CONFIGURABLE AUTONOMOUS FLIGHT TERMINATION SYSTEM AND MISSIONIZATION TOOL

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Abstract: Business models in current and future spaceports operating in the frame of Newspace target multi-launcher operations and multi-mission with high launch rate and low costs, for either launch and ground systems and operations. Autonomous safety systems play a major role in that scenario, being an axe to increase safety decisions responsiveness and a significant reduction on mission operational costs and infrastructures, leading to more agile campaigns and inter-campaigns operations, while respecting the RAMS requirements and constraints.

Two systems respond to the spaceports demand: on-board and ground autonomous flight termination systems (AFTS). Depending on regulatory frameworks and spaceports concept of operations, both can provide an improvement to current manned safety operations. The Ground AFTS presents itself as the logical solution to increase expertise and background on autonomous safety before embarking in the development of an on-board AFTS impacting the launcher design and most certainly under more restrictive regulatory frameworks.

On-board autonomous safety systems contribute to the reduction of ground infrastructures, interfaces and operations, campaign duration and inter-campaign preparation, such as the training devoted to safety range operations, having a direct impact on cost. In terms of performance, on-board safety systems reduce the decision-making chain, which is a critical parameter considering the dynamics of microlaunchers and their structural design, i.e. the capacity to withstand high dynamic pressures under high incidence angles therefore resisting fast deviations from the nominal trajectory.

In the NewSpace context, microlauncher services plan to be operated at different spaceports in order to increase their offer of mission azimuths as well as to increase their launch rate as mandatory specifications for their business model. At the same time, spaceports, namely those under development in Europe, include the operation of multiple microlaunchers as a key aspect of their own business model. In such a scenario, an AFTS, either ground or on-board, shall be designed and conceived to meet the interfaces and requirements for different launcher and ground systems. As a result, the core software of the AFTS shall be configurable and adaptable to fulfil the missionisation needs allowing operations of multiple launchers from multiple spaceports in multiple missions. The missionization capabilities tackle a set of software modules wrapping a core software invariant, obtaining as a result a flexible product able to interface different requirements (from missions, launchers and spaceports) with reasonable configuration effort matching the responsiveness, campaign duration and RAMS requirements.

The paper presents GTD research activities developing the Ground AFTS and also their application on operational GAFTS systems. The paper also introduces the research on on-board flight autonomous safety algorithms, architectures and strategies in the framework of H2020 projects and the partnership with Safran Data systems (SDS) and Safran Electronics and Defense (SED) on the future on-board AFTS for European launchers.

References:
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