MetaSensing compact, high resolution interferometric SAR sensor for commercial and scientific applications

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***Abstract*— For the first time in the world airborne Frequency Modulated Continuous Wave (FMCW) Synthetic Aperture Radar (SAR) images have been acquired in interferometric mode. The paper reports on the X-band images collected by the new high resolution, compact MetaSensing interferometric SAR sensors in 2009.**
MetaSensing approach allows cost-effective SAR mapping by employing small, readily available Cessna 172/182 or similar in order to drastically cut the costs of current radar campaigns for scientific and commercial applications.
MetaSensing X-band SAR sensor is able to transmit more than 1.4 GHz of bandwidth and its versatile two receiving channels allow along-track and cross-track interferometric acquisitions.
A fully polarimetric L-band sensor is in the final test stage and is available from the third quarter of 2010.
The new MetaSensing approach is an optimal solution for commercial and scientific application which requires SAR mapping on local areas.

I. Introduction

By combining Frequency Modulated Continuous Wave (FMCW) technology and advanced Synthetic Aperture Radar (SAR) techniques [1], MetaSensing has developed a very high resolution, cost-effective airborne sensors operating at X-band.

High resolution mapping is desirable for homeland security, environmental assessment and infrastructure monitoring, but it has been usually too expensive or of difficult realization.

MetaSensing provides the cost effective mapping solution which meets the needs of scientific institutes and private companies who face daily the increasing demand for accurate monitoring. The mapping technique is based on SAR, a technology for producing imaging employing a radar sensor [2].

Big and expensive sensors and aircrafts are not needed for mapping campaigns using MetaSensing technology. Accurate mapping measurements can be carried out by employing small, readily available and cost effective aircrafts (see Figure 1), cutting the high operational costs of such campaigns. One of the main advantages of MetaSensing sensors is the very low irradiated power, which results in a low power consumption of the whole sensor. This feature is of very importance when considering the possible use of MetaSensing high resolution SAR sensors on board small Unmanned Aerial Vehicles (UAVs).

The reduced operational cost of the airborne mapping radar services directly translates into benefits for commercial and scientific airborne radar mapping applications.

In September 2009, flight campaigns have being organized for cross-track interferometric measurements. This configuration mode allows the generation of geocoded 3D images.

The paper reports on first radar images and interferograms generated by the MetaSensing sensor. The images parameters match to the expected values.

Airborne FMCW SAR interferograms have been generated for the first time in the world using the compact MetaSensing technology.

Based on these results, other sensors at different frequencies are being built at MetaSensing, i.e. at P, L, X and Ku band in order to provide a real multi-frequency, polarimetric affordable SAR solution.

II. MetaSensing SAR images

All the images presented in the paper have been processed with a spatial resolution of 40 cm and a pixel spacing of 25 cm. MetaSensing X-band sensor is however able to acquire

Fig. 1 The MetaSensing radar is a compact sensor that it can be mounted on small unmanned aircrafts or on single-engine aircrafts such as the Cessna 172, shown here. It is therefore easy to image any item or area on land at a much lower cost than traditional surveys.