

## Final project report

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| <i>Project ID</i>             | 2004/7.1   |
| <i>Title</i>                  | Installation, operation and scientific exploitation of two ionospheric HF radars (SuperDARN) at Dome C |
| <i>Principal investigator</i> | Ermanno Amata  |
| <i>Institution</i>            | IAPS-INAF, Rome (formerly IFSI-INAF)   |
| <i>Email</i>                  | <a href="mailto:ermanno.amata@iaps.inaf.it">ermanno.amata@iaps.inaf.it</a>                             |
| <i>Duration</i>               | 3 years  |
| <i>Assigned funding</i>       | 210 kEuro  |

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### Activities and results (max 3000 characters)

The Super Dual Auroral Radar Network (SuperDARN) is an international project devoted to the study of the high latitude ionosphere in the framework of Solar-Terrestrial Relations. SuperDARN consists of two longitudinal chains, in the Northern and Southern hemispheres. The 2004/7.1 PNRA project aimed at completing the longitudinal coverage of SuperDARN in the Southern hemisphere through the installation at Dome C of two radars whose fields of view will point from the invariant geomagnetic pole towards regions not covered by the network. The project rested on a Franco-Italian collaboration based on an equal share of financial involvement and saw the participation of two institutes: the Istituto di Fisica dello Spazio Interplanetario (IFSI) of CNR, Rome, (PI Dr. E. Amata), and the Laboratoire de Physique et Chimie de l'Environnement (LPCE) of CNRS, Orléans, (PI Dr. J.P. Villain).

After most of the material for the installation had been prepared, in 2006 a mission was carried out by two LPCE people for one month at Dome C for the preparation of the site: pickets were placed at each antenna mast location; afterwards, the snow was compacted over the area devoted to the installation.

After the death of the French PI, Dr. J.P. Villain, on January 9th 2008, a Franco-Italian meeting held at INAF headquarters (Rome, September 2009) decided that IFSI and LPCE will pursue together the installation of the radars and that, after the installation, the responsibility for the scientific and technical management of the two radars will be assigned to IFSI (now Istituto di Astrofisica e Planetologia Spaziali, IAPS, of INAF). All the hardware for the installation of the two radars has been prepared: the electronics and computer systems are stored in Rome at IAPS-INAF, while the antennae are already on site at Dome C, stored in three containers.

As regards the mechanical design of the radar, the new generation SuperDARN wire antennae (first installed at Wallops Island, Virginia, USA, in 2006) have been used. A thorough technical evaluation has been made of all the material to be used under the extreme temperature conditions of Dome C and all the procedures to be followed for the installation of the two radars have been analysed and described in detail. Moreover, the performance of the radars has been numerically simulated with care, in order to tune the size of the radiating elements and the shape and dimensions of the back side reflecting wires to the characteristics of the high latitude antarctic ionosphere; in this regard, it has been decided that the two Dome C radars will operate mainly in the lower part of the nominal SuperDARN frequency interval which spans from 8 to 20 MHz, i.e. at frequencies slightly lower than those usually used (around 14 MHz) by the rest of the SuperDARN chain.

The installation, after several delays in the last years, could take place during the 2012-2013 campaign and will require the participation of 6 people, 3 Italians and 3 French.

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### Products

#### A – papers in scientific magazines

## Programma Nazionale di Ricerche in Antartide (PNRA)

### B – book chapters

### C - proceedings of international conferences

E. Amata, M. F. Marcucci, J.-P. Villain, I. Coco, D. Ambrosino. Future Extension of the Super Dual Auroral Radar Network. *Earth Moon Planet* (2009) 104:29–31, DOI 10.1007/s11038-008-9247-x

### D – proceedings of national meetings and conferences

Amata, E., Berrilli, F., Candidi, M., Cantarano, S., Centrone, M., Consolini, G., Contarino, L., Criscuoli, S., De Lauretis, M., Del Moro, D., Egidi, A., Ermolli, I., Francia, P., Giordano, S., Giorgi, F., Oliviero, M., Magrí, M., Marcucci, F., Massetti, S., Messerotti, M., Parisi, M., Perna, C., Pietropaolo, E., Romano, P., Severino, G., Spadaro, D., Storini, M., Vellante, M., Villante, U., Zlobec, P., Zuccarello, F. SINERGIES, the Italian Network for Ground-Based Observations of Sun-Earth Phenomena. *Mem. S. A. It. Suppl.*, v.9, p 79. 2006.

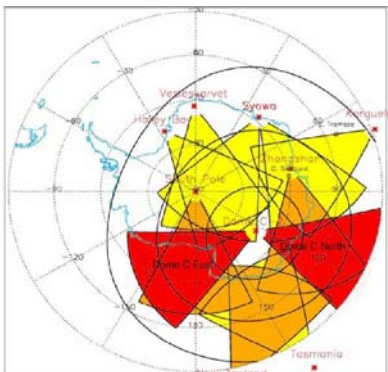
Amata, E., Candidi, M., Centrone, M., Consolini, G., Contarino, L., Criscuoli, S., De Lauretis, M., Diego, P., Ermolli, I., Francia, P., Giorgi, F., Laurenza, M., Magrí, M., Marcucci, F., Massetti, S., Messerotti, M., Oliviero, M., Penza, V., Perna, C., Pietropaolo, E., Romano, P., Severino, G., Spadaro, D., Storini, M., Vellante, M., Villante, U., Zlobec, P., Zuccarello, F. SINERGIES (Sun, INterplanetary, EaRth Ground-based InstrumEntS) or the potential of the Italian Network for Ground-Based Observations of Sun-Earth Phenomena. *Mem. S. A. It. Suppl.*, v.9, p 82, 2006.

Bertello, I., Amata, E., Marcucci, M. F., Coco, I. Towards a statistical model of the Southern ionospheric polar convection maps. *Mem. S. A. It. Suppl.*, v.9, p 88, 2006

Francia, P., Candidi, M., Villante, U., Amata, E.. Space weather or the solar variability effects on the terrestrial environment: the Italian activities. *Mem. S. A. It.*, v.74, p.757, 2003.

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### E – thematic maps



In red the fields of view of the two SuperDARN Dome C radars.

### F – patents, prototypes and data bases

### G – exhibits, organization of conferences, editing and similar

### H - formation (PhD thesis, research fellowships, etc.)

Dr. Igino Coco, Assegno di ricerca, IFSI ASS. RIC. 2004-05, Title: "Project, realisation, and scientific use of the SuperDARN Dome C radars".

### Research units

The original project comprised of a research unit, base at IFSI-INAF, Rome, which included the following participants:

Dr. Ermanno Amata, PI, IFSI staff

Dr. Maria Federica Marcucci, IFSI staff

Dr. Maurizio Candidi, IFSI staff

Dr. Giuseppe Consolini, IFSI staff

Dr. Igino Coco, PhD Student, University of Siena (PhD in 2005)

Igor Bertello, Phd Student, University of Siena

In the course of years, other people have participated in the project:

Dr. Danila Ambrosino, PhD Student, University of Siena (PhD in 2008)

Mr. Maurizio Maggi, Electronic engineer, IFSI-INAF

Mr. Nello Vertolli, Electronic engineer, IFSI-INAF

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Date: 30 January 2012

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#### *Notes.*

The publications listed in this report only refer to the design and building of the radar subsystems to be installed at Dome C. The scientific production of the IFSI group is documented in the report regarding the Kerguelen radar (PNRA project 2004/7.04).