

## UND-PURDUE HYPERSONIC RESEARCH PARTNERSHIP AGREEMENT

February 23, 2015

The following summarizes a Agreement between the University of Notre Dame and Purdue University to partner on the development new “quiet” hypersonic wind tunnels, with the ultimate objective of being designated a national “Hypersonics Research, Testing and Evaluation Center”.

Vehicles that can travel at hypersonic speeds within the atmosphere are becoming essential to the security of the United States and its partner nations. This is motivated by the need for information gathering anywhere in the world on short notice, for example in the loss of satellites, as well as high-speed maneuverable weapons delivery. We presently lack critical information with regard to aerodynamic heating that is essential for the optimal design of these vehicles. This information can come from ground testing in a properly designed hypersonic wind tunnel.

In partnership with Purdue University, we propose to build two ground test facilities that are designed to address critical issues of turbulent transition and heat transfer on vehicles flying at hypersonic Mach numbers. These facilities will have design Mach numbers of 6 and 10. Both of these will be based on Ludwig tube designs. The most important aspect of these facilities is that they will accurately simulate the low disturbance flight environment. Such designs are referred to as “quiet” wind tunnels. Although the concepts of the design are well known, the few existing facilities are very limited in size and do not allow for testing models of suitable scale. By applying the proven principles behind these smaller facilities, the substantially larger hypersonic quiet tunnels we propose will enable economical ground testing that is essential to the successful design and implementation of current and future generations of hypersonic air vehicles.

The Mach 6 “quiet” Ludwig tube design is well underway, with Boeing partnering on the design of the nozzle, and an ONR/AFOSR DURIP proposal currently under review. The University of Notre Dame is also currently seeking benefaction support for the facility and supporting infrastructure. Through this agreement between the University of Notre Dame and Purdue University, the Mach 6 facility will be located at the University of Notre Dame.

The development of the Mach 10 facility presents a significantly greater challenge because of the higher temperatures it involves. However there is substantial industry interest in developing such a facility and when completed, it will assuredly become a national research asset. Through this agreement between the University of Notre Dame and Purdue University, we will share in the research and development needed for the Mach 10 facility, with the intend of locating it at Purdue University.

The two hypersonic wind tunnels will be the centerpiece of a “Hypersonics Research, Testing and Evaluation Center” that will attract aerospace companies presently involved in developing hypersonic air vehicles. These include Boeing, Raytheon, Lockheed-Martin, and Rocketdyne, as well as a number of small businesses. This influx of high technology talent will have a significant impact on the state of Indiana. Additionally these facilities will employ approximately 15 full-time engineering and technical staff for their day-to-day operation. The Center will also jointly involve from 15-20 Ph.D. students annually from the two Universities.