

DELIVERing a ReVAMPed Vacuum Technology Program



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Workforce Challenges

Advanced manufacturing and research organizations depend directly or indirectly on **vacuum technology**

- Vacuum technology use is increasing
- Senior technical personnel are retiring
- Businesses anticipate a **shortage of workers** with the knowledge and skills to support complex vacuum systems

Vacuum-reliant industries need a pipeline of educated workers with STEM knowledge (algebra, gas chemistry, physics) and hands-on experience with vacuum systems

Education Challenges

- Vacuum technology education is a niche in engineering technology education
- Jobs requiring vacuum technology skills are a niche in advanced manufacturing
- Regional need is unevenly distributed across the U.S.

Small class sizes cannot sustain vacuum technology education programs

TO DO... Increase enrollments

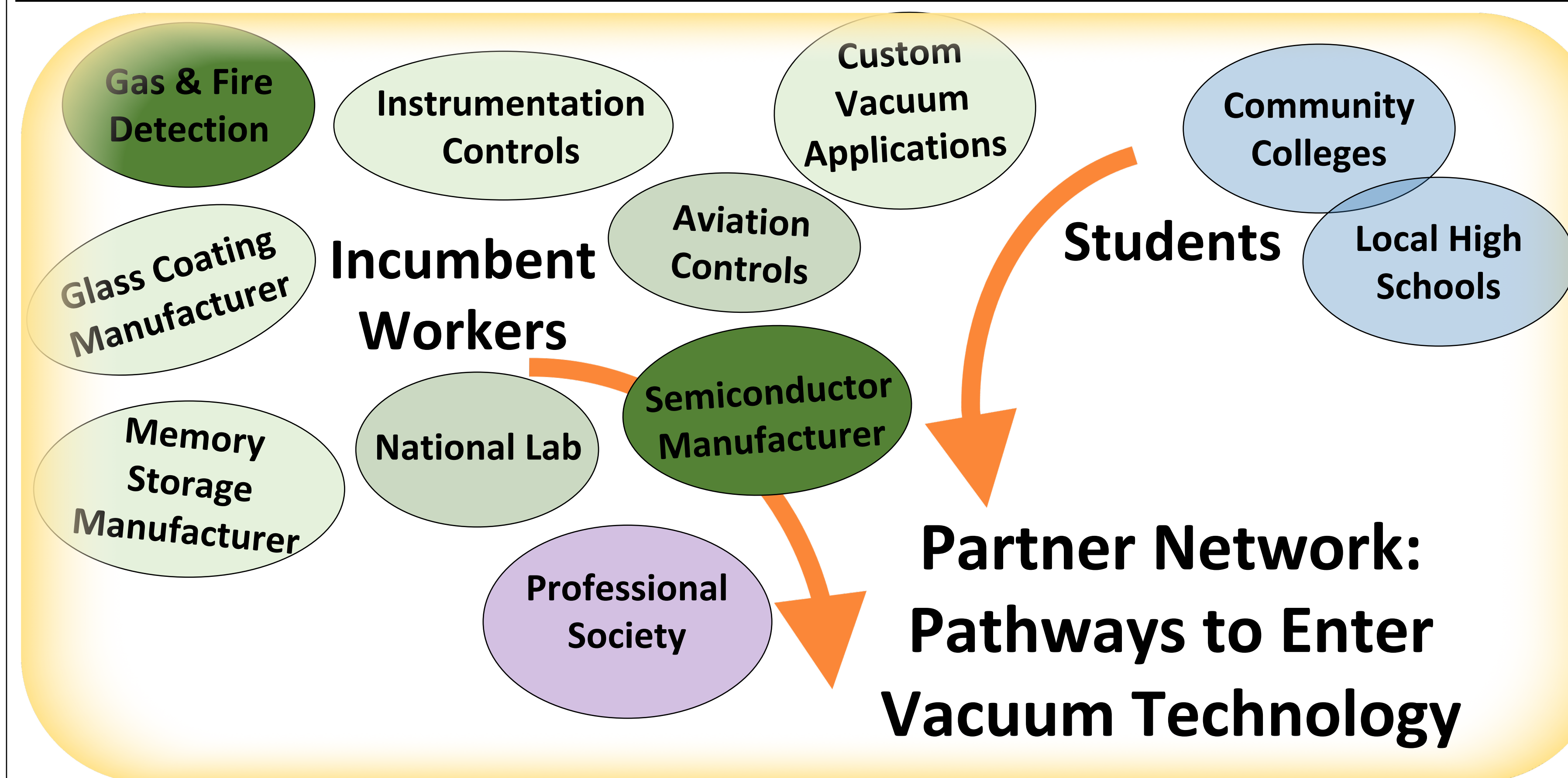
- Expand the pipeline of new students
- Recruit & train more vac tech instructors
- Educate a distributed workforce

Proposed Solution

Goal: Offer a high-value, highly accessible credential in vacuum technology through the strategic use of distance learning modalities to prepare skilled technicians for work in industries that rely on vacuum-enabled processes.

Project DELIVER: Distance Education and Learning In Vacuum technology for Employment Readiness (DUE #1700624)

★ Anywhere Technical Education ★

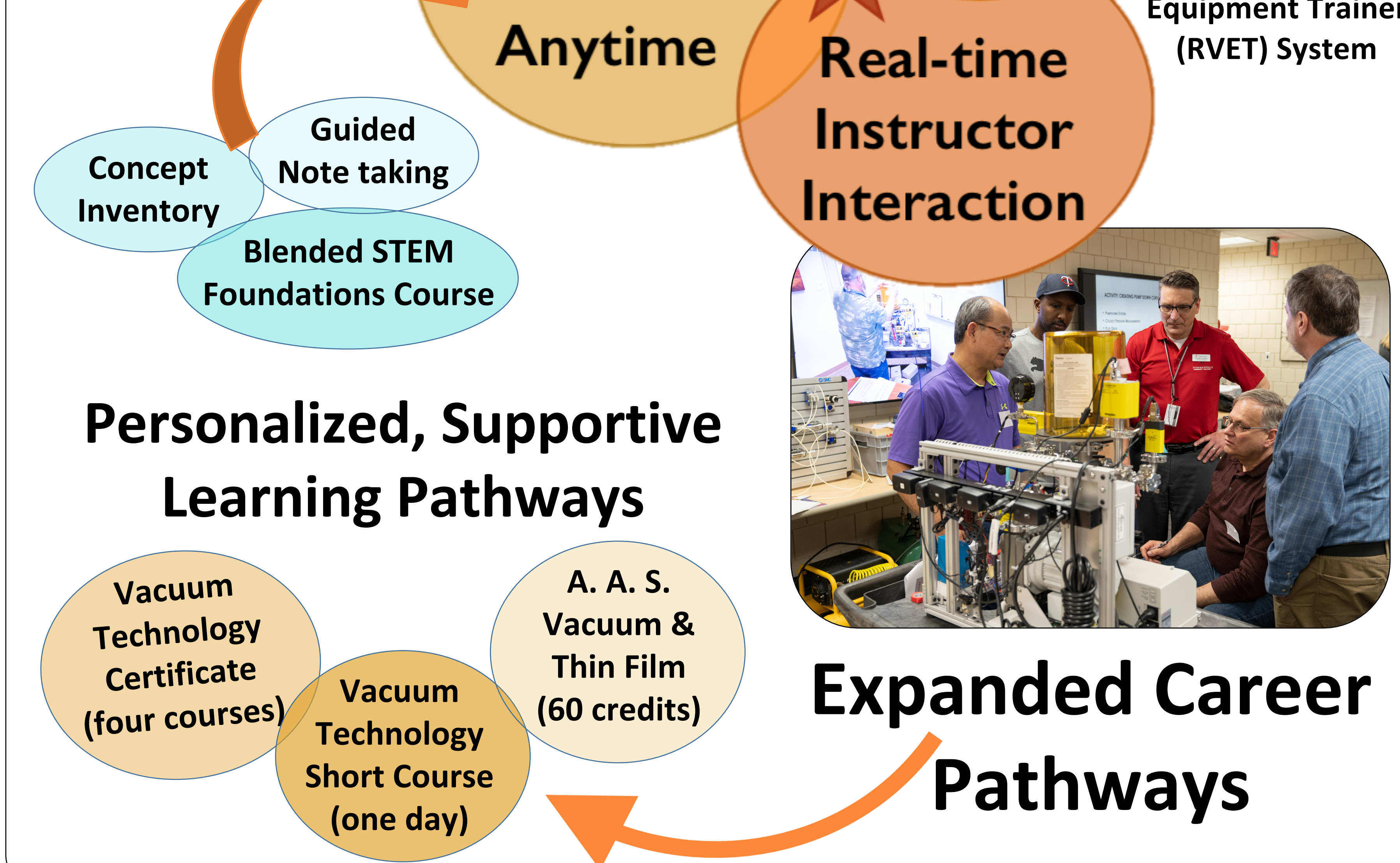


Session 6 - Throughput and Conductance in the Viscous Flow Regime

The removal of gases from a vacuum system is achieved via vacuum pumps that are characterized by the conductance (C), ultimately related to the system's ability to allow a gas depends on the pressure of the system. In a vacuum system, the flow of gas is due to the rough vacuum regime and the high vacuum regime (and lower pressures) respectively; the transition flow regime is complicated.

$$C = \frac{Q}{P_1 - P_2}$$

P_1 (Torr) P_2 (Torr)
 Q (Torr·L/Sec) C (L/Sec)



Project Outcomes 2015-20

Recruited new students to Vac Tech courses

- Enrolled 392 students in 43 class sections
- **Average class size increased from 7 (AY 15) students to 13 (AY 20)**
- Half of the students attend via telepresence

VET systems engage students in progressive knowledge- / skills-building

- 6 RVET systems for "Intro to Vac Tech"
- 6 HVET systems for "Analysis & Troubleshooting"
- 1 remotely operated DVET system for "Thin Film Deposition"

Engaged offsite partners via telepresence

- 16 vacuum-reliant businesses
- 3 academic institutions (4-yr and 2-yr)
- 1 national lab
- 54 students attain Vac Tech Certificate

Learn More

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