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Mr. North is a senior aerospace engineer in the Systems Analysis and Concepts Directorate at the NASA Langley Research Center.

He has provided mission analysis and conceptual design engineering for NASA's space exploration program since 2004. He is currently serving as the mechanical engineering and mockup lead for NASA's Altair lunar lander design team.

Mr. North previously worked at Pratt & Whitney on various rocket engine and jet engine design teams including the Space Shuttle Main Engine, the RL-10 rocket engine, and the F-100, F-135 and Joint Strike Fighter jet engines. He also worked at Siemens designing low-emissions combustors for industrial gas turbines.

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## AIRBORNE WIND ENERGY TECHNOLOGY AND REGULATORY GAPS: A **NASA** PERSPECTIVE

*D. North, NASA Langley Research Center*

NASA has identified key areas of support that are needed to aid in the advancement of this promising technology. These areas include airspace regulation development , system-level and subsystem-level modeling and simulation tools, aerodynamic design and analysis tools tailored for AWE, materials development, autonomous controls technologies, and open prototype testing sites.

Current airspace regulations in both the U.S. and Europe present a challenge going forward for airborne wind energy developers. NASA is working with the Federal Aviation Administration to help them understand the operational requirements of the proposed systems in order to develop new regulations to operate AWE systems in U.S. airspace.

NASA Langley Research Center specializes in both system-level and subsystem-level simulation and testing of aeronautical systems. NASA Langley's potential contribution to the AWE research effort could include work on autonomous control systems, wind tunnel testing, application of inflatable structures to soft kite solutions, tether drag reduction, development of a concept analysis comparative toolkit across the broad design space, aeroacoustic and aeroelastic analysis. Other NASA centers offer additional valuable research capabilities, including the potential of NASA restricted airspace testing centers that could offer third party corroborative experimental evidence and statistical evidence of acceptable airspace safety. Current efforts at NASA are identifying the people, organizations, and tools within the agency to begin collaborative AWE research with private industry and other government agencies.