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Meteorological Risks Mitigation and Nowcasting at Airports: the RIVONA Project

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How RIVONA Project originated (1)

The Apulia Region, in the southern part of Italy, has released a competition among laboratories active in the region for acquiring advanced instrumentation in different domains.

We participated, and won, in the Aerospace area with the "Flight risks mitigation and nowcasting at airports" Project (RIVONA-riduzione dei RIschi di VOlo e Nowcasting Aeroportuale).

How RIVONA Project originated (2)

RIVONA aims at

- **developing an advanced wind-shear alert system**
- **reducing other risks to flights connected with the storm:**
  - **destructive precipitation**
  - **lightning**
  - **icing of aircraft**
  - **aquaplaning on runway**
  - **severe turbulence**
- **improving airport nowcasting systems**

Why we applied to competition with such a project (1)

- **The mitigation of meteorological risks to flight is still a challenging and sensitive objective.**
  - **In the late seventies and early eighties the "Joint Airport Weather Studies" (JAWS) Project was conducted near to Denver's airport (USA). It was a joint program of the University of Chicago (USA) and the National Center for Atmospheric Research (USA) [McCarthy, Wilson and Fujita,Bulletin American Meteorological Society, 1982].**

Why we applied to competition with such a project (2)

Motivations to resume JAWS' objectives have been:

- **The possibility of using dual polarization radars not available at the time;**
- **The advent of TITAN software by which rapid cell development can be followed;**
- **The potential of vertically pointing Ka band in airport to improve application of continuity equation.**

- **We saw the competition as a great opportunity for deploying an integrated observational system which allows advanced research on severe storms.**

The structure of RIVONA Project Observational system

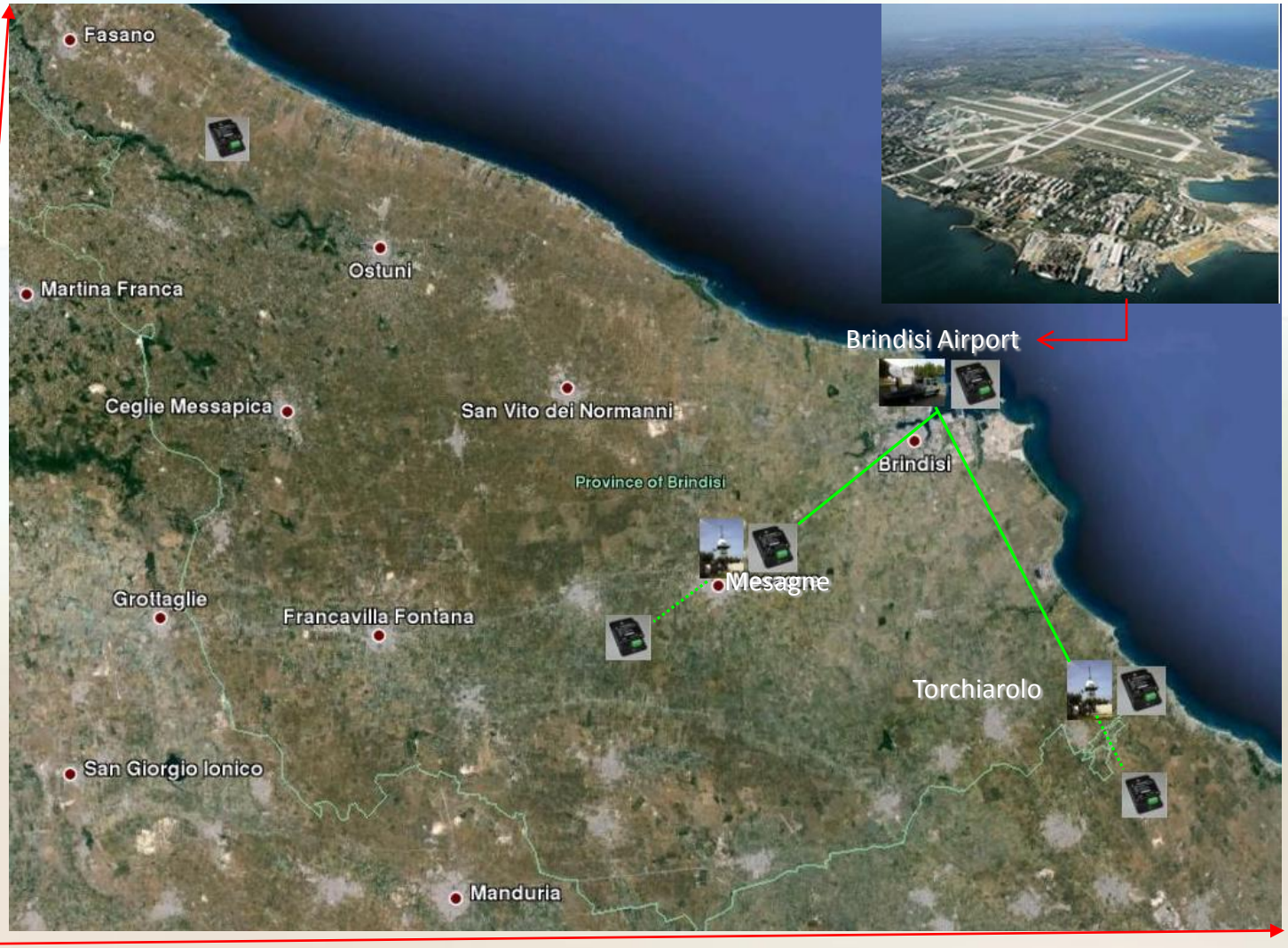
- A system of three Doppler radars, two C band (5.6 GHz), one of which will have full dual-polarization capability, and a Ka band (35 GHz) Doppler, is being established in the Brindisi Airport area in Apulia Region of southern Italy.
- A network of six microbarographs and three microwave disdrometers (PLUDIX) will be deployed in the airport area and will complement the radar observations of the wind-shear events and other potential risks to flight originated by severe storms.

The RIVONA project airport: Brindisi airport

Ka mobile radar

C band radar

Microbarograph



Apulia Region Brindisi Airport

Aeroporto del Salento

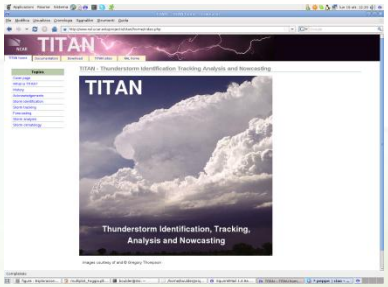
C-band Doppler radars

Acquired after a competition among manufacturers based on our technical specifications and assembled by ISAC RIVONA Project Team.

They use Magnetron Transmitters with Solid State FET Modulators supplied by the Applied Systems Engineering, Inc., the Advanced Radar Corporation HiQ digital receiver and processing board installed in a dedicated PC and the UCAR-TITAN (Thunderstorm Identification Tracking Analysis and Nowcasting) system.

C-band Doppler radars characteristics

- **Peak transmitted power: 250 kW**
- **Antenna diameter: 4.2 m**
- **3-dB beamwidth: 1 degree**
- **Maximum duty cycle of 0.001.**



Ka-Band mobile radar

Bistatic Ka band radar assembled at ISAC Bologna Laboratory. It will be able to transmit linear or circular polarization mode and receive either right and left end circular or vertical and horizontal polarizations with a dual channel receiver.

See poster:
A 35 GHz Mobile Doppler Radar and a Microwave Disdrometer Network for Meteorological
(Research Breckenridge Ballroom , Peak 14-17, 1st Floor)

Ka-Band mobile radar characteristics

- Peak transmitted power: 160 kW
- Average transmitted power: 80 W
- Pulse width: 250 ns
- Antenna diameter: 1.20 m
- Antenna gain: 50 dB
- 3-dB beamwidth: 0.5 degree
- Noise power: -106 dBm
- Minimum detectable reflectivity at 10 km: -29 dBZ

The structure of RIVONA Project

Technique for deriving horizontal and vertical air motion

In RIVONA project we plan to use two techniques for determining three-dimensional wind fields, adapting an approach described by Jorgensen et al. (Meteorol. Atmos. Phys. 59, 1996) and firstly applied to airborne radars.

The equations can be applied to ground-based radars, too. This will be done with RIVONA radars.

Present status of RIVONA Project (1)

Acquisition of instrumentation has been completed.

The installation of the Torchiarolo C-band radar is now close to completion, as well as the final tests of the Ka band mobile radar.

The preparatory work for the installation of the second C-band radar on the Mesagne support tower has started.

Present status of RIVONA Project (2)

Funding allowed:

- **Acquisition of two C-band radars of advanced characteristics**
- **Ground sensors**
- **Truck to host the Ka band radars**

Now the phase of mounting and testing is in full activity, only slowed by the need to get additional funding.

Torchiarolo Radar Site

Torchiarolo Radar Site

Torchiarolo Radar Site

Next steps

1. Completing the Mesagne site test
2. Integrating the three radars
3. Developing airport nowcasting system

Invitation to join

Easy self criticism: evident under-sizing of the group for the challenging objectives

…so *invitation* to individual scientists or agencies to join and cooperate, and to handle the system as an international facility

Thanks!

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