedule - highest impact on schedule if not successful
2	Full qualification of 2 alternatives of FL plus samples in parallel	<ul style="list-style-type: none"> + 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	<ul style="list-style-type: none"> + 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	<ul style="list-style-type: none"> + 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 2 nd alternative) Full qualification of 1 FL plus samples	<ul style="list-style-type: none"> + 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



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Qualification Approach: Strategy for SMOS/MOHA

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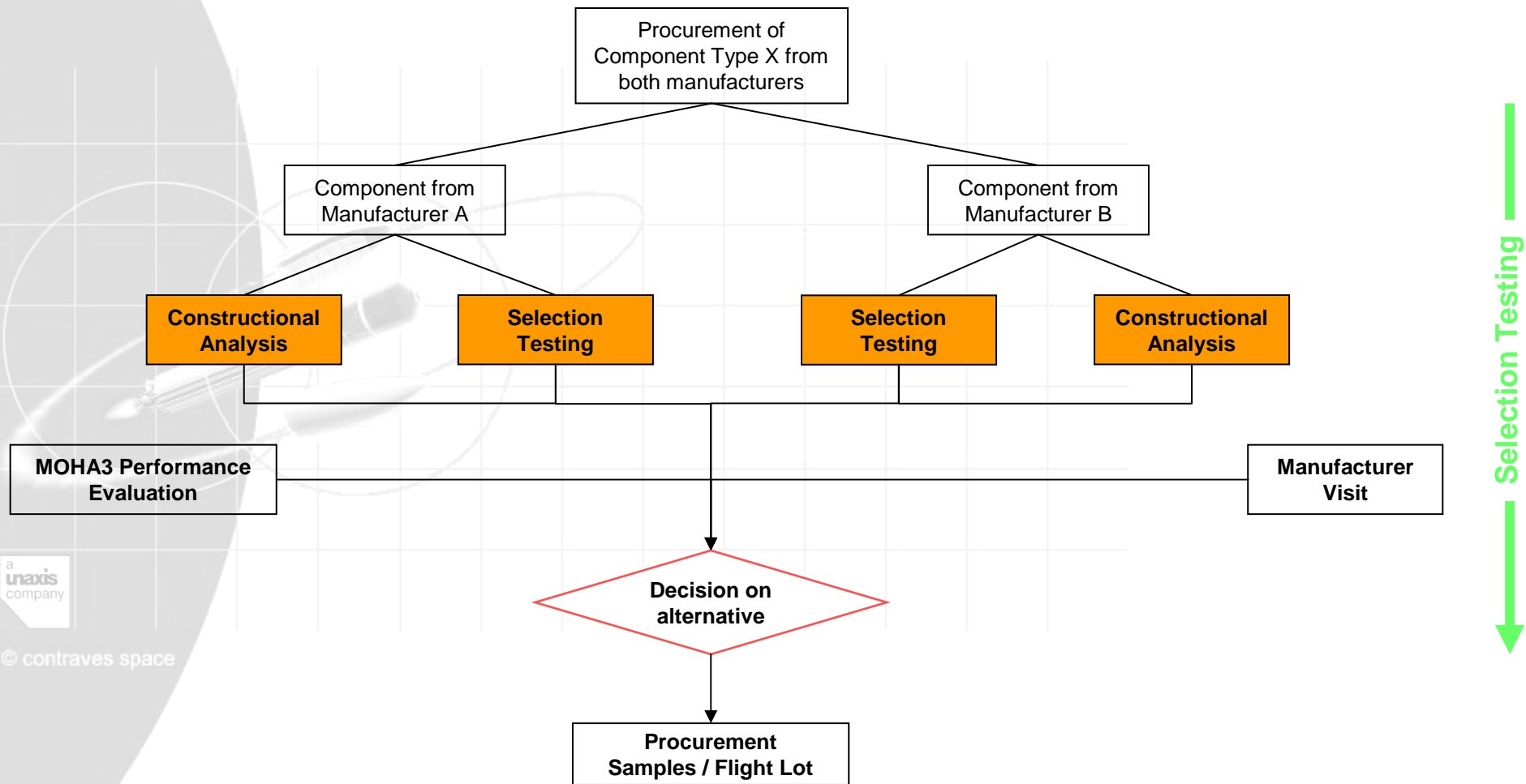
- **One time Lot Acceptance Testing for this particular mission only**
- **One flight lot is purchased and tested for its suitability to the particular space application**
- **In order to reduce risk:
Evaluation phase with two possible COTS candidates for each component (subjected to most critical tests,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



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Qualification Approach: Evaluation Phase

COTS Fibre Optic
Components in SMOS



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Slide-No.: 7

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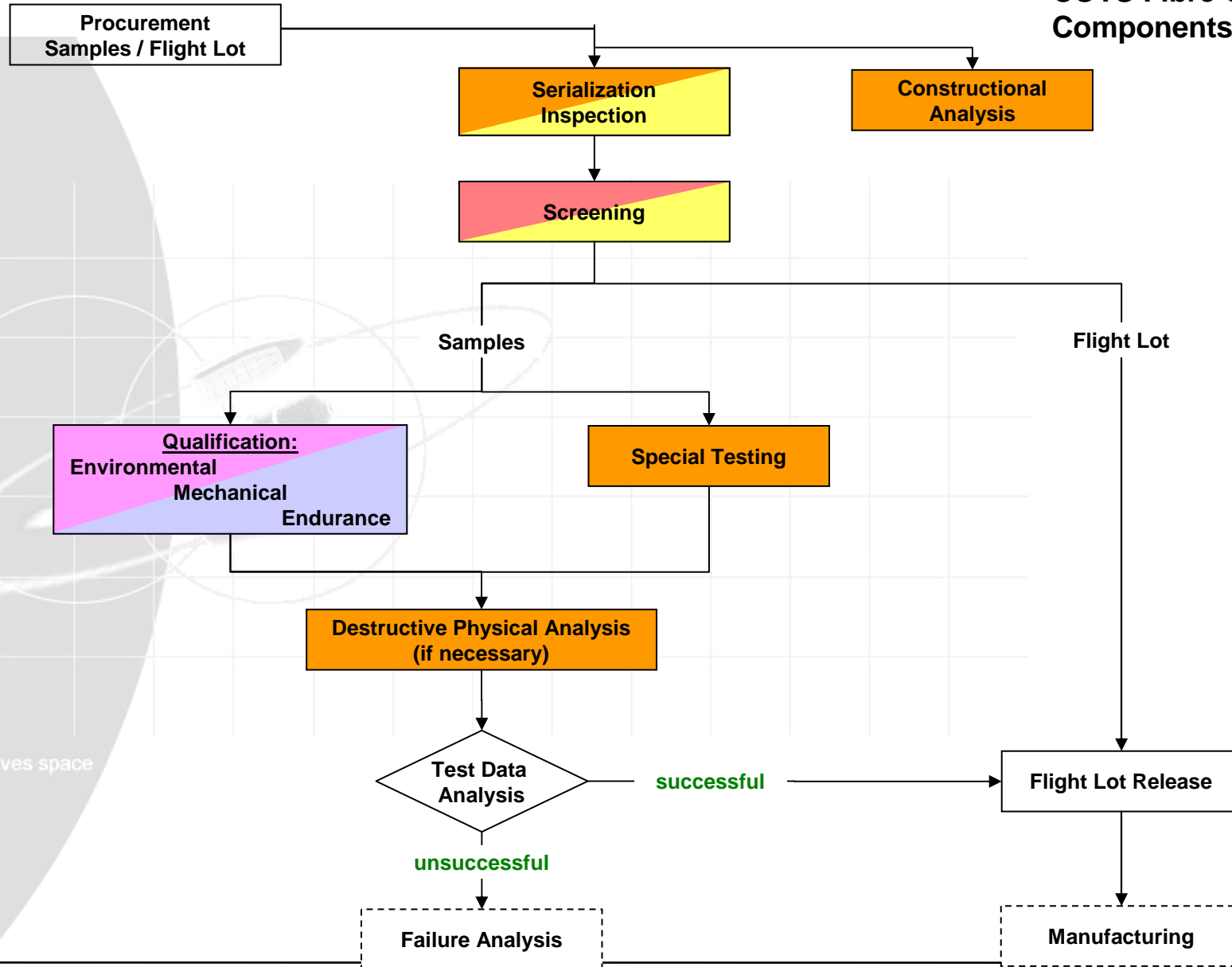
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Qualification Approach: Lot Acceptance

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Flight Lot Qualification



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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



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- **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**



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- 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



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Lessons Learned

COTS Fibre Optic
Components in SMOS

- **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)**



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