ABSTRACTS OF PAPERS, 87th Annual Meeting of the Virginia Academy of Science, May 27-29, 2009, Virginia Commonwealth University, Richmond VA

Aeronautical and Aerospace Sciences

FROM THE EARTH TO SPACE WITH NACA/NASA. M. Leroy Spearman. NASA-Langley Research Center, Hampton, VA 23681 & Heidi Owens, Auburn University, Auburn, AL 36849. Leonardo da Vinci envisioned man-flight in the 15th century and designed a practical airplane concept in 1490. Many other pioneers proposed various types of flying machines over the next 400 years but it was not until December 17, 1903 that the Wright Brothers, at Kitty Hawk, NC, were credited with achieving the first manned-powered flight. Over the next 100 years, several factors have influenced advances in aviation. The use of aircraft by European nations in World War I resulted in concern that the U.S. was lagging in aviation developments. This lead to an act of the U.S. Congress in 1915 that established the National Advisory Committee for Aeronautics (NACA) with the charge to conduct aerodynamic research. The research began at Langley Field, VA in the early 1920's. Over the years this research has transformed low-speed, wood and fabric, propeller-driven airplanes into high speed, all-metal, jet-propelled airplanes. Jet and rocket propulsion enhanced the fields of supersonic and hypersonic aerodynamic flight and provided for access to space. In July 1955 the White House announced plans to launch an earth-orbiting satellite. Before this was done, however, the Soviet Union successfully launched Sputnik, the world's first artificial satellite in October 1957. This event caused concern that the U.S was lagging in the 'space race' and lead directly to the establishment of the National Aeronautics and Space Administration (NASA) in July 1958. The nucleus of the NASA was the existing NACA with the charge expanded to include space research. The skilled researchers at NASA-Langley have continued to provide improvements in aircraft developments and now contribute to the development of spacecraft as well. Continued advances in aerospace research require well trained researchers. To this end, NASA-Langley participates in mentorship programs to encourage high school students to become researchers. The first author of this paper has been a mentor for many years and the second author of this paper has been a student in the program. Encouragement for researchers is also provided by the VAS and the VJAS.

SIGNIFICANT AERODYNAMIC RESEARCH AT NACA/NASA DURING THE FIRST CENTURY OF FLIGHT. M. Leroy Spearman .NASA- Langley Research Center Hampton, VA, 23681 & Heidi Owens, Auburn University, Auburn, AL 36849.The Wright Brothers are credited with having flown the first manned, heavier-than-air, powered aircraft in December 1903 but the U.S. was slow in accepting the newly introduced airplane. In England, Geoffrey deHavilland produced his first aircraft in1908. In France, Louis Bleriot produced an aircraft in1908. Pre-World War I activities in Europe created concern that the U.S. was lagging behind in the development of aircraft. This concern lead to the creation in the U.S. in 1915 of the National Advisory Committee for Aeronautics (NACA) - a government-funded

research organization that was charged, "to supervise and direct the scientific study of the problems of flight with a view toward their practical solution.". Research began at the NACA in the early1920's and has lead to the advancement from low-speed subsonic flight to high-speed transonic, supersonic, and hypersonic flight and to the possibility of achieving space flight. The possibilities of space flight lead to the creation of the National Aeronautics and Space Administration (NASA) in 1958. The NASA absorbed the existing NACA and the charge for aeronautical research was expanded to include space research. Many aerodynamic problems have been analyzed and corrected through wind tunnel testing. In addition to the wind tunnel research, significant aerodynamic results have been provided with rocket-launched pilot-less aircraft as well as the X series of manned aircraft The research conducted by the NACA / NASA has had a direct impact on the design of aircraft and spacecraft for both civil and military systems.

SOME THOUGHTS ON THE HISTORY OF FLIGHT. M. Leroy Spearman, NASA-Langley Research Center, Hampton, VA 23681 & Robert W. Heath , RRMC, Newport News, VA. Leonardo da Vinci envisioned man-flight in the 15th century and designed a practical airplane concept in 1490. Many other pioneers proposed various types of flying machines over the next 400 years but it was not until December 17, 1903 that the Wright Brothers, at Kitty Hawk, NC, were credited with achieving the first manned-powered flight. Over the next 100 years, several factors have influenced advances in aviation. The use of aircraft by European nations in World War I resulted in concern that the U.S. was lagging in aviation developments. This lead to an act of the U.S. Congress in 1915 that established the National Advisory Committee for Aeronautics (NACA) with the charge to conduct aerodynamic research. The research began at Langley Field, VA in the early 1920's. Over the years this research has transformed low-speed, wood and fabric, propeller-driven airplanes into high speed, all-metal, jet-propelled airplanes. Jet and rocket propulsion enhanced the fields of supersonic and hypersonic aerodynamic flight and provided for access to space. In July 1955 the White House announced plans to launch an earth-orbiting satellite. Before this was done, however, the Soviet Union successfully launched Sputnik, the world's first artificial satellite in October 1957. This event caused concern that the U.S was lagging in the 'space race' and lead directly to the establishment of the National Aeronautics and Space Administration (NASA) in July 1958. The nucleus of the NASA was the existing NACA with the charge expanded to include space research. The skilled researchers at NASA-Langley have continued to provide improvements in aircraft developments and now contribute to the development of spacecraft as well.

AN AIRCRAFT DESIGN CONCEPT APPLICABLE FOR VARIOUS MISSION REQUIREMENTS M. Leroy Spearman, NASA-Langley Research Center, Hampton, VA and Katie Klein, MITRE Corp., McLean,VA. Airlift capability can be useful as a means of providing the logistic support of manpower, supplies and equipment in the event of natural disasters such as floods and hurricanes. The need for such support could be within the homeland area or might be at distant worldwide locations. Often, the location for such support may be inaccessible by normal means of transportation. Conventional aircraft can provide the need for speed but the load capacity may be

limited and the requirement for a suitable landing area is critical. An effort to combine the requirements for capacity, speed and basing, has lead to some studies of unconventional aircraft designs. One design concept that has been considered utilizes a large rectangular wing surface with large bodies attached to each wing tip. The use of the two large bodies results in essentially doubling the capacity of a conventional single-body aircraft with no increase in length. The large area of the wing provides adequate lift to sustain normal flight with heavy loads. The bodies could also be shaped to provide for water-based operation With the wing positioned high on the bodies a cushion of air would be provided that would permit operation as a wing-in-ground (WIG) effect vehicle. With judicious positioning of trailing-edge wing flaps and vectoring jet nozzles, vertical take-off and landing (VTOL) capability could be achieved. In addition, the bodies could be designed to contain some helium for buoyant lift with additional kinetic lift provided by the wing. Thus, the inboard wing, twin-body arrangement potentially provides for large load carrying capability with a vehicle that could operate in free-air as an airplane, or near the surface in a WIG mode. Such a design would also have greater basing freedom in a VTOL mode or as a hybrid airship.

Agriculture, Forestry and Aquaculture Science

THE EFFECTS OF SHEEP ON NITROGEN CONCENTRATIONS IN SOIL. Sarah J, Casey, Dept. of Biol., Ferrum College, Ferrum, VA 24088 & Brian D. Whitaker, Dept. of Agriculture, Ferrum College, Ferrum, VA 24088. Ruminants are an important part of agriculture because they add value to the existing ecosystem. This study was conducted to evaluate the effects of grazing sheep on agroforestry pasture on the nitrogen content of the soil. Sheep were placed on a traditional grazing pasture or an agroforestry pasture (with trees). Soil samples were collected at 0, 30, and 60 d during the study and analyzed for total nitrogen content at the end of the study. The amount of nitrogen in the soil from the forest without sheep was significantly greater ($P < 0.05$) compared to the other plots. These results indicate that producing sheep on agroforestry based pasture may increase the quality of the soil by increasing the nitrogen content over time.

NODULATION TRAITS OF TEPARY BEAN INOCULATED WITH 15 BRADYRHIZOBIAL STRAINS. Michele Mohrmann & Harbans L. Bhardwaj, Agricultural Research Station, PO Box 9061, Virginia State University, Petersburg VA 23806. In order to develop tepary bean (*Phaseolus acutifolius* A. Gray), a highly drought-tolerant summer crop, as a summer legume cover crop to meet N needs of succeeding winter cereals, we studied nodulation following seed treatment of three tepary bean lines (Black, Tan, and White-seeded) with 15 bradyrhizobial strains. In this replicated greenhouse study, we nodule number, and nodule size from approximately 40-day old plants. Nodule numbers were recorded on a scale of 1 (less than five nodules per plant) to 3 (greater than 20 nodules per plant) whereas nodule size was recorded on a scale of 1 (nodules small and similar to mustard/canola seed in size) to 3 (nodules large and similar to soybean seed in size). We also recorded chlorophyll readings with Minolta SPAD-502 meter. Significant differences were observed among