

## College Immersion: A Unique Experience for High School Students

HI-TEC Conference  
July 25, 2018  
Greg Kepner

### The Partners

- Indian Hills Community College (IHCC)
  - Comprehensive community college in Ottumwa, Iowa
  - Serving 10 counties in Southeast Iowa
- Columbia Area Career Center (CACC)
  - Career and technical center in Columbia, Missouri
  - Serving 12 high schools, home schooled students, and adult learners in Central Missouri.

### Photonics – The Technology of Tomorrow

- The science and technology of generating (lasers), manipulating (optics), and detecting particles (electro-optics) of light (photons).
- Any light based technology with applications in:
  - Manufacturing, Medical, Military, Communication/Information, Science/Research, Entertainment.
  - Smartphones to laptops to the Internet to medical instruments to lighting technology to military weapons and more.
- The 21st century will depend as much on photonics as the 20th century depended on electronics.

### History of IHCC Laser & Optics Technology

- Indian Hills Community College Laser & Optics Technology program strives to be the best at giving each student the opportunity to learn all they can about photonics, graduate with an A.A.S degree, and obtain a gratifying position in their chosen field.
- Program started in 1985
- Associate of Applied Science Degree
- 81 credits
- 21 month program
- 592 graduates

### Principle Duties of a Laser/Optics Technician

- Assembles, tests, qualifies, installs, maintains, repairs, and utilizes laser/optics for a variety of applications.
- Clean and align the optical elements (lenses, prisms, and mirrors); check electronic subassemblies and power supplies; and prepare the gas-filled plasma tube, crystal rod, dye cell and semiconductor chip used to form the laser.

### Brief Job Descriptions

- **Research Assistant / Laser Technician** - Laser development, photonic related systems
- **Laser Test and Check-out Technician** - Perform final quality testing of optical systems
- **Field Service Engineer** - Installation, diagnosis, repair of photonic systems and accessories
- **Development Technician** - Design optical and electrical test systems for lasers and optics

### Brief Job Descriptions (cont'd)

- **Applications Technician** - Applications development, machine set-up and operation, minor maintenance, leads to supervisory position.
- **Sales Engineer** - Provide quotes, manage backlog, expedite order, develop reports and forecasts, attend trade shows.
- **Technical Training Engineer** - Customer and employee training of photonic systems.
- **Photonics Technician** – Build, install, test, or maintain optical or fiber optic equipment such as lasers, lenses, or mirrors using spectrometers, interferometers, or related equipment.  
(O\*NET 17.3029.08 - Bureau of Labor Statistics)

### Job Opportunities & Placement

- Average of 4-6 job opportunities per graduate
- Placed in 38 states & Germany & Norway
- Placed at 139 companies
- “Border to Border and Coast to Coast”
- “Those who want a job, get a job”
- Job placement 95.5% (2013-2017)
- 2018 average salary: \$57.4k + benefits

### Company Career Opportunities 2011-2018

3D Systems	ABS Global	Chicago Bridge & Iron
Daylight Solutions	Forro Energy	Gateway Laser
General Atomics	J.A. Woolams	John Deere
L-3	Laserage	Lawrence Livermore National Lab
Lumenis	Mazak	MC Machinery
Northrop Grumman	Panasonic	Particle Measuring Systems
Preco, Inc.	Research Optics	RP Support
RPMC, Inc.	Rudolph, Inc.	Sightpath Medical
Spectralytics	Texas Instruments	Laser Light Technologies
Spectra-Physics	IAM AGTECH	Access Laser
Nuburu	Laserline	University of Nebraska
VitalDyne	Trumpf	Lightpath Technologies

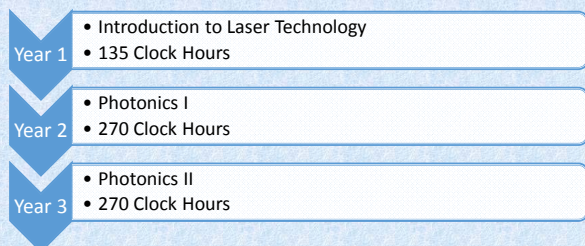
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Nuburu	Laserline	University of Nebraska
VitalDyne	Trumpf	Lightpath Technologies

### History of CACC Laser & Photonics Technology

- Inspired by 3M corporate training
- Program started in 1996
- 2 or 3 year program of study
- High school sophomores, juniors, and seniors

### Laser/Photonics Program of Study at CACC



### Introduction to Laser Technology Topics

Laser and Lab Safety	Laser Light Show
Basic Holography	Advanced Holography
Light and Wave Theory	Medical Applications
Manufacturing Applications	Security/Forensic Applications
Lasers and Telecommunications	

### Photonics I Topics

Scientific Method throughout	Temporal Characteristics of Lasers
Problem-solving Techniques	Spatial Characteristics of Lasers
Basic Electronics	Helium-Neon Gas Laser Case Study
First Aid	Security/Forensic Applications
Concepts of Laser Safety	Laser Classifications/Characteristics
Components	Optical Cavities/Modes of Oscillation
Elements/Operations of a Laser	Holography
Emission and Absorption Spectra	Advanced Holography
Power Meter Operation	Student Projects
Lasing Action	Course Review

### Photonics II Topics

Scientific Method throughout	Temporal Characteristics of Lasers
Problem-solving Techniques	Spatial Characteristics of Lasers
Basic Electronics	Helium-Neon Gas Laser Case Study
First Aid	Imaging with Multiple Lenses
Concepts of Laser Safety	F-stops and Apertures
Components	Optical Systems
Reflection at Plane Surfaces	Advanced Holography
Refraction at Plane Surfaces	Student Projects
Refraction at Spherical Surfaces	Course Review

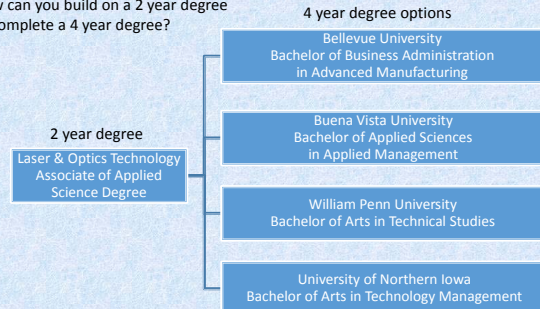
### Articulations – CACC to IHCC

CACC Course	IHCC Course	Course #	Semester Hours
Laser Technology & Photonics I	Photonics Concepts & Introduction to Photonics	LEO101 LEO242	4 4
Photonics I & Photonics II	Introduction to Photonics & Geometric Optics	LEO242 LEO255	4 4
Laser Technology & Photonics I & Photonics II	Photonics Concepts & Introduction to Photonics & Geometric Optics	LEO101 LEO242 LEO255	4 4 4
Electronics I & Electronics II	DC Circuit Analysis & AC Circuit Analysis	ELT373 ELT378	4 4
Electronics I & Electronics II & Electronics III	DC Circuit Analysis & AC Circuit Analysis & PLTW Digital Electronics & Analog Devices	ELT373 ELT378 EGT420 ELT550	4 4 4 4

### Articulations – CACC to IHCC

CACC Course	IHCC Course	Course #	Semester Hours
PLTW Introduction to Engineering Design	PLTW Introduction to Engineering Design	EGT420	3
PLTW Principles of Engineering	PLTW Principles of Engineering	EGT410	3
PLTW Digital Electronics	PLTW Digital Electronics	EGT420	3
PLTW Robotics and Computer Integrated Manufacturing	PLTW Computer Integrated Manufacturing	EGT450	3
A+ Essentials	Computer Hardware Basics	NET122	3

How can you build on a 2 year degree to complete a 4 year degree?



## Areas of Partnership

- Advisory Committee
- Photonics Program of Study Curriculum
- Midwest Photonics Education Center (NSF Regional Center)
- Instructors
- IHCC Campus Visit with **College Immersion** Experience
  - 2 day with overnight stay
  - Campus orientation
  - Laser club activities
  - Laboratory activities
  - Sharing meals
  - Evening activities

## Midwest Photonics Education Center

- **Mission:** A National Science Foundation Regional Center dedicated to **developing a pipeline of qualified photonics technicians** to meet industry needs with an emphasis in laser materials processing in advanced manufacturing.
- A network of **6 educational institutions and partners in the Midwest**
  - 3 Community Colleges
  - 1 College
  - 1 Company
  - 1 High School Career Center
- National Science Foundation Regional Center – (DUE #1400561)
- September 1, 2014 – August 31, 2019



## College Immersion Experience Schedule for Day 1

- |                       |   |
|-----------------------|---|
| • 11:00 am – 12:00 pm | Welcome and Lunch at the Hills Diner                |
| • 12:00 pm – 1:00 pm  | IHCC Campus Orientation & Tour                      |
| • 1:00 pm – 2:00 pm   | Advanced Technology Center Tour                     |
| • 2:00 pm – 2:20 pm   | Financial Aid and Job Corps Information             |
| • 2:20 pm – 2:40 pm   | Laser Program Information                           |
| • 2:40 pm – 3:00 pm   | Laser Club Information & Activities                 |
| • 3:00 pm – 3:20 pm   | Review IHCC Literature & Complete Information Cards |
| • 3:20 pm – 3:30 pm   | Questions and Answers                               |
| • 3:30 pm – 5:30 pm   | Hotel Check In & Swimming/Free Time                 |
| • 5:30 pm – 6:30 pm   | Dinner @ Hills Diner                                |
| • 6:30 pm – 8:30 pm   | Basketball Game @ Hellyer Student Life Center       |
| • 8:30 pm – 8:45 pm   | Return to Hotel                                     |

## College Immersion Experience Schedule for Day 2

- 7:45 am – 8:15 am Breakfast at the Warrior Junction  
With College Students
- 8:15 am – 11:15 am Laser Lab Hands On Activities  
with College Students
- 11:15 am – 11:40 pm Wrap Up Luncheon at Warrior Junction
- 11:40 am – 11:50 am Complete Student Survey
- 11:50 am – 12:00 pm Final Handouts
- 12:00 pm Depart for Columbia

## CACC Students at IHCC

- 190 students have participated in **College Immersion** from 2009-2018
- 46 CACC graduates have graduated from IHCC since 2000
- 7 CACC graduates enrolled currently
- Well prepared
- Cumulative GPA of 3.26 (Dual graduates)



Visiting the Residence Hall



Attending the Warriors Basketball Game



Visiting the Tom Arnold Net Center



IHCC Instructor and Student discussion



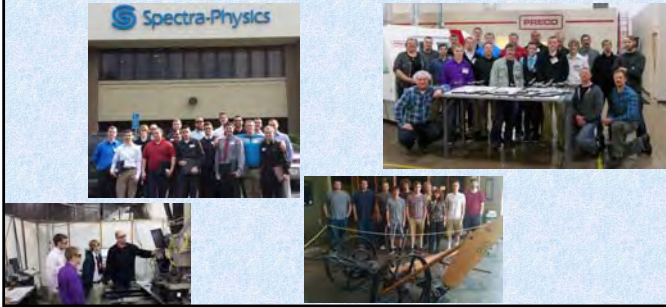
Laser Club Activities – Photonics West Trip



Laser Club Activities – Photonics West Trip



### Company Visits (6 companies in 3 states)



### Meals Together - Learning about Campus Life



### Meals Together - Learning about Campus Life



### Evening Activities

- Basketball games
- Bowling
- Hellyer Student Life Center
- Movies
- Student Areas
- Swimming at Hotel
- Chilling Out

### Laboratory Activities



### Laboratory Activities

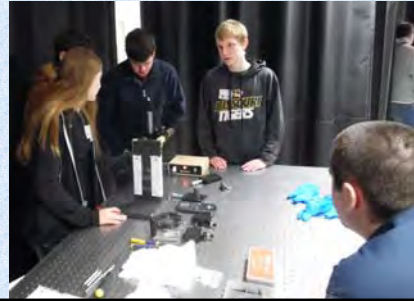




Laboratory Activities – Spatial Filters



Laboratory Activities



Laboratory Activities – Optics Alignment



Laboratory Activities – Laser Welding



Laboratory Activities – Fiber Laser



Learning the Importance of Log Books



Lab Discussion led by CACC-IHCC Students



Lab Activities with CACC-IHCC Laser Students



Project Discussion led by CACC-IHCC Laser Student



Laser Lab Project Led by CACC-IHCC Student



Lab Project Designed by CACC IHCC Student



First IHCC College Immersion Experience 2009

- Midwest Regional Alliance Partners
- New England Board of Higher Education PHOTON PBL CHALLENGE
- Sponsored by OP-TEC (National Center for Optics & Photonics Education)



Indian Hills Community College Visit 2009



Indian Hills Community College Visit 2011



Indian Hills Community College Visit 2011



Indian Hills Community College Visit 2012



Indian Hills Community College Visit 2013



Indian Hills Community College Visit 2014



Indian Hills Community College Visit 2015



Indian Hills Community College Visit 2016



Indian Hills Community College Visit 2017



Indian Hills Community College Visit 2018



CACC/IHCC Graduates – Where are they?

3D Systems - 1	Melles Griot - 1
3M - 2	NGC/Cutting Edge Optronics - 2
Boston Scientific - 1	Northrop Grumman - 6
Gateway Laser - 1	Preco, Inc. - 1
Laser Light Technologies - 1	Raytheon - 5
Laserage Technology Corporation - 1	Rudolph, Inc. - 2
Lawrence Livermore National Lab - 4	Sightpath Medical - 2
Los Almos National Lab - 1	Spectra Physics - 1
Texas Instruments - 1	Nuburu - 1

CACC/IHCC Graduates – Success Stories

- Field Service Engineer - Gateway Laser Services
- Research and Development Technician - Northrop Grumman
- Photonics Technician – Rudolph Technologies
- Laser Technician – Northrop Grumman - Cutting Edge Optronics
- Engineering Technician – Spectralytics
- Injection Laser System Operator – Lawrence Livermore National Lab
- Field Service Engineer – 3D Systems
- Electronics/Optics Technician – Akima Infrastructure Services
- Engineering Student – University of Iowa



Remember These Students From 2011?

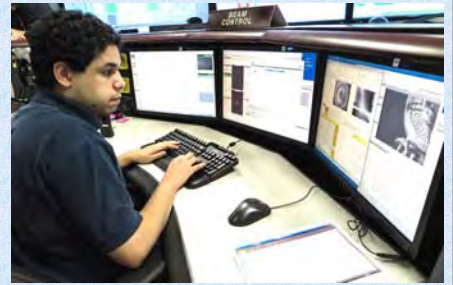


CACC Grad 2011  
IHCC Grad 2013

Beam Control Operator

Lawrence Livermore  
National Laboratory  
National Ignition Facility

California



CACC Grad 2012  
IHCC Grad 2014

Technician IV  
Electronics/Optics  
With Government  
Contractor  
California

Interactive Simulation  
Training for Military

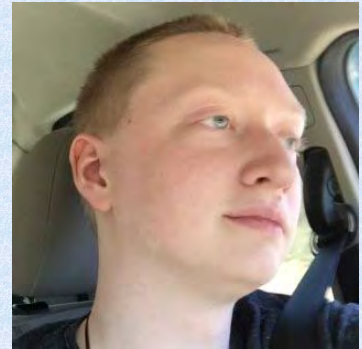


CACC Grad 2013  
IHCC Grad 2015

Field Service Engineer

3D Industrial and  
Consumer Printing  
Technologies

North Carolina



CACC Grads 2012  
IHCC Grads 2014

Featured in the 2017  
October/November issue of  
Community College Journal.

Lawrence Livermore  
National Laboratory  
National Ignition Facility

California



Ideas You Can Implement Immediately

- Identify a like-minded institution:
  - With a worthy program of study with great career opportunities
  - Interested in partnering to benefit students
  - Ideally, with a collaborative staff person
- Plan the partnership activities:
  - To impact students with positive experiences
  - All day or overnight college immersion experience
  - To involve college students at every juncture (especially home graduates)
  - Follow or adapt the format of CACC-IHCC
- Schedule early:
  - Talk with current students at the beginning of the year



## Questions?

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- This material is based upon work supported by the National Science Foundation under Grant DUE #1400561.
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