UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Senior Design Project Information

Company Name	*Mechanical Engineering*	**Date Submitted**	*10/15/2018*
Project Title	*Hypersonic Wind tunnel* **(UNCC_HYPER)**	**Planned Starting Semester**	*Spring 2019*

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	
Computer		Systems	
Other ( )			

Project Overview and Requirements:

The intention is to construct a new Hypersonic Wind Tunnel to allow the potential for research in coordination with **ONR's Code 35 Division 352** of **"Hypervelocity Projectile Program".**

The design of the Hypersonic Wind Tunnel will be similar to the same at Virginia Tech. See https://www.aoe.vt.edu/research/facilities/hyperson.html. Per their web page, the Virginia Tech blow-down type high-speed wind tunnel operates at speeds ranging from Mach 2 to 7 and is shown in Figures 1 and 2. The blow-down type wind tunnel offers run times on the order of a few seconds at high Mach numbers with relatively steady flow conditions. This facility was obtained through their close and long-term collaborations with the Institute of Theoretical and Applied Mechanics of the Russian Academy of Sciences in Novosibirsk, Russia.

Figure 1. Virginia Tech Hypersonic Wind Tunnel

Air (or other working gas) is supplied from a compressor to charge the storage bottles visible within the frame at the bottom. A special fast-acting control valve initiates flow into the plenum chamber. The flow then passes through a contoured, converging-diverging nozzle and out through the diffuser. Due to the working principle of the tunnel and the fast-acting control valve, there is only a slow decrease in total pressure during the run. The variation of the total pressure during the run is in the range of approximately 10%. For Mach numbers above 4, an electric heater raises the total temperature up to 800 K to prevent liquefaction. The nozzle exit diameter is 100 mm. The test cabin arrangement permits the use of relatively large instream models, especially at the higher Mach numbers.

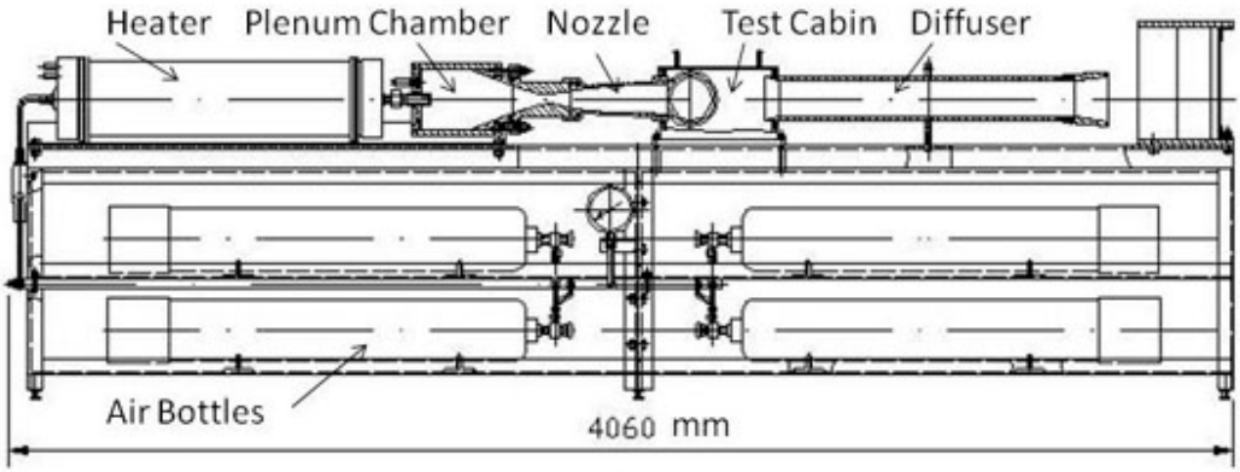

Figure 2. Layout of the Virginia Tech high-speed wind tunnel

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Expected Deliverables/Results:

Deliverables include:

- The full design package of a new Hypersonic Wind Tunnel to include CAD drawings, flow calculations and data acquisition options.
- The construction of the new Hypersonic Wind Tunnel in the Motorsports research shop.
- A users manual with step by step instructions to include safety procedures.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Familiarity or interest in design, procurement, fabrication, and assembly.
- Familiarity or interest in hypersonic testing technology.
- Veterans are preferable

Additional note. I would like for Mr. Jason Solomon to be on the team and be team lead. This project is funded as part of a veteran initiative from the Office of Naval Research for early entry veteran grad students. Jason is an early entry grad student and veteran, and has expressed interest in working on this as his graduate work.