Summary
The course presents and analyses the different systems, architectures and components of spacecraft avionics (on board data handling and processing systems) controlling and commanding spacecraft and payloads (instruments). It will study typical bus structures (standard) used for S/C avionics.

Content
Introduction
Classification of spacecraft functions depending of mission profile and identification of requirements and functions of on board data handling systems

Architecture
Typical spacecraft structure, system and major subsystem, redundancy management, data flow, telematics, service module, payloads

Space environment threads to electronics systems and mitigation tecnics
On board electronics susceptibility to space radiation environment, radiation hardness, radiation mitigation techniques, HW and SW error detection and correction

Components and subsystems
On board microprocessors and microcontrollers, on board communication buses and interfaces, mass memories, attitude and orbit control subsystems, payloads data processing, telemetry and telecommands

Standards and system modelisation
Modellisation of flight avionics systems, spacecraft onboard interface services SOIS, Standard Space links protocols, standard data units, spacecraft synchronization time, buses and networks

www.ecss.nl
Cases studies
examples of flight avionics on International Space Station ISS, Automated Transfer Vehicle ATV, ExoMars (Rover, Lander and Orbiter)
Avionics on CAN
Exercices
Implement simple avionics system components on an advanced design simulation and verification tool
http://vector.com/

Keywords
avionics
spacecraft telecommand/telemetry
intelligent distributed systems
spacecraft onboard interfaces services
space enviroment
spacecraft electronics,
rad hard components
on board processors and systems
ECSS communication standards
Learning Outcomes
By the end of the course, the student must be able to:
• Classify space mission on avionics requirements
• Analyze spacecraft avionics requirements
• Design flight avionics systems
• Model a distributed intelligent system on CAN base
• Order different on board communication bus systems
• Recognize threads and requirements for on board electronics components
• Implement a simulated avionics components on design tool
• Assess / Evaluate flight avionics requirements

Transversal skills
• Plan and carry out activities in a way which makes optimal use of available time and other resources.
• Use a work methodology appropriate to the task.

Teaching methods
Lecture with exercises in Space Center lab

Expected student activities
exercice on CANoe implement some function of a flight avionics system, based on distributed intelligent system peer to peer communication system CAN.

Resources
Notes/Handbook
Script handsout
ECSS standards