

Arnold Engineering Development Complex

Integrity - Service - Excellence

T&E: Young Guns Perspectives

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U.S. AIR FORCE



**Hypervelocity
Wind
Tunnel 9**





U.S. AIR FORCE

Who is George Moraru?

Project/Test Engineer at AEDC Hypervelocity Wind Tunnel 9

- Planning & execution of hypersonic system test campaigns
- PAQ strategic hire

M.S. from Purdue University, 2015

- Research in hypersonic boundary-layer transition; Dr. Steven Schneider

Managed two unique HSST-funded hypersonic test programs at Mach 10 (FY14) and Mach 14 (FY16)

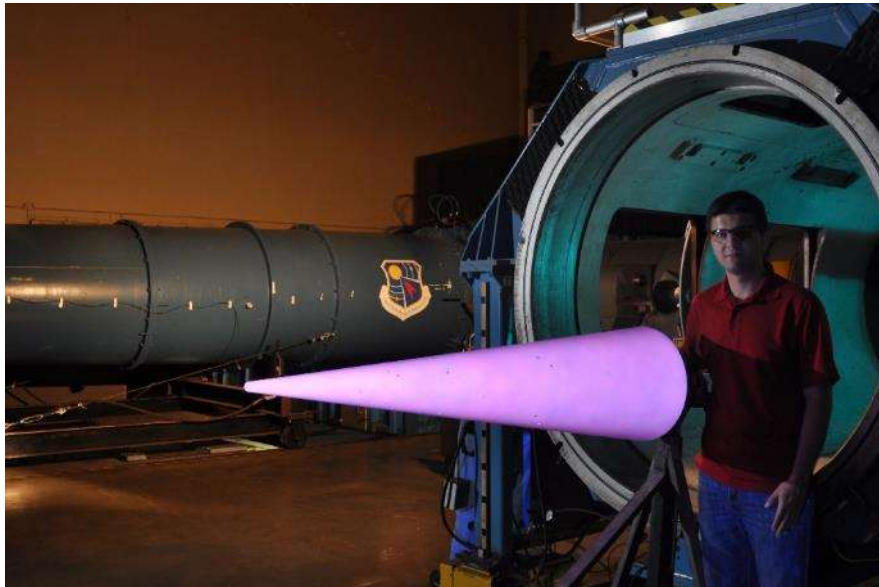
- Successful integration of S&T and T&E
 - T&E SMEs, Universities, industry researchers
 - Novel instrumentation

Enhanced understanding of complex phenomena critical to DoD weapons systems

- Hypersonic system development risk-reduction
- Validation of CFD

Manage and direct the UMD undergraduate student workforce development pilot program (HCoTE)

- Hypersonic research
- Develop the next-gen hypersonic workforce in T&E



Test Before Flight



Early Workforce Development



Current shortfall

- Small hypersonic T&E community combined with cyclic nature of the business has led to large knowledge gaps in the T&E workforce
 - Impact on system development; systems proceed to flight with higher risk
 - Likely relevant in other T&E communities
- Current T&E workforce is aging
 - Lack of overlap between experienced and inexperienced personnel

Future solution

- Investment in the next generation of T&E workforce must start early
 - Required skills are largely developed on the job
 - Need for interaction between T&E community and universities
 - Internships, co-ops, graduate work
- Small but highly-successful pilot program ongoing at AEDC Tunnel 9 in collaboration with TRMC (HCoTE) and UMD
 - ~ 10 graduate and 5 undergraduate students
 - Growth of existing staff

Challenges

- Sensitive work
- Implementation across a multi-disciplinary, multi-organizational, and multi-geographic domain

Level PRL or TRL	Technology Readiness Level	T&E Personnel Readiness Level (PRL)
9	Actual system proven through successful mission operations	Senior level T&E workforce with sufficient years of professional training, T&E experience, and management responsibility
8	Actual system completed and qualified through test and demonstration	Senior level T&E workforce with sufficient years of professional training and operational T&E experience
7	System prototype demonstration in an operational environment	Intermediate level T&E workforce, <i>extensively trained & tested in operational T&E environment</i>
6	System/subsystem model or prototype demonstration in a relevant environment	Intermediate level T&E workforce, <i>trained & tested in relevant T&E environment (Demonstrated complex technical project leadership)</i>
5	Component and/or breadboard validation in relevant environment	Intermediate level T&E workforce <i>trained in relevant T&E environment (Demonstrated technical project leadership)</i>
4	Component and/or breadboard validation in laboratory environment	Intermediate level T&E workforce with <i>extensive training in research or laboratory environment (Doctoral degree or sole responsibility for a technical project)</i>
3	Analytical and experimental critical function and/or characteristic proof of concept	Entry level T&E workforce with advanced training of proven rigor or capability <i>(Master's degree or prime responsibility for a subtask on a technical project)</i>
2	Technology concept and/or application formulated	Entry level T&E workforce with S&T background from certified training program <i>(Bachelor's degree or assistant on a technical project)</i>
1	Basic principles observed and reported	Entry level T&E workforce with <i>little or no previous training in S&T or T&E (Undergraduates)</i>

Marren, D., Marineau, E., & Yu, K. (2016). *ITEA Journal*, 37(2), 127-136.



Questions



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