

A Ground-based Ultra-wideband Ultra-high Frequency Mills Cross Array for Ice Sounding

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In order to fully validate the concept of ice sounding at UHF frequencies as well as to image internal layers within the bottom 10% of ice, a surface-based multi-channel radar system operating from 600 to 900 MHz with a significantly higher sensitivity has been designed. From the link budget calculation, the radar would require a large antenna array with a two-way gain of 60 dBi and a peak transmit power of 100 W to sound ice with a thickness of more than 3 km. An electrically large ultrawideband UHF monopole antenna array has been designed to meet these specifications. The monopole array is comprised of eight planar subarray modules, which in combination will form a 16 m by 17 m Mill's cross array configuration to maximize spatial selectivity in both cross-track and along track directions. Each planar subarray module is 1 m by 2 m in size with a 6.35 cm thick rigid insulation foam panel separating the individual monopole elements from metal foil ground plane on the top such that the maximum radiation is directed to nadir. Each subarray panel consists of 4 by 8 circular monopole antenna elements with a spacing of 0.5 m. Metal foil strips are placed along each row covering the bottom half of each board, forming a contiguous ground along the entire Mill's cross array. The total weight of each subarray panel is 20 lbs., making for a very lightweight and low-profile antenna construction. The radar system was deployed to the East Greenland Ice-core Project (EGRIP) site in August 2018 for field tests. Radar system design with focuses on the antenna design together with field test results will be presented at the conference.