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THE PYRONUMERIC, A NEW TECHNOLOGY TO ANSWER TO THE FUTURE LAUNCHERS
CHALLENGES**Abstract**

During the last years, the space launcher domain has evolved rapidly. The cost reduction and reusability objectives have created new needs of simple, robust technologies and easy to refurbish products. CNES has supported since 2010 Dassault and Laas in a research program to create new solutions for pyrotechnic system and devices used on launchers. The pyronumeric concept has emerged as a good candidate combining the advantages of numerical potential and soft pyrotechnics through the use of nanothermites. The result is a light and miniaturized device, much simpler to implement and to control, and integrating safety management. This technology could replace the historically used on launchers pyrotechnics transmission lines and the safe and arm device. The IFI concept has also others applications possible as for instance pyrotechnics valves actuators.

This has a great interest for reusable launchers because of the gain in refurbishment : with classical pyrotechnic lines, the whole line has to be removed and changed, with this concept, only terminal small part named IFI could need to be removed. Controls of the state for the complete system will be simply managed with the numerical pyromaster. The IFI is an integrated system combining a smart initiator and a safe and arm device. The DFI is derived from IFI to build a detonator.

After a research period, including two PhD thesis in LAAS, Dassault with the support of CNES has reached a sufficient maturity to propose to build a prototype in accordance with industrial need and able to space launcher flight and to demonstrate it in flight.

The article will describe the main functions of the concept IFI and DFI. Some results obtained until now at laboratory scale will also be shown. Finally, the application of the pyronumeric technology at launcher level will be emphasized.