

---

# POLISH-AMERICAN ENGINEERS ASSOCIATION

FOUNDED

IN 1934



---

1 Watergate Drive South Barrington Illinois 60010, USA • [www.polishengineers.org](http://www.polishengineers.org)

---

All members and friends of Polish-American Engineers Association are cordially invited to attend our March 2011 meeting.

DATE: **Friday, April 15th, 2011**

TIME: **7:30 p.m.**

PLACE: **Polish National Alliance**  
6100 North Cicero Ave.  
Chicago, Illinois

SPEAKER: **Professor Michael P. Wnuk**  
College of Engineering and Applied Science  
University of Wisconsin – Milwaukee

TOPIC: **WHY SPACE SHUTTLE COLUMBIA 7 DESINTEGRATED  
IN THE AIR WHEN RETURNING TO EARTH?**

---

## ABSTRACT:



When NASA's shuttle returns from space and re-enters the Earth atmosphere at speed of Mach 18.3, which translates to 20,000 km/h, the underbelly of the ship heats up to temperatures ranging from 750 oF to 3,000 oF depending on the specific location. A picture taken by a thermo-vision camera shows a colorful complex distribution of temperature. In space there is no problem with temperature since the environment consists of near vacuum. However during the re-entry the ship makes its first contact with the upper layers of the atmosphere, the laws of Aerodynamics begin to work. The spaceship is designed for just such an event. The enormous heat generated due to friction between air and the surface of the shuttle fuselage is absorbed by a thick layer of the thermal shield. The "angle of attack" during the re-entry is twenty degrees, so that the entire ship is used as a huge aerodynamic brake. The thermal shield is designed to withstand temperatures up to 5,000 oF, and it consists of 34,000 tiles each measuring 6" by 6" with the thickness of 3.5".

Statistics of the safety concerns of the shuttle are mind boggling. What one faces here is a complex system consisting of two and a half million parts. Thus, even if the structural reliability of the shuttle is established at 99.9%, then there remain 2,500 components susceptible to failure. For the Columbia 7 shuttle it turned out that the critical "weak link" in the system was the adhesion of the tiles used to build the thermal shield. Each such tile is manufactured as a heat treated composite containing silicon fibers embedded in the boron matrix. All the tiles are attached by polymer adhesive to the lower surface of the shuttle fuselage. This unique composite that possess extraordinary physical properties is manufactured by Cerac, Inc., a company located in Milwaukee, Wisconsin. When looking at the microstructure of the heat absorbing shield, one finds that in a cubic inch of a tile there is more than a million silicon fibers.

The purpose of the lecture is to point out the possible causes of the February 3, 2003 catastrophic failure that occurred at around 9 AM and resulted in disintegration of Columbia 7 at the height of about 63,000 meters during the descent from the West Coast toward Florida (to cover this distance at shuttle's operating speed it would have normally taken just 16 minutes). Columbia never made it. The debris of the shuttle were spread all across the land along the ship's trajectory, falling on ground in the states of Texas, California, Arizona, New Mexico and Louisiana.



## **SPEAKER BIO:**



**Professor Emeritus Michael P. Wnuk** has taught Engineering Mechanics at the University of Wisconsin Milwaukee for more than 20 years. In 1968 he completed his post-doctoral studies at California Institute of Technology in Pasadena, CA, specializing in Aeronautical Engineering. His paper resulting from the NASA supported research at Caltech won a reward at the IUTAM Congress at Stanford University in August 1968. He has also taught and performed research at various schools in the United States, including Michigan State University, Stanford University, California Institute of Technology and Northwestern. Dr. Wnuk has also worked abroad in England, Poland (his native country), Germany, Russia, Italy, Yugoslavia and China. In 1970 he worked as a Distinguished Visiting Scholar in the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge, UK. The British Science Council and the Office of Naval Research of the US have sponsored his research there. The other sponsors of his researches include NATO, NASA, the National Science Foundation, National Academy of Sciences and the National Institute of Standards and Technology.

In 1991, he was appointed a Fulbright Scholar, and in 1992, he received the Lady Davies Scholarship from the Government of Israel. He is a member of the Sigma Xi Research Society, an Associate Member of the Cambridge Philosophical Society in England, member of the American Academy of Mechanics, and a life member of the New York Academy of Sciences.

Dr. Wnuk is one of the co-founders and a co-chairman of the International Conference and Research Workshops on Mesomechanics, which convenes every two years (in 1996, Tomsk, Siberia, in 1998, Tel Aviv, in 2000 in China, and in 2002 in Denmark at the Aalborg University) in order to merge interdisciplinary research of high-tech nature involving Physics at nano-scale, Materials Engineering and Mechanics.

He has been selected an ASEE/NASA Summer Faculty several times; in 1966 at the Johnson Space Center NASA White Sands Test Facility in New Mexico, and then in 1998, 1999, 2000, 2001, 2002 and 2003 at California Institute of Technology/Jet Propulsion Laboratory in Pasadena, California. Some of his recent work pertains to the bio-medical applications of Mechanics of Continuous Media, in particular Fluid Mechanics describing flow of non-Newtonian multi-phase fluids, such as flow of blood in the human arteries.

Since 1994 Dr. Wnuk serves as President of the Panslavia International Research Institute, Inc., which assists multinational partners in trade, science and technology transfer with particular emphasis on global problems of ecology and bio-medical R&D.

Pertinent data may also be found at the Internet using the address [www.uwm.edu/~mpw](http://www.uwm.edu/~mpw) or by writing an email at any of the addresses: [mwnuk1@wi.rr.com](mailto:mwnuk1@wi.rr.com), [mpw@uwm.edu](mailto:mpw@uwm.edu).

## ADMINISTRATION UPDATE

**Board of Directors** Ballot was completed on February 15th. Following members of PAEA became the first members of BOD: Miroslaw Noyszewski, Dr. Ron Wolosewicz, Dr. Jan S Plachta, Walter Rymsha, Stanley Witczak, Jacek Zaworski and Jerzy Pietrowski. Board had their first telecon on March 4th. That was followed by a face to face meeting hosted by Dr. Plachta. One of the main projects that BOD is currently tackling is History of PAEA. Any documents pertaining to the last 76 years will be very welcome. Additionally Dr. Ron Wolosewicz and Mirek Noyszewski provided suggested changes to the Constitution and By-Laws

## TRIP TO ROCK ISLAND

**PAEA-sponsored visit to Rock Island** is being organized by Dr. Jan Plachta and Mr. Rafal Kopacki.

As it was previously discussed we are organizing a one-day bus trip to the Quad Cities on the Mississippi River. We will be leaving Chicago at 8 am on **Saturday, April 16, 2011** and return at about 8 pm the same day. We are planning to meet at the PNA office building at 6100 N. Cicero Ave. There is a large parking lot, which on this day will be available for us to use. In the program is visit to the **Lock and Dam structure #15** where from the tourist visitor center we can observe operation in the very busy lock chambers and view operation of the movable span of the Government Bridge. This historical bridge was designed by Ralph Modjeski and was opened to traffic in 1896.

[http://www.johnweeks.com/river\\_mississippi/pagesB/umissB06.html](http://www.johnweeks.com/river_mississippi/pagesB/umissB06.html).



Copyright © 2008 John A. Weeks III

Later we will visit the **Rock Island Museum and Arsenal** historical monuments.

<http://www.tactical-life.com/online/exclusives/rock-island-arsenal/>

After lunch we plan to go on a short ride to Bettendorf where we could visit impressive **Memorial Bridge**.

<http://www.aaroads.com/blog/2008/06/07/i-74-bridge-replacement-will-it-ever-get-built>

This is a suspension type bridge that was designed by Modjeski in 1930's.



The cost of the one-day excursion to include family style lunch will be **\$40/person and \$20/student**. Our Treasurer Mr. Richard Kaczmarek will be collecting and maintaining the attendance list. For additional information please call **Rafal Kopacki at 773-822-4842** or **Dr.Jan Plachta at 773-415-1818**. To date we have 45 members and sympathizers who made reservations. There are a limited number of seats available, final opportunity to sign up will be during April 15th meeting if seats are still available.

Mr. Roman Korczak working with ASPA to updated **scholarship application** portion of our web page with most current information. Revised guidelines and language was adopted and posted on the scholarship link. Site became available at the end of March.

**May 3rd Parade** is coming up fast. It will take place on May 7th. We have sent our application with the customary donation of \$250. Please make plans to support our marching unit and increase our visibility. We will invite all those who joined our marching unit to our customary Pizza lunch.

PAEA approved \$250 renewal of our **membership in Polish Museum of America**.

Our sister organization **Polonia Technica is celebrating 70th anniversary**. PAEA was invited to participate in the festivities which are scheduled for May 13th, 14th and 15th. At Polish consulate in New York. All the requisite details and sign up Information will be provided during the April 15th meeting.

Mr. Rene Pietrzyk, Social Director suggested June 18th as the potential date for our **picnic at Fourth Lake Resort**. Please check Your calendar and reserve this date.

**P.A.E.A. MEMBERSHIP DUES.** PAEA fiscal year began in January. **Please plan to pay your 2011 dues during the next meeting.** Dues remain unchanged for 2011 and are \$50 per year; senior citizens (over 65 years of age) and students \$25 per year. Questions? You may send an email to: paea.info@gmail.com

[www.polishengineers.org](http://www.polishengineers.org)