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# DEPENDABLE DESIGN FOR THE GNC SYSTEM OF THE "CHASER" SPACECRAFT

**Abstract**

In the last decade, space agencies and industries addressed part of their research efforts to define mission studies devoted to mitigate the risk of collisions on orbit between operative spacecraft and uncontrolled bodies. One of the main investigated solutions refers to the debris removal from orbit using a "chaser" spacecraft able to capture and take out from the nominal orbit the debris. The capabilities of the "chaser" strongly depend on its Guidance Navigation and Control system design because effective and safe approach shall be guaranteed. That is reached reducing the risk of collisions with the target, properly managing misbehaviors, especially in the final approach, and maintaining high performances in terms of attitude and position accuracy during the mating phase. The present paper is focused on the dependability of the "chaser" GNC system taking into account that cost effectiveness and high reliability shall be key issues of the overall process of design, development, manufacturing and verification of the system. Firstly, the mission and system requirements of a reference mission based on the removal of SPOT3 satellite are analyzed in terms of environmental conditions, type of target and mating solution (i.e. grasping mechanism), data and time managing, and chaser features (i.e mass, dimensions, layout). A system engineering approach is followed: the functional analysis helps to indentify critical tasks for the GNC system, and functions/products matrices and N2 diagrams allow the definition of the block schemes in which parts and components are highlighted. Passive and active hardware redundancy techniques are investigated and applied on the main equipment for determination and control (e.g. attitude sensors) and the health monitoring of the critical parts. Information redundancy techniques are included to increase the reliability in the communication between GNC and other on board subsystems as well as among GNC systems elements. Tasks distribution, reconfiguration and voting strategies for nominal and off nominal conditions are studied and applied. The advantages and the drawbacks of the proposed hybrid solution that puts together redundency techniques and tasks distribution methods are deeply discussed.