

# HYCAM - a software-defined testbed for experimentations of new S band surface radar concepts

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**Abstract**— In 2008, ONERA started developing a radar designed for experimental studies on new concepts for naval and surface applications. The project is called HYCAM. The aim is to be able to be representative of most of the categories of surface radars (multi-function radars, surveillance radars, target analysis systems, NCTR radars, tracking radars, weather radars,...). To achieve such a versatility, a modular and software defined architecture has been proposed thanks to modern and high performance digital technologies (FPGA, DAC, ADC). Moreover, micro-wave front-end/antennas are reconfigurable. The device is expected to be validated in 2011. In this paper, radar definition and specifications are detailed.

## I. INTRODUCTION

For years, Onera has been working on radar studies and developed radar test beds like the X-band MERIC system [1], RAMSES SAR system and more recently SETHI [2]. Hycam is an ongoing project, founded by French MoD, devoted to surface S band radar studies. ONERA is the project leader but works in close cooperation with French companies.

The goals of this program are to support radar developments (de-risking) and to evaluate new concepts in radar systems (multi-functions radar, NCTR, MIMO, polarimetry, STAP, super-resolution, detection in non-gaussian environment) on the basis of real signals.

To cover such a wide radar area, a strong effort has been done on a reconfigurable RF architecture and the digitisation of radar functions.

The basic principle of the device is to record signals on RAID disks as raw as possible in order to keep the maximum amount of information in the signals that will be processed off-line. Nevertheless, a huge real-time processing capability has been included in the numeric recording system. This capacity is used both to reduce data flow (IQ demodulation and decimation, real-time digital beamforming) and to realise functionalities that are necessarily real-time (mono-pulse tracking, real-time experimentation monitoring).

In this paper, main radar features and architecture issues will be discussed including waveform generation, active phased array, reconfigurable receiver, data processing and storage.

## II. RADAR ARCHITECTURE

### A. General overview

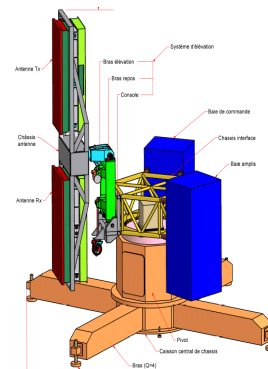


Fig. 1 Overview of the system

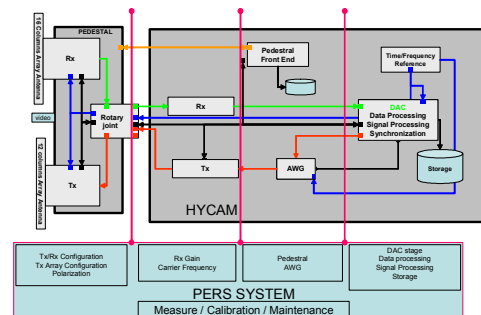


Fig. 2 Synoptic of the system

Hycam system includes:

- One Rx antenna, one Tx antenna, both being phased arrays and placed on a pedestal.
- A set of arbitrary signal generation cards.
- Microwave chains for up/down conversion and low-noise amplification.
- 24 power amplifiers.
- One optical rotary joint.