

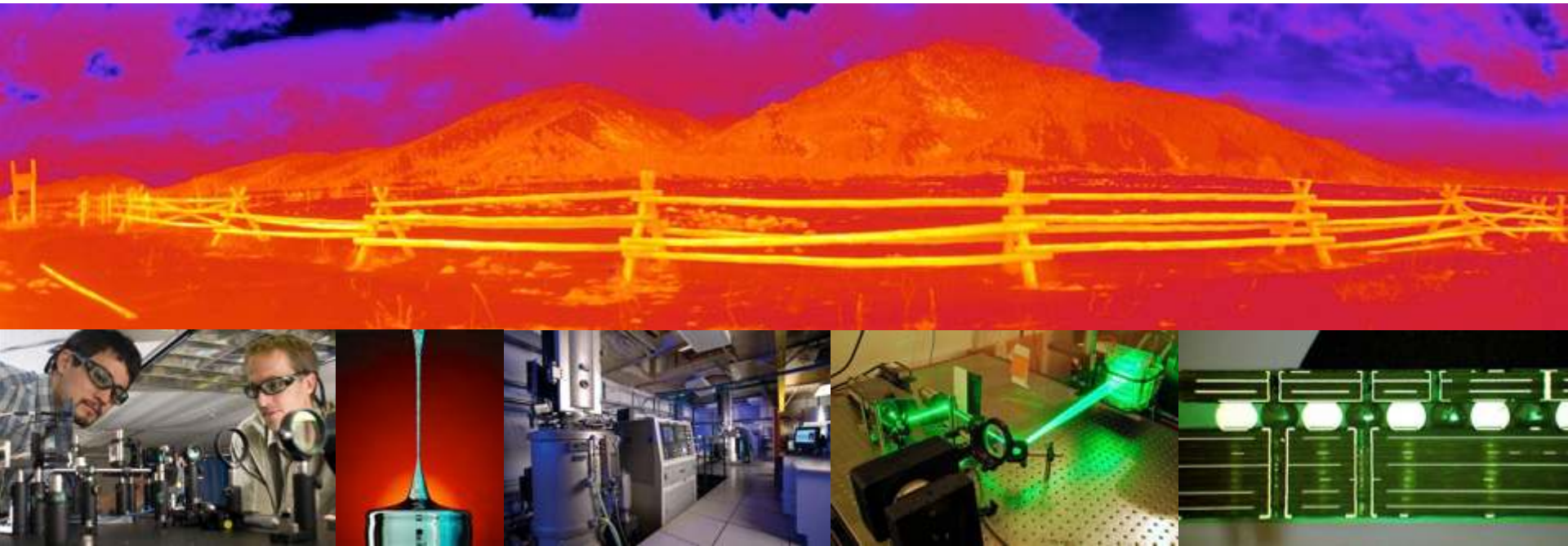
PHOTONICS AND MONTANA'S EMERGING PHOTONICS INDUSTRY

Larry Johnson

President, Montana Photonics Industry Alliance

May 18, 2015

What is Photonics?



Photonics Is ...

The branch of technology concerned with the properties and transmission of photons (light):

- Generation of light
- Amplification of light
- Transmission of light
- Modulation of light
- Detection of light

*Photonics is to light and photons the same as
Electronics is to electricity and electrons*

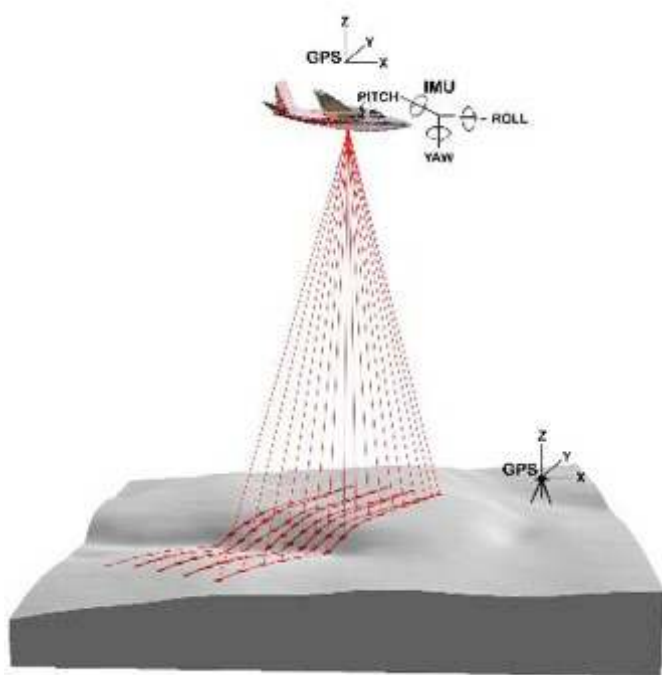
Why is Photonics Important?



Photonics Enables ...

Aerospace

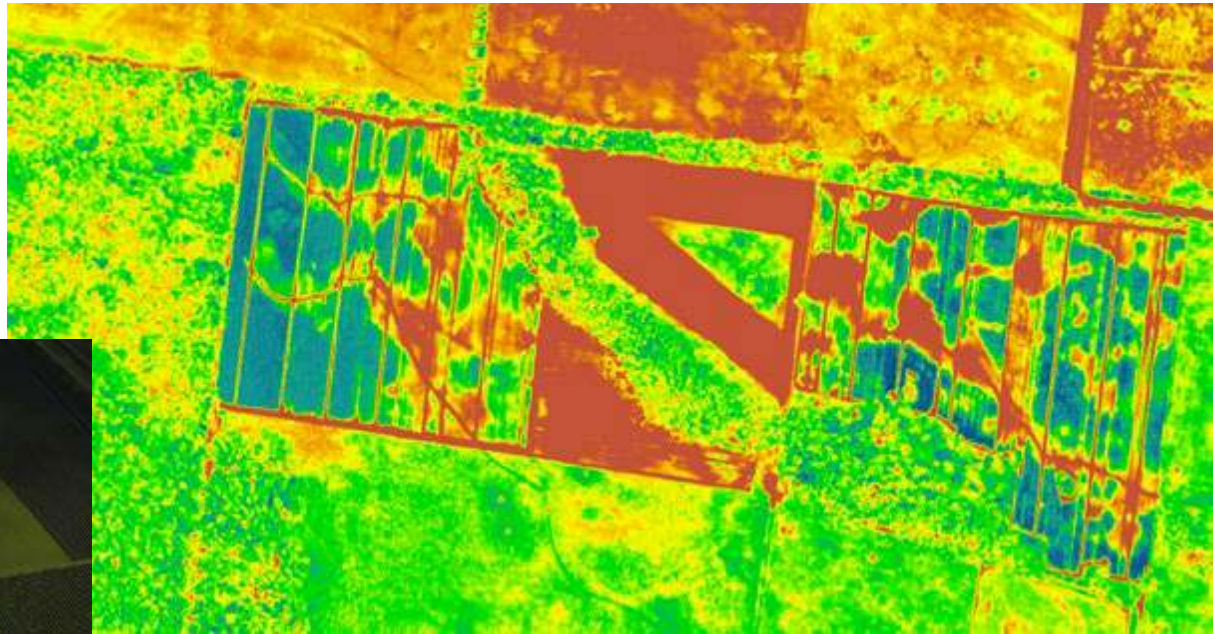
LiDAR (laser RADAR systems) and laser altimeters, imaging systems for test and analysis of aircraft, holographic heads-up displays, and optical pattern recognition systems for navigation



Photonics Enables ...

Agriculture

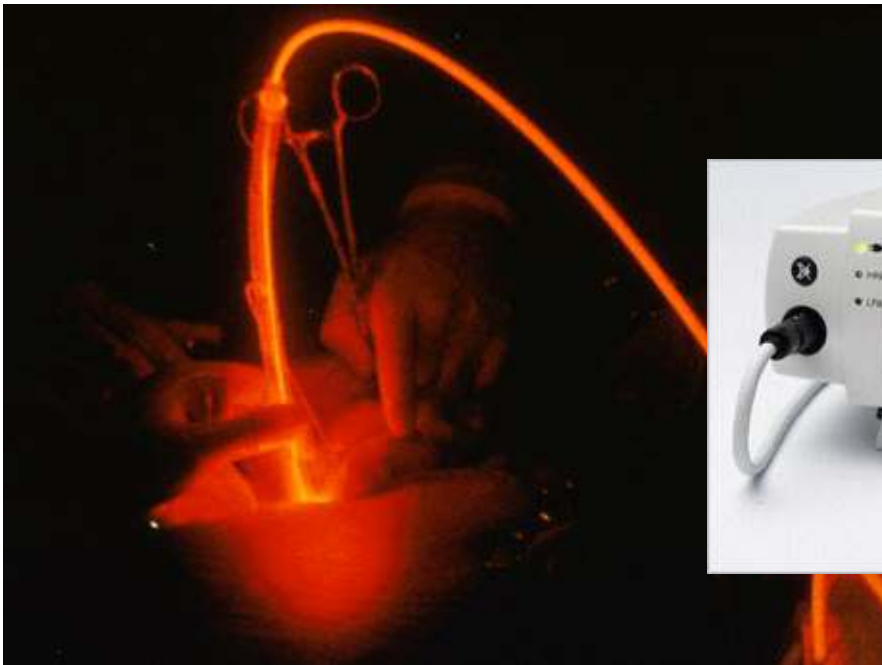
Satellite remote sensing to detect large-scale crop effects, scanning technology and infrared imaging to monitor food production and quality, and sensor systems for planting and irrigation.



Photonics Enables ...

Biomedicine

Lasers for surgery, therapies such as photodynamic therapy, and in situ keratomileusis (LASIK) procedures; used in testing and analysis devices such as noninvasive glucose monitors.



Photonics Enables ...

Construction

Laser systems for scanning site topography, laser bar-code readers to inventory materials, laser distance measuring and alignment, and three-dimensional analysis to track the progress of construction.



Photonics Enables ...

Alternative
Energy

Photovoltaic Devices (PVDs) are used for Solar Electric Panels. Recent improvements in cost, efficiency and reliability promise that PVDs will be an even greater contributor to Alternative Electric Energy in the future.



And Photonics Enables ...

Environmental
Technology

Transportation

Geographic
Info Systems

Homeland
Security

Information
Technology

Manufacturing

Solid State
Lighting

Chemical
Technology

Biotechnology

Photonics Enables ...



Photonics is One of the Key Global Markets of the 21st Century

Global market volume in 2011 was \$400 billion;
Expected to grow faster than global GDP and reach
\$690 billion in 2020

Largest segments:

- Displays
- Photovoltaic
- Information technology
- Light sources
- Medical technology & life sciences
- Safety and defense technology
- Measurement & automated vision
- Optical components and systems

China, Japan, and Europe are investing heavily in photonic technology;
the US is lagging behind.

“The 21st century will depend as much on photonics as the 20th century depended on electronics.”



2015 INTERNATIONAL YEAR OF LIGHT
AND LIGHT-BASED TECHNOLOGIES

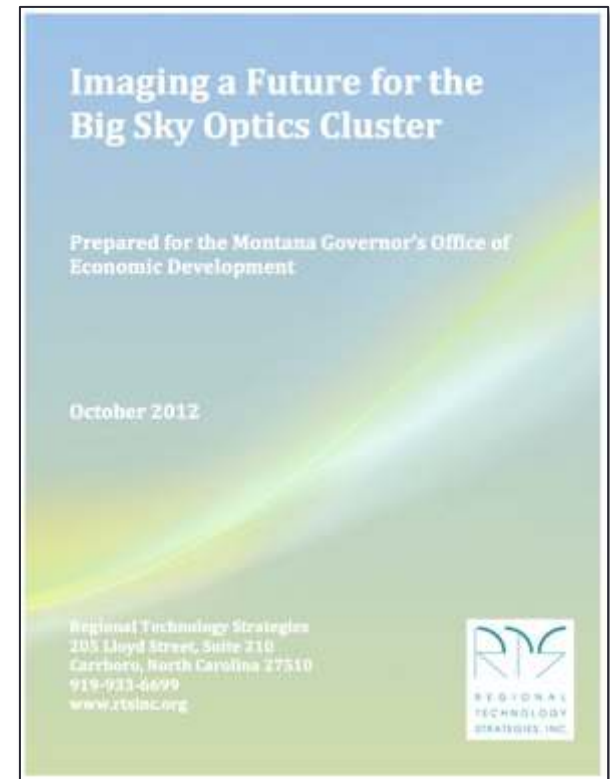
IYL2015 is a global initiative adopted by the United Nations to raise awareness of how optical technologies promote sustainable development and provide solutions to worldwide challenges in energy, education, agriculture, communications and health.

Montana's Emerging Photonics Industry



The Montana Optics Cluster

In 2012 Regional Technology Strategies, Inc identified a rapidly growing cluster of optics and photonics companies and research institutions in Montana. Comprised of over 25 organizations, this cluster is the highest per capital concentration of optics and photonics companies and research institutions in the United States.



Montana's Emerging Photonics Industry

Results of Second Annual Industry Survey

Conducted in the spring of 2015

- 26 survey respondents
- 28 optics and photonics companies
- 517 employees
- \$59,500 average pay and benefits (excl MSU)
- Forecast to grow at 13% in 2015

Montana's Emerging Photonics Industry

Definition

We define Montana optics and photonics organizations to include those that meet one or more of the following criteria:

- a. Manufacture or sell products that rely on optics or photonics technology for a significant portion of their functionality. Examples include companies that manufacture or sell lasers, laser ranging systems, optical spectrometers, or optical materials such as silicon and laser crystals.
- b. Derive a majority of their revenue from products that are sold into the optics or photonics market. Examples include companies that sell laser power supplies and companies that sell cryogenic cooling systems used in photonic research.
- c. Departments and other groups within universities that teach and/or engage in optics or photonics research. Examples include the MSU Physics and EE/Optics programs, the Optical Technology Center, and Spectrum Lab.

Montana's Emerging Photonics Industry



Montana's Emerging Photonics Industry



Montana's Emerging Photonics Industry


Company Size Distribution

Company size distribution at the end of 2013

1 – 10 employees	14
11 – 20 employees	5
21 – 50 employees	4
51 – 100 employees	1
>100 employees	1
Total	25

Montana's Emerging Photonics Industry

Interests are well aligned with the Governor's Main Street Montana project

Train and Educate Tomorrow's Workforce Today	Create a Climate that Attracts, Retains and Grows Businesses	Build Upon Montana's Economic Foundation	Market Montana	Nurture Emerging Industries and Encourage Innovation
Align educational system with the needs of a changing economy	Foster a business-friendly climate through efficient and effective government	Responsibly develop Montana's natural resources for long-term economic growth	Strengthen and promote the Montana brand to recruit businesses, workers and tourists	Strengthen role of universities as technology incubators through research, development and commercialization
Engage private-public partnerships to provide job-training, apprenticeship, and professional development opportunities	Increase access to capital and resources for Montana businesses	Ensure Montana businesses and communities have efficient and reliable infrastructure		Foster innovation and encourage knowledge-based industries to locate and grow in Montana
Provide a lifetime continuum of quality education from preschool through adulthood	Coordinate economic development efforts throughout the state	Protect Montana's quality of life for this and future generations	Increase promotion of Made in Montana products and exports	Support entrepreneurs and small businesses to enhance their potential to achieve growth and stability
				

Montana's Emerging Photonics Industry

Interests are well aligned with
Street Montana program

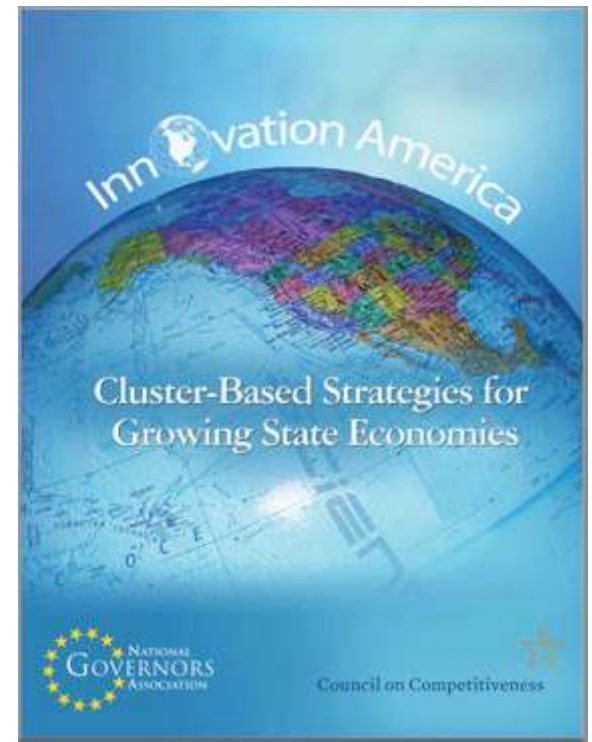
Governor's Main



Why Are Clusters Important for Montana?

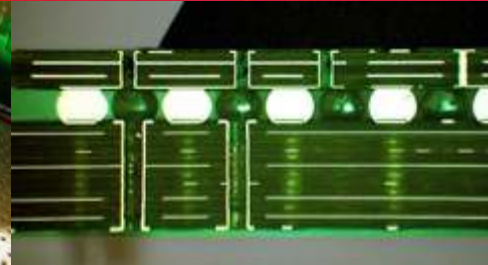
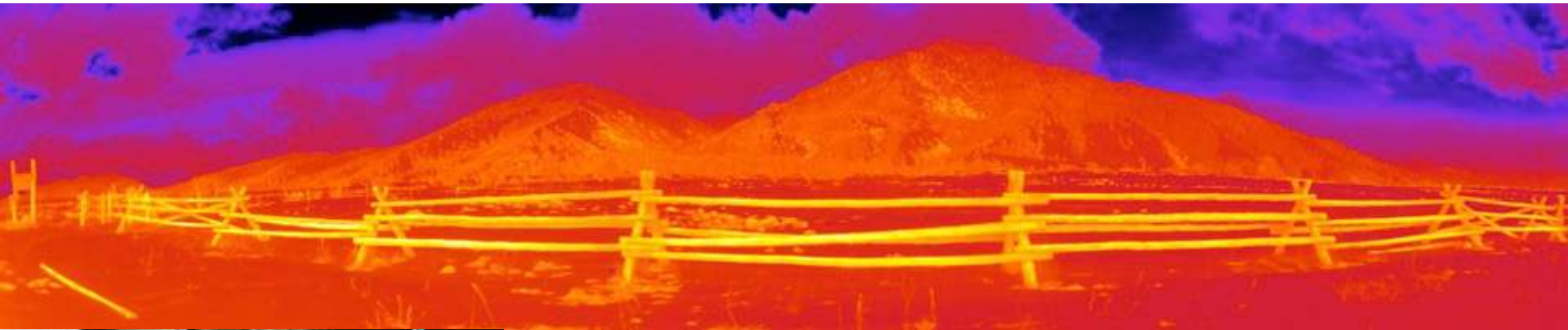
“Clusters are of interest ... because they can help power a regional economy...”

- Clusters boost innovation
- Clusters lead to higher wages and productivity
- Clusters improve employment opportunities
- Clusters stimulate regional entrepreneurship
- Clusters aid diversification and improve regional sustainability



National Governor's Association, 2007

Montana Photonics Industry Alliance



Montana Photonics Industry Alliance

Who We Are

The Montana Photonics Industry Alliance is a network of Montana optics and photonics companies, entrepreneurs, laboratories and universities.

- 28 companies
- 520 employees
- Forecast to grow at 13% in 2015

Montana Photonics Industry Alliance

Mission

The Montana Photonics Industry Alliance serves as a hub for Montana's optics and photonics companies, entrepreneurs, laboratories, and universities to commercialize, grow and sustain globally leading organizations that create high quality jobs and economic opportunity in Montana.

Montana Photonics Industry Alliance

Long-Term Objective

Foster the growth of Montana optics and photonics companies, universities, and other organizations to achieve at least 1000 photonics-related jobs by the end of 2024.

Montana Photonics Industry Alliance

We are supported by



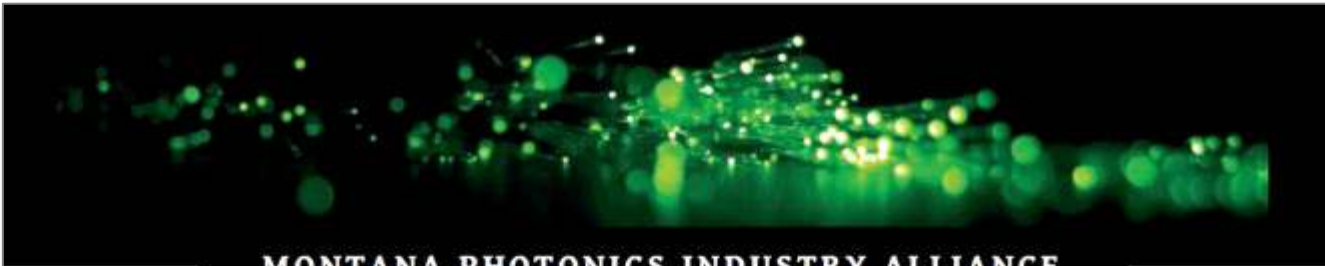
State of Montana



City of Bozeman



Prospera Business Networks



MONTANA PHOTONICS INDUSTRY ALLIANCE

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Montana provides an attractive business climate, pristine beauty and an excellent quality of life.



Optics and photonics are growing in Montana providing excellent career opportunities. Move your career and your life to a higher level.



Get the inside story on Wavelength Electronics in Bozeman.

www.MontanaPhotonics.org

ADVR



Bridger Photonics

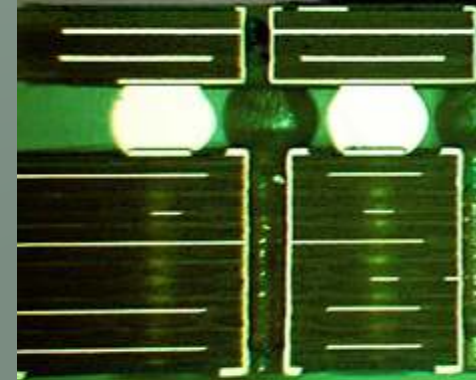


Lattice Materials

Lattice Materials



Wavelength Electronics



NWB Sensors



Resonon

