COGNITIVE RADIO FOR SATCOM APPLICATIONS: THE SCREEN PROJECT

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SCREEN Key Facts

- **Budget: 1 M€**
- **Partners: 4**
- **Start Date: Jan/2015**
- **Duration: 2 years**
- **Call: H2020-SPACE: COMPET-6-2014: Bottom-up space technologies at low TRL**
- **Coordinator: Tekever (Portugal)**
- **http://h2020-screen.eu**

CONSORTIUM

TEKEVER ASDS (Coordinator)
Portugal
SME / RTD

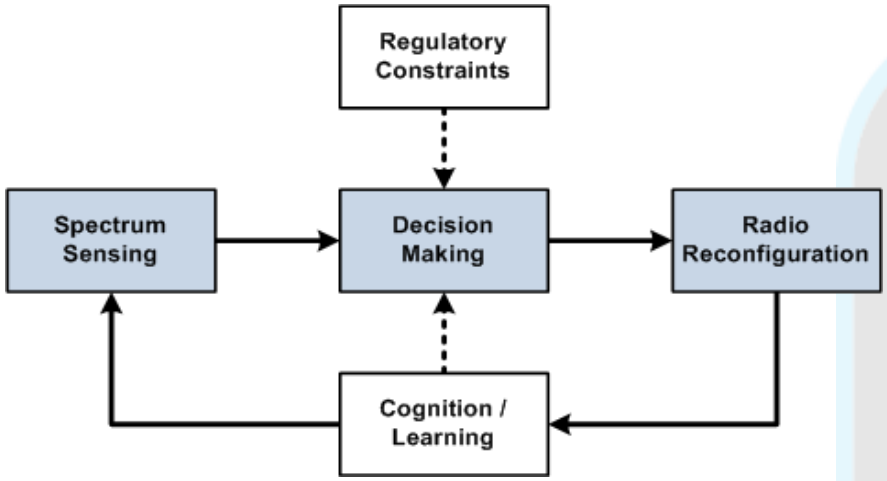
AVANTI PLC
United Kingdom
SME / Satellite Operator

INESC-TEC
Portugal
RTD Institute

Munich Innovation Group
Germany
SME / RTD / Innovation Mgt

CONCEPT

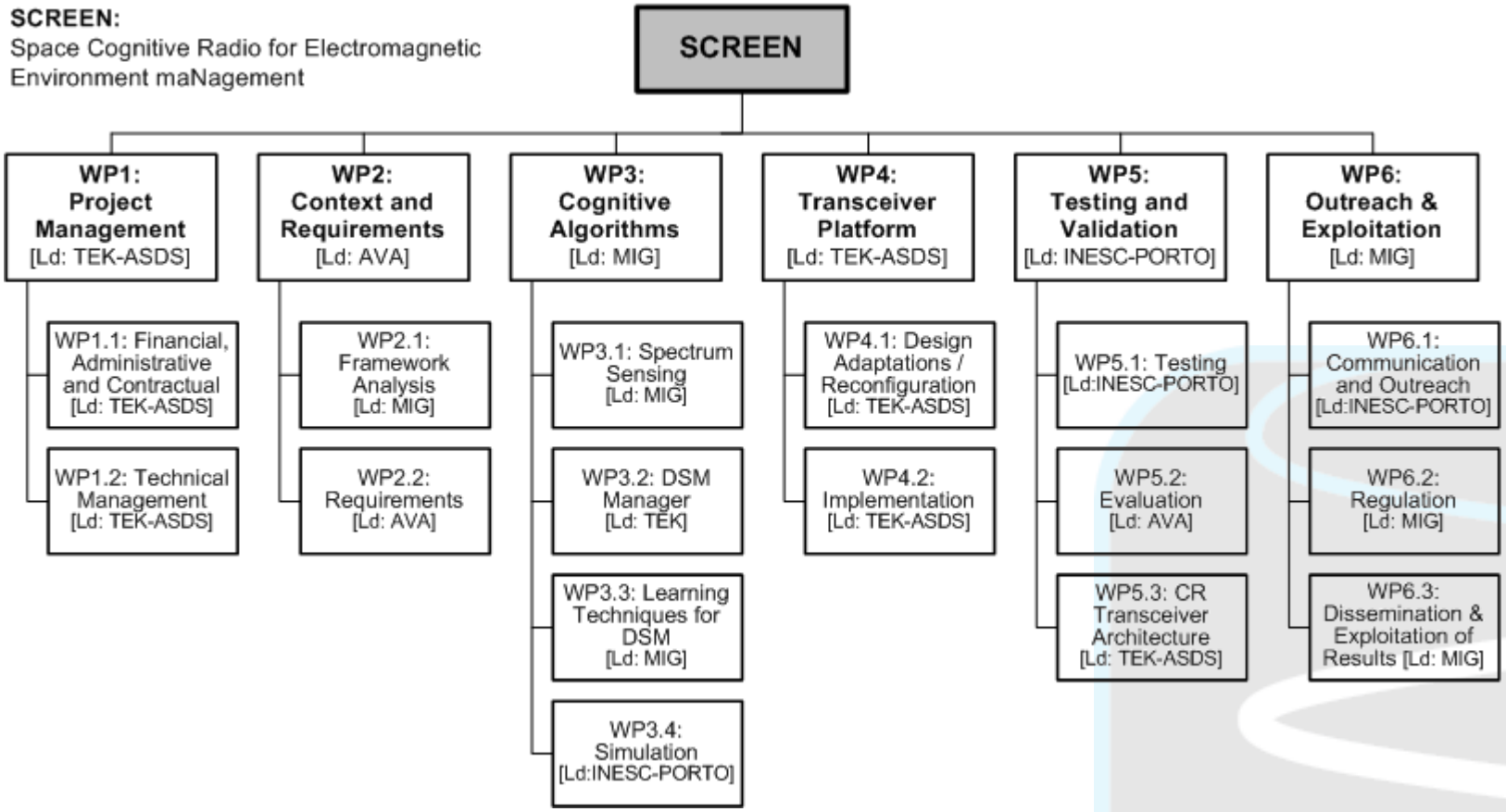
- Develop and test emerging SDR-based cognitive radio technologies for the Satcom and Inter-Satellite Link space markets, in order to:
  - Optimise the usage of the electromagnetic spectrum;
  - Improve flexibility and Quality of Service (QoS) in communications;
  - Provide a sustainable solution for the growing space wireless communications traffic.



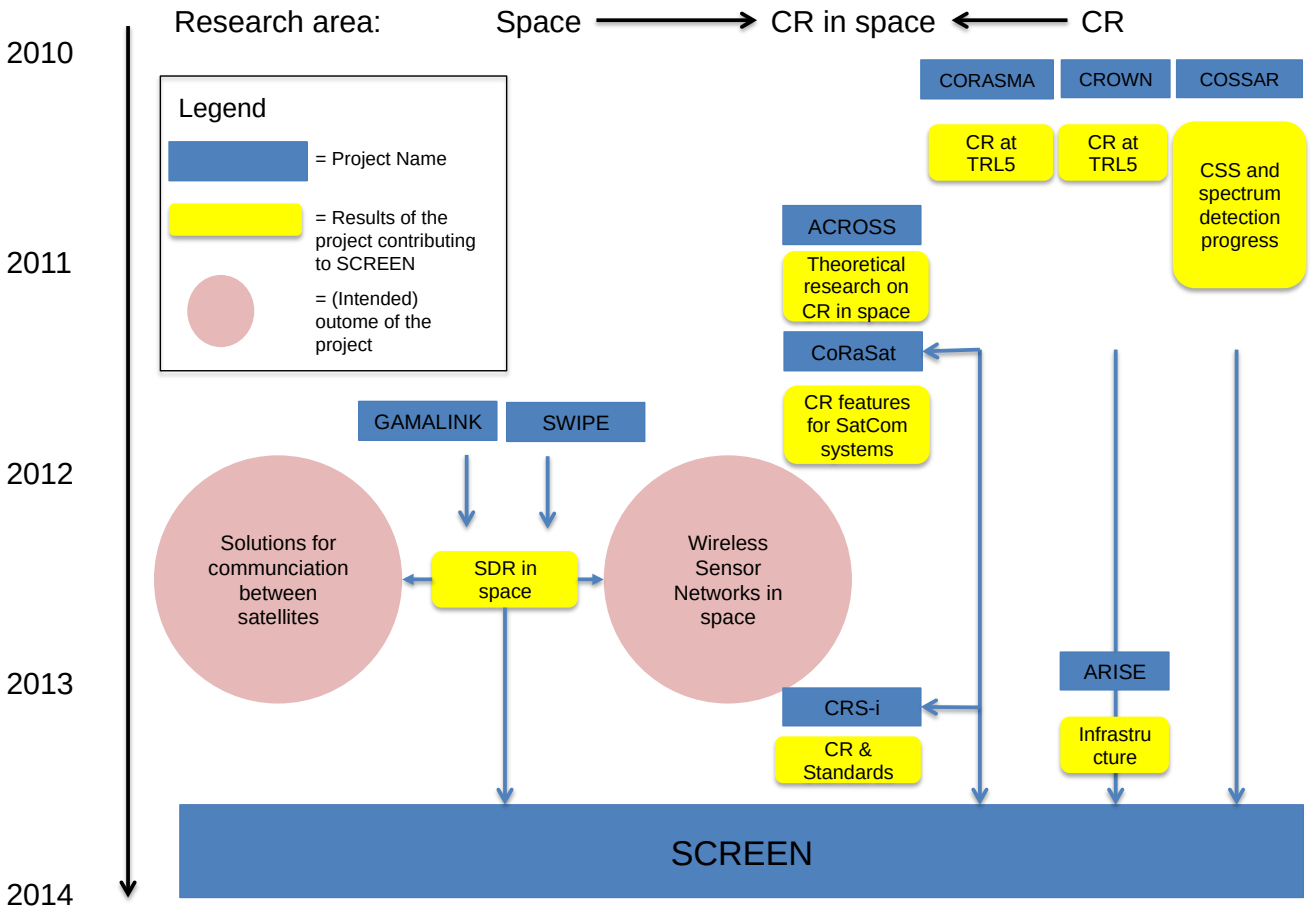
OBJECTIVES

- Derive **cognitive radio requirements based on the Satcom and ISL** market needs and specifications and taking into account regulatory constraints.
- Analyse, select, develop and simulate **cognitive radio algorithms** for spectrum sensing, dynamic spectrum management and learning.
- **Adapt an existing SDR platform** based on the radio reconfiguration requirements and use it to implement the cognitive algorithms.
- **Test, validate and evaluate the prototype** in laboratory and representative environments (TRL4/5).
- **Derive an optimised CR S-band transceiver architecture**, based on the performance results obtained and constraints identified during the tests.
- Address all **regulatory issues** and **exploit strategies** to build an adequate framework to allow future implementations of cognitive radio in space.

WORK BREAKDOWN STRUCTURE



Framework analysis



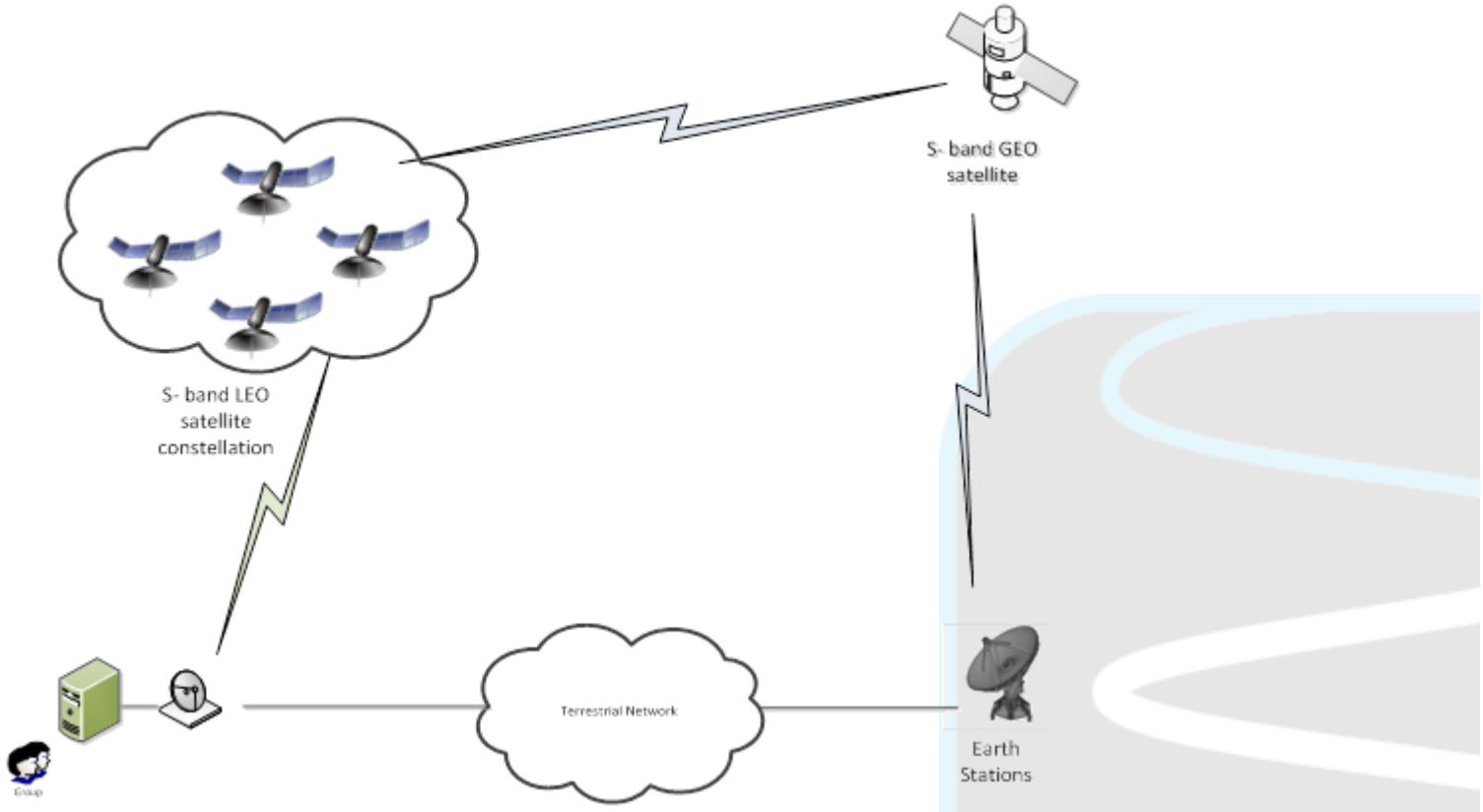
Use Cases

Use Cases Ranking

Scenario	Market size (1-5)	CR benefits (1-5)	Regulatory environment (1-5)	Total (3-15)
Small satellite constellation	4	4	4	12
UAV constellation	5	4	3	12
In-flight connectivity	2	4	1	7
Smart cars	2	1	1	4
Telemetry for high speed assets	1	3	1	5

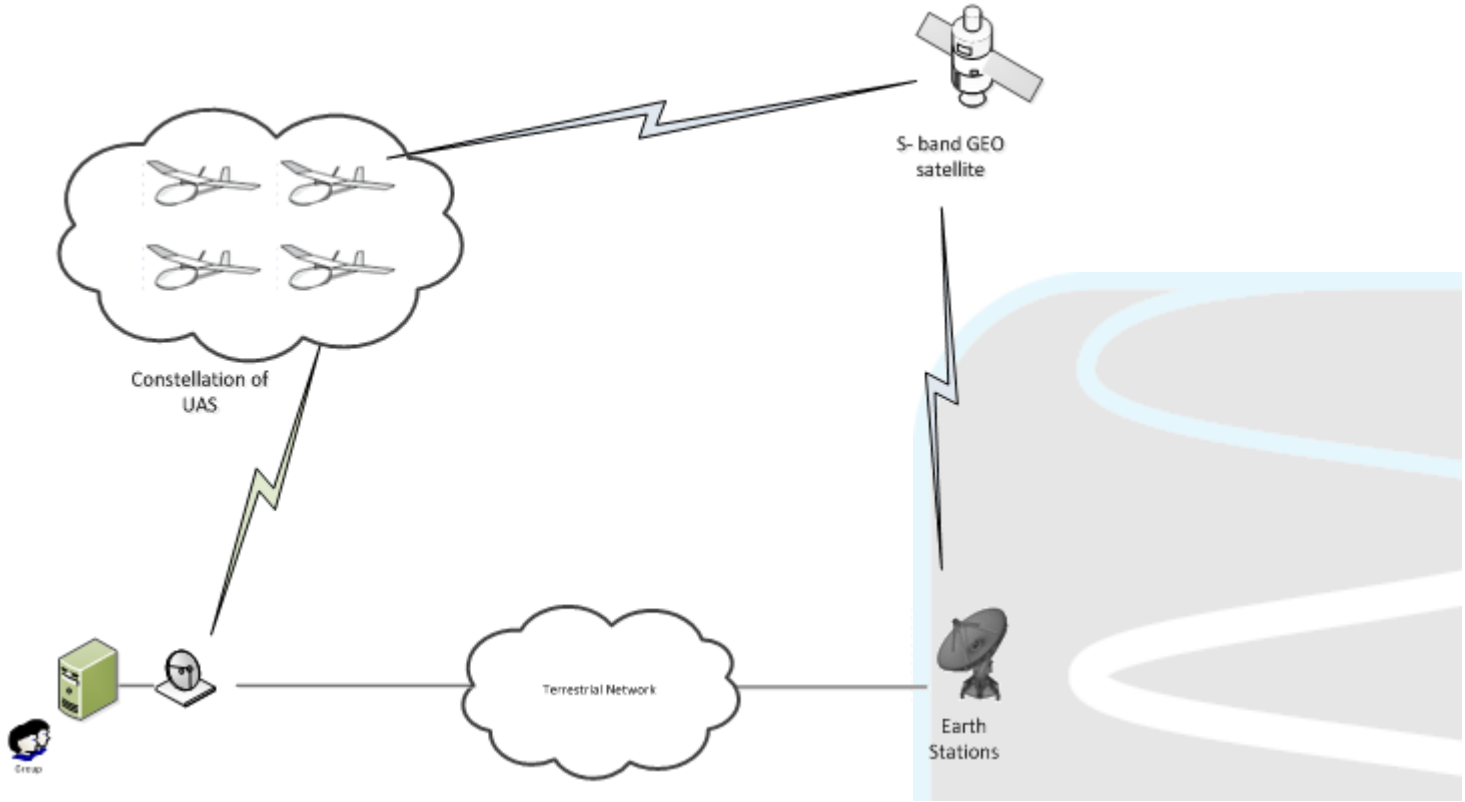
USE CASES: SATELLITE CONSTELLATIONS

- Make use of other frequency bands to allow the faster data transmission from a constellation of small satellites.



USE CASES: UAV CONSTELLATIONS

- Make use of other frequency bands to allow for better data rates in the transmission of data from a constellation of UAVs.



GAMALINK PLATFORM

Frequency range:	300 MHz to 3GHz
Bandwidth:	40 MHz
Data Rate:	up to 80 Mbit/s
Positioning precision:	5 m (GPS)
GPS update rate:	5 Hz
PCB size:	95.9 x 90.2 x 11 (mm)
Total PCB mass:	<100 g
Data Interface:	I2C, UART, SPI
Storage capacity:	from 2 x 2GB
Supply Voltage:	3.3V or 5V

CR MAIN REQUIREMENTS

- The cognitive radio algorithms shall be compatible with the MSS and ISM bands.
- The cognitive radio algorithms shall be compatible with a GEO bent pipe link architecture.
- The cognitive radio algorithms shall be compatible with a direct Ground link architecture.
- The cognitive radio algorithms shall enable at least 24 kbps of data rate for command and control of each platform.
- The cognitive radio algorithms should enable at least 4 Mbps of data rate for payload data transmission from each platform.
- The cognitive radio algorithms shall enable an overall latency below 2 seconds.

SCREEN REGULATORY OBJECTIVES

- **Identify, monitor and act on potential regulatory constraints** and legal framework that may reduce the impact of SCREEN results.
- **Analyse the inputs provided by the regulatory advisory board** and translate them to actions to be taken during the project execution.
- Communicate main project achievements to the relevant legal bodies.
- **Prepare formal procedures for regulation and standardisation activities.**

Conclusions

- SCREEN aims at bringing the benefits of CR from terrestrial to space applications.
- The use of CubeSat and UAV is growing and expected to keep growing in the next decade.
- Cognition is expected to be beneficial in both scenarios:
  - Fast moving LEO satellites for which the terrestrial frequency occupation is constantly changing
  - UAVs needs to comply with strict regulations to be allowed to fly in segregated airspaces.
- The cognition would increase the availability of the communication link, manage interference, manage handover, and get awareness of the environment; therefore better managing the use of the spectrum which is becoming a rare resource.