Microwaves and Radar Institute

Status Report 2006 – 2011

Research Results and Projects
PREFACE

Since the last Institute’s evaluation in 2006, a new era started in Germany’s spaceborne radar program with the launch of TerraSAR-X and TanDEM-X. These missions are a result of a consistent radar technology program over more than 3 decades. Our Institute has participated and shaped this program from the very beginning, when Germany contributed with the X-band radar systems for the space shuttle missions Spacelab-1, SIR-C/X-SAR and SRTM in 1983, 1994 and 2000, respectively. Besides the great success of the Institute in the national radar missions, it has increased its benchmark values remarkably in the last 5 years with respect to scientific output, acquired projects and finances. The Institute is the driving force of the SAR activities at DLR and also holds the DLR recognition as a Center of Excellence on Synthetic Aperture Radar since 2000.

Let’s first take a look back to the last five years, which couldn’t be more fascinating: On June 15, 2007, TerraSAR-X was launched. The first images were acquired and processed just 4.5 days after launch. This was a world record. Since then, TerraSAR-X has surpassed all expectations in terms of operability, performance and image quality.

Just 3 years later, TanDEM-X, which was initiated by the Institute jointly with EADS Astrium GmbH, was launched and opened a new era in spaceborne radar remote sensing: It is the first bistatic radar in space and the first close formation flight of two satellites with the orbit concept being developed and patented by the Institute. With the systematic acquisition of interferometric data, the operational phase of TanDEM-X started in December 2010 after successful monostatic and bistatic radar calibration. TanDEM-X set a new world record as the first image was acquired and processed just 3.5 days after launch.

22 days later the first DEM was produced with a height accuracy of only a few decimeters, due to the large distance between the satellites at that time. The global digital elevation model with 2 m relative height accuracy at 12 m posting will be available by mid 2014 and will certainly become a standard data set for innumerable applications, as it is a unique product in terms of coverage and accuracy. With TerraSAR-X and TanDEM-X we are demonstrating several innovative techniques and applications, including the first vegetation height measurement from space using single-pass polarimetric SAR interferometry.

Our new airborne SAR, F-SAR, performed its first operational flight campaign in 2009 and is now flying in 4 different frequencies in a fully polarimetric acquisition mode. Following the successful history of the predecessor system, E-SAR, we have performed several international flight campaigns with F-SAR in the last few years for the demonstration of advanced techniques, technologies, and applications, as well as to simulate data from future spaceborne SAR systems.

According to the recommendation from the last Institute’s evaluation, the TechLab – a new building for high-tech microwave sensor development – has been built and was inaugurated in 2009. With the exception of the mechanical lab, all the Institute’s laboratories, facilities and microwave sensor developments have been moved to the TechLab, providing a huge stimulus for our technology-related activities.

Let’s now take a look to the future. Tandem-L is a proposal of the Institute for an innovative radar mission that enables the systematic monitoring of dynamic processes on the Earth’s surface with unprecedented quality and resolution. The mission concept has been developed in the last 3 years in the scope of a pre-phase A study in cooperation with NASA/JPL. Tandem-L will answer key scientific questions about the biosphere,
geosphere, hydrosphere and cryosphere and will close essential gaps in climate research. Besides the scientific component, Tandem-L is distinguished by its high degree of innovation with respect to methodology (e.g. polarimetric SAR interferometry and tomography) and technology (e.g. digital beamforming in combination with a large reflector).

Our vision is that Tandem-L represents the next major milestone in the development of spaceborne radar systems and will form the basis for future generations of SAR satellites. It will unlock the door to a future global remote sensing system for the continuous observation of the Earth’s surface, as currently exists for weather prediction, where a network of geostationary satellites is used.

Due to the high degree of innovation and success achieved with TerraSAR-X and TanDEM-X, I believe that the last 5 years have been the most successful in the 100-year history of our Institute. It has been an honor and pleasure to work together with a first-class team of highly motivated colleagues and to be guiding the Institute towards new challenges.

I wish you an enjoyable reading of this report.

Oberpfaffenhofen, August 2011

[Signature]

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Contents

1 Overview

1.1 Institute’s Mission and Goals ................................................................. 1
1.2 Major Achievements ............................................................................... 6
1.3 Benchmark ............................................................................................. 11
1.4 Future Research Activities and Projects ............................................... 12

2 Research and Project Results

2.1 Spaceborne SAR Missions .................................................................... 15
  2.1.1 TerraSAR-X ...................................................................................... 15
  2.1.2 TanDEM-X ....................................................................................... 23
  2.1.3 Tandem-L ......................................................................................... 35
  2.1.4 Sentinel-1 ......................................................................................... 40
  2.1.5 ALOS PalSAR ................................................................................... 42
  2.1.6 BIOMASS ......................................................................................... 44
  2.1.7 CoReH2O ......................................................................................... 45
  2.1.8 SIGNAL ........................................................................................... 47

2.2 Microwave Systems: Research and Technology .................................. 49
  2.2.1 Digital Beamforming ........................................................................ 49
  2.2.2 Bistatic Radar ................................................................................... 55
  2.2.3 Traffic Monitoring ........................................................................... 58
  2.2.4 Experimental TanDEM-X SAR Processor ......................................... 63
  2.2.5 Calibration ......................................................................................... 68
  2.2.6 Polarimetric SAR Interferometry ....................................................... 73
  2.2.7 Tomography ..................................................................................... 78
  2.2.8 Antennas ......................................................................................... 81
  2.2.9 Compact Test Range Facility ............................................................. 83
  2.2.10 Radar-Based Surveillance of Space Debris ....................................... 85
## Contents

2.3 Airborne SAR ...................................................................................................................... 87  
2.3.1 The DLR Experimental Airborne SAR: E-SAR ................................................................. 87  
2.3.2 The New Airborne SAR: F-SAR ...................................................................................... 88  
2.3.3 Major Campaigns ........................................................................................................... 92  
2.3.4 Processing Algorithms ................................................................................................. 96  

2.4 Reconnaissance and Security .............................................................................................. 101  
2.4.1 Reconnaissance Missions ............................................................................................. 101  
2.4.2 Mission Planning ......................................................................................................... 103  
2.4.3 SAR Analysis ................................................................................................................ 107  
2.4.4 SAR Simulation ............................................................................................................ 108  
2.4.5 SAR Image Analysis ..................................................................................................... 111  
2.4.6 Protection of Spaceborne Systems ................................................................................ 113  
2.4.7 Ground-Based Radar Systems ..................................................................................... 114  
2.4.8 Radiometry and Security Applications ......................................................................... 116  
2.4.9 Radar Signatures ......................................................................................................... 123  
2.4.10 Metamaterials ............................................................................................................ 127  

3 Documentation

3.1 Academic Degrees ............................................................................................................ 129  
3.2 Guest Scientists ............................................................................................................... 134  
3.3 Scientific Awards ............................................................................................................. 135  
3.4 Participation in Scientific and Technical Committees ....................................................... 136  
3.5 Conferences ..................................................................................................................... 138  
3.6 Tutorials and Annual Courses .......................................................................................... 139  
3.7 Lectures at Universities .................................................................................................... 140  
3.8 Publications ...................................................................................................................... 141  
3.9 Journal Reviews and Editorial Boards ............................................................................. 173  
3.10 Patents ............................................................................................................................. 174  
3.11 Acronyms and Abbreviations ........................................................................................ 175
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Thank you very much for your interest.