WP 5
Coordinator
Mario Mattia

- **NEMESI**
- **NEar fault observatory in MEssina StraIt**

In May 2022, the MEET project (Notice n. 3264 of 28/12/2021 «Strengthening and creation of IR in the context of the National Recovery and Resilience Plan (PNRR)») is approved

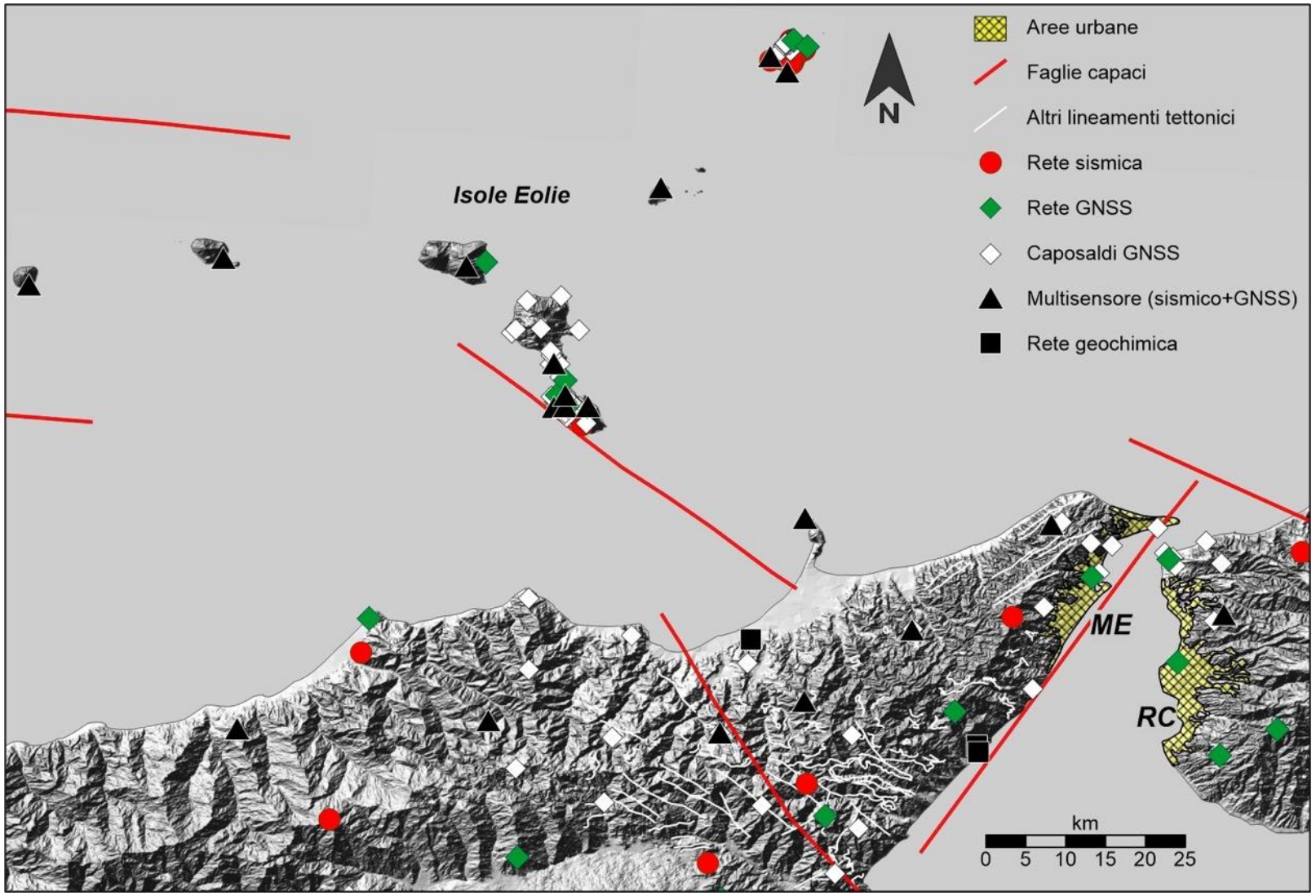
WP5 «NEMESI» (NEar fault observatory in Messina StraIt) receives a total funding of 3,500,000 euros

WP5 provides for the implementation of four project actions

As part of WP5, 3 new units of TD staff have been hired (2 technicians and a researcher)

A reconstruction of the INGV Messina office (Viale Regina Margherita - Parco Aldo Moro) is currently underway

The aim of WP05 is the improvement of research and monitoring networks (geophysics, geodetics and geochemical) in Aeolian and Messina Strait area



Resuming, this proposal is founded on four main premises:

- 1. The availability of an INGV office in Messina, under the direct control of the INGV Etnean Observatory section.
- 2. The need to stimulate, in the Strait of Messina area, seismological and geo-environmental research activities, aimed to study seismic and hydrogeological hazards.
- 3. The existence of an important seismic and geodetic monitoring network, built by INGV in the last twenty years
- 4. The availability of an additional dense network of drillings (186), whose property was transferred in 2017 from the former Stretto di Messina S.p.A. to INGV, destined to host piezometers (120 sites in Sicily and 40 in Calabria) and inclinometers (66), but presently not instrumented.
- **The main goal of this WP is creating a research pole in Messina, capable of acquiring, analyzing and distributing data from a vast network of sensors.**

			REVISION			
Sub-action	Deliverable	Cost	IO5.1	IO5.2	IO5.3	IO5.4
1	Running costs-seismic network	14.000 €				14.000 €
1	Acquisition of instrumentation	100.000 €	100.000 €			
1	Civil infrastructures-seismic network	78.720 €			78.720 €	
1	***Total seismic network***	***192.720 €***	***100.000 €***	***0 €***	***78.720 €***	***14.000 €***
2	Running costs-Individuation of sites-GNSS	3.000 €				3.000 €
2	Running costs-Installation of remote sites-GNSS	10.000 €				10.000 €
2	Acquisition of GNSS receivers and accessories	94.000 €	94.000 €			
2	Acquisition of software for dataprocessing-GNSS	40.000 €	40.000 €			
2	Hiring of temporary personnel-GNSS	99.760 €	99.760 €			
2	Civil infrastructures- GNSS monuments and shelters	27.220 €			27.220 €	
2	***Total GNSS***	***273.980 €***	***233.760 €***	***0 €***	***27.220 €***	***13.000 €***
3	Running costs-Evaluation SdM SpA network and individuati	10.000 €				10.000 €
3	Running costs-Installation hydrogeological network	4.000 €				4.000 €
3	Acquisition advanced hydrogeological monitoring station	100.000 €			100.000 €	
3	Acquisition multiparametric downhole hydrogeological stati	150.000 €			150.000 €	
3	Civil infrastructures- Housing of hydrogeological monitoring	30.000 €				30.000 €
3	Hiring of temporary personnel-Hydrogeological network	113.520 €	113.520 €			
3	***Total hydrogeological network***	***407.520 €***	***113.520 €***	***0 €***	***250.000 €***	***44.000 €***
4	Acquisition of the tilt network hardware	76.000 €		76.000 €		
4	Civil infrastructures-Installation of tilt stations	35.500 €			35.500 €	
4	Hiring of temporary personnel-TILT	99.760 €	99.760 €			
4	Running Costs-TILT	8.000 €				8.000 €
4	***Total TILT***	***219.260 €***	***99.760 €***	***76.000 €***	***35.500 €***	***8.000 €***
5	Acquisition of downhole mobile lab automotive platform ar	130.000 €	130.000 €			
5	Running costs-mobile lab	10.000 €				10.000 €
5	***Total downhole mobile lab***	***140.000 €***	***130.000 €***	***0 €***	***0 €***	***10.000 €***
6	Acquisition of hardware, software and satellite data-Multidi	180.000 €		180.000 €		
6	Civil infrastructures-Multidisciplinary lab	10.000 €			10.000 €	
6	Running costs-multidisciplinary lab	13.000 €				13.000 €
6	***Total multidisciplinary lab***	***203.000 €***	***0 €***	***180.000 €***	***10.000 €***	***13.000 €***
1	Running costs-Individuation of sites	9.000 €				9.000 €
1	Running costs-Installation of the network	50.000 €				50.000 €
1	Acquisition of instruments-OSU	600.000 €	600.000 €			
1	Civil infrastructures-Accomodation of existing infrastructure	120.000 €			120.000 €	
1	Hiring of temporary personnel	99.760 €	99.760 €			
1	***Total OSU***	***878.760 €***	***699.760 €***	***0 €***	***120.000 €***	***59.000 €***
1	Running costs-Data Center	60.000 €				60.000 €
1	Civil infrastructure-Accomodation and facilities Data Center	25.000 €	25.000 €			
1	Data Center hardware	750.000 €			750.000 €	
1	Hiring of temporary personnel -Data Center	0 €	0 €			
1	***Total Data Center***	***835.000 €***	***25.000 €***	***0 €***	***750.000 €***	***60.000 €***
1	Running costs-TELECOM	18.000 €				18.000 €
1	Civil infrastructures-Adaption of the INGV Messina facilities	20.000 €	20.000 €			
1	Aquistion of telecommunication hardware, software and hig	160.000 €			160.000 €	
1	Development of FAIR platforms for data diffusion	52.000 €			52.000 €	
1	Hiring of temporary personnel	99.760 €	99.760 €			
1	***Total TELECOM***	***349.760 €***	***119.760 €***	***0 €***	***212.000 €***	***18.000 €***
		3.500.000 €	**1.521.560 €**	**256.000 €**	**1.483.440 €**	**239.000 €**

5.1 Technological implementation of instrumental networks (A.L. Paolo Madonia): This activity will be aimed at the consolidation and implementation of a dense network of sensors able to quantify the seismicity and micro-seismicity of the Strait area, to evaluate the deformation rate associated to the main faults and to evaluate the effects of the rainfall/runoff regime on hillslope stability and recharge of groundwater bodies exploited for human usages.

Sub-actions comprehend the following products:

1) The extension of the present seismic network (13 sites) with new 5 seismic-accelerometric stations.

2) The extension of the present GNSS network (20 sites) with 4 new stations, acquiring high frequency and meteorological data that will be processed in real time at the master station of the Messina INGV office.

3) A new hydrogeological network, to be built after an accurate inspection of the boreholes of the S.P.A. Stretto di Messina S.p.A. network, consisting of 10 sites plus one master station.

4) A new high precision tiltmeters network, consisting of 4 stations installed in 40 m deep holes, providing high-precision signals (resolution 5 nanoradians) close to Peloritani Mts. main faults.

5) A mobile laboratory facility for inspection and maintenance of overground and borehole monitoring networks, execution of downhole hydrogeological and geophysical surveys and in situ non-destructive tests on geomaterials.

6) Two laboratories hosted by the Messina INGV office, supporting the monitoring networks: a geophysical lab, for the characterization of soils and shallow crustal structures, and a second one devoted to the analysis and modeling of geodetic, geotechnical and remote sensing data

5.2 Development of Urban Seismic Observatories and seismic-accelerometric networks in industrial areas with high risk of major accidents (A.L. Domenico Patanè) : The main objective of this action is to create rapid response monitoring networks in north-east Sicily and south Calabria, based on the most recent micro-electronic (low-cost and low energy consumption devices), and computing technologies (Artificial Intelligence, Machine Learning, Internet of Things, etc.). The Urban Seismic Observatories, similar to those already operational in the city of Catania (PON EWAS), will be implemented in the metropolitan areas of Messina and Reggio Calabria and in the industrial area of Milazzo, few km W of Messina.

The products are:
1) Implementation of a strong-motion monitoring system in densely urbanized areas, by means of a dense network (35 stations) of low cost seismic-accelerometric sensors.
2) Extension of the INGV-OE seismic laboratory (L.E.D.A., Laboratory of Earthquake engineering and Dynamic Analysis), at the University of Enna KORE, devoted to calibration, dynamic tests and diagnosys of seismic instruments. Acquisition of a laser vibrometer for primary low frequency calibration and of a vertical shaker to be added to the existing system; accreditation of calibration and calibration measures in accordance with ISO 17025.

5.3 Enhancement of the Messina INGV office - Data Acquisition Center (A.L. Marcello D'Agostino): The recent availability of new INGV offices at Messina, in the building located in Viale Regina Margherita 87, Parco Aldo Moro, aims to create a driving force for research activities on the geodynamics of the Strait and southern Calabria area. For this reason, the choice of hosting a Data Acquisition Center at the INGV offices must be considered strategic for the pursuit of the aforementioned purposes.
The products are:
1) Creation of a Data Processing Center, supporting acquisition, storing and processing of data from the monitoring networks, supporting intensive server workloads such as Artificial Intelligence, Deep Learning and High Performance Computing.
2) Creation of a Cloud Computing infrastructure for virtual machines, bare metal and containers, able to control and distribute pools of computing, storage and network resources, made available by the Data Center for all monitoring and research needs.

5.4 Enhancement of the Messina INGV office - Development of systems for acquisition, analysis, archiving and automatic distribution of data (A.L. Massimo Rossi): The main function is to offer a telecommunication infrastructure to all remote monitoring and research stations, both permanent and periodically used. Its specific aim is the connection to the EPOS platforms for data distribution. The INGV office in Messina, will be equipped with all the necessary technologies to ensure effective and secure data transmission, bot wired and wireless, connected to INGV data transmission backbones and external facilities.

The products are:

1) Adaption of the internal systems of the Messina INGV building to current standards for interconnecting workstations, laboratories and the high-speed data center in both wired and wireless mode.

2) High-speed CED Internet connection, based on cloud technologies, private-public and processing and archiving "on-demand" protocols and systems, continuously optimizing computing resources.

3) Development of a geographic network based on a mixed radio/terrestrial/satellite system for the acquisition of data from the monitoring network and the mobile lab described at Action 1-e).

4) Implementation of adequate security and data protection systems (firewall, backup, cloud storage) to prevent external attacks and hacking.

WP5 Action 1 – Status of administrative procedures for instrumentation acquisition

Allotments of European tender notices

5.1.1 Seismic network
concluded

5.1.2 GNSS network
concluded

5.1.3 Hydrogeological network
concluded

5.1.4 Tilt network
on the go

Local ("Sezioni" INGV) procedures

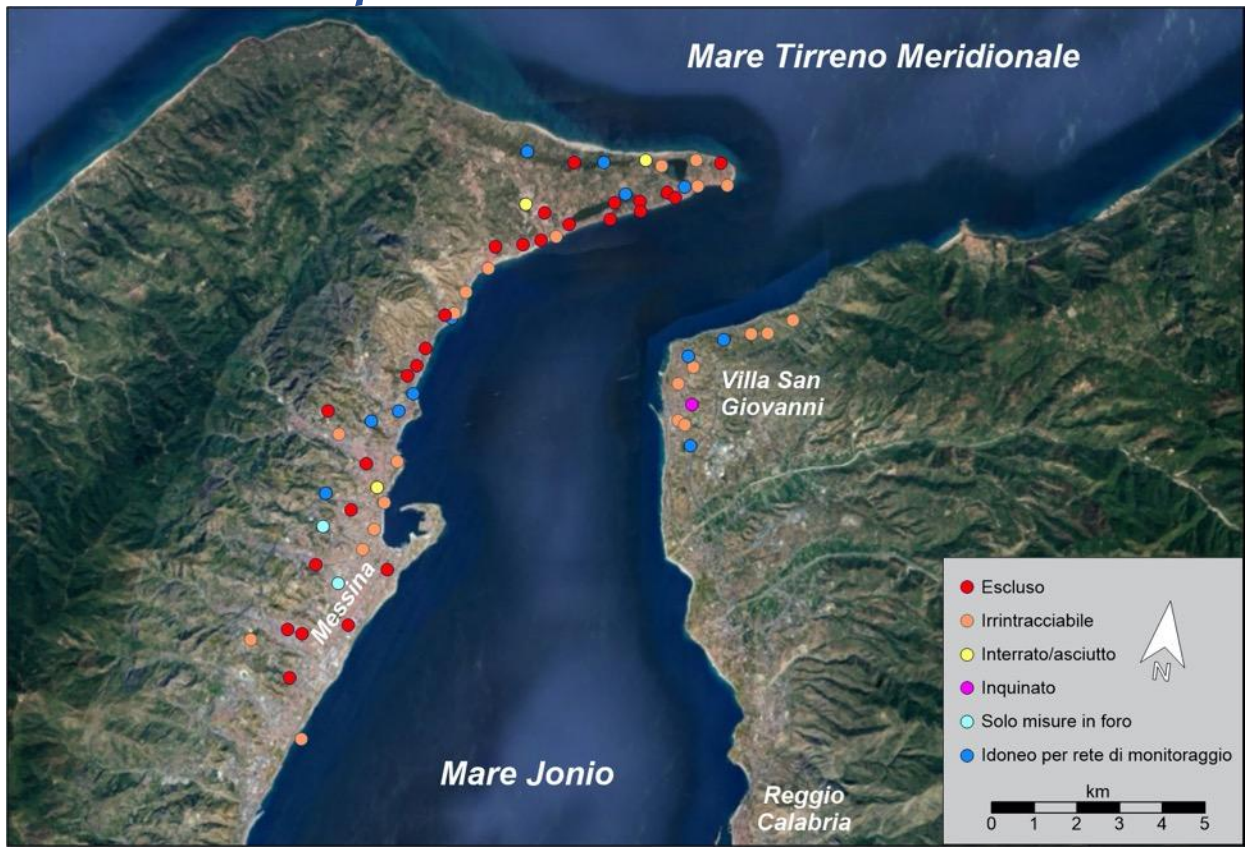
5.1.3 Advanced hydrogeological monitoring station
on the go, very close to be concluded

5.1.5 Downhole mobile lab
to be launched

5.1.6 Multidisciplinary lab
to be launched

WP5 Action 1 – Activities

Evaluation of the Stretto di Messina SpA piezometric network



Individuation of stakeholders for hydrogeological data (collaboration started)

1) **Autorità di Bacino della Sicilia**
   (regional quantitative monitoring network of underground aquifers)

2) **Azienda Meridionale Acque Messina**
   (quantitative monitoring of drinking water underground sources for the urban area of Messina)

3) **Città Metropolitana di Messina**
   (environmental management of the Nature Reserve "Laguna di Capo Peloro e Laghi di Ganzirri")

WP5 Action 2 – Urban Seismic Observatory (Messina-Reggio Calabria)

Acquisition of Instrumentation * (480 k€)

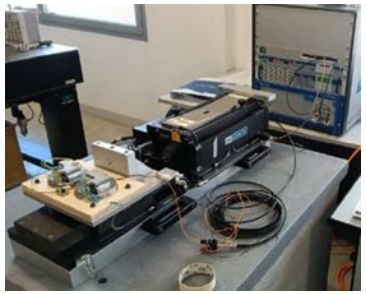
48 Smart Seismic stations
48 Q-MEMS accelerometers with very high sensitivity and ultra-low noise characteristics

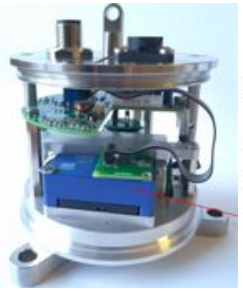
* The contract notice for the acquisition of the above apparatus has started.

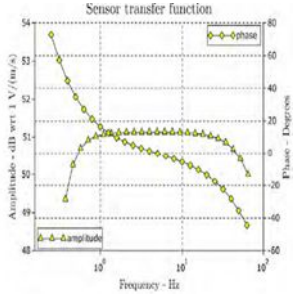
Civil Infrastructures accomodation (50 k€)

Running costs (9 k€)

Expansion of the INGV Shaker-table for the primary calibration of sensors (120 k€) 2024







WP5 Action 3 – INGV Messina Data Center

Computing Resources

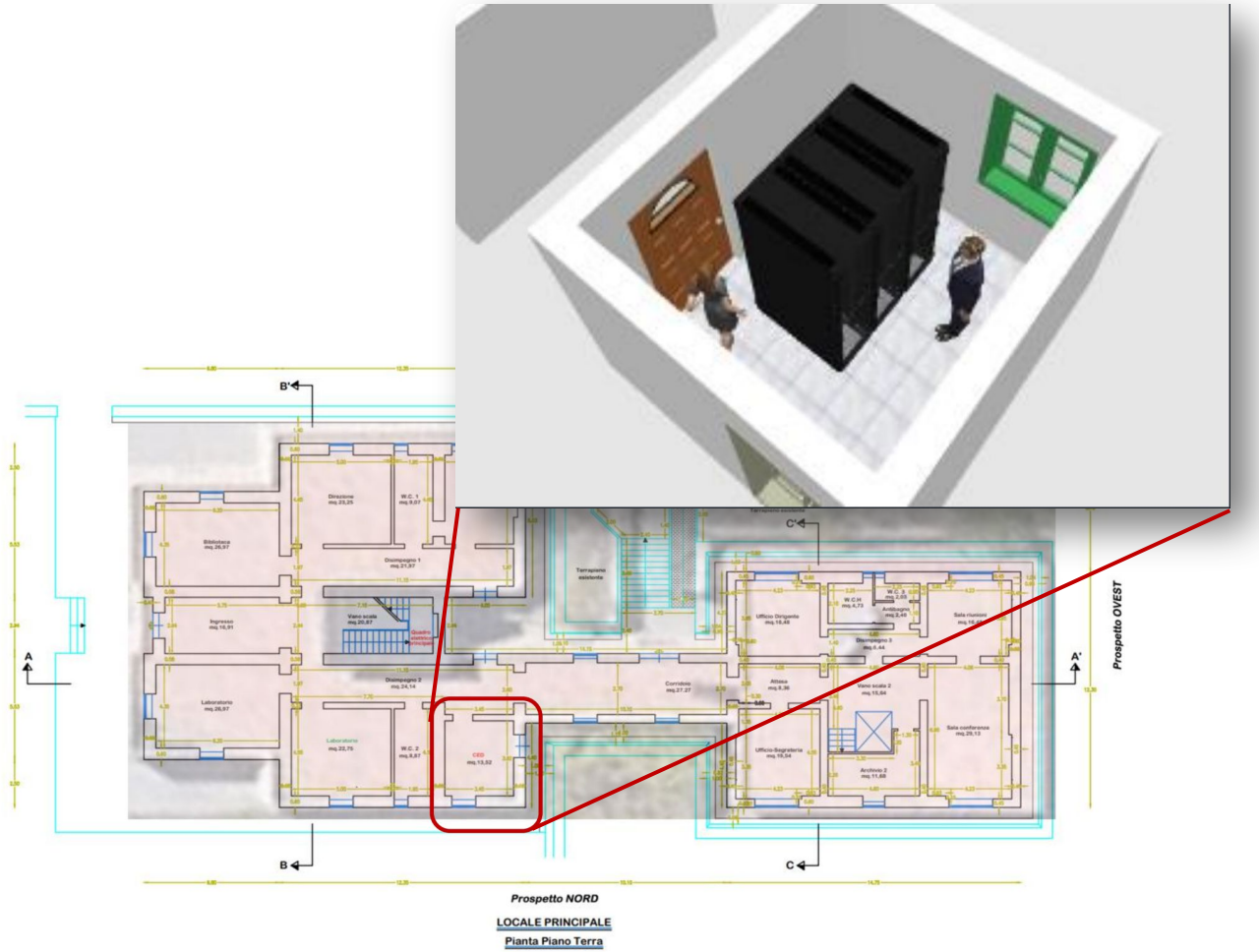
256 Core 4th Generation Processors
2TB DDR5 ECC Registered Memory
8x **GPU** NVIDIA L4 ADA 24GB
8x **32Gbit** HBA FC/NVMe-oF
16x **25Gbit** Ethernet RoCEv2

Network Resources

25Gbit Switches RDMA over Converged Ethernet

Storage Resources

150TB SSD NVMe PCIe Storage for Virtualization
20TB SSD SAS 12Gbit Storage for FlashPool
500TB SAS-NL 12Gbit Storage for Data Archiving



WP5 Action – INGV Telecommunication systems

Line-of-sight availability of WLAN link between INGV office of Messina and Dinnammare antenna for a direct connection to INGV WLAN network for data transmission from Eolie-Messina-Etna-Catania areas

WP5 Action 3 and 4 – INGV Messina Data Center

Data Center Hardware and telecommunication infrastructure (750 k€)

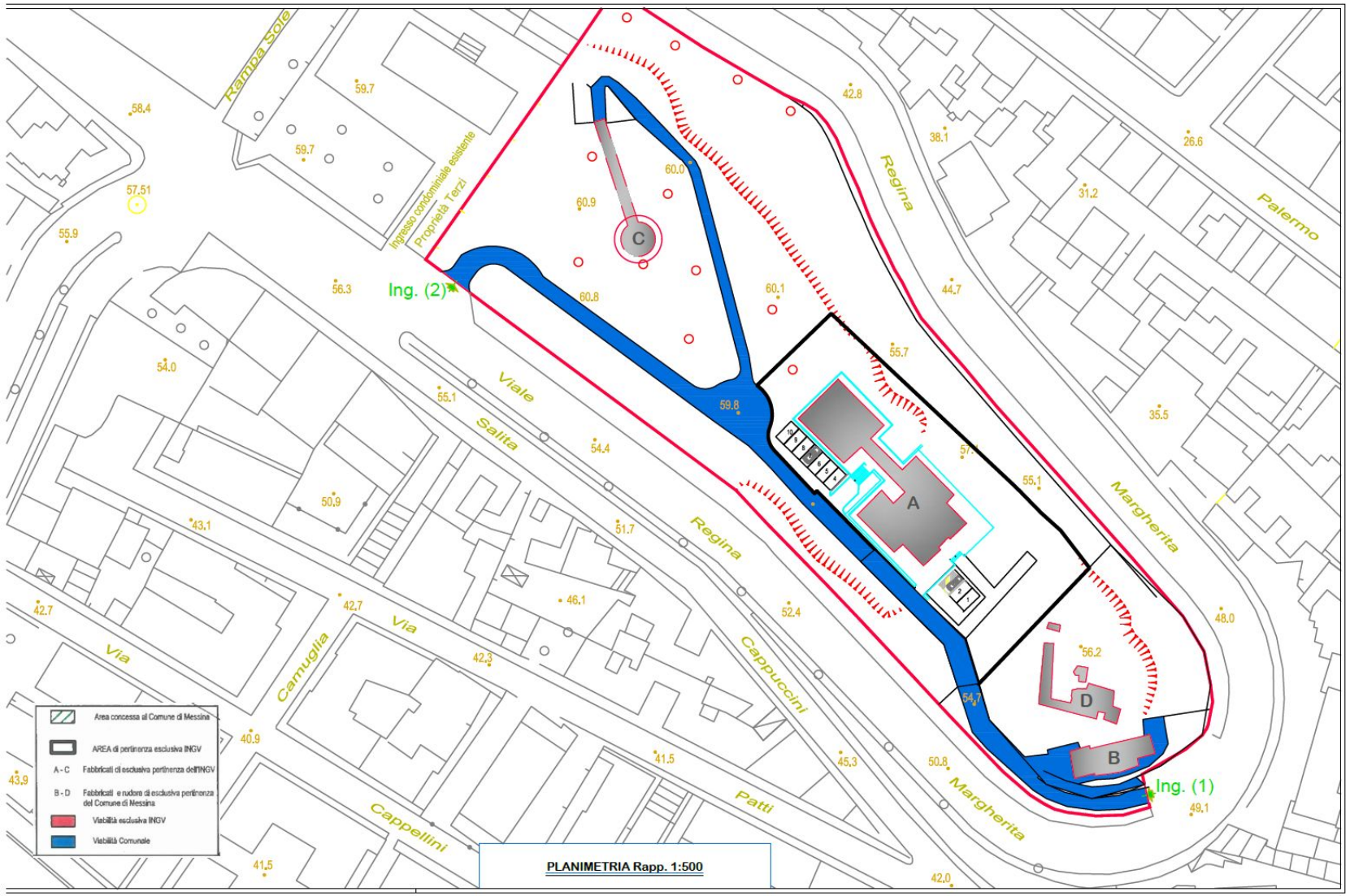
- 300k€ transferred to CINECA for HPC infrastructure
- Waiting for the start of the European tender for the remaining servers and telecommunication devices

Civil infrastructure - Accomodation and facilities Data Center Room (25 k€)

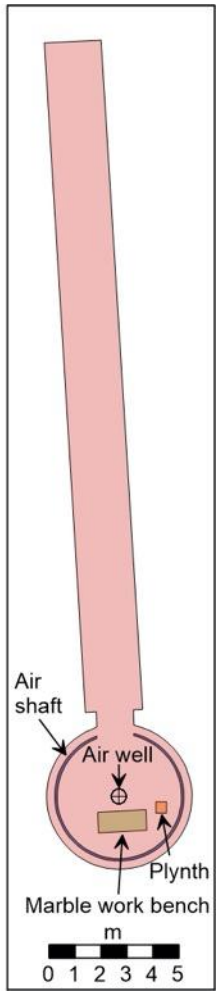
- purchase procedure started

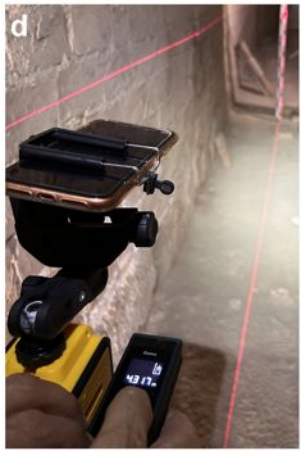
Running costs – Data Center (60 k€)

Planimetria Parco Aldo Moro

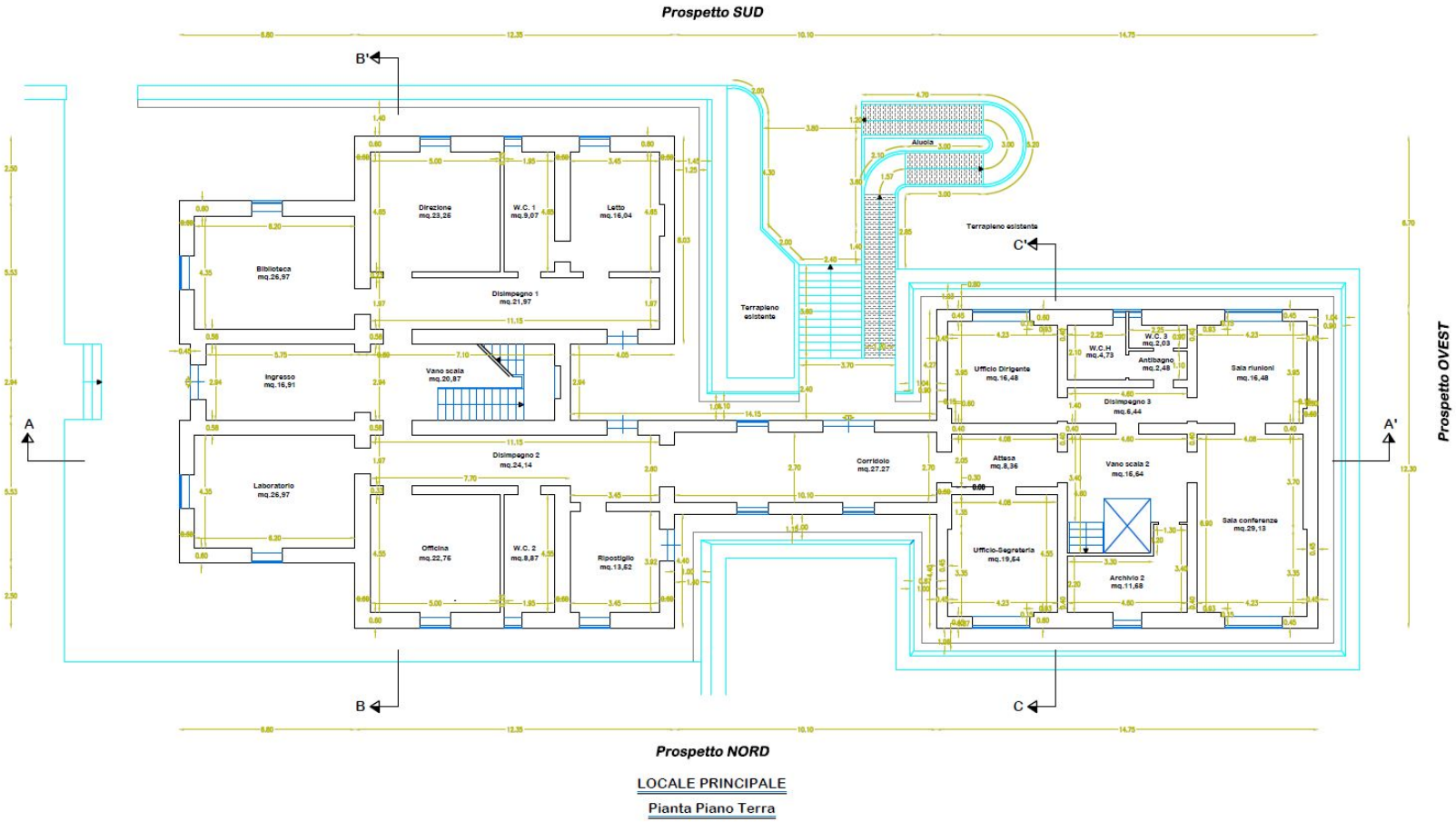


WP5: Topographic survey of the INGV Messina headquarter geophysical

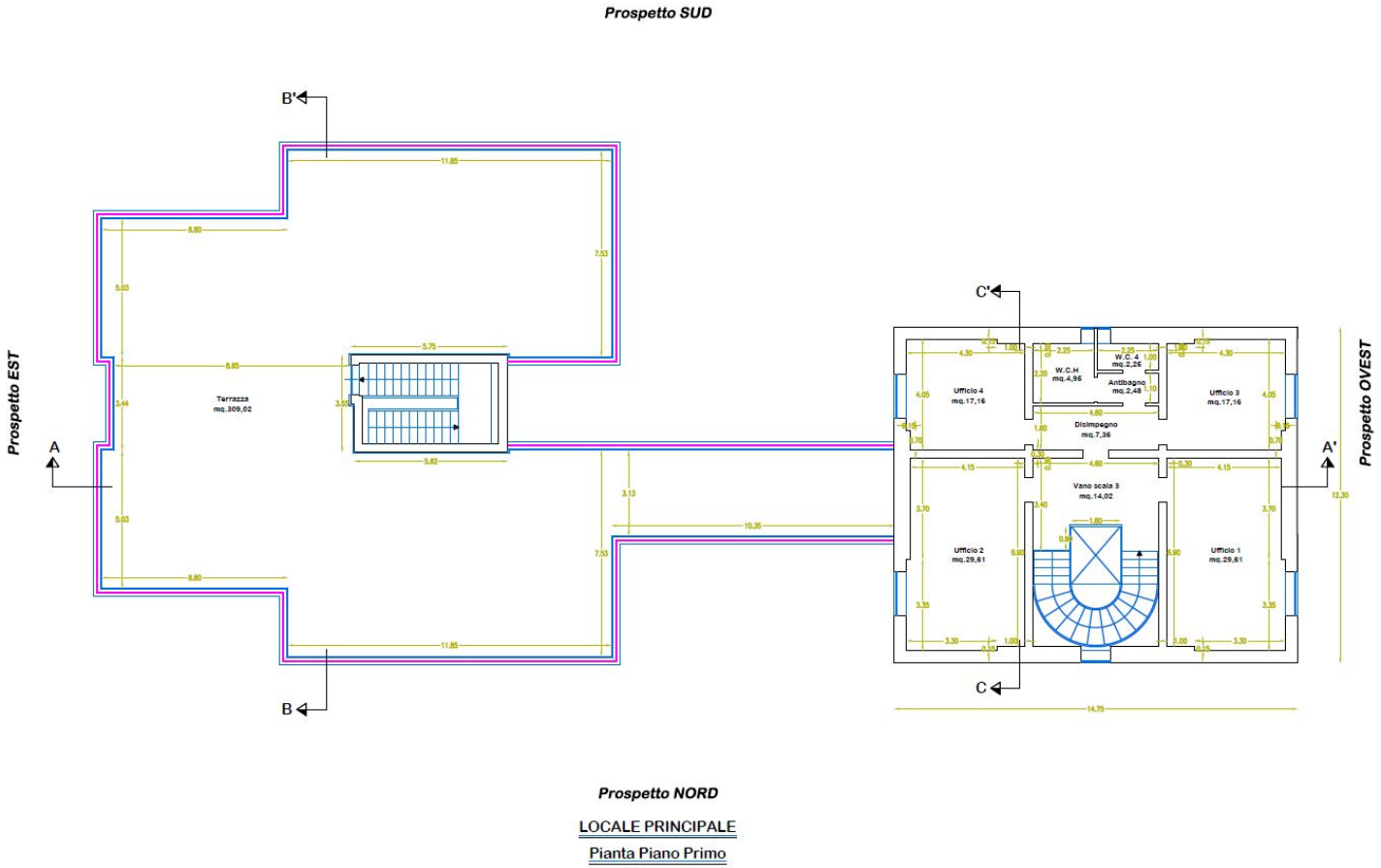




Sede di Messina INGV – Piano Terra

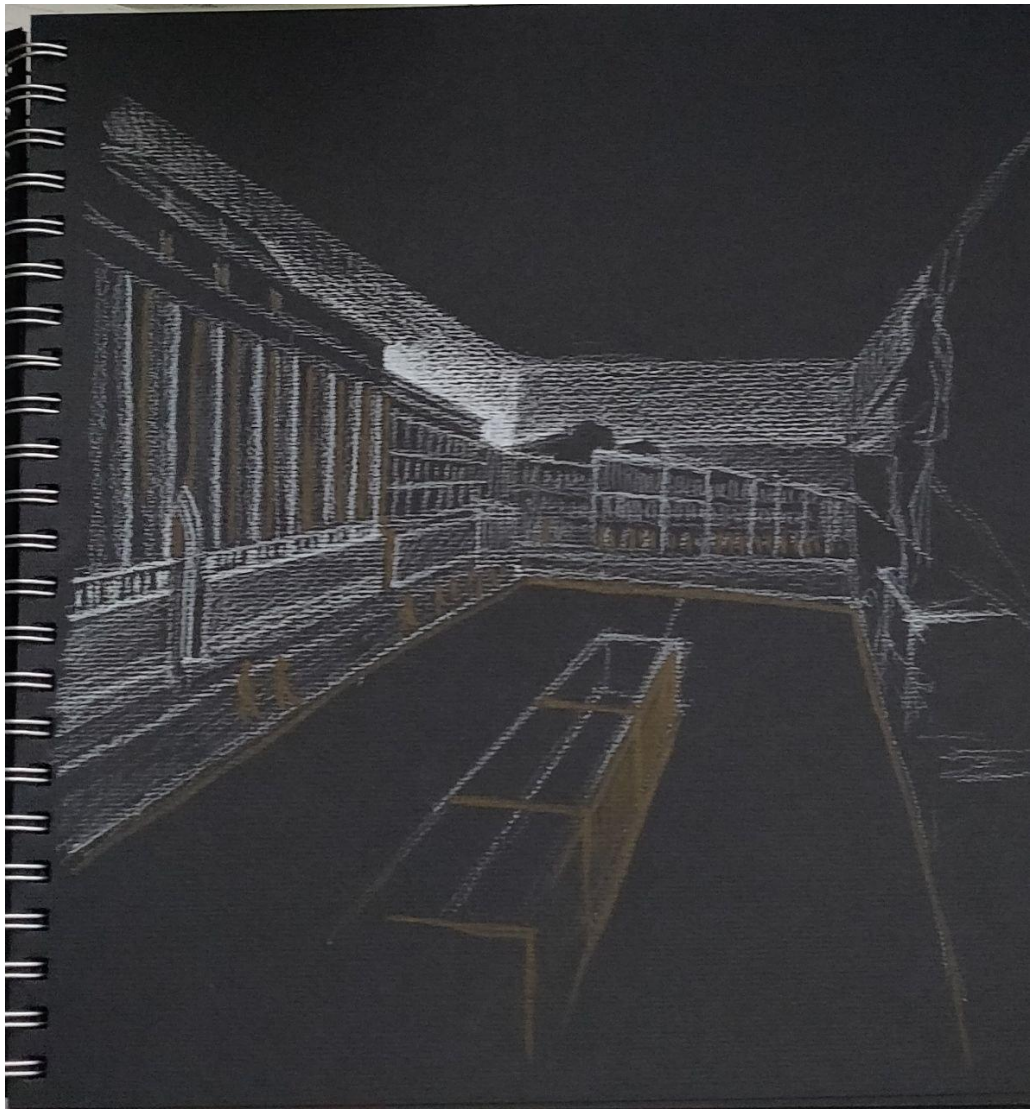


Sede di Messina INGV – Piano primo



LOCALE PRINCIPALE

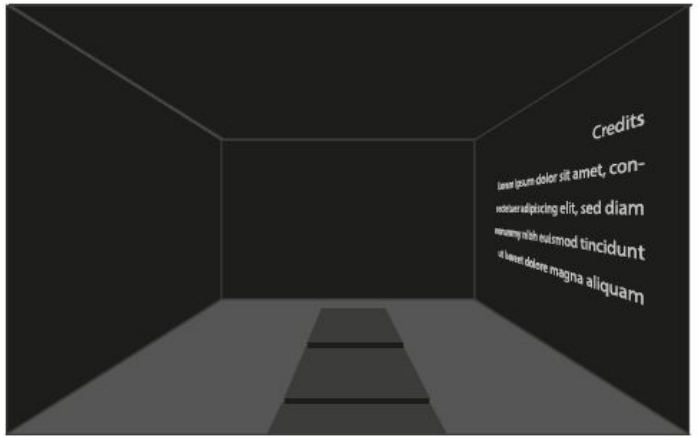
Pianta Piano Primo



Sulle pareti, appaiono adesso le immagini di Messina distrutta, animate e arricchite da elementi grafici e testi.

Audio da decidere.

Durata: 180-240 secondi



Al termine, sulle ultime immagini di Messina post-terremoto, se possibile inserire qualche immagine odierna e poi presentare i credits.

Audio da decidere.

Durata: 30-40 secondi

Acquisizione immagini dell'archivio del giornale «L'Ora» di Palermo relative al terremoto del 1908

Grazie per l'attenzione!