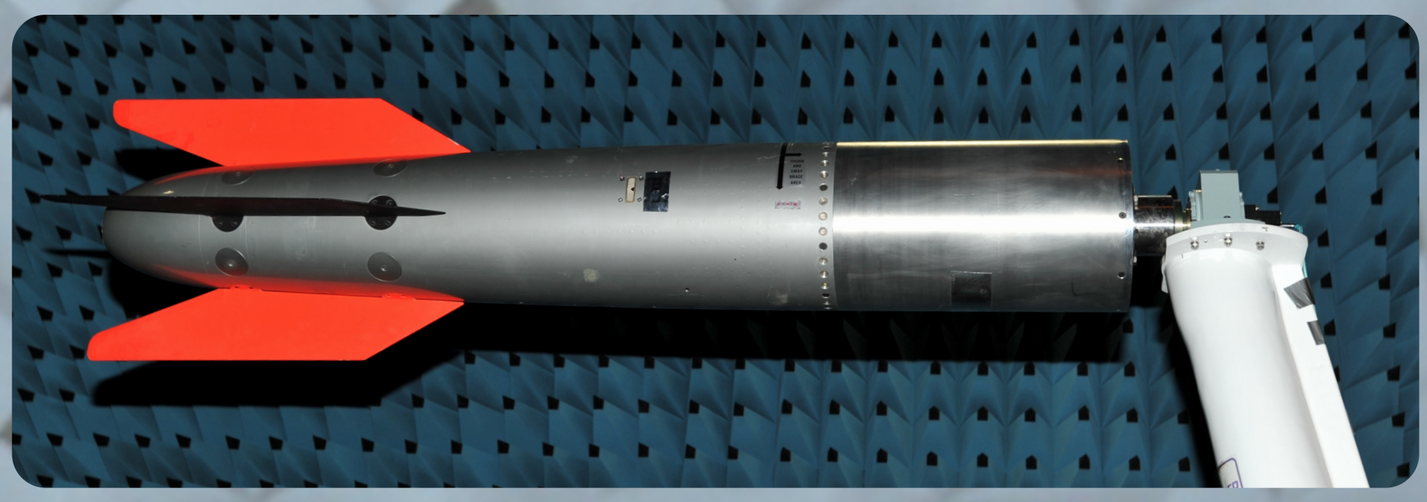
B61 Telemetry Link Analysis for Tonopah Test Range

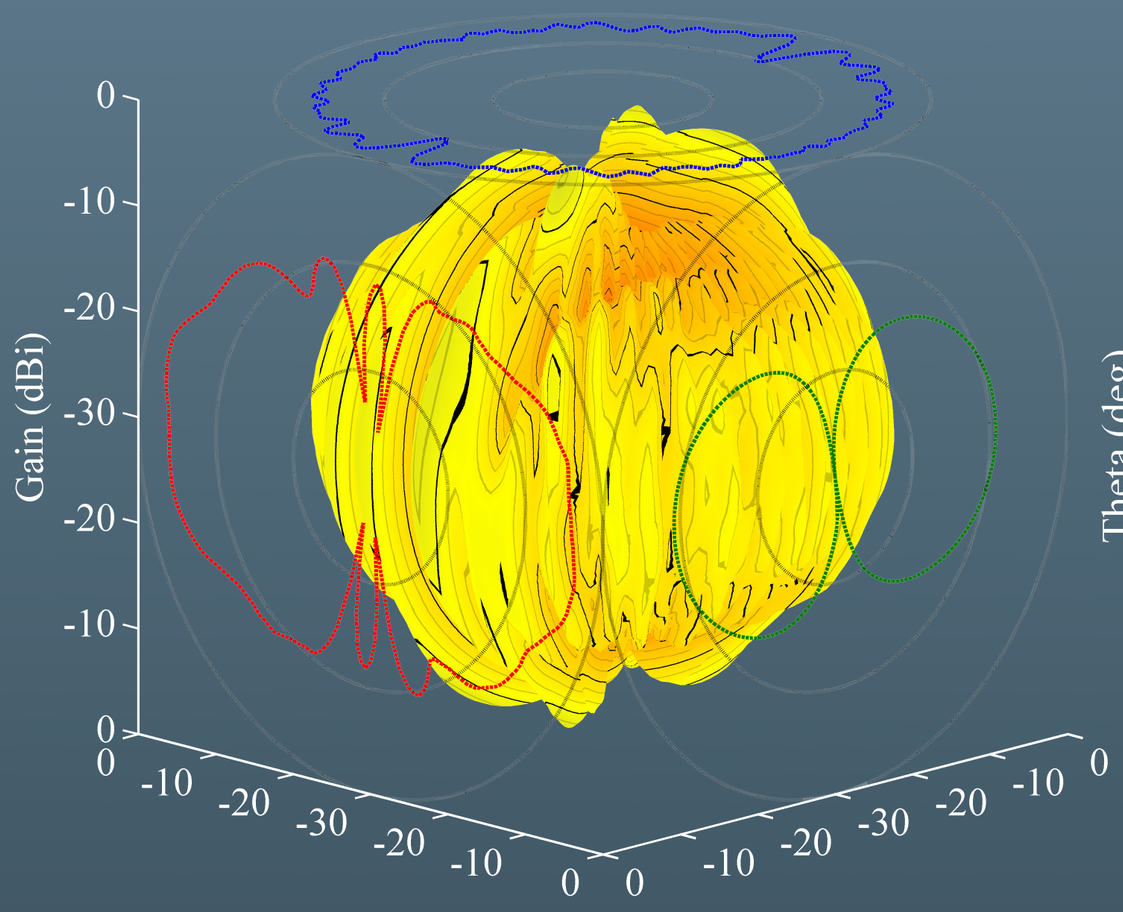
SAND2012-6871P

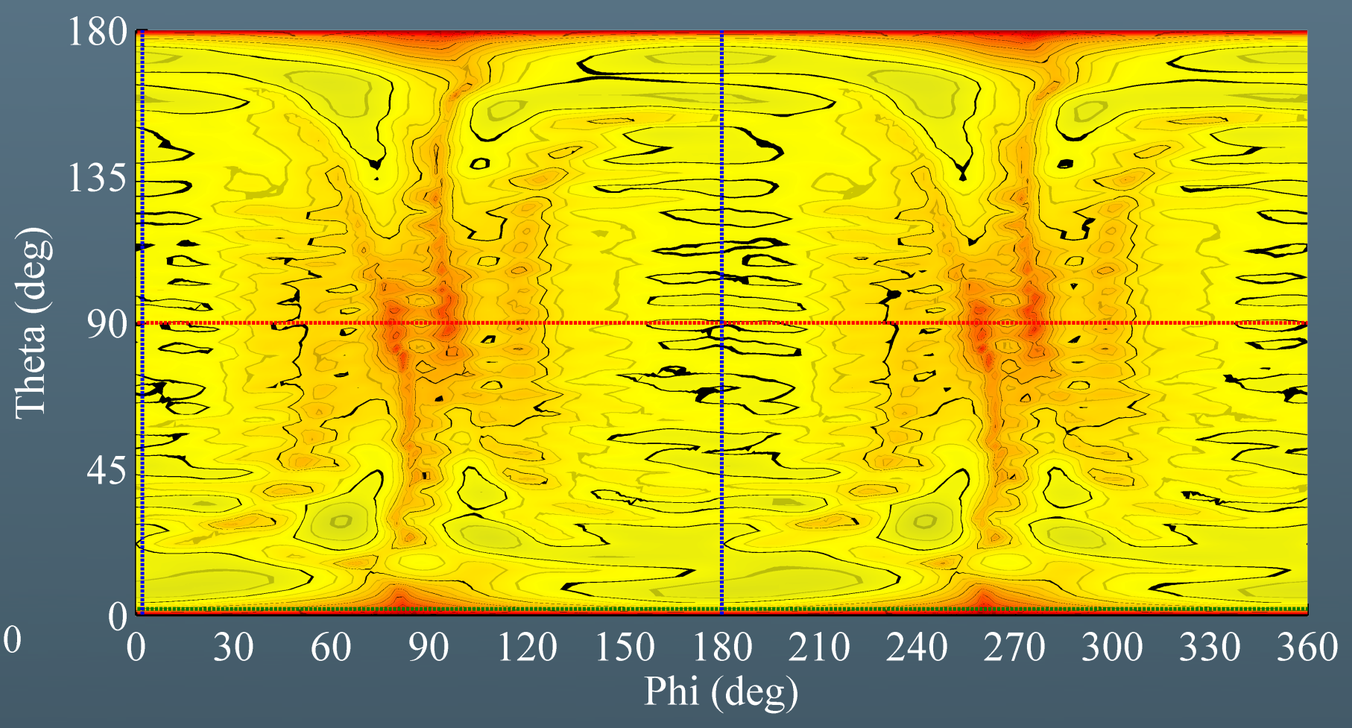
Donald R. Dowdle, Matthew D. Sena, Michael A. Forman, Jeffrey N. Jortner, Randy M. Clarin, Kiet Tieu
Sandia National Laboratories, Livermore, CA 94550 USA

Array Pattern Measurements

The telemetry array pattern was measured in an anechoic chamber at Sandia National Laboratories in New Mexico using a B61 aft-section with telemetry antennas, power divider, and cabling. The pattern measurements are presented below as a 3D spherical plot and as a 2D surface plot with principle-plane cuts at Θ = 0º, Θ = 90º, and Φ = 0º. Gray contour lines represent 1 dB divisions in gain and black lines represent 3 dB divisions in gain.







B61 Flight Simulation

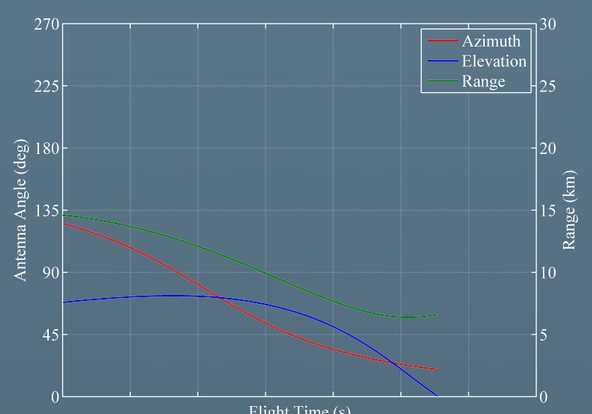
Measured telemetry array pattern, vehicle trajectory and attitude are included in the flight simulations using Satellite Tool Kit Pro (STK). A dynamic link budget is calculated using the vehicle geometry to ground stations at Tonopah Test Range (TTR) in Nevada.

The azimuth, elevation, and range to the receiving ground station are shown to the left for three release types: level flight at 50,000 ft (a), steep loft at 16,000 ft (b), and retarded air at 10,000 ft (c). Flight times have been removed for distribution purposes.

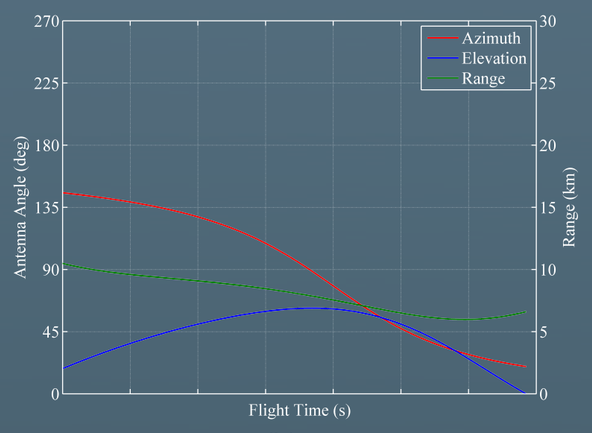
Included to the top right is a roll-plane extrema plot for the telemetry array with an angle Θ of 180º at the nose of the B61 and 0º at the tail. The roll-plane extrema shows the maximum and minimum array gain for a given rotation of the vehicle in Φ. This provides a best and worst case gain for link calculations given the attitude of the B61 during flight.

B61 flight simulations use measured array patterns, simulated vehicle trajectory and attitude, and ground terrain and imagery to provide a detailed link budget prior to an actual test flight. The measured array gain allows for a more accurate dynamic calculation of received signal power at the ground station shown to the lower right.

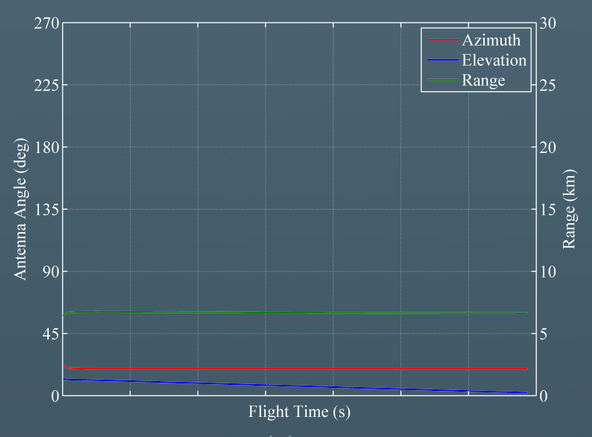
The received signal power shows the effect of the gain roll-plane extrema as the vehicle rotates during flight.



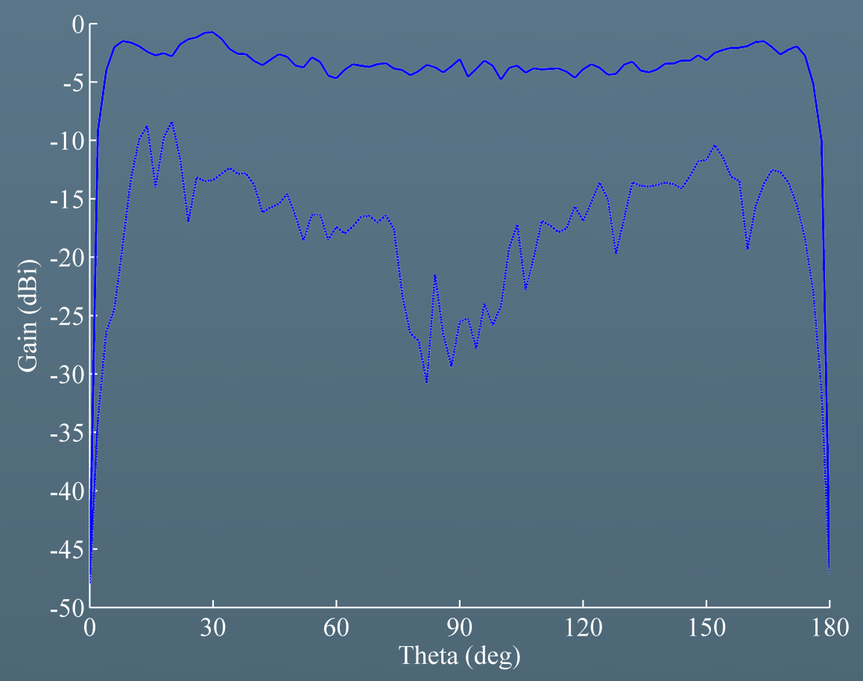
(a)

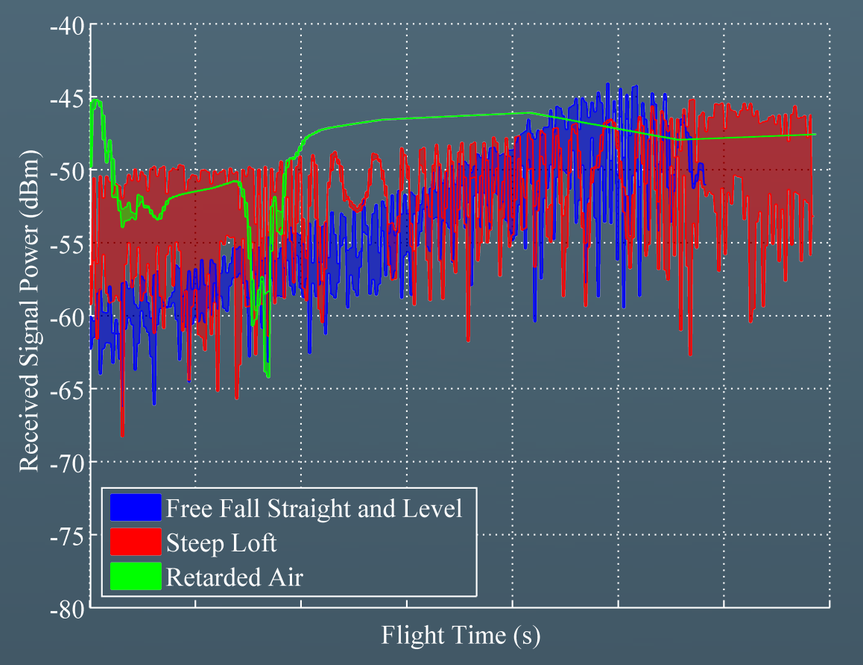


(b)



(c)





Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the United States Department of Energy's National Nuclear Security Administration under Contract DE-AC04-94AL85000. Approved for public release under SAND2012-xxxx; further dissemination unlimited.

Sandia National Laboratories