

Shaping the Future of Vacuum Technology Education WORKSHOP #1: TECHNICAL PROGRAM PERSPECTIVE



SEPTEMBER 24, 2020

This work was made possible in part by a grant from the **National Science Foundation** (ATE DUE #1700624)





#### Workshop Organizers



Nancy Louwagie Principal Investigator DELIVER Project



**Bob Bailey** External Evaluator DELIVER Project Outcomes Consulting Services



Sarah Holsted Communications Specialist DELIVER Project With gratitude for the support of the administration of Normandale Community College and the DELIVER Project team.

**Cary Komoto**, Dean Science, Technology, Engineering, Math and Education Division

Tom Johnson, Co-Pl Dr. Ruth Robinson, Co-Pl John Lasswell, Instructor Dr. Angela Foudray, Instructor Rand Whillock, Instructor Steve Osell, Lab Assistant Cindy Zoul, Project Manager Tim Lapanne, Student Services



#### Normandale DELIVER Project Team



Nancy Louwagie Program Chair Intro to Vacuum Tech



Dr. Ruth Robinson CHEM faculty, VACT instructor, co-PI, DELIVER



**Tom Johnson** VACT instructor, co-PI, DELIVER



Dr. Angela Foudry PHYS and ENGR instructor, VACT instructor, Sr Personnel DELIVER



John Lasswell VACT Instructor, Sr Personnel, DELIVER



Steve Osell VACT Lab Assistant



Rand Whillock VACT automation instructor, Sr Personnel,



#### Orientation





Shaping the Future of Vacuum Technology Education WORKSHOP #1: TECHNICAL PROGRAM PERSPECTIVE



**Introduction: About the Workshop Series** 

SEPTEMBER 24, 2020

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#### Workshop Series Agenda and Objectives

#### Past

- Provide history and context
- REVAMP and DELIVER
   Projects at Normandale
  - Results
  - Impact

Present

- Map the current state of vacuum technology in the U.S.
  - Identification of gaps
  - Industry perspective
  - Student perspective
  - Demonstrations of current practice

#### Future

- Plan for growing and sustaining the program
- Identification of opportunities and needs
- Identification of sectors
- Brainstorm



#### Shaping the Future of Vacuum Technology 2020-2021 Workshop Series





#### **Independent Assignments**

Assignment

Gap Analysis
Identify gaps as opportunities for growth

NImpact Analysis

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Analysis

Impact of past activities and desired impact for future activities

Brainstorming
 Use collective experience of this group to identify potential strategies and opportunities



## Workshop Series Timeline

Session 1	September 24
Assignment 1 – Gap Analysis	<ul> <li>Due back October 8 - 2 weeks after session 1</li> </ul>
Session 2	• Oct 19 – Oct 30
Assignment 2 – Impact Analysis	<ul> <li>Due back 2 weeks after session 2</li> </ul>
Session 3	• Nov 9 – Nov 20
Assignment 3 - Survey	<ul> <li>Due 2 weeks after session 3</li> </ul>
Session 4	• Jan 19 – Jan 29, 2021
Prep for Session 5	<ul> <li>1 week prior to session 5</li> </ul>
Session 5	<ul> <li>March 1-5 or March 15-19, 2021</li> </ul>
Final Report	Early April 2021



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#### **Participant List**



#### Recording

#### **Series Deliverables**

https://www.normandale.edu/departments/stem-andeducation/vacuum-and-thin-film-technology/shaping-the-future-ofvacuum-technology-education



Slides



**Final Report** 



# Q&A Break





Shaping the Future of Vacuum Technology Education WORKSHOP #1:



TECHNICAL PROGRAM PERSPECTIVE

#### Normandale's Vac Tech Program and NSF Projects

SEPTEMBER 24, 2020

This work was made possible in part by a grant from the **National Science Foundation** (ATE DUE #1700624)



#### Vac Tech Program History



NORMANDALE

COMMUNITY COLLEGE



#### **Motivating Rationale**





#### Revising Vacuum Technology – an Advanced Manufacturing Program (REVAMP) NSF DUE #1400408

#### Revise curriculum

Design and build trainer system for hands-on learning

Deliver courses via telepresence

Expanded use of LMS Delivered 7 VACT class sections via telepresence Built 4 HVETs and 3 RVETs Shipped VETs to partner sites

Engaged 4 industry partners, 1 academic partner and 1 national lab as partner sites



#### Distance Education and Learning in Vacuum Technology for Employment (DELIVER) NSF DUE #1700624





#### Enrollment in ALL Normandale Vac Tech Courses\* Fall 1998 – Fall 2021





#### Reach of Vac Tech Program since 2014

State       # Enrolled         MI       2         FL       3         OR       3         WI       4         NY       7         PA       8         NI       9         TX       29         UT       55         CA       90         MN       165
MI       2         FL       3       OR       3       OR       10       MI       ND       MN         OR       3       OR       3       OR       55       WY       SD       192         MI       4       NY       7       PA       8       NI       9       TX       29       UT       55       MM       OK       AZ       NM       OK       AR         MN       165       465       90       AZ       NM       OK       AR
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#### Partners: Industry, Academic, Professional Society





# Q&A Break





Shaping the Future of Vacuum Technology Education WORKSHOP #1: TECHNICAL PROGRAM PERSPECTIVE **Introduction to Gap Analysis** 

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### Gap Analysis Assignment



Why is that element important?

What will be different if the gap is addressed?

#### Growth and Sustainability of Vacuum Technology Programs



#### Gap Analysis Worksheet

#### **Respondent (Name and Organization):**

Date:

Question	Response	Other notes or comments
What sector do you represent?	<ul> <li>Coatings</li> <li>Advanced manufacturing</li> <li>R&amp;D</li> <li>Education and training</li> <li>Other - describe in notes/comments</li> </ul>	
Describe your organization briefly – products and services, size,		
Describe the role and importance of vacuum technology to your sector		

Gap or Opportunity	Rationale	Outcomes
List and describe what is missing from	Provide the reasoning for why is it important to	List the expected results of the actions taken.
<ul> <li>existing knowledge (e.g. curriculum</li> </ul>	address this gap.	How will we know that the action is effective
content' technical topics, skills)		in addressing the gap?
<ul> <li>infrastructure (e.g. labs, equipment,</li> </ul>		
networks)		
Other resources		
<ul> <li>activities and programs for education</li> </ul>		
and training in vacuum technology		
(e.g. telepresence; recruitment,		
credentials)		
<ul> <li>geographic or sector specifics</li> </ul>		
• Opportunities (unmet markets,		
emerging markets, partnerships)		

Example		NORMANDALE COMMUNITY COLLEGE		
Question	Response	Other notes or comments		
What sector do you represent?	<ul> <li>□Coatings</li> <li>□Advanced manufacturing</li> <li>□R&amp;D</li> <li>⊠Education and training</li> <li>□Other - describe in notes/comm</li> </ul>	nent		
Describe your organization briefly – products and services, size,	Normandale Community College offers a number of credentials in vacuum technology including an Associates of Applied Science (AAS) two-year degree (60 credits) and a Vacuum Technology Certificate (9 credits). VACT courses are offered in the following modes: in- person, on-line asynchronous, and on-line synchronous in telepresence. One VACT course is fully on-line experience. Three VACT courses incorporate the use of vacuum equipment trainer systems to support hands-on activities.			
Describe the role and importance of vacuum technology to your sector	Normandale is the only higher ed institution in the U.S. that offers credentials in N Thin Film Technology (AAS degree and Certificates). This is largely shaped by the i the region. The Vacuum and Thin Film Technology program works with the local c that use this technology to put together a curriculum that emphasizes the relevan			



## Example



Gap or Opportunity	Rationale for addressing	Outcomes
Perception of community colleges are second or third options for post-high school education. Often perceived as transfer school and not as a credential awarding institutions leading to employment opportunities	Community colleges are an underutilized resource for meeting workforce needs	Increased enrollments, more completers, more workforce placements
Community colleges are still learning how to embrace and deploy distributed learning technologies – these technologies have limited resources in CC budgets	Classes utilizing video conferencing have been rapidly mainstreamed. Telepresence is an emerging technology platform in education, especially in a COVID environment	Realize increased enrollments in telepresence classes



# Breakout Session and Q&A Break





#### Workshop Timeline

Workshop	• September 24	
End of Workshop Survey	<ul> <li>https://www.surveymonkey.com/r/655ZTDT</li> </ul>	
Participant Support Request / Worksheets Due	• October 8	
Results Compiled	• October 15	
Initial Report and Next Workshop	• October 19 - 31	



Shaping the Future of Vacuum Technology Education WORKSHOP #1: TECHNICAL PROGRAM PERSPECTIVE



**Demo: Tour of Anywhere-Technical-Education** 

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**SEPTEMBER 24, 2020** 



#### **On-Ramp to Vacuum Certificate**

VACT 1010 Foundations Course

Asynchronous on-line designed for returning learners

Selected concepts from Applied Math, Chemistry and Physics



#### Course Content – Foundations in Vacuum Science

- Module 1: Matter & the Periodic Table
- Module 2: Compound names, units & converting numbers
- Module 3: Moles, mass, particles, & the Kinetic Molecular Theory of Gases
- Module 4: Pressure, temperature, density, significant digits & vacuums
- Module 5: Gas laws & basic graphing
- Module 6: Heat transfer, logarithms & Excel graphs
- Module 7: Intermolecular forces, vapor pressure & surfaces
- Module 8: Chemical safety, acids/bases & simple electric circuits







- Colorful backbone notes
- Guided note-taking

https://mediaspace.minnstate.edu/media/lons/0\_05jw3ktp

Ions	# ele	ctrons ;	≠ # protor	23 IS
			*	
Atoms are neutral whe	<u>n</u>			
#+	#	Species		
Examples:				
=> <u>Try this</u> : Compl	ete the t	able below		
Formula	#	#	Cation, anion	
	protons	electrons	or neutral?	
Ca Co <sup>2+</sup>				
Sn <sup>4+</sup>				
	53	54		
P <sup>3-</sup>				
	26	24		



#### **Course Element: "Try This" Practice**

<u>Try this</u> : Match each data set to the correct form of graph.									
	Gra	ph 1		Gra	ph 2		Gra	ph 3	
	Х	Ŷ		X	Ý		Х	Ŷ	
	1	1		4	17		1	30	
	2	8		8	29		2	15	
	3	27		12	41		3	10	
	4	64		16	53		4	7.5	
	5	125		20	65		5	6	
						(			

<u>Try this</u>: The pressure in a vacuum chamber has been pumped down to 1.0 Pa. What value would be displayed on a pressure gauge that reads in torr?

Try this:	Put the numb	pers below in	order of inc	reasing size.
4 x 10 <sup>-3</sup>	$6 \times 10^{14}$	.0041	800	1.0
	7.3 x 10 <sup>2</sup>	2.2 x 10 <sup>14</sup>	9 x 10 <sup>-2</sup>	:

 $\underline{\text{Try this}}:\ Cl_2 \quad H_2O \qquad N_2$ 

A) Which of the three molecules above is most likely to stick to the walls of a vacuum chamber?

B) Which is the least likely?

<u>Try this</u> :	Circle all the factors below that affect the vapor pressure of a substance.		
volum	e of container	volume of substance	
	Pressure	temperature	
identit	y of substance	surface area	



## **Course Element: Activities**

- •Activities- 2 times each module
- •Longer, more in-depth practice and application
  - -Worksheets
  - -Case studies
  - -Simulations, https://normandale.learn.minnstate.

edu/d2l/le/content/5094464/viewCo ntent/44537142/View







## Tour of Anywhere-Technical-Education Classroom @ Normandale



# Q&A Break





#### Post Workshop

- Look for an e-mail from Normandale that provides
  - Link to evaluation survey for workshop
    - https://www.surveymonkey.com/r/655ZTDT
  - Instructions for application for stipend
  - Gap analysis worksheet due back by October 8
  - Link to workshop site on Normandale's page
  - Request for participant bio for list





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Shaping the Future of Vacuum Technology Education

WORKSHOP #2: Control of the second se

## THANK YOU!!!

DATE TBD OCT 19-30, 2020

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