MÁSTER UNIVERSITARIO EN SISTEMAS ESPACIALES
POR LA UNIVERSIDAD POLITÉCNICA DE MADRID

POLITÉCNICA

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UPMSat-2 on-board software

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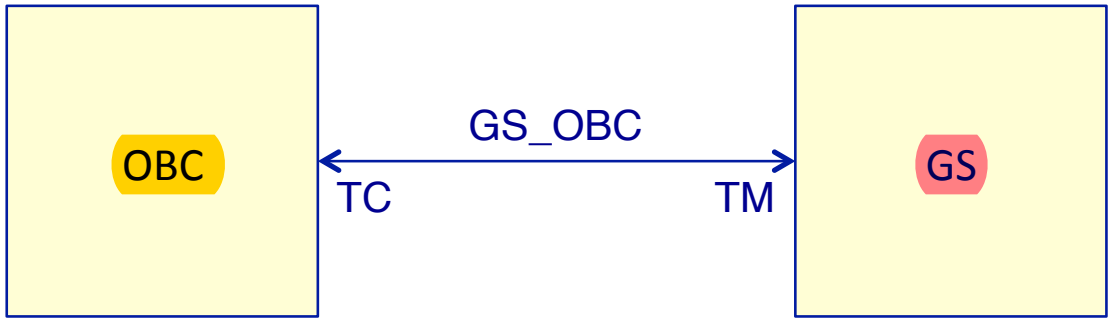
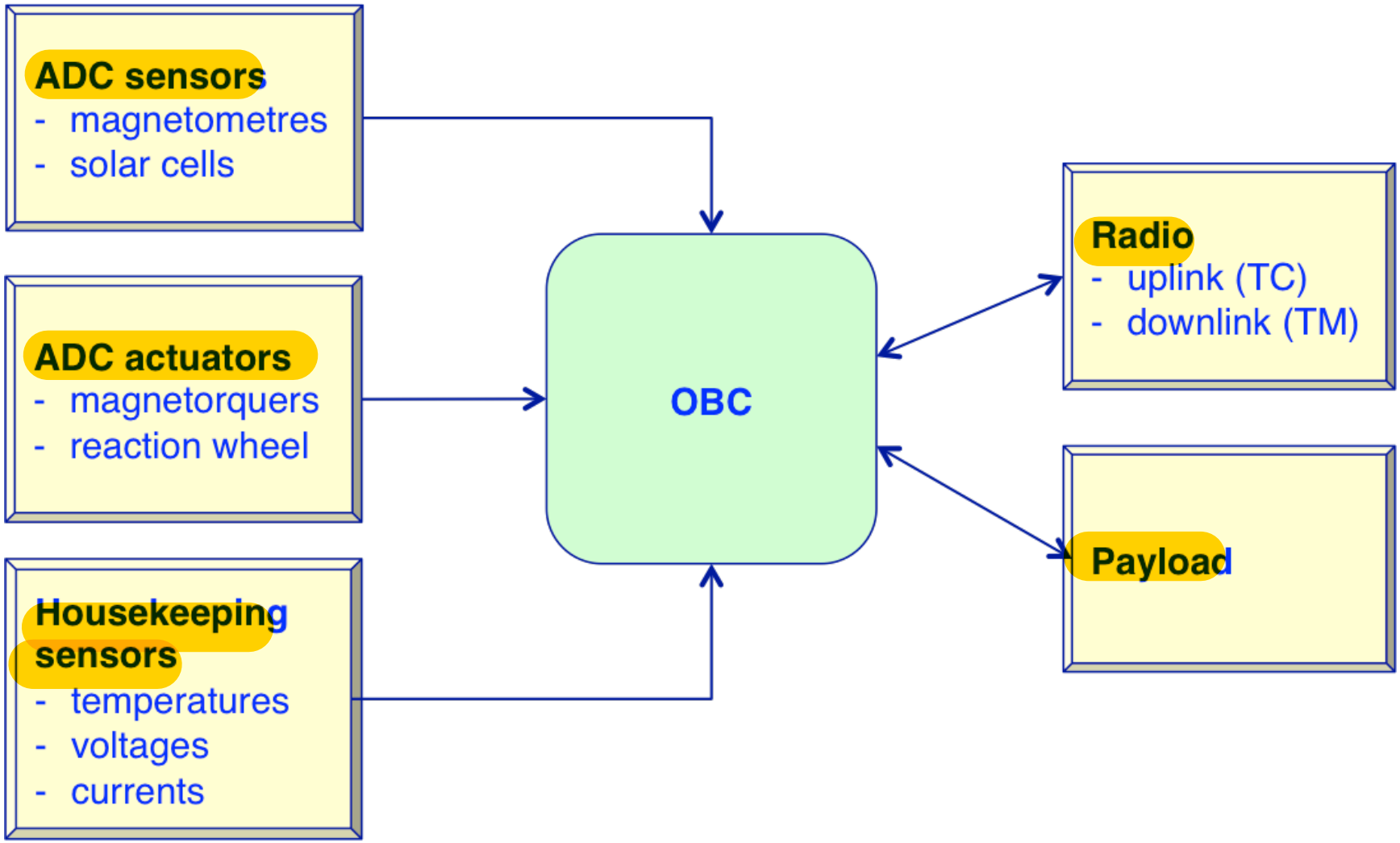
STRAST

Top-level architecture



- Data links
  - UHF U band (AMSAT): 435.00–438.00MHz
    - AUL: Uplink (telecommands): max 1200 bps
    - ADL: Downlink (housekeeping data): max 1200 bps
  - UHF space research band: 400.15 – 401.0MHz
    - RDL: Downlink (experiment data): max 9600 bps

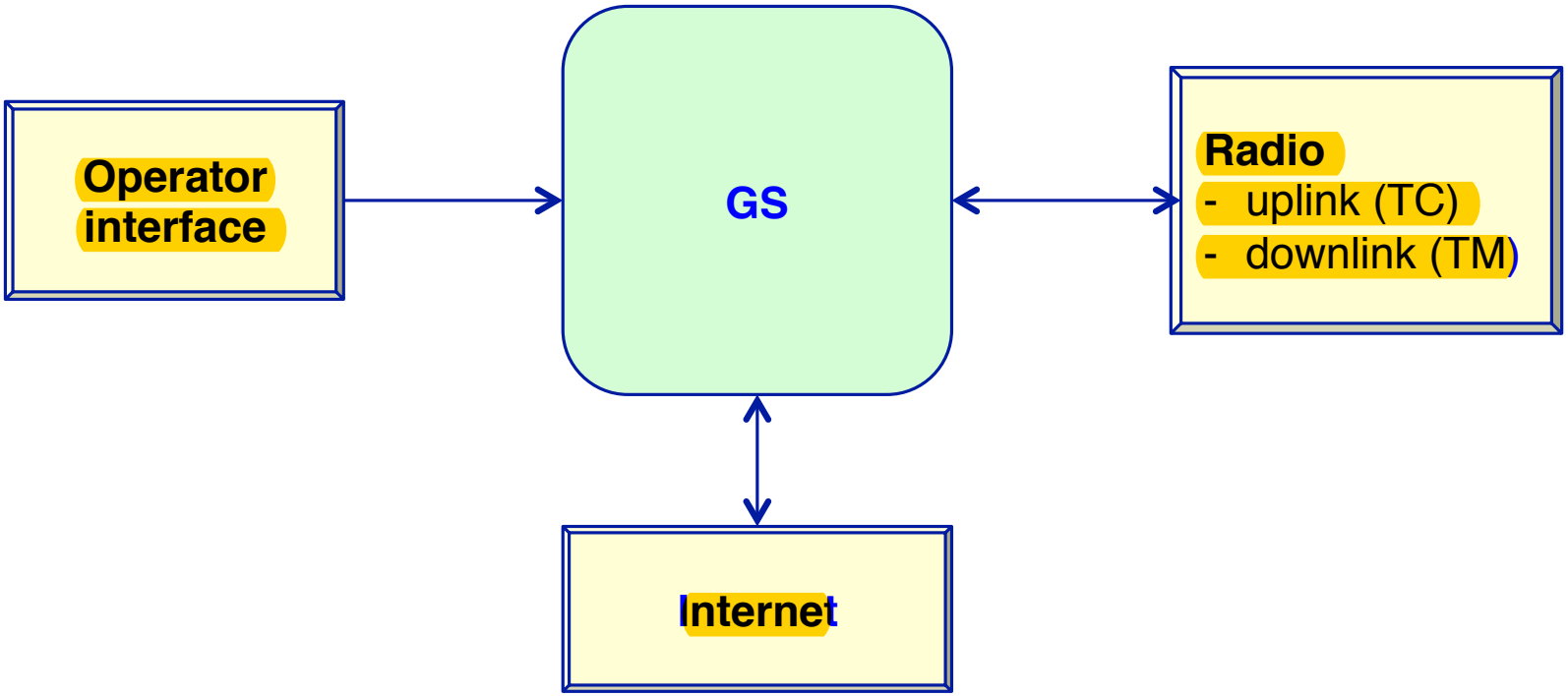
OBC context



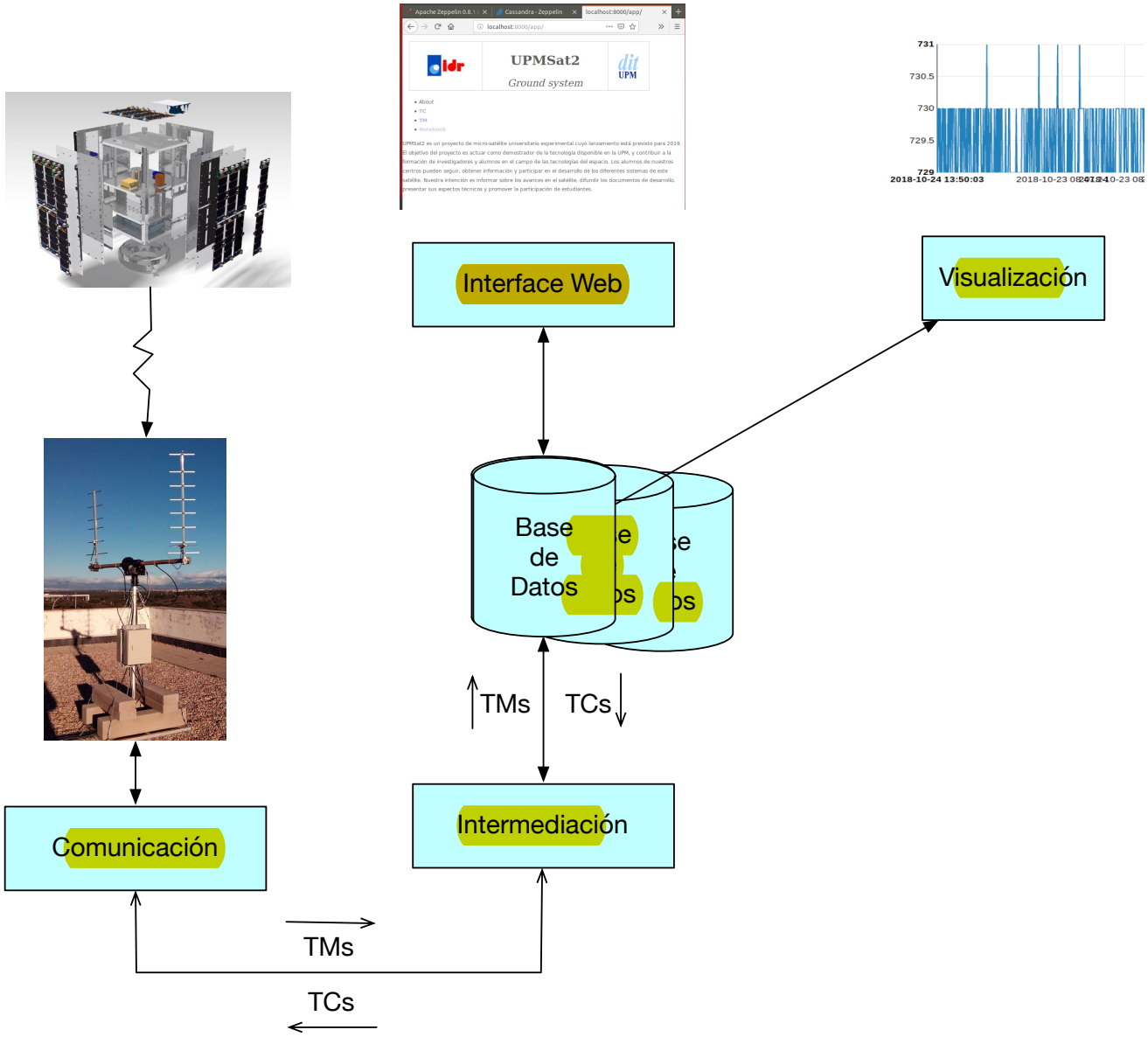
Experiment payload

- MTS Micro Thermal Switch (*IBERESPACIO*)
- RW Reaction Wheel (*Satellite Services Ltd.*)

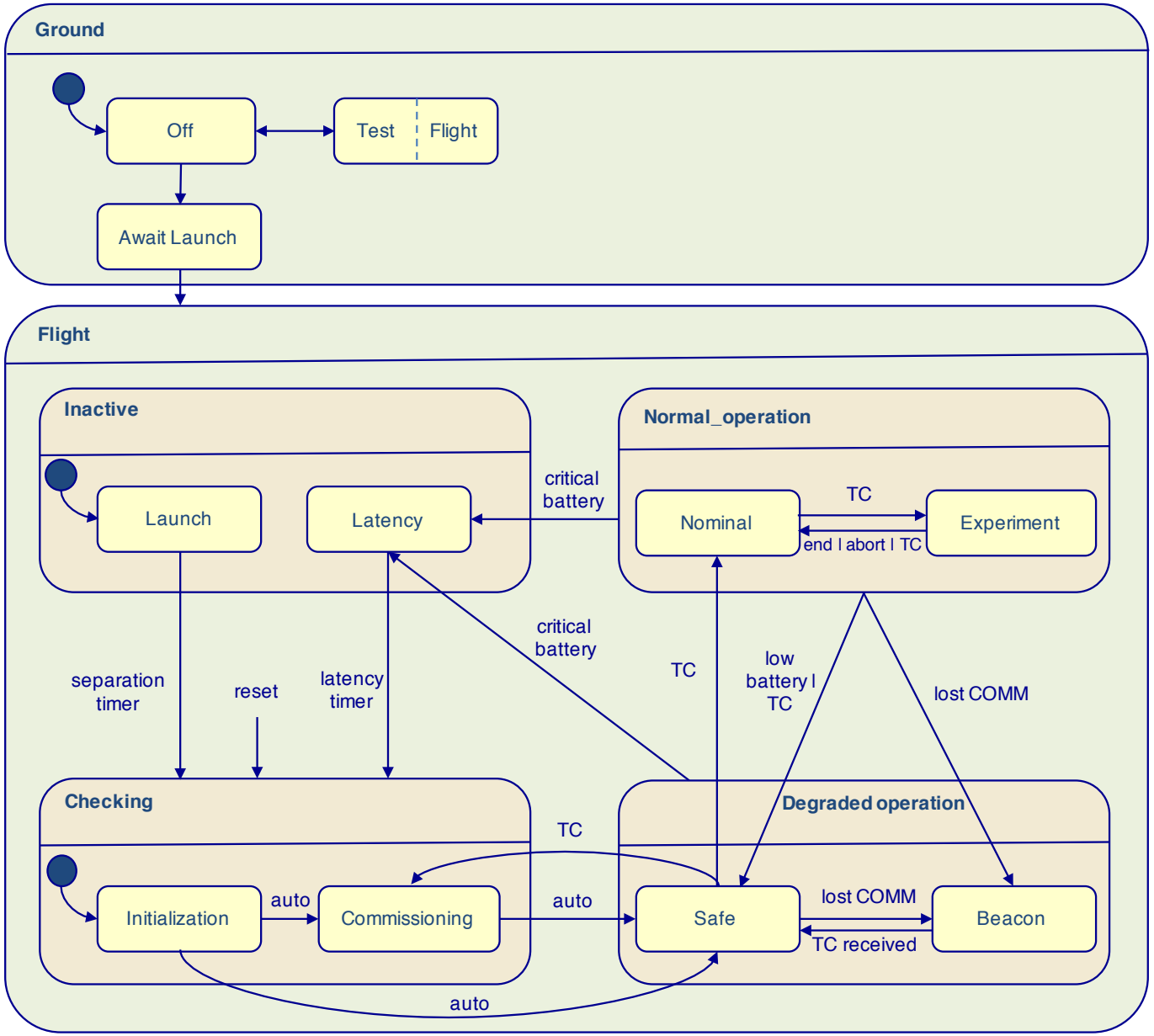
GS context



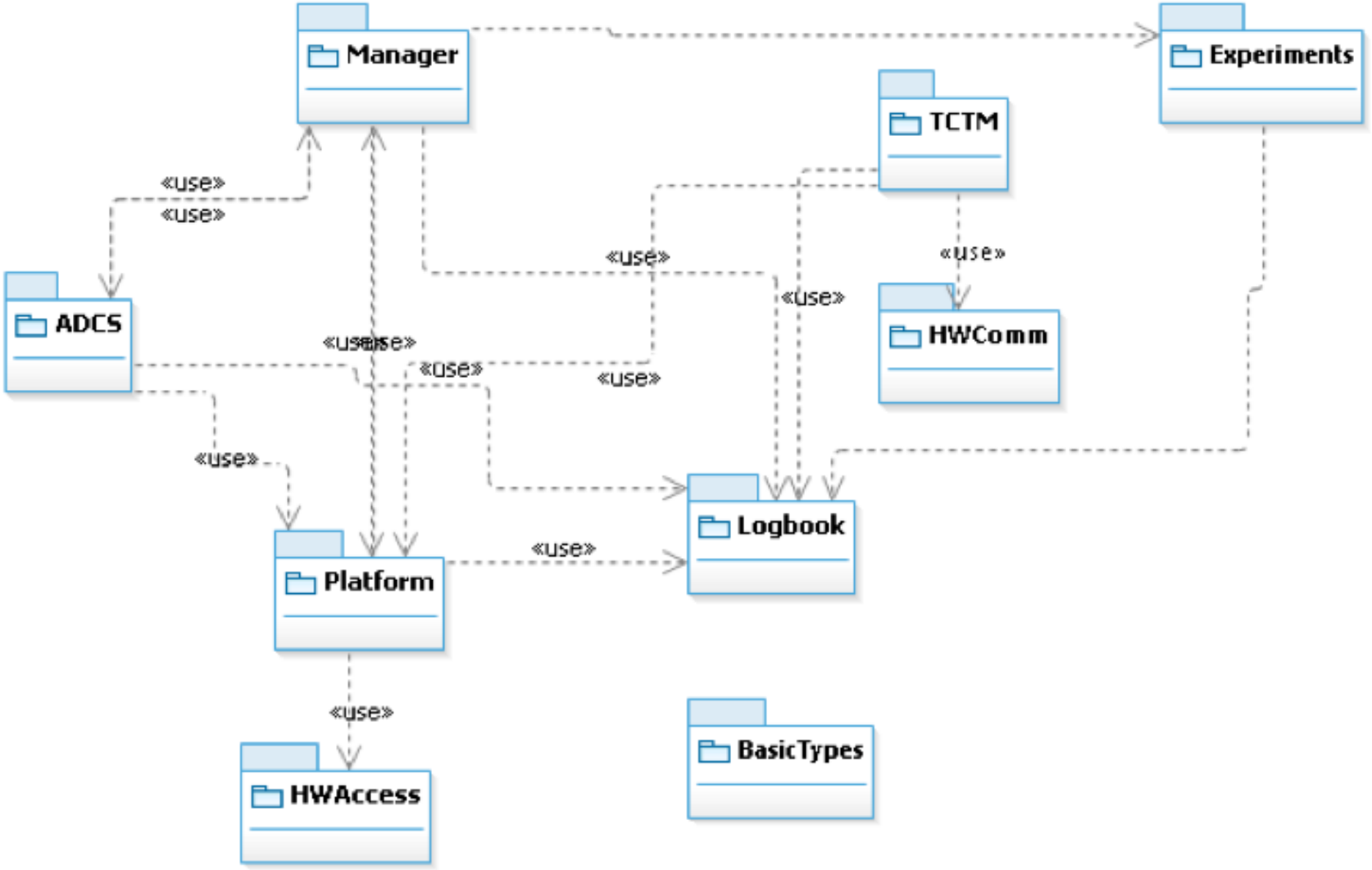
GS: Architecture



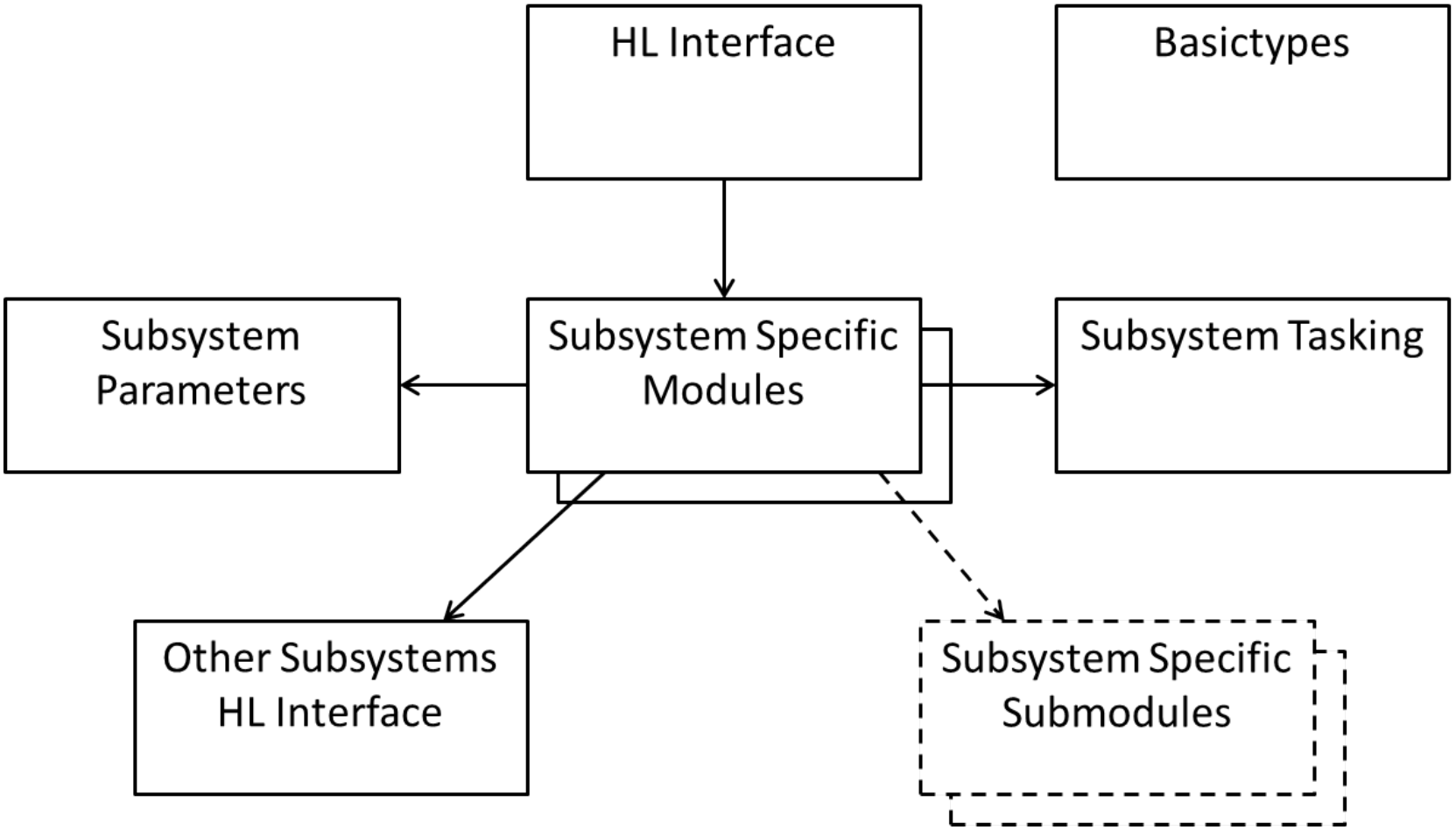
OBC operating modes



OBSW architectural design



Architecture of a subsystem



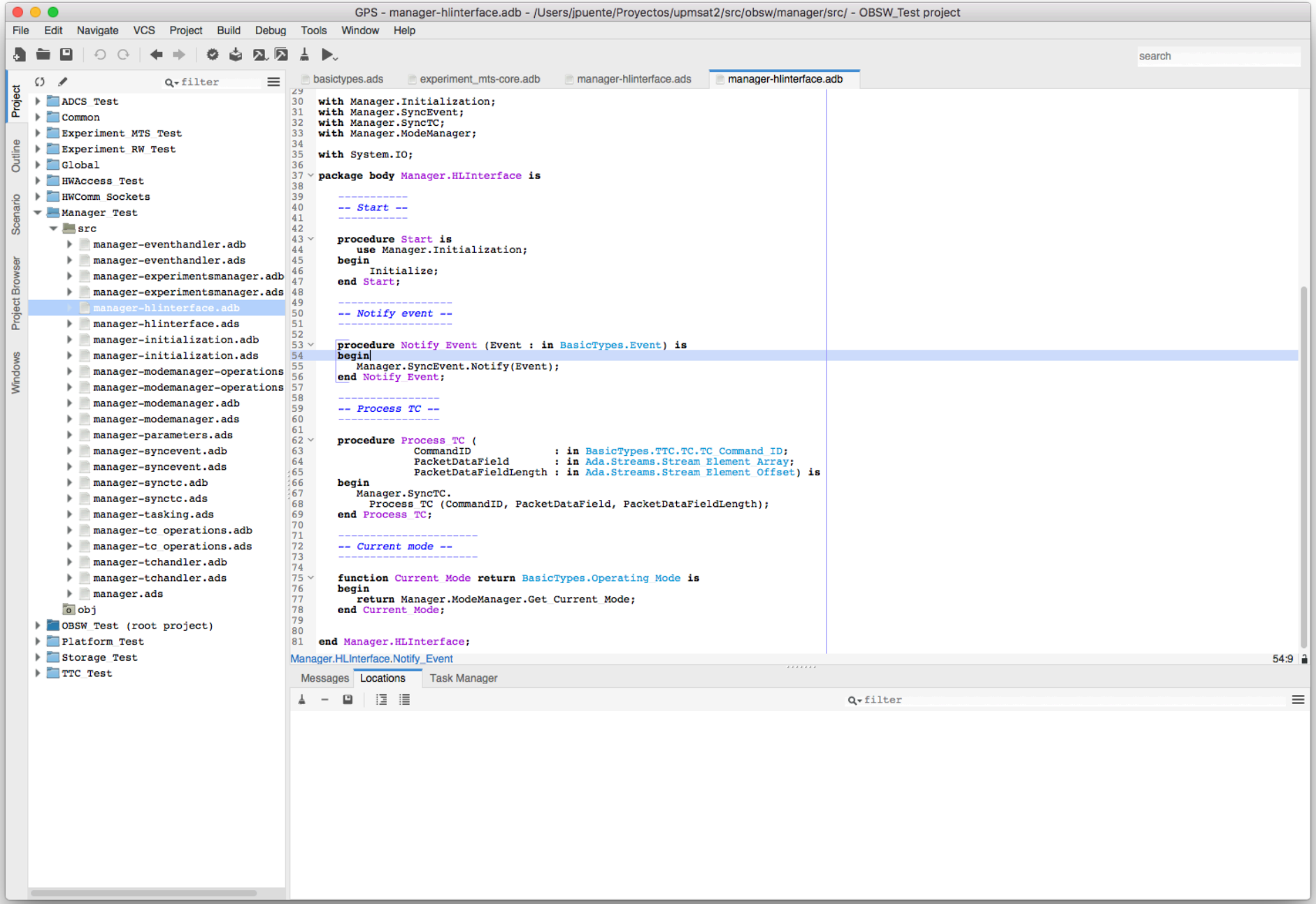
Sample code

```
with BasicTypes.TTC.TC;
with Ada.Streams;

--  @summary
--  High-level interface of the manager subsystem.
--
--  @description
--  This package provides the external interface of the Manager component.
--  It manages the overall satellite operation. It manages the satellite state
--  and handles events, errors and TCs
--
package Manager.HLInterface is

   -- Start the execution of the on-board software
   procedure Start;

--  Notify an event to the manager
--  @param the event to be handled
   procedure Notify_Event (Event : in BasicTypes.Event);

-- Notify a TC to the manager
-- @param CommandID Identifier of the command in the TC
-- @param PacketDataField  Contents of the TC
-- @param PacketDataFieldLength Length of the contents of the TC
   procedure Process_TC
     (CommandID             : in BasicTypes.TTC.TC.TC_Command_ID;
      PacketDataField       : in Ada.Streams.Stream_Element_Array;
      PacketDataFieldLength : in Ada.Streams.Stream_Element_Offset);

   -- Get the current operating mode of the OBSW
   -- @return the operating mode
   function Current_Mode return BasicTypes.Operating_Mode;

end Manager.HLInterface;
```

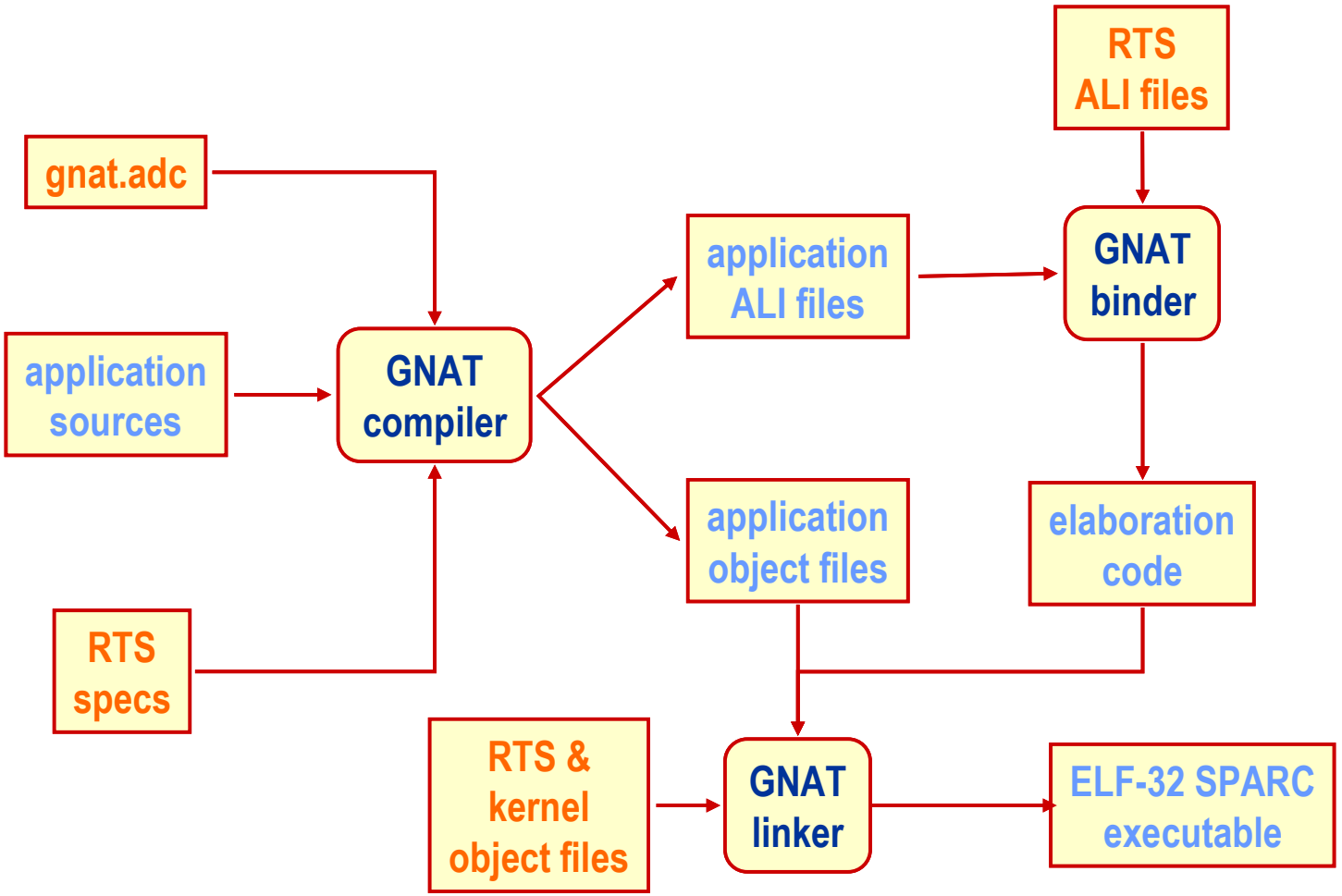
Development tools

- Ada 2005 language
  - a few modules in C
    - automatically generated from Simulink
- Graphical programming environment
  - GPS: GNAT Programming System
- GNAT compilation chain
  - GNU Ada New York University Translator
  - Native compilers for development and high-level testing
  - Cross-compiler (GNU/Linux - LEON3) for production

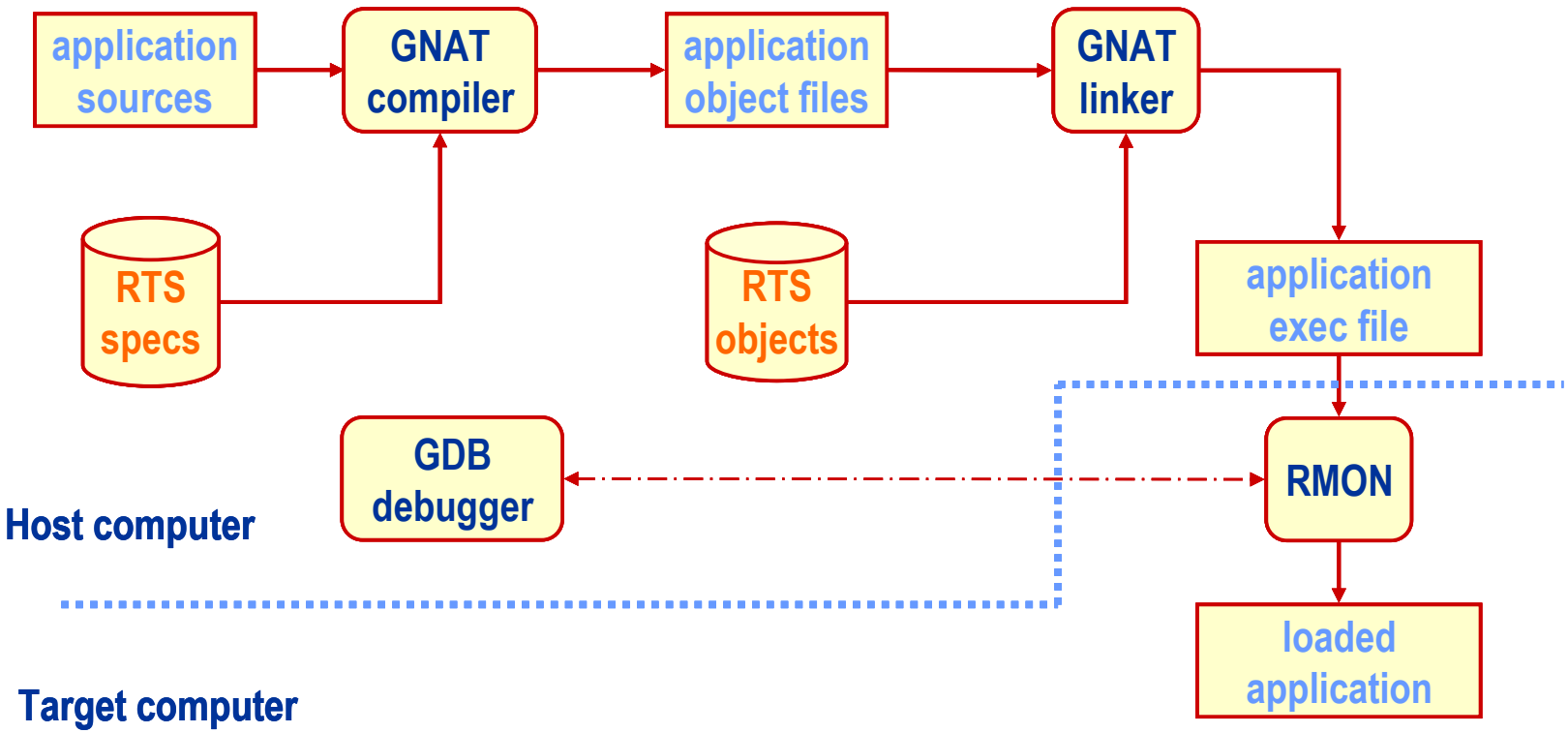
GNAT Programming System



Cross-compilation process

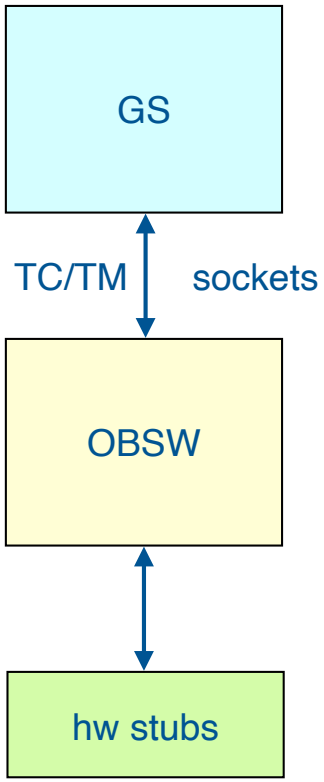


Debugging tools



Testing (1)

Built with project `obsw_test.gpr`



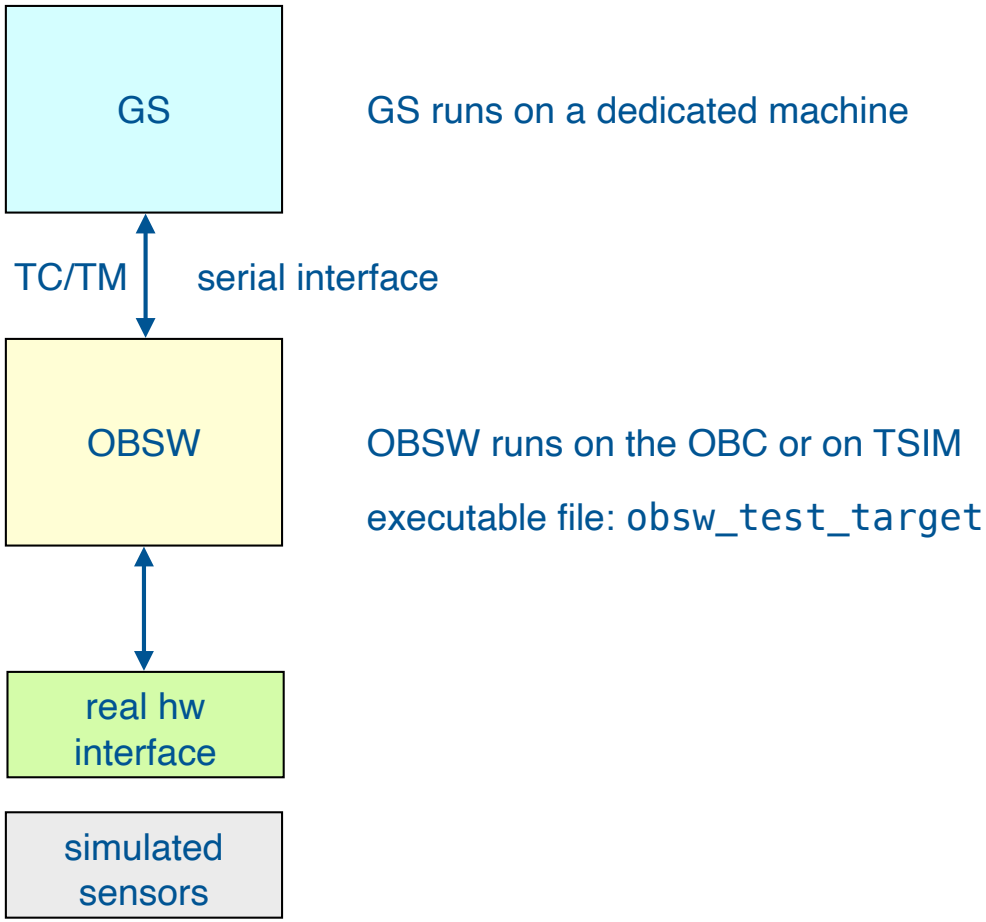
GS runs on the development workstation
or on a different machine

OBSW runs on the development workstation

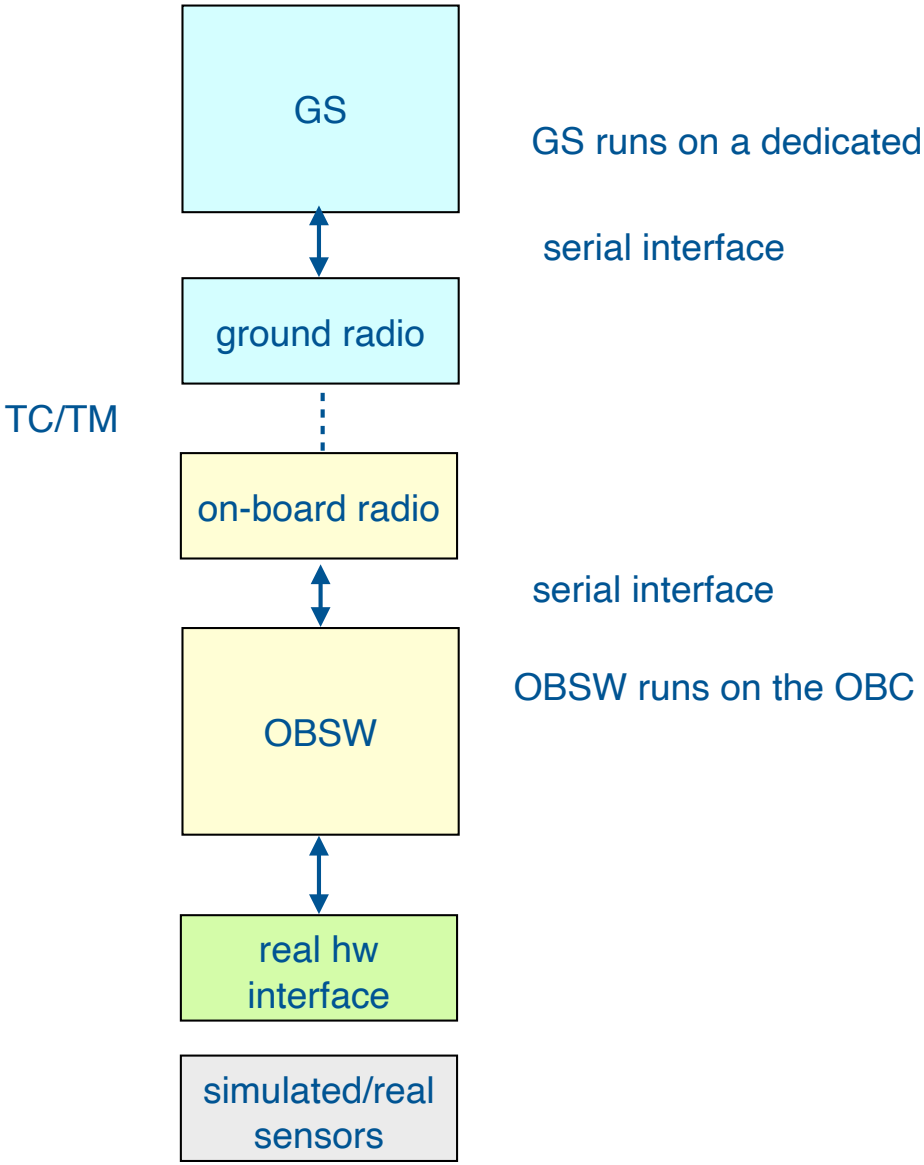
executable file: `obsw_test`

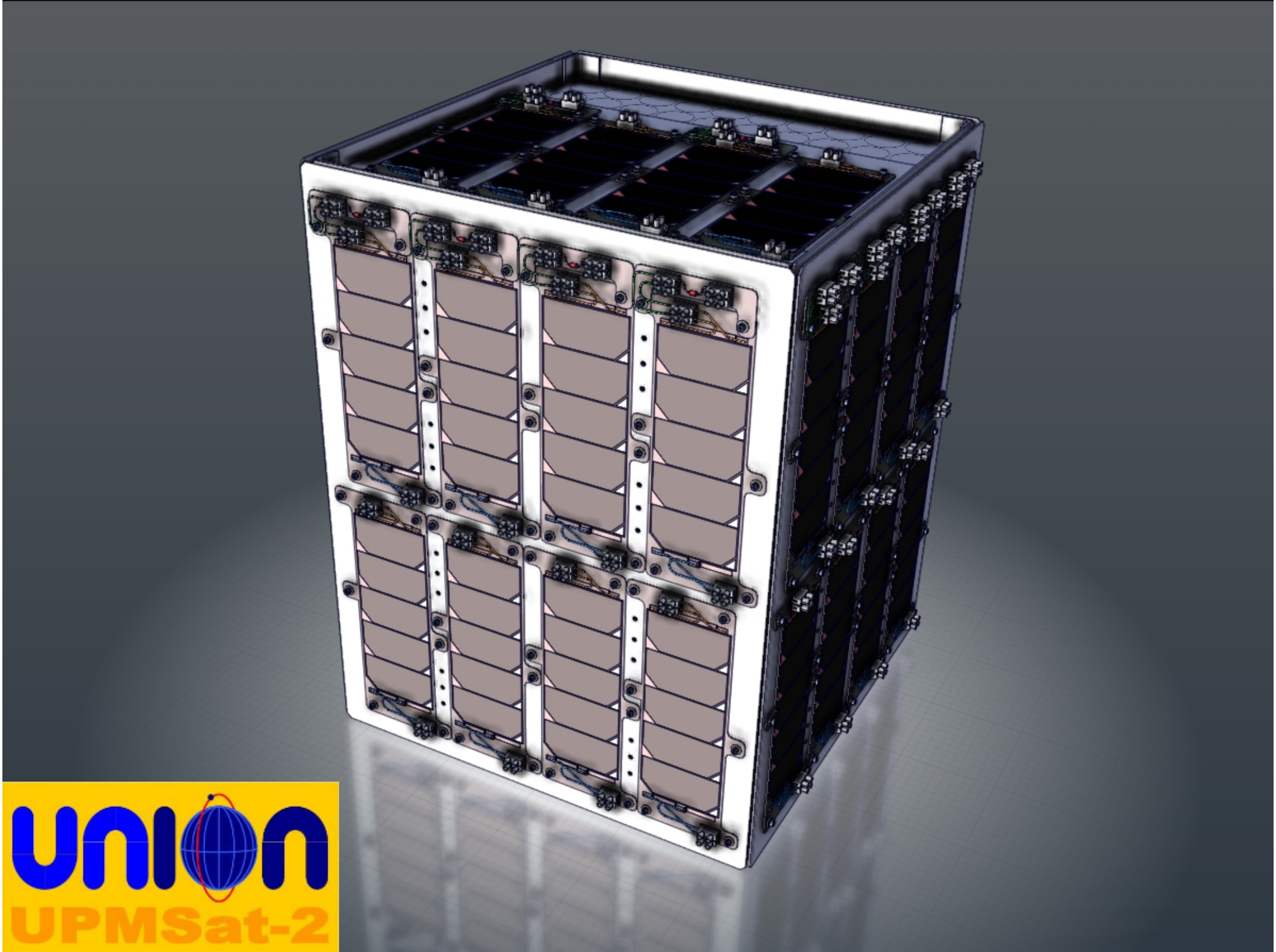
Testing (2)

Built with project `obsw_test_target.gpr`



Testing (3)

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