FDIR DD&V from Behind-the-Scene to Front Stage

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Strengthening of FDIR DD&V is considered to play a key role for mastering the cost and risks of current and future projects. At least within a short time span the success and return of investment often is difficult to quantify as there is no simple mean to measure what has been avoided by an early successfully mastered complex process. The FDIR DD&V is a challenging task as it requires to

- identify functional design requirements from high level primary mission requirements as well as from secondary system design objectives, targets and boundary conditions,
- develop in early project states the system functional capabilities and assignments despite lack of final system design details
- manage and integrate the emerging multi-discipline, highly dynamic and iterative detailed design feedback into the FDIR design and development
- define verification strategies and means for functions, which often are not testable on the flight model
- keep the solutions simple and cost efficient
- monitor and master these aims over the complete product life cycle.

The effort and challenges of this key system engineering task has often been underestimated thus leading via late design changes, limited verification capabilities, schedule delays to significant over costs and/or high vulnerability risks.

Mastering of this challenging task requires an inevitable and explicit instantiation of a corresponding role within a company as well within the projects. This can only be achieved by improving awareness of management and technical teams regarding RAMS / FDIR activities. Each entity has to clearly know what they have to do and why. The definition needs to be embedded within an overall and common RAMS / FDIR Policy, defining the roles and responsibility of each contributor. FDIR like operations engineering has major impact on DD&V and operation costs. It is further necessary to improve the efficiency of the RAMS / FDIR process by an integrated functional operational system engineering approach and to establish measuring criteria.

The paper presents the organizational embedding of FDIR as a key functional system engineering discipline aside the normal operation and functional system engineering. FDIR architects together with the operations architects are responsible for all system engineering activities analyzing, defining and verifying how to control, observe and recover the S/C system under all nominal and failure conditions. Particular focus of the paper is put on the FDIR policy definition as well as on presentation of approaches intending to strengthen the FDIR DD&V process starting from early phases, over monitoring attempts to quantify FDIR complexity and maturity as well as the use of model and improved knowledge management based approaches for design and verification throughout the DD&V life cycle up to an improved feedback from in-orbit experience. The paper outlines status and expected potential of presented approaches and presents opportunities and spotlight feedback from inherent different missions like single string micro satellites to Columbus.