Perspectives for future SAR Antenna Development (Review Lecture)

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A Synthetic Aperture Radar, principally, produces a long linear array antenna by means of computer technique moving a small antenna along a straight line and collecting and storing all signals with respect to amplitude, phase, frequency, polarization, and running time for gaining desired information with special processing algorithms. Therefore, a SAR is an antenna. The most essential SAR system component, however, is the real SAR antenna itself; it is, for example, the greatest weight driver for space borne SAR, and there is no SAR system design equation which does not content SAR antenna parameters.
Goal of the paper is to present the expected development of future antennas for space borne SAR based on the state of the art and to point out under that aspect some perspectives and visions for future space borne SAR systems.
Future space borne SAR systems will consist mainly of the antenna with a small number of peripheral elements only, like solar cells, GPS, power supply, downlink equipment etc.. The present space borne SAR Antenna will mutate to a complete Antenna SAR that means a SAR which is primary an antenna where all radar components inclusive the AD-Converter and the image processing computer are integrated. A substantial step to an Antenna-SAR is the expected progress in miniaturization shown in a respective roadmap. The miniaturization will drastically reduce the mass and volume of the antenna including the RF system down to 10 % of the today's value. Ultra-light-weight antennas with large structural components, such as deployable ore inflatable booms, and membranes with very low power consumption will be available during the next decade.
For a senor fleet in space consisting of many satellites in a well known and controlled formation flight each satellite receiver (and transmitter respectively) may be considered as a single element of a very large DBF-Array.
For airborne SAR the antenna dimensions are limited due to the size and shape of the platform. Here digital beam forming allows to form small sub arrays to a conformal array, a so called smart skin. For the next two decades broadband arrays are expected which are able to share between SAR, other radars, forward looking radar for example, electronic support as well as electronic countermeasures, and communication purposes. This will increase the effectiveness and the applicability of future SAR systems by reducing the overall mass, volume, and cost which are indispensable requirements for the future.
Based on both the states of the art and the expected developments of antennas, RF micro electronics, and SAR techniques and technologies an outlook in the future of SAR antenna development shows that the SAR Antenna will mutate to an Antenna SAR.