



TECS –Technological Consulting Services Srl



Unione europea



REGIONE
LAZIO



PROGETTI STRATEGICI AdS AEROSPAZIO



TECS Mission

- **TECS - Technological consulting Services Srl** is a private capital company founded in July 2003 to pursue the following objectives:
 - a) to pool together the resources coming from industries and universities having an high level of expertise and specific know how, operating in the field of Satellite TLC, Remote Sensing , ICT systems design and applications .
 - b) to direct such resources towards high-tech level projects, products, applications and services associated with competitive prices.
- Such objectives are obtained through specific co-operations with Research Institutes and SMEs operating in the field of space activities and hi-tech civil applications. TECS also acts by means of the Consorzio ARES (Advanced Research and Engineering for Space) a research non-profit consortium of external relevance, equally held (50%) by TECS and the University of Tor Vergata



TECS Background

- TECS background derives from the experiences gained during the activities performed within the development phase of very important space programs, both in the field of satellite TLC systems (Italsat, Artemis, David, Rosetta, Mars Express, etc.) and in the field of airborne/satellite scientific-remote sensing (ENVISAT, CASSINI, I-Know, RADARSAT2 Telaer, Cosmo, Archeo, etc.). By means of its background and steady cooperations with Research Centres and Universities (*in primis* the University of Rome “Tor Vergata”), TECS know-how covers the following main areas :
 - Satellite Communication and Radio Navigation;
 - Airborne and Satellite Remote Sensing;
 - Mechanical and Electromechanical systems;
 - Process Management and Control;
 - ICT, Big Data and Artificial Intelligence



TECS Background

- As far as the high-frequency satellite telecommunications is concerned, TECS, through the ARES Consortium, benefits from the heritage derived from the ASI R&D programs in the Q, V (35-75 GHz) and W (75-110 GHz) bands, such as DAVID, WAVE, TRANSPONDERS. In particular, in the context of the WAVE-A2 program, ARES was responsible, as sub-contractor of the University of Rome Tor Vergata (holder of the contract with ASI), of the IKNOW (*In orbitKey-test and validation Of W band*) project study for the development of a payload for the experimental application of W band telecommunications. Recently, TECS, within the framework of the POR FESR 2014-20 UE Program of Lazio Region, has successfully finalized the development of the following projects:
 - **GANIMEDE 60** (G60-CUP F87H18000100007 managed by TECS with the role of prime);
 - **GANIMEDE 4 SIGINT** (G4S-CUP F87H18000020007, managed by TECS through ARES (prime));
 - **ADVISER** (CUP F85F18000070007, managed through ARES, responsible for the “Expert System”);



TECS Background

- TECS has acquired, in June 2020, as part of the “Strategic Projects 2019” call, the project **GIDE** (Application n. Prot. A0320-2019-27151) covering the role of industrial prime for the development of a system aimed at locating interfering radio signals both from ground transmitters and UAVs to ground receivers.
- In autumn 2020, in response to the call of the Italian Space Agency "CALL FOR FUTURE MISSIONS FOR CUBESAT", TECS, as prime representative of a grouping of companies and research organizations (TECS Srl, University of Rome Tor Vergata, Politecnico di Milano, Altec SpA, Tyvak International Srl, RadioPoints Srl, Italspazio Srl) presented the **WIN** proposal ("**W**-band **I**n-orbit communication and propagation mission) , an innovative mission for a 6U Cubesat with the main objective to enable in the near future the use of W-band for satellite communications, both for a High Throughput Satellite (HTS) scenario (e.g. feeder link of a GEO/LEO satellites for broadband communications) and for an Internet of Remote Things (IoRT) scenario.



GIDE Project

GIDE : GNSS INTERFERENCE DETECTION EQUIPMENT



GIDE Project

GIDE project is founded by Regione Lazio as for:

“Domanda di Contributo numero di protocollo A0320-2019-28151 -Avviso Pubblico Progetti Strategici 2019” -POR FESR Lazio 2014-2020 -Azione 1.1.4 - approvato con Determinazione n. G04052 del 04/04/2019 -modificato con Determinazione n. G09335/2019 -pubblicato sul BURL n. 29 del 09/04/2019.”

L'obiettivo del progetto e' quello di concepire un sistema capace di rilevare, localizzare e classificare interferenze nella regione di frequenze UHF (300-3000MHz) con particolare attenzione alle bande di frequenza GNSS e IoT. (800-1600 MHz)

Il progetto sarà quindi basato su un payload imbarcabile su un Cubesat (6U) che può operare da solo o in formazione a seconda dell' accuratezza che si vuole ottenere per la localizzazione dell'interferente. Vista la forte miniaturizzazione del payload derivante dall'utilizzo di tecniche di SDR verrà studiata anche la possibilità di montarlo a bordo di UAV, HAPS, droni o ultraleggeri.

Il progetto valuterà la possibilità di utilizzare, in sinergia , informazioni provenienti anche da questi altri sensori o da ground stations

GIDE Project

OBIETTIVI DUAL USE

- Rilevamento, localizzazione e classificazione di segnali interferenti.
- Rilevamento, localizzazione di jammer a livello strategico.
- Riconoscimento e classificazione di interferenti occasionali per atti di terrorismo o fuorilegge.
I dati di GIDE possono essere combinati con altri provenienti da sensori a terra e in aria.
- Allarme (Warning) per situazioni anomale in ambito dell'uso dello spettro elettro magnetico. Per esempio in caso di preparazione di azioni militari o disastri ambientali –
- 'analisi dello stato di attività EM nello spazio può risultare interessante per rilevare satelliti ostili o interferenti in modo intenzionale o non intenzionale .

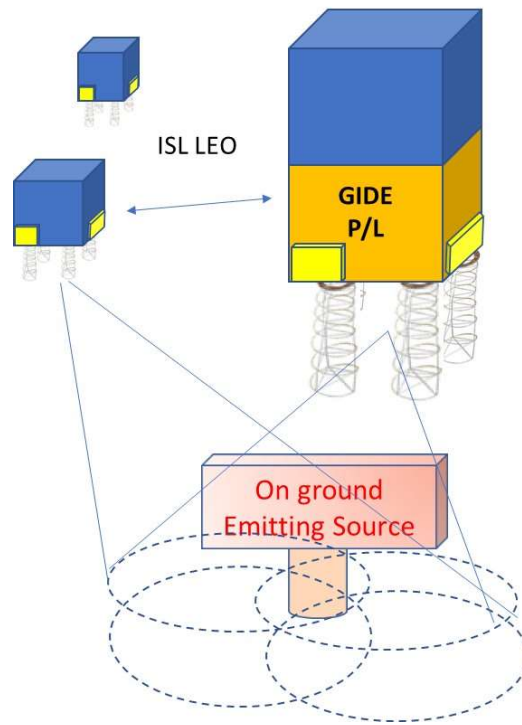
Relativamente agli algoritmi per localizzare gli interferenti, non si prevede l'uso di un sistema di antenne multiple, che faciliterebbe molto la localizzazione ma complicherebbe altresì molto il progetto del payload satellitare da imbarcare sul cubesat.

Si prenderanno quindi in considerazione:

- i) **approcci utilizzabili con singolo satellite come un approccio di tipo monopulseradar, o anche sull'uso di algoritmi basati sul concetto di Frequency of Arrival (FoA);**
- ii) **ii) approcci basati sull'uso di una piccola costellazione di cubesat almeno 3 cubesat, e di tecniche di tipo TDoAo AoA.**

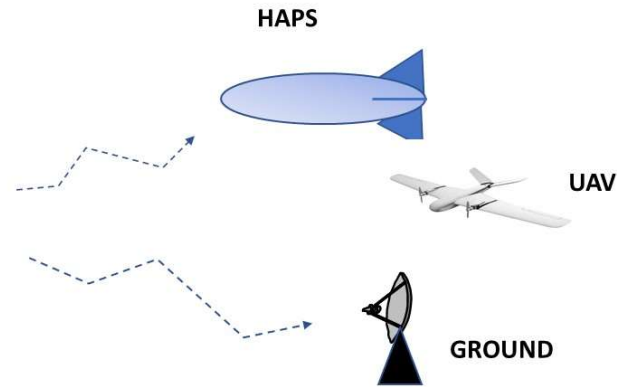
GIDE Project

GIDE: EGNSS INTERFERENCE DETECTION INSTRUMENT



Tre modi operativi:

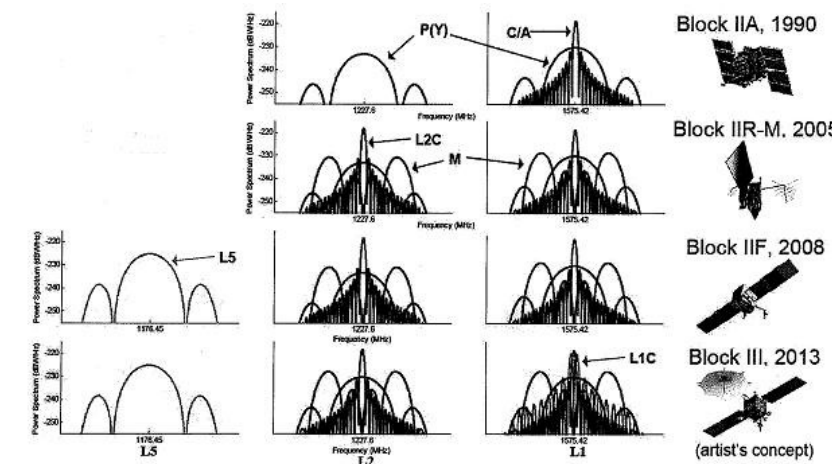
- Singolo satellite (monopulse + FDOA)
- Formazione satelliti (TDOA+ FDOA)
- Sistema eterogeneo ?



GIDE Project

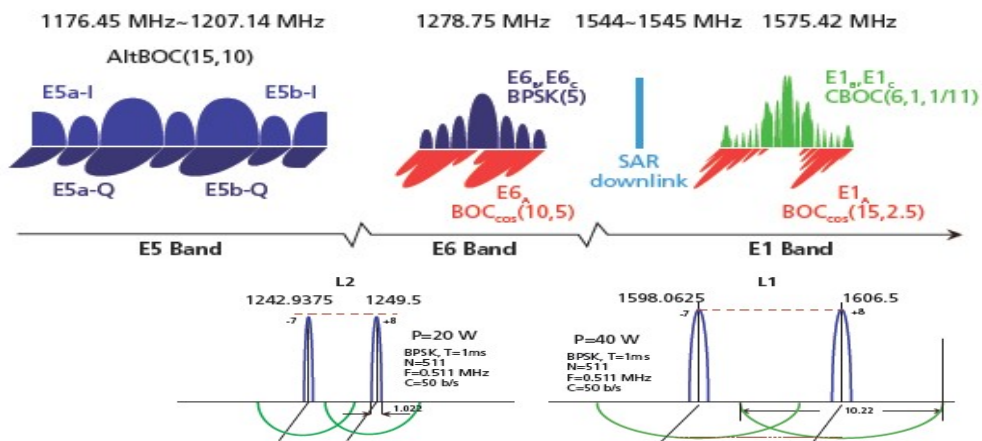
ITU Band	Frequency
VHF	138 - 144 MHz 216 - 225 MHz
UHF	420 - 450 MHz 890 - 942 MHz
L	1.215 - 1.400 GHz
S	2.3 - 2.5 GHz 2.7 - 3.7 GHz

ITU RADAR FREQUENCIES



GIDE COVERAGE

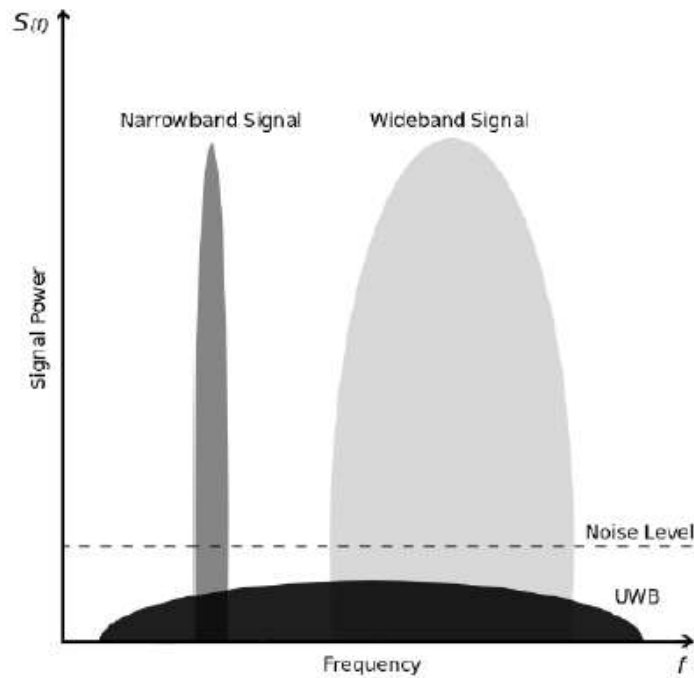
300-3000 MHz



GPS, Galileo e GLONASS spectrum

GIDE Project

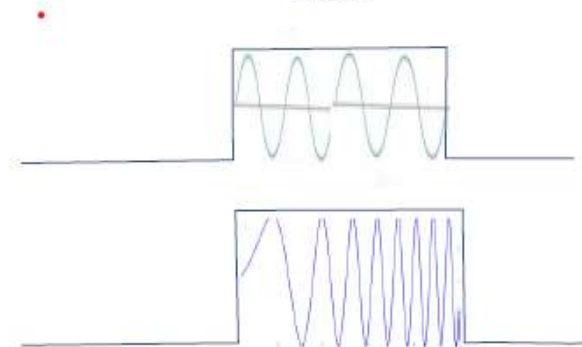
SIGNALS TO BE DETECTED



CW/Continuous

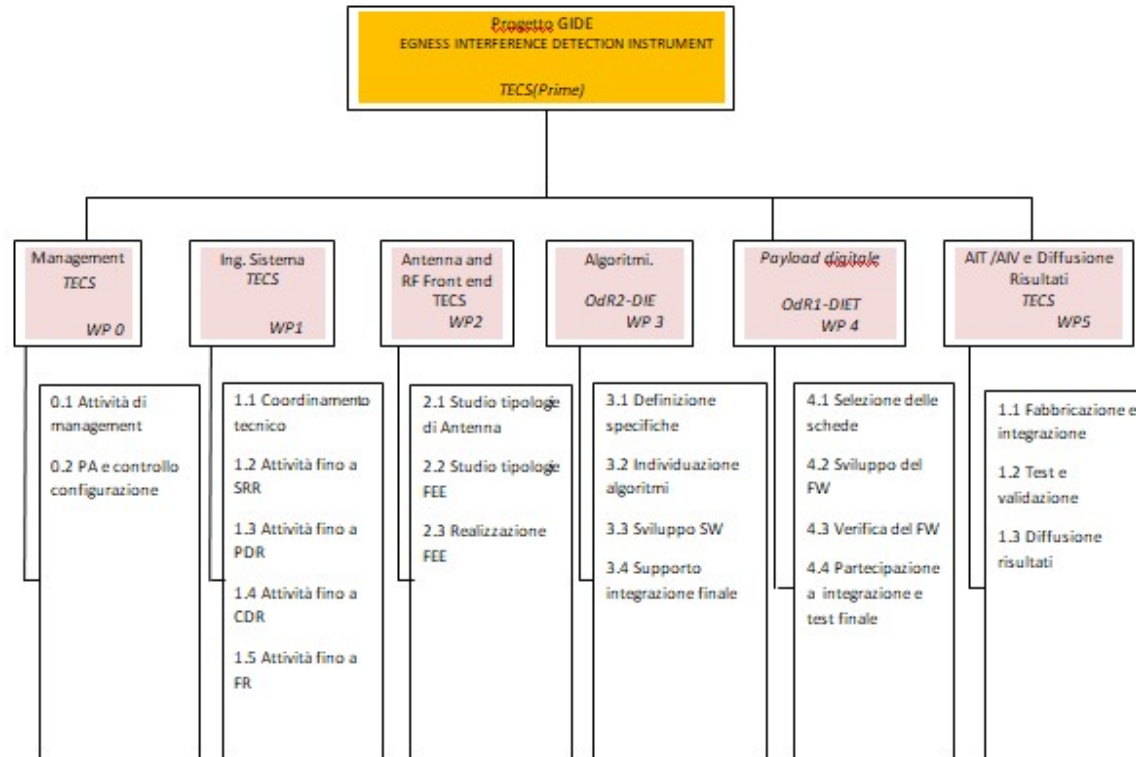


Pulsed



GIDE Project

WBS





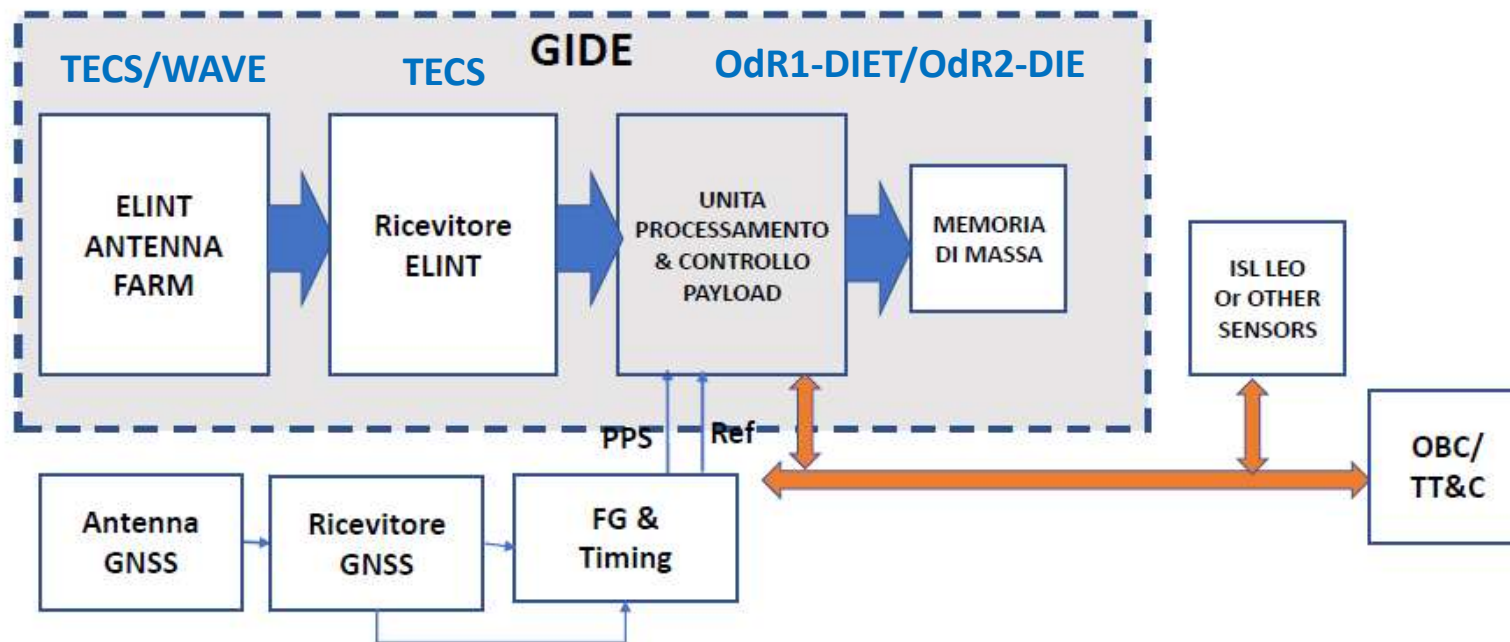
GIDE Project

CRONOPROGRAMMA

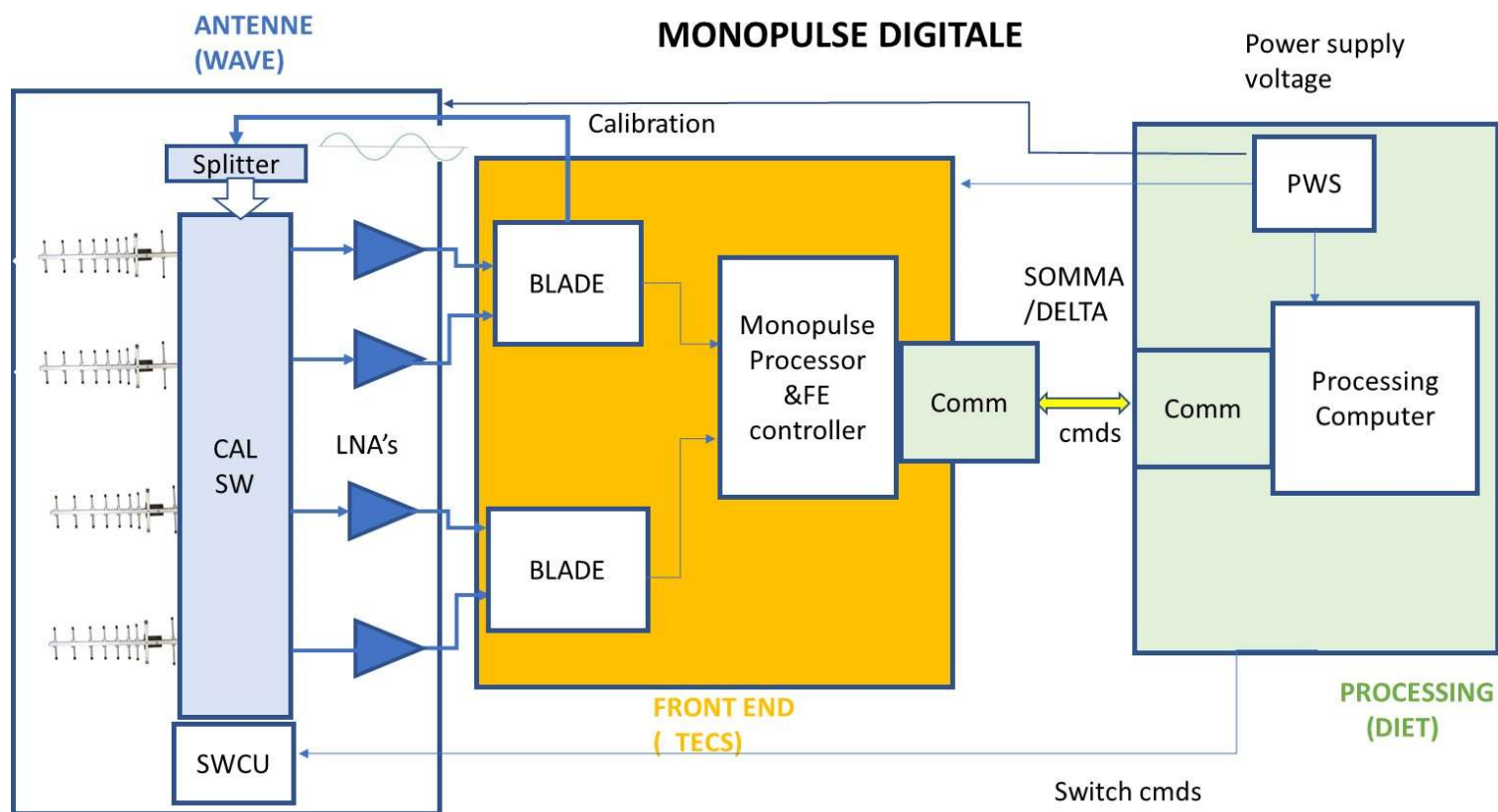
		Anno 2020					Anno 2021													
GIDE	Attività	Pre KO		Post KO																
	Durata(mesi)	G	L	A	S	O	N	D	G	F	M	A	M	G	L	A	S	O	N	D
SAL di Contratto												EA								
RIS: VP	Descrizione VP																			
RI, SS	1000 Management																			
	1100 Attività di Program Management																			
	1200 PA & CADM																			
RI, SS	2000 Engineering di sistema																			
	2100 Coordinamento Tecnico																			
	2200 Studio prel. Sistema e SS; prep. doc. per SRR																			
	2300 Def. Arch. e req Sistema e SS,... doc per PDR																			
	2400 Prog. esecutivo Sist. e SS,... data Package CDR																			
	2500 Resl.&test SS, AIT Sistema, pre/post test anal.																			
RI, SS	3000 Antenna & FEE																			
	3100 Studio tipologie di antenna																			
	3200 Studio tipologie FEE																			
	3300 Prog. esecutivo , MAIT FEE																			
RI, SS	4000 Localizzazione																			
	4100 Def. Specifiche																			
	4200 Individuazione algoritmi																			
	4300 Sviluppo S'w																			
RI, SS	5000 Progetto Payload Digitale																			
	5100 Selezione schede																			
	5200 Sviluppo firmware																			
	5300 Verifica firmware																			
	5400 AIT scheda realizzata in sistema complessivo																			
SS	6000 AIT/AV & Diffusione Risultati																			
	6100 Realizzazione e assy payload complessivo																			
	6200 Testing e validazione																			
	6300 Diffusione risultati																			
	Milestones di Programma																			
	KO Kick Off (svvio form. attiv. post stipula AT\$)																			
	SRR System Requirement Review (T0+ 2 mesi)																			
	PDR Preliminary Design Review (T0 + 6 mesi)																			
	CDR Critical Design Review (T0 + 10 mesi)																			
	FR Final Review of Activities (T0 +14 mesi)																			

KO: 12 ottobre 2020; SAL : trimestrali; FR: 11 dicembre 2021 RI : Ricerca Industriale; SS: Sviluppo Sperimentale

GIDE Project



GIDE Project



GIDE Project

ATTIVITA' OdR2 DIE

- to provide a review of literature techniques for interference geo localisation from space;
- Identification of the key trade-off to be considered and performance metrics, based on the specific scenario, constraints and system requirements
- selection of an initial set of algorithms to be further investigated and optimized through simulations

Focus on SINGLE SATELLITE solutions

mainly developed considerations for the monopulse processing approach.

However, also other type of algorithms are presented and will be considered for further investigations