Determining the Probability of Violating Upper-Level Wind Constraints for the Launch of Minuteman III Ballistic Missiles at Vandenberg Air Force Base

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The 30th Operational Support Squadron Weather Flight (30 OSSWF) provides comprehensive weather services to the space program at Vandenberg Air Force Base (VAFB) in California. One of their responsibilities is to monitor upper-level winds to ensure safe launch operations of the Minuteman III ballistic missile. The 30 OSSWF tasked the Applied Meteorology Unit (AMU) to analyze VAFB sounding data with the goal of determining the probability of violating (PoV) their upper-level thresholds for wind speed and shear constraints specific to this launch vehicle, and to develop a tool that will calculate the PoV of each constraint on the day of launch.

In order to calculate the probability of exceeding each constraint, the AMU collected and analyzed historical data from VAFB. The historical sounding data were retrieved from the National Oceanic and Atmospheric Administration Earth System Research Laboratory archive for the years 1994-2011 and then stratified into four sub-seasons: January-March, April-June, July-September, and October-December. The AMU determined the theoretical distributions that best fit the maximum wind speed and maximum wind shear datasets and applied this information when calculating the averages and standard deviations needed for the historical and real-time PoV calculations. In addition, the AMU included forecast sounding data from the Rapid Refresh model. This information provides further insight for the launch weather officers (LWOs) when determining if a wind constraint violation will occur over the next few hours on the day of launch.

The AMU developed an interactive graphical user interface (GUI) in Microsoft Excel using Visual Basic for Applications. The GUI displays the critical sounding data easily and quickly for LWOs on day of launch. This tool will replace the existing one used by the 30 OSSWF, assist the LWOs in determining the probability of exceeding specific wind threshold values, and help to improve the overall upper winds forecast for the launch customer.

This presentation will describe how the AMU calculated the historical and real-time PoV values for the specific upper-level wind launch constraints and outline the development of the interactive GUI display.