cleansat

BB#16
IDT: Independent Deorbiting Trigger
GMV

24/05/2016

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AIRBUS DEFENCE & SPACE

OHB

ThalesAlenia Space
A Thales / Finmeccanica Company

Description of proposed technology Building Block

- **Technology Goal**: **increasing the reliability of the end of life disposal**
  - Currently percentage of disposal success required 90%
  - Low-cost add-on module permitting increasing this figure with low impact at system level
- Not a de-orbiting technology per se, but **a bus independent electronic system that triggers the deorbit systems already installed on the spacecraft** in case of failure of the primary activation system
  - Ground commanded or autonomous triggering will be traded off
- Trade-offs to find a compromise between **range of applicability & BB complexity**
  - Different deorbit technologies and failure modes will be studied to **define the associated requirements for the BB**
  - A mapping of technological solutions vs de-orbiting strategies will be addressed
  - The BB shall maximizing the applicability range being **as generic and flexible as possible**, i.e. not being specifically linked to any de-orbiting technology/strategy, spacecraft class or orbital range
  - The BB could be also potentially used as **passivation device**, i.e. activating a predefined sequence of events to passivate the S/C before disposal
  - A study case (specific de-orbit solution and SC class) will be more deeply analyzed

Description of proposed technology Building Block

- The BB will be composed of (minimum requirements):
  - **Simplified communication system:** Rx, sharing antennas with main system or, if deemed necessary, mounting a dedicated omnidirectional antenna
  - **Miniaturized data handling system:** micro OBC managing TC reception and handling, post mission disposal triggering, passivation sequence triggering (if any), etc.
  - **Independent power system** limited to a primary battery with a lifetime of few days
  - **Interfaces** to the disposal device and to the power generation system
- Some **AOCS software functionalities** could be also included, e.g.:
  - Safe mode using minimal spacecraft hardware like magnetotorquers and magnetometers
  - Spin-up mode for solid rocket motor de-orbiting
  - 3-axis stabilization for chemical or electric propulsion de-orbiting (increasing complexity)
  - Interfaces to the AOCS units shall be provided to the BB in this case
- System level impacts:
  - **Very small mass and power budget foreseen** (~few hundreds of grams, small volume, few Watts)
  - Technical risks: **false triggering** to be avoided by design
  - Programmatic risks: **no important constraint foreseen in the development plan of the main mission**

Development

- Three possible options identified for the design and development of the BB
  - **Re-use of standard space qualified equipment**: low development risk, but high recurrent costs
  - **Development of ad hoc system**: higher development cost but lower recurrent costs, higher development risk wrt. previous option
  - **Reuse of cubeSat technology with delta qualification campaign:** higher development risk but significantly lower recurrent cost
  - Decision will depend on the final BB requirements and its area of applicability
- The main technical challenge will reside in developing a BB maximising the range of applicability with respect to:
  - Bus architectures and protocols
  - Failure modes
  - De-orbiting devices
  - De-orbiting procedures (e.g. need to control the spacecraft during disposal)