Final project report

Project ID: 2002/11.06
Title: *Developement and integration of instrumentaion for ice sampling, and in-situ and continuous ice measurements.*

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Duration: 2 years
Assigned funding: € 49.400,00

Activities and results

Introduction

The aim of the project was the development IDRA (Italian DRilling system for Antarctica), the innovative system for polar deep ice coring, with all the supporting systems for the drilling management. These instrumentation was developed to be transported by De Havilland DH-6 Twin Otter.

Task 1

First of all we developed a drilling system that can drill glacier ice with thickness more than 1000 m, and reach the maximum Antarctic deep at around 4500 m below the surface. The development was split into 3 main parts, from the original EPICA drilling system, used in Dome C: the core barrel-head system; the pump-filters system for the chips; the motor-rotation-data transmission system. The antitorque system were completely copied by EPICA system to maintain the complete compatibility between the two systems.
The core barrel wss developed using a two-tube technology with the rotation of the inner tube. The chips rise between the two tubes and reach the chip-chamber in the upper part. The drilling head, developed in collaboration with the University of Bern (Switzerland), uses an international standard lock system for the interchange of the different heads. The system can recover ice core between 3 to 4 m long, with a diameter of 10 cm, another standard to permit drilling operation in old holes.
The pump-filter system, for recovery and separating the chips from the liquid is the critical part of the entire drilling system. The aim is to clean as fast as possible the head from the ice chips that can create problems at the drilling operations.
All the electrical motor for the core-barrel and pumps rotation and the data transmission system were stored in the upper part of the drilling system, before the antitorqe. The system can transmit data for the operations and for the control of the drilling activities.
Some test were done in laboratory, both for the data transmission effectiveness and the operation controls.

Task 2

The tilting tower and operation command system was developed with the same standard of the drilling system, maintaining the compatibility with the EPICA system. The cable were buy with mechanical and operational characteristics of the drilling system. However the winch and the drum were developed to be stored and transported in the Twin Otter.
The tilting tower can reach 14 meters, the hat can also be used with most of the international drilling systems. The commanding system was developed to control all the drilling operations and display also the graph of all motor and drilling parameters. The winch can mount cables until 4 km long, but now, for the future Talos Dome drilling operations, a 1.8 km long cable, 0,8 cm diameter, with 8 conductors inside was used with.

Task 3
The testing of the system was done in Talos Dome drilling operations in order to understand the efficiency of the pump-filter system and the data communication system. However, the winch and tower were tested because used for the preliminary operation of the Talos Dome ice core activity.
The winch-tower system worked very well without important problems, while the pump system showed the need of a new electrical motor, more powerful in order to maintain the pressure difference between the head and the chip chamber.

Products

A – papers in scientific magazines

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B – book chapters

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C - proceedings of international conferences

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D – proceedings of national meetings and conferences

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E – thematic maps

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F – patents, prototypes and data bases

Prototype of the IDRA system (Italian DRilling system for Antarctica) – see drawings and pictures in the notes.

G – exhibits, organization of conferences, editing and similar

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

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Research units

UO 11.6.1: Prof. Valter Maggi (DISAT-UNIMIB) - responsabile

UO 11.6.2: Ing Gianluca Benamati (ENEA-Brasimone)

Unità di supporto U.O. 11.6.3: Dr. Silvia Becagli (DCA-UNIFI)

Date: 29/10/08

Notes – some drawings and pictures of the IDRA system

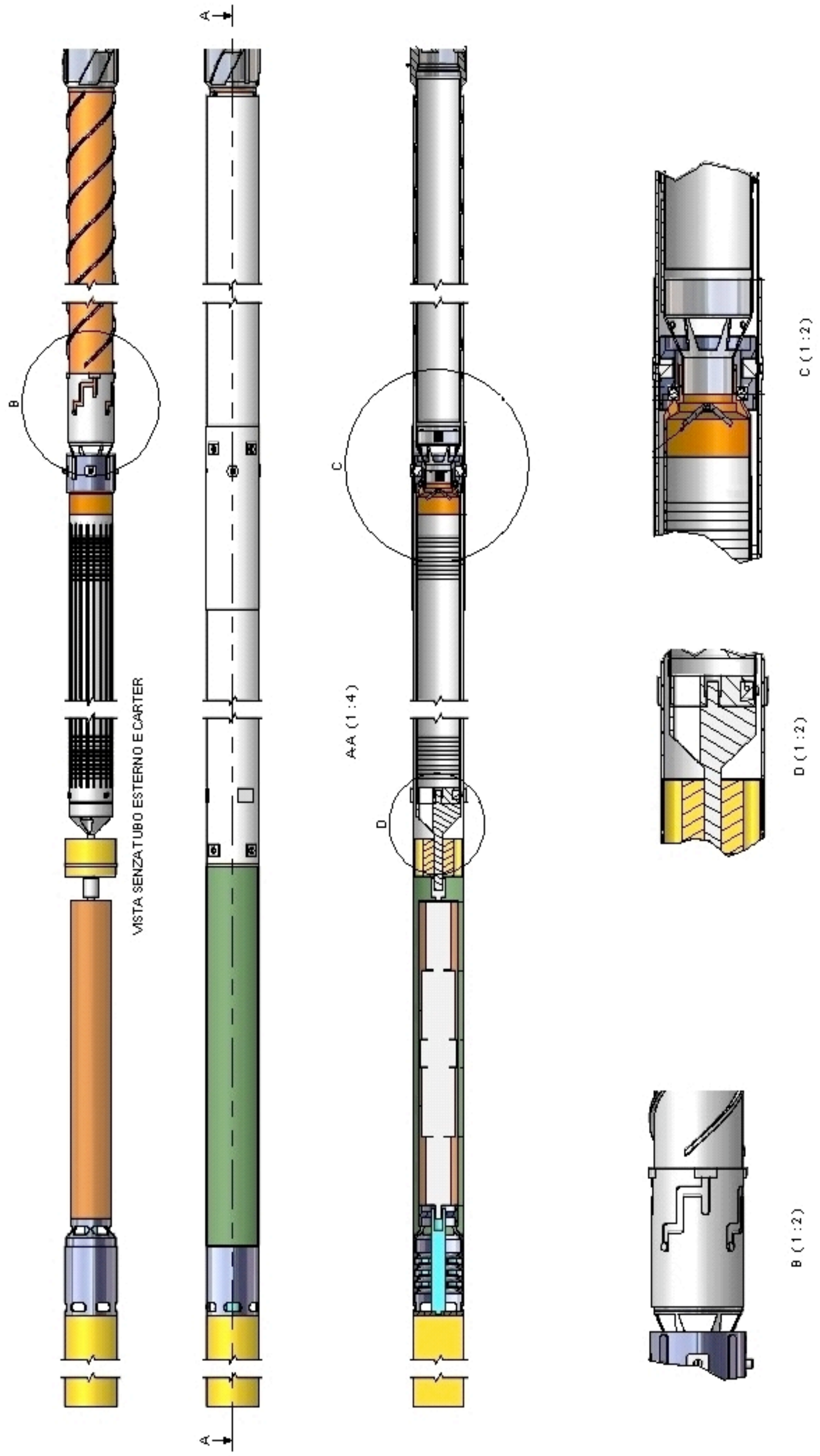

Fig. 1: Schema della sonda di perforazione IDRA.

Fig. 2 - I test effettuati a Talos Dome della sonda IDRA

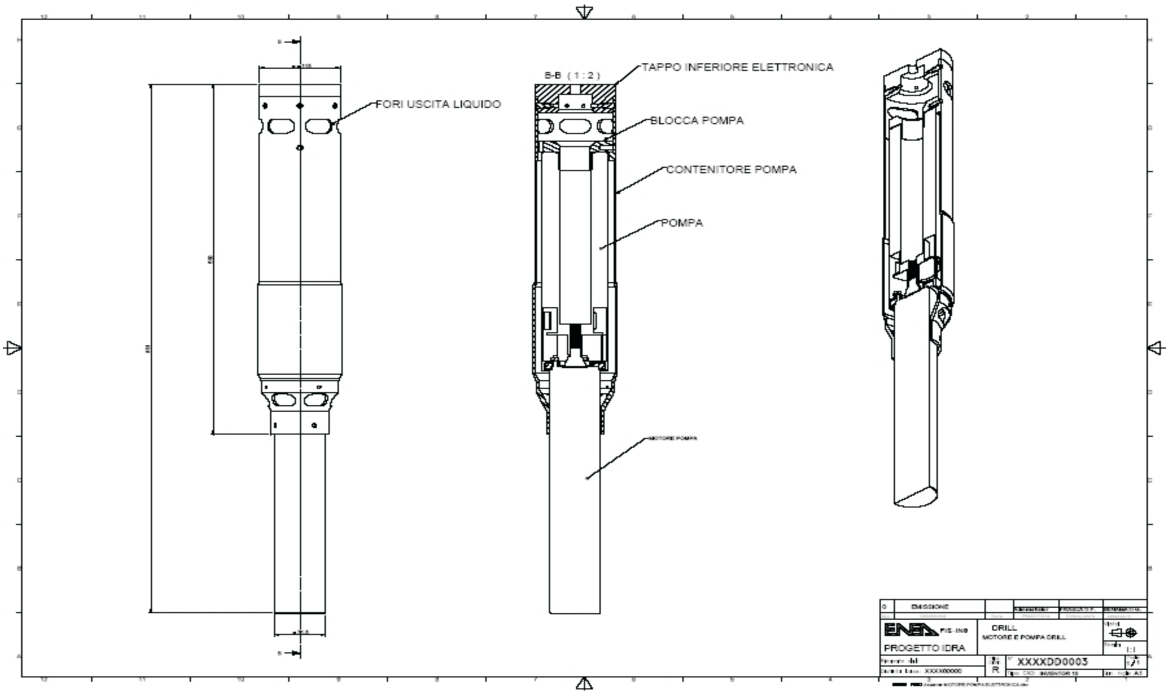

Fig. 3 - Sitema di contenimento

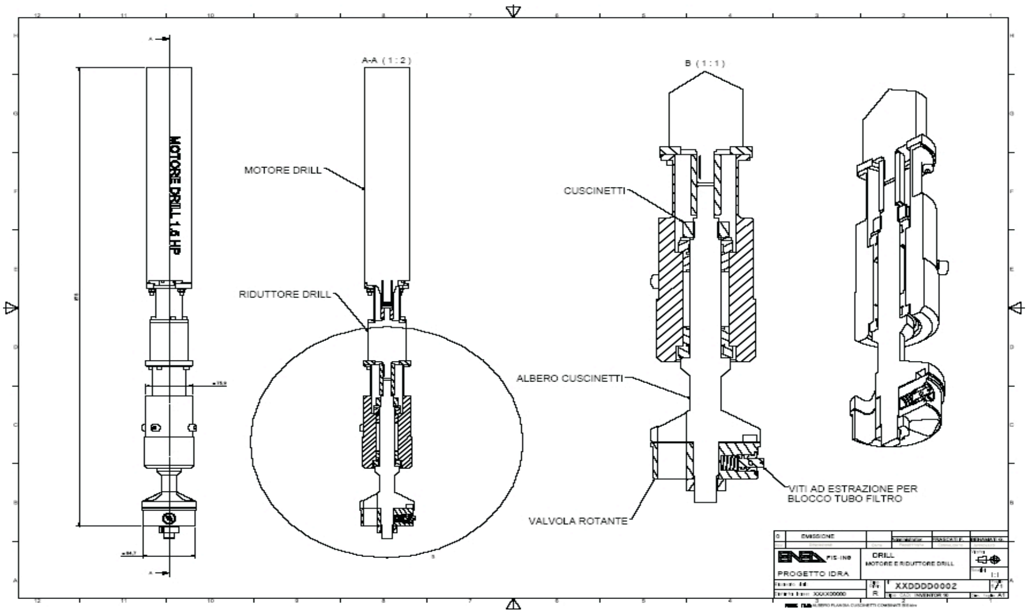

Fig. 4 - Sistema di accoppiamento motore-carotiere, con valvola di controllo del flusso del liquido.

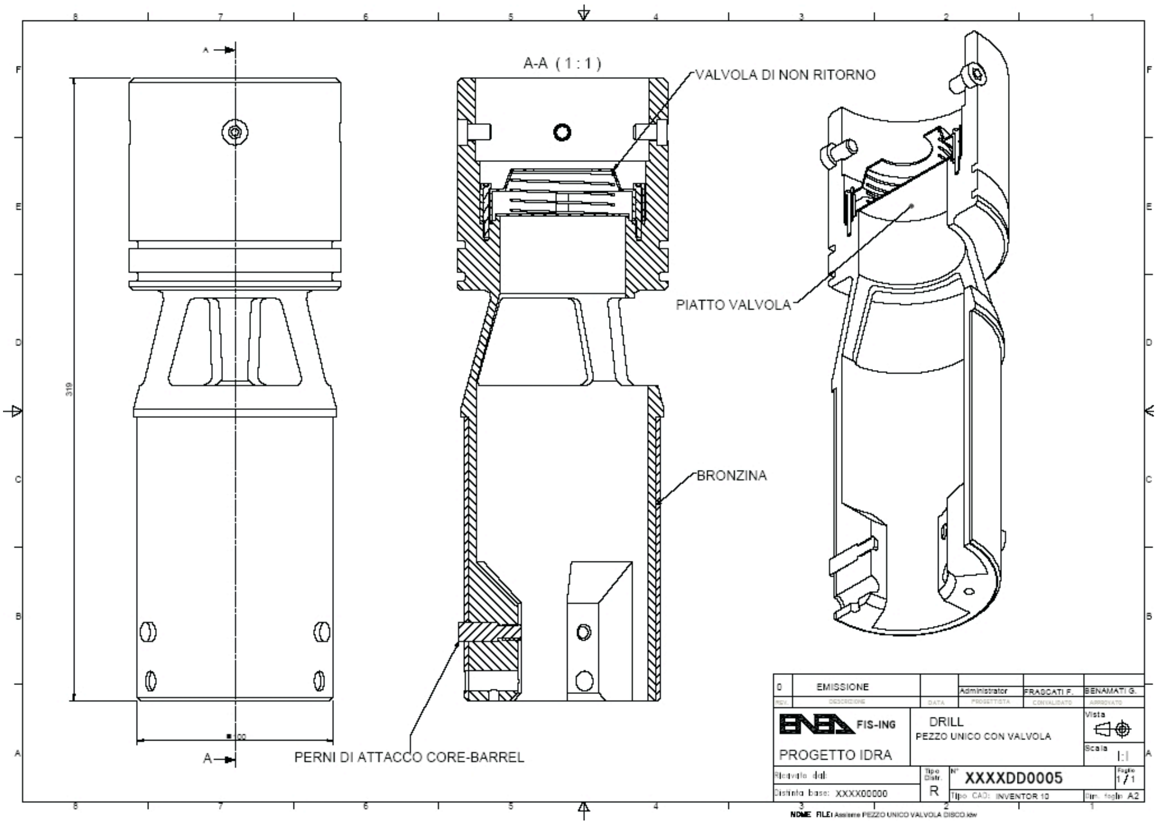

Fig. 5 - Schema della valvola di giunzione

Fig. 6 - Tubi portafiltri per la separazione dei chips dal liquido.

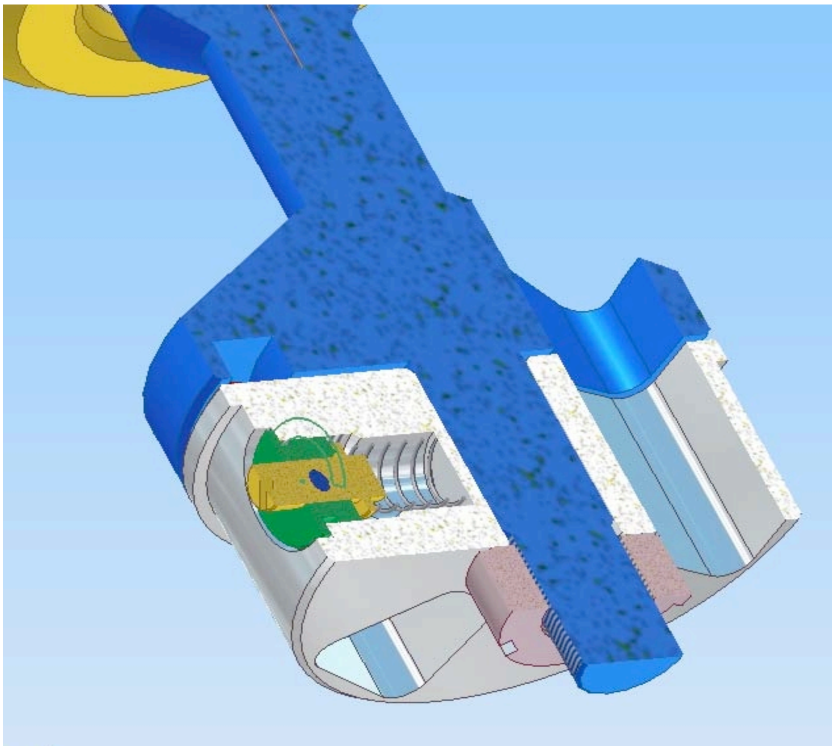

Fig. 7 - Schema del sistema di attacco dei tubi portafiltri

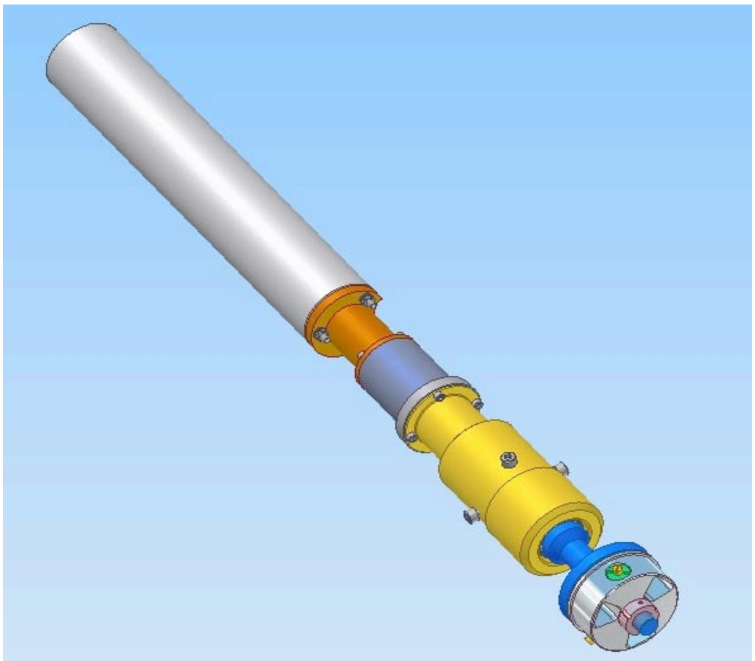

Fig. 8 - Schema dell'intero sistema coassiale di trasmissione delle rotazioni e degli attacchi delle varie componenti.

Fig. 9 - Foto dell'insieme motore-alberi-trasmissione-attacchi del carotiere.

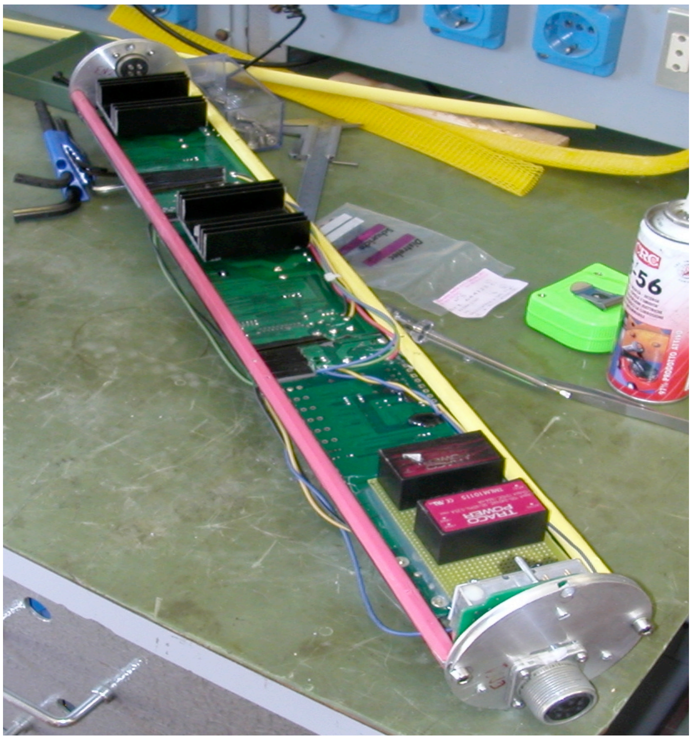

Fig. 10 - Schema dell'elettronica all'esterno del tubo pressurizzato.