



Tracker Thermal Control System Electrical overview

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TTCS -- Electrical Overview

- **What is part of the TTCS?**
 - Subssystems
 - ‘Architectural design’

- **More detailed view of TTCS high level controller**
 - To be implemented in USCM

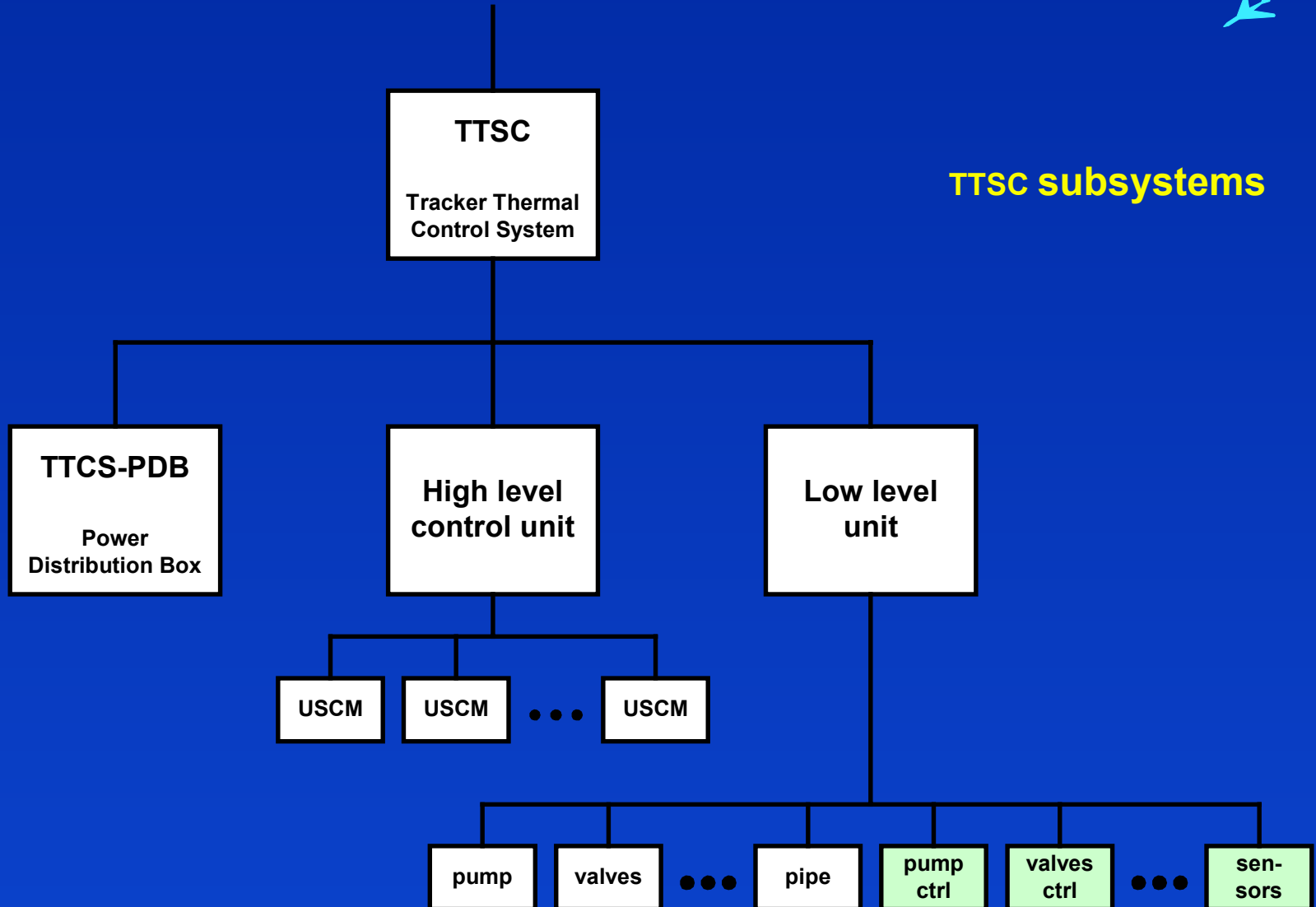
- **What to be done in near future?**

- **[questions can be asked ‘on the fly’]**



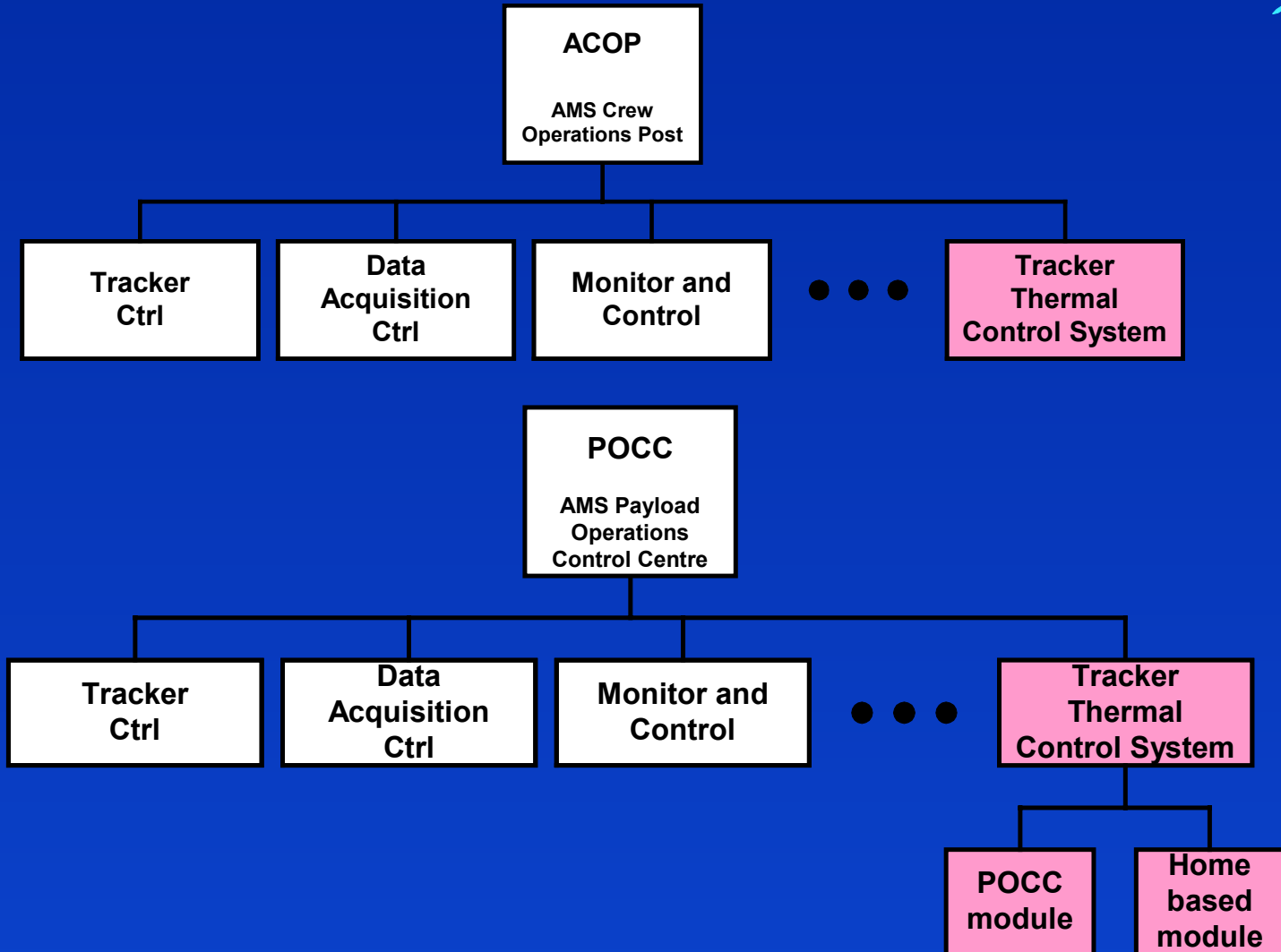
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TTCS subsystems

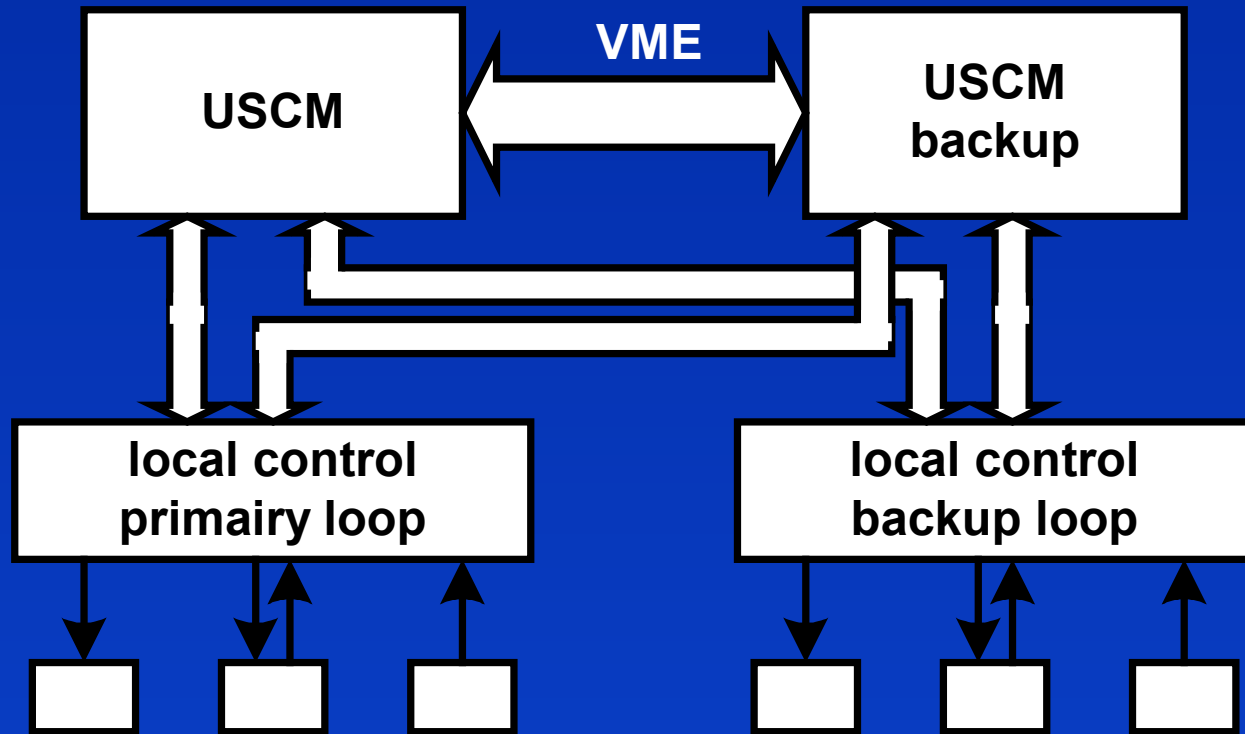




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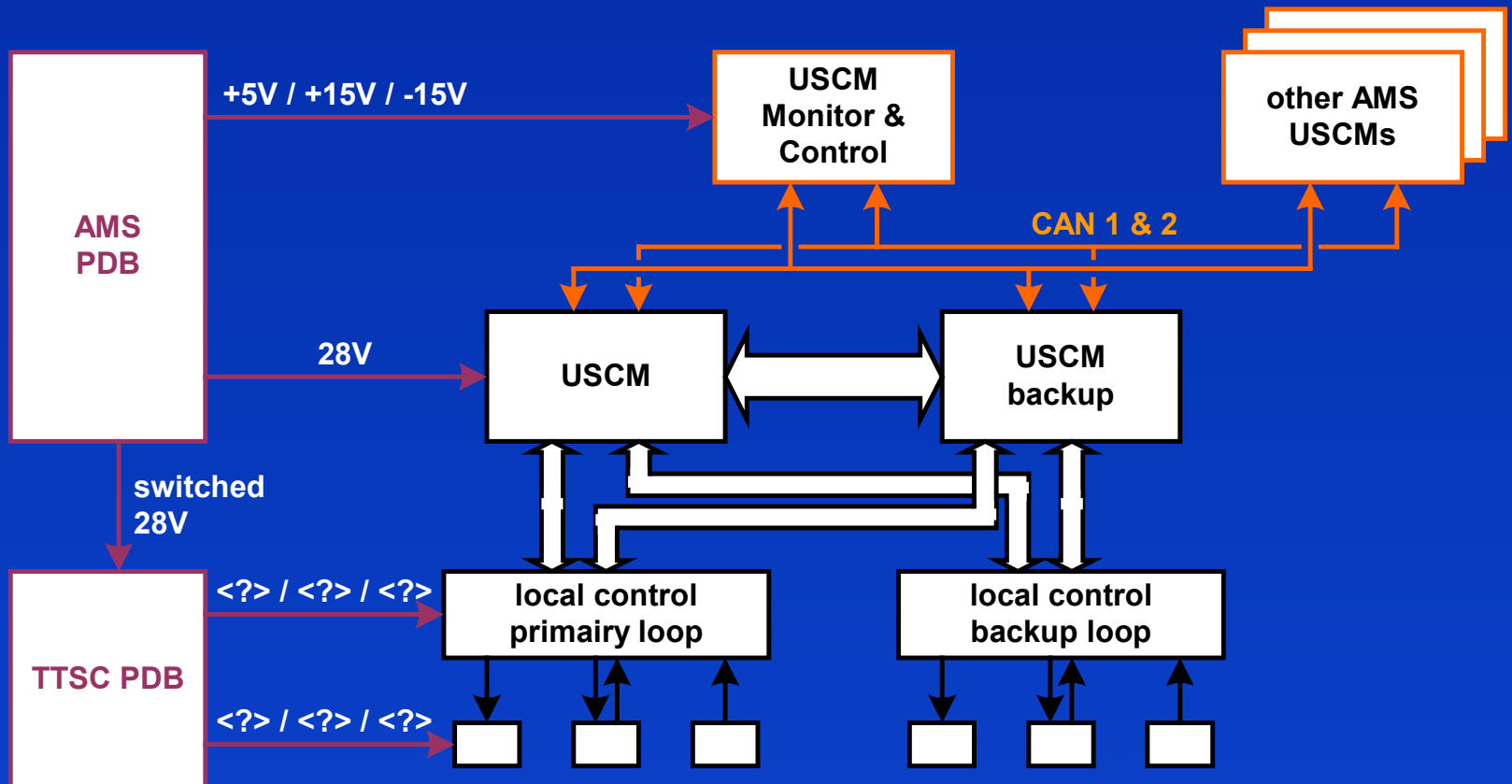
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actuators, actuators with feedback, sensors

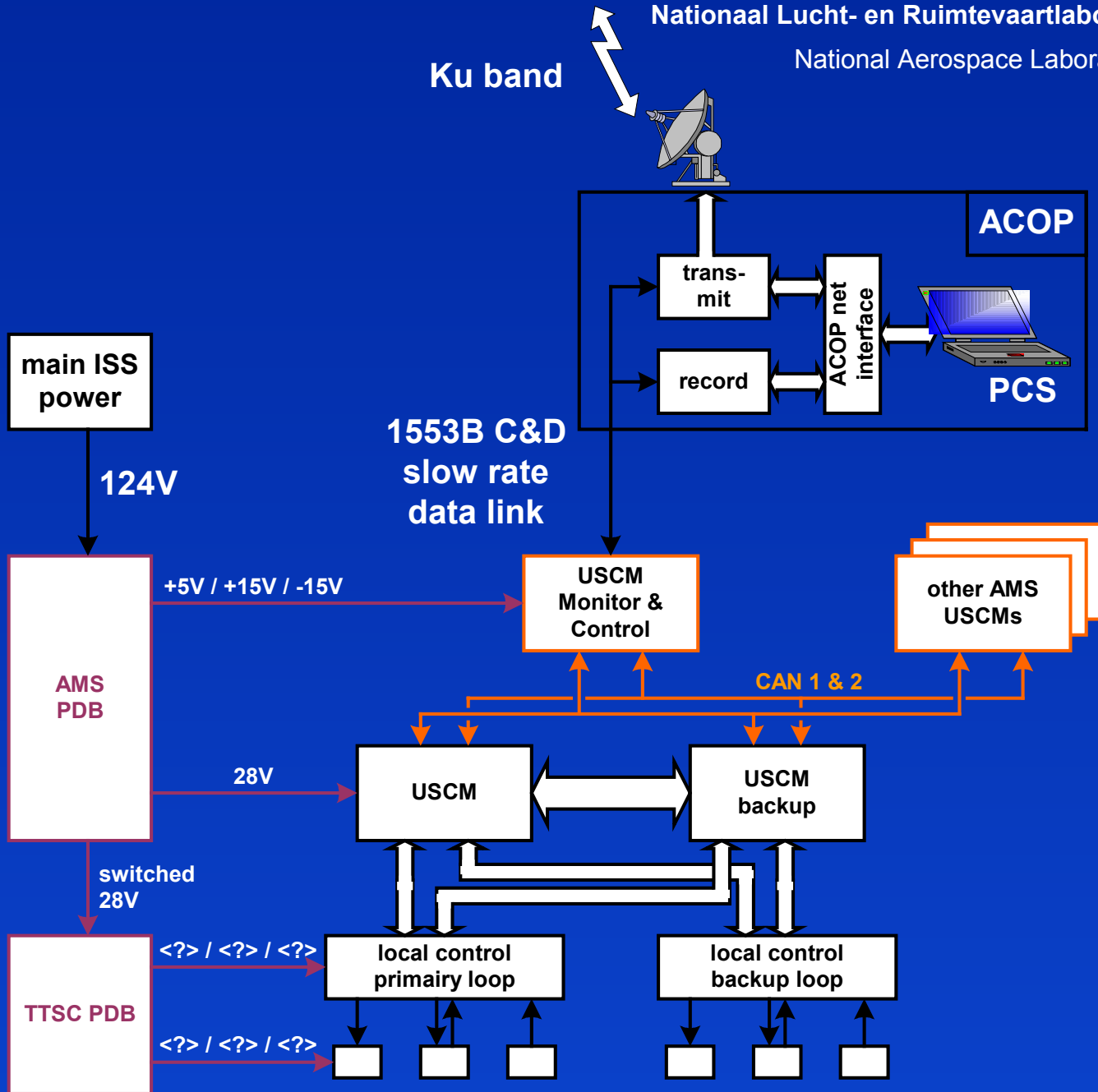


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Ku band





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- **Primary loop -- actuators**
 - Pumps (probably **two**)
 - speed control
 - Two way valves (probably **two** times **three**)
 - higher level controller will determine failure
 - Three way valves assemblies (probably **one** times **two**)
 - higher level controller will determine failure
 - Pre-heaters (probably **two** times **two**)
 - local temperature sensor feedback & overrule by higher level controller
 - Peltier-heaters (probably **two**)
 - local temperature sensor feedback & overrule by higher level controller
 - Experiment-heaters (probably **two**)
 - without any local feedback



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- **Primary loop -- sensors**

- Liquid flow meters (probably **three**)
 - higher level controller read-out directly
- Absolute pressure sensor (probably **one**)
 - higher level controller read-out directly
- Differential pressure sensor (most probably **one**)
 - higher level controller read-out directly
- Temperature sensors inside the low level unit (about **50**)
- Temperature sensors outside the low level unit but part of the TTCS (about **256**)
 - routed via the local controller unit



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- **Backup loop -- actuators**
Exactly same configuration as primary loop
(with each its own local control)

- **Backup loop -- sensors**
Exactly same configuration as primary loop
(with each its own local readout circuit)

total actuators: $2 * 18 = 36$

total sensors: $2 * 55 + 256 = 366$



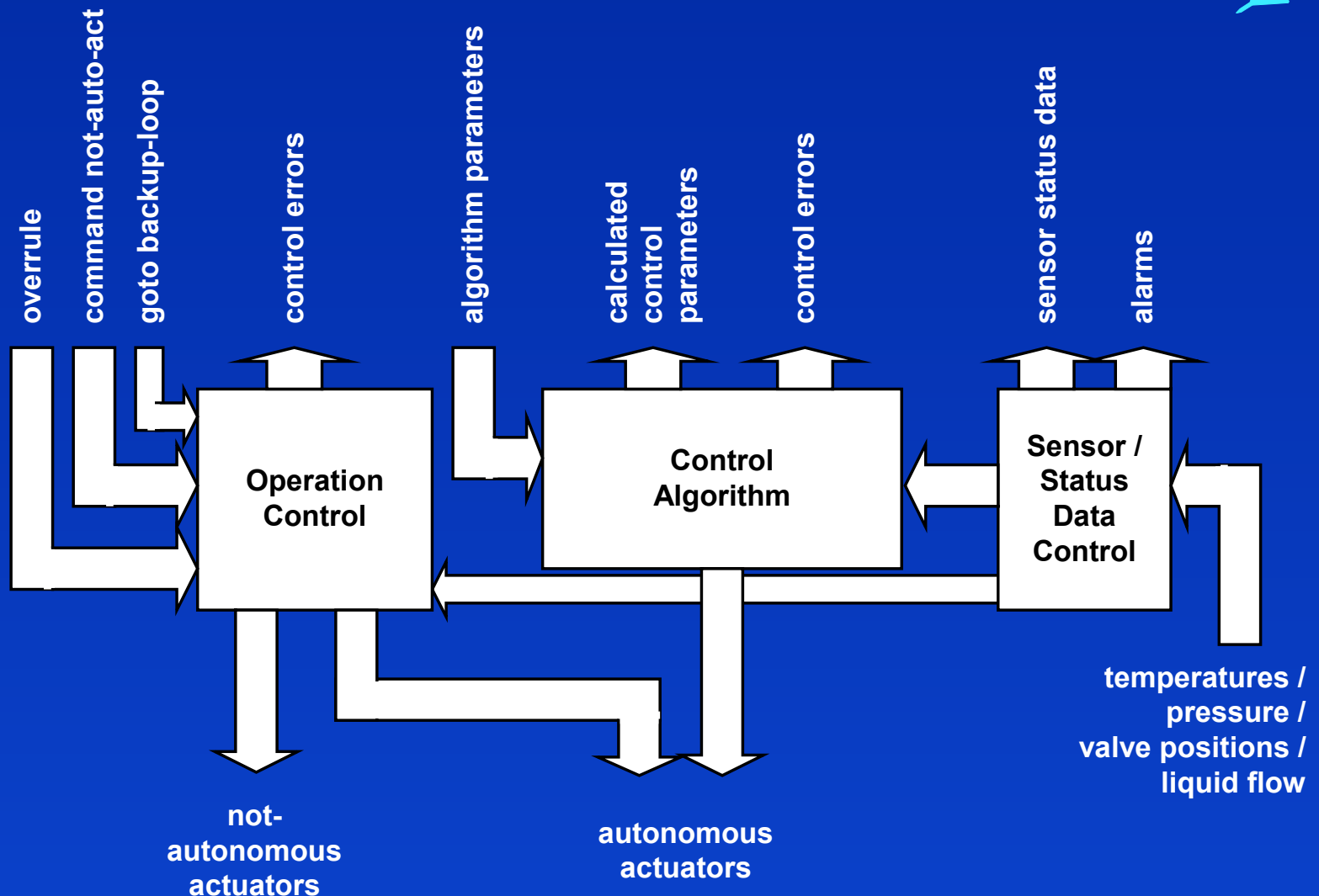
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Higher level controller (USCM)

- **Autonomous control of the thermal part**
- **sensor part**
- **algorithm part**
- **command part**

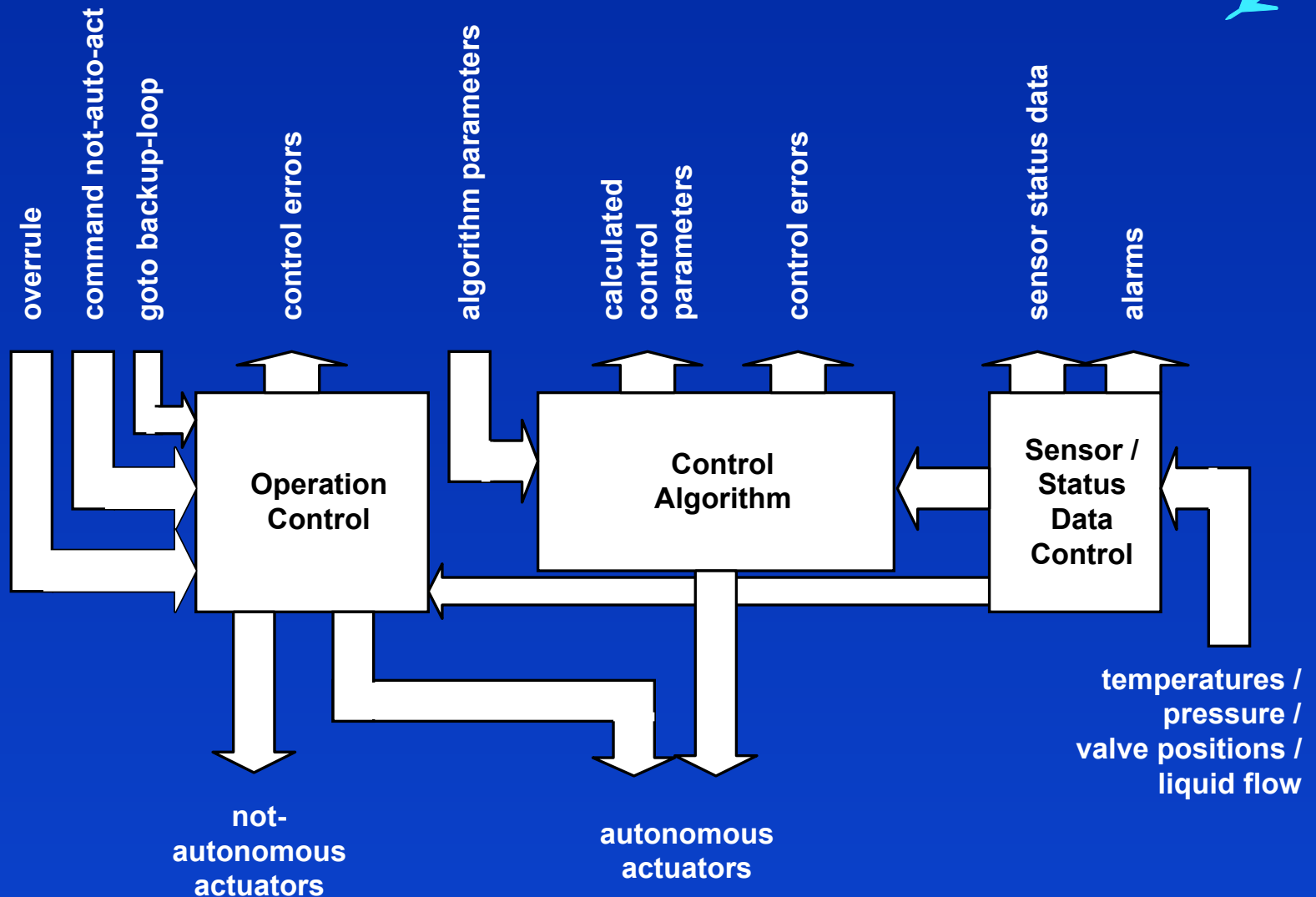


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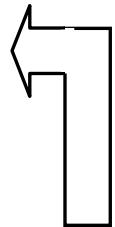
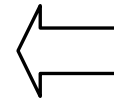
**Operation
Control**

**Control
Algorithm**

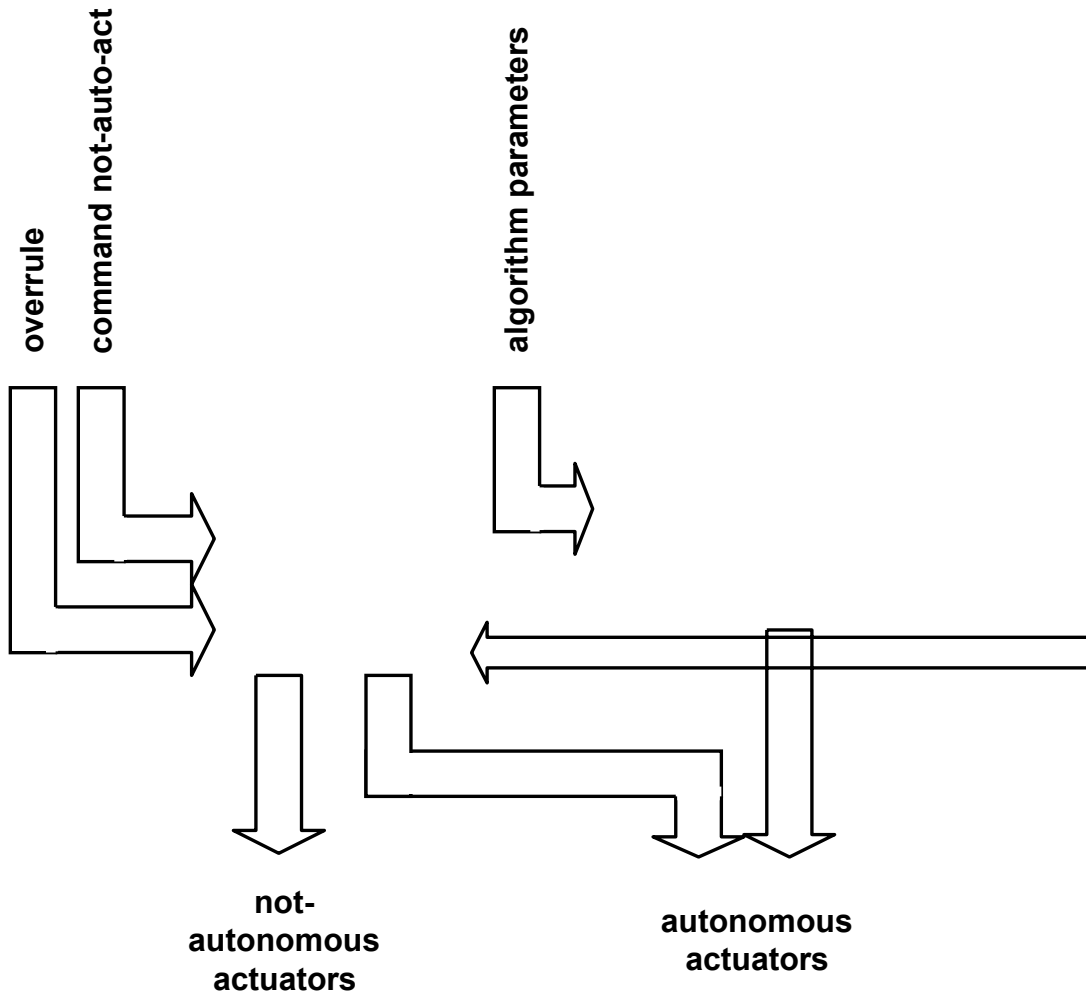
**Sensor /
Status
Data
Control**

sensor status data

alarms



**temperatures /
pressure /
valve positions /
liquid flow**





goto backup-loop



control errors



**calculated
control
parameters**



control errors

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What to do in the near future

- **some electrical requirements capture**
 - radiation <??>
 - documentation <like safety assessment, EEE parts list, thermal analysis, mechanical analysis, etc ??>
- **internal NLR decision about sensors and actuators to be used**
- **architectural design of low controller electronics and TTCS-PDB (power distribution box)**