

Air Force Institute of Technology SPIE Student Chapter Annual Report 2010

AFIT SPIE Student Chapter
AFIT/ENG
2950 Hobson Way
Wright-Patterson AFB, OH 45433

Introduction

In our first annual SPIE report, current leadership information, membership data, and financial status are presented. The activities we participated in throughout the last year are described in detail. Also, some tentative future plans are discussed. Our founding year was a memorable year, and the Air Force Institute of Technology (AFIT) SPIE Student Chapter has ensured its longevity and place among the fellow SPIE student chapters.

Members

Leadership

Our current chapter officials were elected on 3 June 2010 and are listed below:

- Jeffery Dennison, jeffery.dennison@afit.edu, President (ID: 03320037)
- Paul Dolce, paul.dolce@afit.edu, Vice President (ID: 03330526)
- Edward Hurd, edward.hurd@afit.edu, Treasurer (ID: 03316672)
- Mark Spencer, mark.spencer@afit.edu, Secretary (ID: 03283429)

Our current committee chairs were elected on 3 June 2010. They are listed below along with the members for each committee:

- Publicity committee
 - Chairman: Eric Guild
 - Member: Milo Hyde
- Membership committee
 - Chairman: Derrick Langley
 - Member: Russell McGuigan
- Programs Committee
 - Chairman: Paul Dolce
 - Members: Jason Tallez and Daniel Wheeler

Our founding chapter officials were elected on 19 November 2009 and are listed below:

- Mark Spencer, mark.spencer@afit.edu, President (ID: 03283429)
- Jason Tellez, jason.tellez@afit.edu, Vice President (ID: 3286323)
- Daniel Wheeler, daniel.wheeler@afit.edu, Treasurer (ID: 3286886)
- Milo Hyde, milo.hyde@afit.edu, Secretary (ID: 3275083)

We held elections for our current chapter officials before the one year term was served by our founding chapter officials, as required by the chapter constitution, so that our chapter elections would better fit with the AFIT academic calendar. Our chapter advisor, Maj Jason Schmidt, PhD, USAF, made the off-cycle election issue known to Dirk Fabian who approved the election of our current chapter officials.

Current members

Currently, our chapter has 20 student members. All student members and their membership expiration dates are listed in the Table 1 below. The AFIT SPIE student chapter maintains two chapter advisers, one military faculty member for continuity and one civilian faculty member for longevity. Our current military faculty member chapter advisor is Maj Jason Schmidt, PhD, USAF and our current civilian faculty member chapter advisor is Michael Marciniak, PhD. Both of our current chapter advisors are members of SPIE and have written consent from their respective department heads, as required by the chapter constitution. The AFIT SPIE student chapter also elicits the participation of AFIT faculty members who are current members of SPIE or show desire in becoming members of SPIE. For example, a few faculty members have made it a point to attend chapter meetings. Increasing their involvement has the potential to increase chapter support and longevity.

Table 1: Current members of the AFIT SPIE Student Chapter.

Name	Membership Expiration
Monte Anderson	13 Dec 2010
Stanley Crozier	14 Jan 2011
Jeffery Dennison	18 Jan 2011
Paul Dolce	25 Feb 2011
Kurtis Engelson	28 Mar 2011
Si Ferrel	19 Nov 2011
Eric Guild	18 Jan 2011
Edward Hurd	4 Jan 2011
Milo Hyde	5 May 2011
Derrick Langley	31 May 2011
Douglas Macdonald	17 Jan 2011
Russell McGuigan	4 Jan 2011
Jessica Schafer	21 Nov 2011
Michael Seal	21 Sep 2011
Mark Spencer	5 May 2011
Matthew Spidell	23 Jan 2011
Michael Steinbock	6 Oct 2011
Jason Tallez	1 Jun 2011
Jason Vap	22 Sep 2011
Daniel Wheeler	5 Jun 2011

Chapter Activities

Chapter initiation and meetings

Our chapter was established on 2 November, 2009, with 12 founding members as shown in the Fig. 1 below. The main players in the formation of our chapter were Maj Jason Schmidt, PhD, USAF (our current chapter advisor) and Mr. Mark Spencer (our founding chapter president and current chapter secretary). Since that time, our chapter has had up to 25 active student members and currently has 18 active student members as previously stated. We have had four chapter meetings to date, in accordance with the chapter constitution, each with a high participation rate (about 75%) from active and potential members. We serve pizza at our chapter meetings, which always draws a big crowd!



Figure 1: Initial AFIT SPIE student chapter members.

LaserFest

One of the first chapter initiatives was to apply for the LaserFest Grant opportunity offered to SPIE student chapters. Mr. Mark Spencer led the initiative with support from the current chapter advisors and current chapter members. This grant proposal initiative included coming up with laser based demonstration to support LaserFest, a yearlong initiative to celebrate the 50th anniversary of the laser.

Our chapter was successful in receiving a LaserFest Grant for \$650 (\$750 max), which we used to develop our idea for a Laser Propagation Demonstrator to accompany the LaserFest lectures that AFIT hosted (with support from a separate LaserFest Grant through SPIE) on 16 September 2010 with the theme of laser development in the DoD. Approximately 100 people attended the event, ranging from experts in the field of optics to curious high school students from the local Science, Technology, Engineering, and Math (STEM) school. Overall the event went very well and several attendees commented that they enjoyed the hands-on demonstration.

Located at the Dayton Engineer's Club, the event comprised of two guest speakers and a hands-on demonstration to show the optics principles of diffraction, refraction, and attenuation on laser propagation. Specifically, atmospheric turbulence and its effect on laser propagation was simulated and displayed by the developed Laser Propagation Demonstrator. There were two lectures given for the LaserFest event hosted by AFIT. The first speaker, Joseph Verdeyen, PhD, discussed recent advances in established gas lasers, and the second speaker, Charles Hogge, PhD, regaled us with his personal and historical work on laser development in the Air Force research labs. The setup for the laser demonstrator booth is shown in Fig. 2. It consisted of the laser demonstrator, 2 posters explaining the optics principles, and the uses of lasers in military applications, and handouts for visitors. The front and back of the handouts which fold up are shown in Fig. 3.

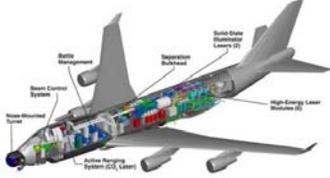


Figure 2: The Laser Propagation Demonstrator.

Military Laser Applications

Energy Weapons

The Airborne Laser (ABL) is built to destroy intercontinental ballistic missiles during their boost phase. The system has been operationally tested and can actually do this (it really works!)



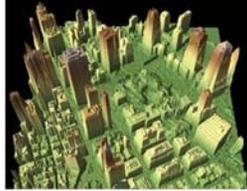
The Advanced Tactical Laser (ATL) is designed to attack targets on the ground.



LIDAR

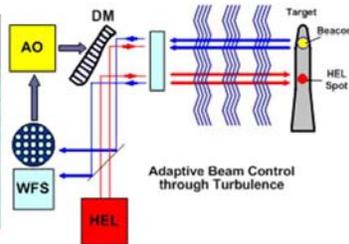
Lasers are used to map terrain, identify potential threats, track enemy movements, and "paint" targets to be destroyed.

LIDAR can generate a 3D map of enemy terrain from the air, like this 3D image of the WTC after the attacks on 9/11.



Adaptive Optics

Adaptive optics can be used to correct for atmospheric turbulence effects on wave fronts resulting in amazing clear images, even at very long distances.



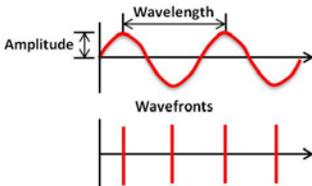
Laser Propagation Demonstration



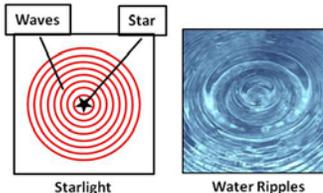
Laser Propagation Basics

Theoretical Description

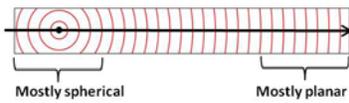
Laser light propagates in the form of a wave and has a distinct amplitude and wavelength. We can represent laser light propagation pictorially using lines called wavefronts. Most light sources, like the sun, are composed of many different wavelengths. Laser light is different because it is usually composed of a single wavelength and is called coherent light.



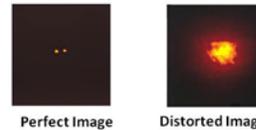
Light emanates from a point in space in the form of a spherical wave. Dropping a pebble in water simulates a point in space and creates a spherical wave. In the vastness of space, stars are considered naturally-occurring point sources even though they are very large and emanate light in this way.



As a light propagates in the form of a spherical wave over a long distance, it begins to resemble a plane wave for small viewing angles from the optical axis. Experimentally, we can use a pinhole to simulate a point in space and create a spherical wave out of laser light. We can also use a lens to simulate spherical wave propagation over a long distance.



Propagation through different media tends to change the properties of laser light. For example, laser light in the form of a plane wave becomes a distorted wave after propagating through the Earth's atmosphere. This is like seeing fuzzy images through a telescope as shown in the images of the twin stars. Turbulence created by the Earth's atmosphere can significantly degrade laser light propagation as demonstrated here on the screen.



Experimental Description

Coherent light from a laser (A) is incident on a pinhole (B). After the pinhole, the laser light propagates as a spherical wave (C) until it passes through a lens (D) and is transformed into a plane wave (E). As this plane wave propagates through the simulated turbulence (F) it becomes a distorted wave (G). The resulting image on the screen (H) is a spot with an uneven irradiance pattern.

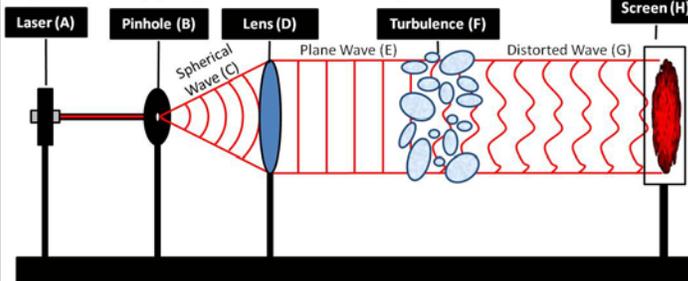


Figure 3: Handout used to accompany the Laser Propagation Demonstrator.

The operation of the laser demonstrator was quite simple. A collimated laser beam was propagated through a single rotating screen. The screen was made from of a transparent disc coated with a thin layer of clear acrylic spray paint and was attached to a variable controlled electric motor. Once rotating, the screen modeled dynamic atmospheric turbulence. When the collimated laser beam passed through the screen, the resulting pattern was scintillated. While this didn't model the exact effects of turbulence, it demonstrated the optics principles taught in the posters and handouts. It also provided insight as to how lasers are used in military applications which were also displayed in the posters and handouts.

The apparatus develop for LaserFest will serve as a legacy demonstration for the AFIT SPIE student Chapter. We plan to display it for years to come at many events, such as TechFest, an annual STEM outreach exhibition in Dayton sponsored by the Affiliate Societies Council.

Travel Grants and Scholarships

As the founding chapter president, Mr. Mark Spencer applied for and received a 2010 SPIE Student Chapter Travel Grant to attend the 2010 Student Chapter Leadership Workshop at Optics + Photonics. By having the opportunity to attend Optics + Photonics through this travel grant, Mr. Mark Spencer also had the opportunity to present his research results at the conference. Both opportunities greatly benefited the AFIT SPIE Student Chapter through the experienced gained by the founding chapter president. In the future, we will encourage more people from the chapter to attend the 2011 Student Chapter Leadership Workshop and at least one of our chapter officers will definitely apply for the 2011 SPIE Student Chapter Travel Grant.

Mr. Mark Spencer was also successful in applying for and receiving a \$3,000 graduate scholarship from SPIE for his contributions to the field of optical science and engineering. The AFIT SPIE Student Chapter greatly appreciates the honor endowed with the receipt of Mr. Mark Spencer's SPIE graduate scholarship and will continue to support and encourage future civilian students in the chapter to apply for graduate scholarships from SPIE.

Chapter Coin

Following military tradition and as a recruiting tool, we developed a coin for the current and future SPIE student chapter members. Capt Jeffery Dennison (our current chapter president) led the initiative and its design was a culmination of chapter support. Typically, military members carry a coin bearing their organization's unique emblem. These coins are given to the military member to prove membership and enhance morale. Our coin is shown below in Fig. 4. The shape is unique in that it is a triangle instead of a typical circle. The front features the AFIT logo and the back is the laser warning sign. Two holes are punched through the coin as if a high energy laser burned through it. Members who join receive this as a token of appreciation.

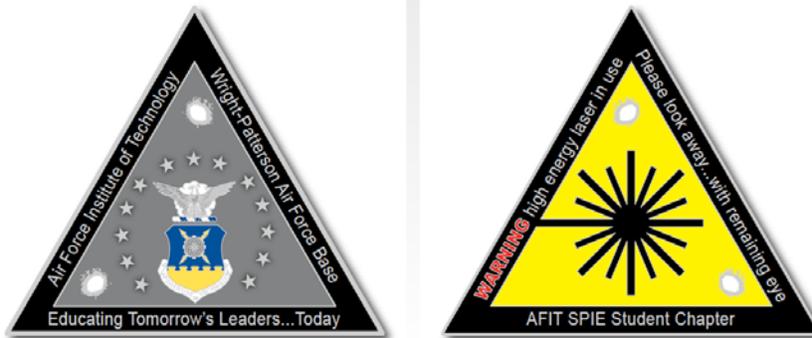


Figure 4: AFIT SPIE student chapter coin.

Future Activities

Several future activities are in the works. The STEM school faculty member who chaperoned the students at the LaserFest event was so impressed by our hands-on demonstrator that he invited us to bring it to their school. This is tentatively scheduled for late December or early January. Also, the Rosa Parks school in Dayton has a boys group that is interested in seeing a laser demonstration. We are in the process of finalizing a date, which is possible in the next few months. TechFest, an annual STEM outreach exhibition in Dayton sponsored by the Affiliate Societies Council is scheduled for 13-14 February 2011. We plan to display our LaserFest Laser Propagation Demonstrator at this event, which has over 70 different stimulating and informative exhibits and has motivated over 15,000 youth since 2003. Finally, a recruiting campaign to increase our membership numbers is underway. New students arrive at AFIT every year who go on to study and conduct research in optics and photonics. We are actively introducing these new students to SPIE and encouraging them to join our student chapter.

Financial Information

Attached here are our financial records through 2010.

Air Force Institute of Technology Student SPIE Chapter		
Statement of Cash Flows		
CY 2010		
Cash Flows - Operating Activities		
2009 Funding from SPIE	\$500.00	
2010 Funding from SPIE	\$900.00	
Name Registration w/ State of Ohio	(\$50.00)	
Purchase Checks	(\$25.00)	
Advertising / Recruitment	(\$12.36)	
Food & Supplies for Chapter Meetings	(\$118.79)	
Chapter Coins	(\$799.00)	
<i>Net Cash Flow from Operating Activities</i>		\$394.85
Cash Flows - Chapter Grants		
LaserFest Grant from SPIE	\$650.00	
Equipment for LaserFest	(\$523.97)	
<i>Net Cash Flow from Chapter Grants</i>		\$126.03
Net increase in cash and cash equivalents		\$520.88
Cash and cash equivalents, beginning of year		\$0.00
Cash and cash equivalents, end of year		\$520.88

Air Force Institute of Technology Student SPIE Chapter			
Balance Sheet			
CY 2010			
Assets		Liabilities	
Cash	\$520.88	Notes Payable	\$0.00
Chapter Coins (92)	\$735.08	Equity	
Tools & Equipment	\$507.34	Chapter Equity	\$1,763.30
Total	\$1,763.30	Total	\$1,763.30

Summary

In closing, we feel that we have had a fun and productive year. As the stability of our chapter improves, we fully intend to expand our outreach efforts and continue to grow. We greatly appreciate the honor of being part of this international organization and will strive to improve the already sterling reputation of SPIE. From all of us here at the AFIT student chapter, thank you.

Jeffery Dennison
 President
 SPIE AFIT Student Chapter
 Air Force Institute of Technology
 30 November 2010