MAARSY - The new MST radar on Andøya/Norway

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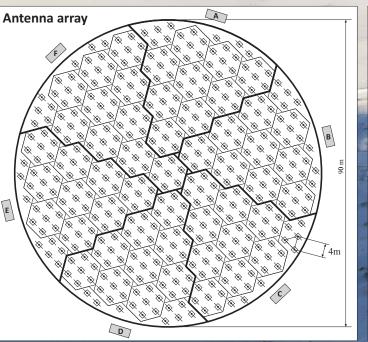The Leibniz-Institute of Atmospheric Physics in Kühlungsborn, Germany is installing a new powerful VHF radar on the North-Norwegian island Andøya (69.30°N, 16.04°E). The new **M**iddle **A**tmosphere **A**lomar **R**adar **Sy**stem (MAARSY) replaces the ALWIN radar which has been operated continuously on Andøya for more than 10 years.

The new system is a monostatic radar operated at 53.5MHz with an active phased array antenna consisting of 433 Yagi antennas. The 3-element Yagi antennas are arranged in an equilateral triangle grid forming a circular aperture of approximately 6300m^2. Each individual antenna is connected to its own transceiver with independent phase control and a scalable output up to 2 kW. This arrangement allows very high flexibility of beam forming and beam steering with a symmetric radar beam of a minimum half power beam width of 3.6°, a maximum directive gain of 33.5 dBi and a total transmitted peak power of approximately 800 kW. The IF signals of each 7 transceivers connected to each 7 antennas arranged in a hexagon are combined to 61 receiving channels. Selected channels or combinations of IF signals are sent to a 16-channel data acquisition system with 25 m sampling resolution and 16-bit digitization specified which will be upgraded to 64 channels in the final stage. The high flexibility of the new system allows classical Doppler beam swinging as well as experiments with simultaneously formed multiple beams and the use of modern interferometric applications for improved 3D studies of the Arctic atmosphere from the troposphere up to the lower thermosphere with high spatiotemporal resolution.

The installation of MAARSY started in September 2008 with the dismantling of the antenna array of the ALWIN radar. The installation of the new antenna array and the laying of the RF cables between the 433 antennas and the six containers accommodating the transceivers as well as the 61 IF cables from the containers to the radar control house was completed in August 2009. The radar control and data acquisition hardware as well as 217 transceiver modules were installed in spring 2010. This initial expansion stage using 31 hexagons of the array has full beam steering capability with a symmetric radar beam of a half power beam width of 5.8°.

The full extension of MAARSY is scheduled for spring 2011.

Basic system parameters

Location	Andenes, Norway (69.30°N, 16.04°E)
Operating Frequency	53.5MHz
Peak power	~ 800kW
Allocated bandwidth	4 MHz
Maximum duty cycle	5%
Pulse length	≥ 0.33 µs
Sampling resolution	25m
Transmitted waveforms	Single pulse, Complementary code, Barker code
Pulse shapes	Square, Gaussian, Shaped Trapezoid
Antenna array	433 three-element (crossed) Yagi
Effective antenna area	~ 6300 m^2
Half power beam width	3.6°
Directive gain	33.5 dBi
Beam directions	arbitrary zenith angles < 30°
Receiving channels	16 (64)

Antenna array

System block diagram