Hot Topic 1: Industrial Applications

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This first technical session is further developing the technological dimensions of technology transfer, with three illustrations of successful and representative industrial applications. It covers the cases of embedded autonomy in spacecraft applications, advanced avionics solutions for satellite communication and component hybridization for navigation.

Paper 1: Embedded Autonomy in spacecraft applications

Spacecraft are considered as critical and autonomous embedded systems. Initially, they were some sequential automata performing a priori known tasks. Today a satellite is a smart embedded system being able to react to some known events (environmental or behavioural changes) and to select a decision among a predefined set. Tomorrow a satellite will be an autonomous and easily operable by the end user embedded system by the mean of an ergonomic interface and high level requests. These new needs require to trust more in the embedded system and to give more degree of freedom to the spacecraft, but offer a lot of new capabilities for the future missions.

The introduction of autonomy concept in the design of such spacecraft is critical for the development and industrialization phases. Indeed, on one hand it should not reduce the reliability, safety and robustness of the system and on the other hand, it increases the complexity of the system and thus the complexity of its development cycle. A good criteria for evaluating this evolution is to keep balanced the triplet : cost – availability – performance which are the main drivers for satellite manufacturer. That's why in order to increase the degree of confidence in such an embedded system, it is necessary to introduce some advanced technologies issued from other industrial domains (Integrated Modular Architecture (IMA), ARINC 653 standard from aeronautic, …), to use some innovative technologies (formal method, …) issued from academic research and to adapt some existing technologies (use of COTS, …) and methodologies (Model Driven Engineering, Domain engineering…). Concrete examples are used to illustrate that : development of next generation of architecture for autonomous satellite, use of COTS, …

Paper 2: Key features and first flight return for advanced avionics solutions

Alcatel Alenia Space has developed a new high performance avionics for SPACEBUS 4000 telecommunication satellites. The Avionics 4000 development included equipment development and qualification, on board software development, and the avionics functional validation including AOCS
performance for a complete SB4000 family (8 to 20KW).

The six SPACEBUS 4000 satellites currently operational in-orbit exhibit an excellent behaviour for all subsystems although significant different platforms configuration due to mission constraints and customer selected options: NiH2 and Li/ion battery, ciphering, payload FDIR, ?

SPACEBUS avionics modularity provides high flexibility and growth potential to support with optimized hardware configuration, new mission constraints and customer requirement with minor impact on the generic core design.

Based on the first flight return, this paper presents:

- Avionics modular concept
- Avionics qualification process
- Flight return
- Flexibility and potential growth for the mission

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Paper 3: Component hybridization for navigation application

Location based services are booming. Applications such as “Find A friend”, “Field Force management”, “Fleet management”, are getting more and more available. This is part of the mobile revolution that started 30 years ago.

There are today GNSS techniques which provide already very good accuracy and robustness performances such as Assisted-GNSS, Augmented GNSS (SBAS, GBAS) for some category of user environment. But for lot of specific environments such as Indoor, Urban area, the service availability offered is not meeting the user expectations.

More and more hybridization techniques are studied in order to try to get the most out of each available technology and finally propose to the end user an always accurate, always available location experience. The hybridization purpose is to be able to provide position fixes to the user whatever the environment.

To provide the targeted service, the GNSS sensor unit can be hybridized with several components:

- Network infrastructure technology (WiFI, Wimax)
- MEMS, odometer
- Low cost Inertial
- Low cost miniaturised Time & frequency

This paper is aiming at presenting a survey of the different techniques, detailing the analysis of the benefits (at user level) of them. The second objective of this paper is to illustrate through the example of the technology developed by Alcatel-Alenia-Space based on hybridization of A-GNSS and its expected benefits in the frame of the future environment (combining GPS and Galileo).