The Current Source

Newsletter of the Schenectady Section of the IEEE

Chairperson's Message

Engineering Education and the job market is one of the hot topics these days. Is it the time for change? Do we need to change our engineering education system to cope with the current challenges the engineering profession is facing? Industry nowadays calls for engineers to have more communication and management skills in addition to the solid engineering knowledge base and practical design approach. However, universities are still trying to cram all these contents into their four years curriculum. On the other hand, over the past several years we have witnessed worldwide workforce shifts due to the globalization. In a recent report by the IEEE-USA, the drops occurred among computer programmers, followed by electrical and electronics engineers, then computer scientists and systems analysts. These declines were offset by substantial employment increases for computer and information systems managers, computer hardware engineers and computer software engineers.

To get an idea on how universities in the Capital Region are preparing for the Engineering Education challenges and the job market in the 21st century, the Section invited Bob Kozik, Dean of the Graduate College of Union University - School of Engineering and Computer Science, to provide an overview of the school's current programs and initiatives at the March membership meeting. The new College in the City of Schenectady is focused at integrating industry partnerships into the programs, expanding adjunct faculty and courses consistent with student and Tech Valley industry objectives, and providing Capital District Professional Engineering license and continuing education courses. Also in this issue of "Current Source" there is an article by James Tiens, Professor at the RPI, on "Time to think about a Master's of Engineering". In his article, Prof. Tiens is proposing moving engineering education to a level on a par with doctors and lawyers. He is proposing a master's of engineering degree built on a two-year/three-year framework that can help ensure that future engineers will have a better technical grounding as well as a more professional status.

Enjoy this issue of *The Current Source* and share with us your comments and views!

Sam Salem
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News from the IEEE Foundation:

Grainger Foundation Gift to Honor Outstanding Power Engineers

The Grainger Foundation, known for its generous support of the field of power engineering, gave a US$100,000 gift to the IEEE Foundation for the annual presentation of the IEEE Nikola Tesla Award. The Grainger Foundation's co-sponsorship of this important power engineering Award will bring new understanding and elevated importance to both the Award and its recipients.

Established in 1975 and named in honor of Nikola Tesla, this award may be presented annually to an individual or a team that have made outstanding contributions to the generation and utilization of electric power. The prize items include a plaque and honorarium. This gift is expected to support the cost of the annual honorarium through 2017. To learn more about this and other IEEE Awards, go to the website http://www.ieee.org/awards

Communicators "Racing to the Future" in Saratoga

From October 24-26, 2006, the IEEE Professional Communication Society's annual conference will be coming to Saratoga Springs, New York. The IEEE Conference on the Convergence of Technology and Professional Communication will bring together engineers, technical communicators, and educators for three days of conference sessions, workshops, and networking. Members of the Professional Communication Society focus their efforts on information design, architecture, and dissemination.

With a theme of "Racing to the Future," this conference will focus on the tremendous changes we have seen in how information is disseminated as well as directions for the future. This conference is for anyone who works on documentation, training, or any other method of information dissemination.

During the awards banquet at the conference, Dr. John Carroll will be presented with his IEEE Fellow Award. Dr. Carroll has been active in the technical communication field for many years and would like to receive his award during the conference.

For more information, please contact conference Chair, Dr. Beth Weise Moeller (b.w.moeller@ieee.org).

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Announcement: Position Open - PACE Chair

The PACE Chair is a liaison to the Professional Activities Committees for Engineers (PACE), a grassroots network of IEEE volunteers and committees organized at the Section level. The PACE Network promotes the professional status of the electrical engineering profession and of IEEE membership and provides a mechanism for communication of members' views on their professional needs. This Network also provides the local PACE Chair with information, assistance and resources (both intellectual and financial).

The PACE Chair supports and distributes information to the Section on professional development opportunities such as job fairs, seminars and conferences. There is grant money available from IEEE for implementation of program ideas for Section members.

This position is expected to take only 2 - 4 hours per month, with more time required should local events/classes be planned.

Support for new volunteers is available from the past and present members of the Schenectady Section Executive Committee and past PACE chairs. Training will be provided if desired.

To volunteer for this position, contact Becky Nold (r.nold@ieee.org) or Sam Salem (s.salem@ieee.org)

Call for Contributions

The Current Source is always open for contributions for future newsletters. There is certainly much more going on in this area then gets profiled in the newsletter. Do you have an article about a historical moment, a future event, or a notable discovery that might be of interest to the local IEEE community? How about a picture of some momentous occasion? Please contribute! Staff editors can even take your bulleted list and turn it into printable article if writing does not appeal to you. We do however have to reserve the right to refuse any material of a commercial nature.

The Current Source is published twice a year by the Schenectady Section of the IEEE. If you are interested in volunteering for *The Current Source* or wish to submit material for consideration, please contact the editor.

Capital District Future City Competition 2005

By Peter E. Sutherland, Ph.D., P.E.
Student Activities Chair, Schenectady Section of IEEE and Mentor Recruitment Chair, Capital District Future City Planning Committee

The fourth annual Capital District Future Cities competition was held in the McNeil Room of the RPI student union on January 15, 2005. Nineteen middle school teams from area schools competed for an all-expenses-paid trip to the National Future Cities Competition in Washington, D.C. during National Engineer's week. This was the largest turnout in the history of the event. The theme of this year's competition was "Use of Aggregate Materials in Futuristic Transportation Systems."

The Future City Competition is a program for middle school students (7th and 8th graders) to use their creative and innovative imaginations to design a city of the future. The students work with their guiding teacher and a volunteer engineer from the community to design and build the city. The students apply math, science, engineering and technology, as well as enhance their writing and presentation skills through this project.

Area businesses and professional groups provided over 40 cash prizes and awards; the total of which was over $5,000. The IEEE Schenectady Section sponsored an Award for Excellence in Generation and Conservation of Electrical Energy. IEEE volunteers had an important role in the entire competition. Chandra Reis was the Schools Recruitment chair. Jason MacDowell and Paul Sikora were engineer mentors. Student Activities Chair Peter Sutherland attended the competition to review the projects, interview teams and make the tough choice of who would receive the IEEE award. This award was won by the team from Farnsworth Middle School (Guilderland) with a city named "New Albany". The team used a balanced energy mix of solar, wind and fuel cells. and hydropower from the Hudson River for their electrical generation. The run of the river hydro plant featured a turbine, which rotated on a vertical shaft, turned by paddles extending out into the river current.

The Future City design effort is very similar to a real world consulting engineering project, and gives students a realistic experience of what engineers do. Each team designs a city of the future using the SimCity computer software, and builds a tabletop model using recycled materials. The team must also write an essay on an assigned engineering topic and prepare an oral presentation to give at the competition.

Three students represent the team with their teacher and mentor at the Regional competition. The students present their city at the competition to compete for locally sponsored awards and prizes as well as the Regional Title. The winner of the Regional competition also wins a trip to Washington, DC to compete in the National competition.

The day began with an opening ceremony featuring Harry Tutunjian, Mayor of Troy, and Joe Chow, Acting Associate Dean of Research, School of Engineering, RPI. This was followed by the preliminary round of judging, where each team had to make a presentation of their city before a panel of judges. After lunch, the finalists were announced. Each finalist team presented their city before a full audience and answered questions from a panel of judges. The Master of Ceremonies was Mike Bono, Chief Meteorologist for Channel 9, and the keynote speaker was Alan G. Hall of Lansing Engineering on "The Future of Aggregates: It's in Your Hands." The awards were then presented to this year's winning teams. The competition was featured on two local TV news broadcasts and covered in several local newspapers.

The Holy Spirit Middle School donated their $500.00 Third Place prize to Tsunami victims. Holy Spirit also won four other awards and were featured in the Troy Record.

This competition would not be possible without the support of many volunteers, mostly local engineers. Volunteers are active in many areas, including finance, hospitality, judging, awards, logistics, mentoring, publicity, school recruitment, and making the "day of" the competition a success. For further information, e-mail FutureCity@plugpower.com or visit www.capitaldistrictfuturecity.org.

…The Future City Competition is a program for middle school students to use their creative and innovative imaginations to design a city of the future.

This year's winners:

1st Place($1,000)

Maple Hill Middle School
"Manila"

2nd Place ($750)

W.K. Doyle Middle School
"Star Gate"

3rd Place ($500)

Holy Spirit School
"Cinnabar"

4th Place

Koda Middle School
"Troy"

5th Place

Lansingburgh Central School
"Technoville"

…The winner of the IEEE award was Farnsworth Middle School in Guilderland with a city named "New Albany".

Time to think about a Master's of Engineering

By James M. Tien,
IEEE VP, Educational Activities
Published in The Institute, June 2003

Even though industry persistently calls for engineers to have more communication and management skills, a solid knowledge base, and a practical design approach, universities are still trying to cram all that content into only four years.

We must also address the dual stresses created by the U.S. education system on poorly prepared students and rising tuition costs.

As engineers, we are in the business of designing new and better ways to solve problems. That same thoughtfulness and determination should be applied to moving engineering education to a level on a par with doctors and lawyers. I believe this can be accomplished with a master's of engineering degree – perhaps built on a two-year/three-year framework – that can help ensure that future engineers will have a better technical grounding as well as a more professional status.

Long before nanotechnology, computational cybernetics or space flight, there was a call to reform engineering education. It was made by C.R. Mann in a 1918 article he wrote for the Carnegie Foundation for the Advancement of Teaching. In it he urged that language, economics, and social science subjects be added to an already overcrowded curriculum.

Even though industry persistently calls for engineers to have more communication and management skills, a solid knowledge base, and a practical design approach, universities are still trying to cram all that content into only four years. There wasn't enough time to cover these in the 20th century, and four years certainly won't be enough time in the 21st.

I propose restructuring the U.S. undergraduate and graduate degrees into a professionally oriented program based on a five-year European model such as the Diplomingeniur program in Germany, which includes writing a master thesis similar to that required by the current U.S. master's of business administration degree. IEEE Fellow Adolf J. Schwab of the University Karlsruhe in Germany noted that his university had tried the separate bachelor's and master's degree model, but believes "that the classical five-year program is superior."

We must also address the dual stresses created by the U.S. education system on poorly prepared students and rising tuition costs. The lack of pre-college preparation leads to a shocking drop-off in potential engineers. Less than one-half of students who enroll as science and engineering majors complete a degree within five years, according to the U.S. National Science Board.

One solution is to split the five years into a two-year preparatory or associate's degree followed by a professional three-year study leading to a master's – rather than a bachelor's – degree as the first professional degree. This change would create a para-professional, two-year degree for those who want to stop there and become technicians.

Although the first two years of study could be done at a traditional university, it would be more cost effective if students took these classes at a community or junior college, saving them anywhere from US$1,000 to US$10,000 a year.

The two-year, pre-engineering undergraduate curriculum would emphasize the fundamentals of engineering, such as math, physics, and computing. Teachers at community colleges could pay closer attention to students and assign them remedial work, if necessary.

The reduced tuition and frustration may lead to more students transferring to a university. Transferring engineering students – who are usually more focused and mature – have higher retention and graduation rates than other students.

The ensuing three years would allow students to take discipline-specific courses, conduct hands-on experiments, explore growing cross-disciplinary fields, work with mentors, practice management skills, and carry out team-based projects.

The distinction between technicians and engineering professionals would help properly define an engineer's role and gain greater esteem for the profession in the public's eye.

Stakeholders' challenges

The three main groups that share the responsibility for evolving engineering education – universities

and their students, industry, and professional associations – face many challenges.

The effort it would take for universities to change how they've taught engineers for the last century cannot be minimized. Universities and accrediting bodies would have to establish new evaluation procedures. Students would face a mandatory extra year of studies at a time when only the most ambitious and focused graduate on schedule in a four-year program. Although educators face a difficult transition, the need for well-educated engineers is imperative.

Companies cannot afford to hire employees who lack proper education, and engineering graduates with bachelor's degrees may still have a lot to learn. In the past, industry often subsidized advanced degrees, and older employees turned novices into engineers through mentoring. But the weak economy and accelerated pace of technology have caused many companies to streamline their operations.

"Industry is no longer willing to take on the role of being an engineering finishing school," according to a report by Terry S. King, dean of engineering at Kansas State University in Manhattan, USA.

Industry may balk at the higher salaries that more advanced professionals command, but the need for more thorough schooling before beginning an engineering career has undeniable benefits.

Getting to work

Professional associations traditionally have been the guardians of their members' educational requirements and program accreditation. Therefore any change in educational criteria would have to be mandated by these groups, such as the IEEE, the American Society of Mechanical Engineers, and others. Just as the American Medical Association and the American Bar Association took the lead in changing the parameters of undergraduate and graduate curricula for their professions, engineering associations will have to do the same.

Responsibility for accreditation is complicated by the profusion of engineering disciplines, each represented by a different learned society. We need a coalition that would work for the 10 to 20 years it may take to change the individual engineering disciplines.

Much work has already been done. Engineering professional societies have brainstormed ideas, industry and government organizations have issued papers, and conferences have been convened. Already, groups such as the Industry University Government Roundtable for Engineering Education, the National Science Foundation, the National Academy of Engineering, the Engineering Deans Council, and the Corporate Roundtable of the American Society of Engineering Education have been working on updating and enhancing engineering education.

Information about the author: Dr. James Tien is Yamada Corporation Professor with the Department of Decision Sciences and Engineering Systems, at Rennselaer Polytechnic Institute. Dr. Tien has also served as Acting Dean of Engineering and as Acting Chair of the Department of Electrical, Computer and Systems Engineering at Rensselaer. He is on the IEEE Board of Directors and is an IEEE Vice President in charge of the IEEE Publication Services and Products Board. He is a Fellow of IEEE and a member of INFORMS and IIE. He has received numerous research and education awards, and is an elected member of the National Academy of Engineering. Prof. James Tien can be reached via e-mail at: tienj@rpi.edu

Past, Present, Future:

The history of electrical engineering in our area

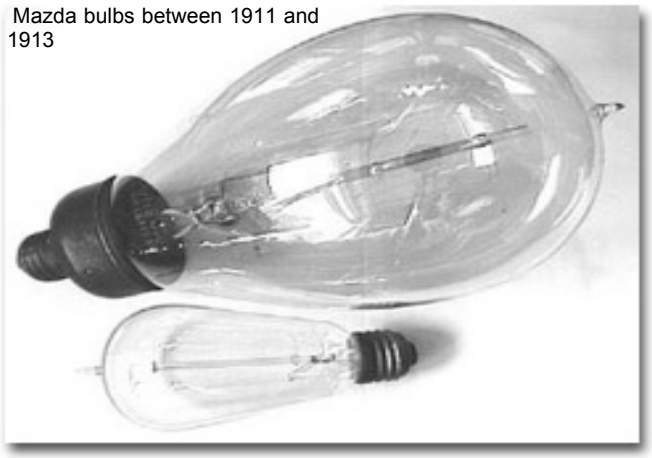
Chandra Reis, our Section Historian, continues her regular column. If you have any people, communities, or ideas you would like to see profiled, please contact the author at creis@igc.com.

William David Coolidge

There are many cases where a person with a background in one scientific discipline has a particularly large impact on another. One such person in our area was William David Coolidge. Coolidge was a physical chemist (bachelor's degree from MIT in 1896, doctorate from University of Leipzig in 1899) whose work with tungsten in the early 1900s enabled both the wide-spread use of incandescent electric light and the use of X-rays as a diagnostic tool.

William David Coolidge was born in Hudson, Massachusetts, near Boston, on October 23, 1873. He joined the General Electric Company in the research laboratory in 1905. In 1914 he was awarded the Rumford Medal of the American Academy of Arts and Sciences. Coolidge was awarded the AIEE (one of the precursor organizations to the IEEE) Edison Medal in 1927 for "for his contributions to the incandescent electric lighting and the X-rays art." Coolidge's innovations covered a broad spectrum: he worked on magnetized steel, improved ventilating fans, radar systems, and the electric blanket. In total, he was awarded 83 patents, including patent #US1,203,495, granted in 1913 for the vacuum tube foe generating x-rays.

Coolidge served as director of the GE research laboratory (1932–40) and vice president & director of research (1940–44), postponing his retirement until the end of World War II. He was elected in his lifetime to the National Inventor's Hall of Fame, a rare occurrence and died on February 3, 1975 at the age of 101, in Schenectady, New York.


Mazda bulbs between 1911 and 1913

Coolidge's first major accomplishment at the GE Research Laboratory was to dramatically improve the lifetime and brilliance of electric light bulbs. The carbon filament light bulbs presently manufactured from Edison's design lasted only around 100 hours. These carbon bulbs were not very energy-efficient. Bulbs using tantalum had been devised in Europe but worked well only on direct current.

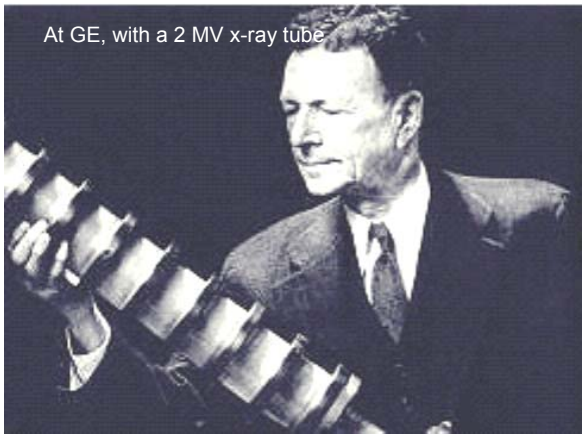
In 1904 several European inventors had developed filaments from the metal tungsten, but the best available processes created very brittle sintered tungsten filaments that could not be bent once formed. In 1909, Coolidge succeeded in preparing a ductile tungsten wire. General Electric sold Coolidge's bulb under the trade name "Mazda" beginning in 1910. Samples of early Mazda bulbs used to be on display in the hallway outside Proctor's theater. The additional improvement of winding the wires into fine coils reduced convective heat loss, allowing the filament to operate at the desired temperatures. This new bulb was able to last around 1500 hours. Tungsten lamps are still made essentially the same way Coolidge made them.

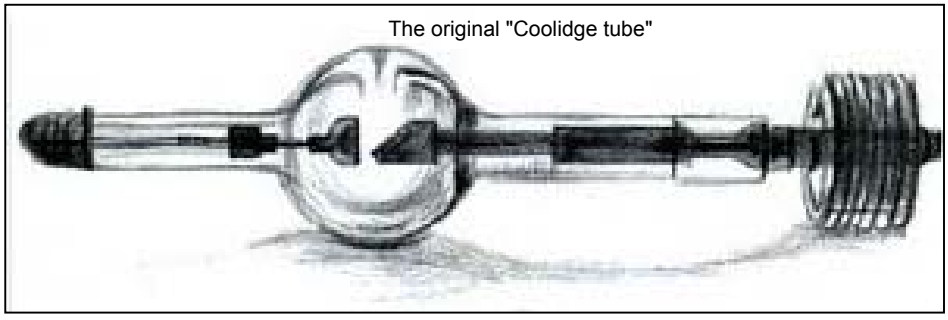
Because of the high melting point (3410°C / 6170°F) and good electrical conductivity of this ductile tungsten, Coolidge explored its use as an electrical contact to replace the platinum that was the material of choice at the time. Tungsten performed very well in all situations where extreme high temperatures were not present (causing undesired oxidation) and showed much greater contact life than platinum.

Coolidge's second major invention, the practical X-ray tube, is also essentially the same today as it was then. Early X-ray tubes then in existence were full of gas and operation was very erratic. The gas was required to produce ions, which produced electrons by bombardment of a cold aluminum cathode. A colleague at the Research Center, future Nobel Prize winner Irving Langmuir, found that he could get controllable electron emission from one of Coolidge's hot ductile tungsten filaments in high vacuum. Coolidge then installed a heated tungsten filament in an X-ray tube with a tungsten disk anode. The tube was introduced to the world in 1913 and finally granted a patent in 1916. Despite subsequent advances, Coolidge's basic design has never been superseded. The Coolidge tube was adapted to a field X-ray unit for use in World War I. Many practitioners became acquainted with it for the first time in this setting. This cycle of introducing new medical advances to soldiers in the field continues today.

During World War I Coolidge and the Research Laboratory were also involved in a collaborative development of a submarine detection system involving GE, the Submarine Signaling Company, and Western Electric. An experimental station was set up on the Mohawk River. Coolidge soon found that sealed rubber binaural listening tubes provided excellent range. This device went into service on U.S. and British vessels as the "C" Tube—for Coolidge. These devices helped submarine chasers to clear the Mediterranean of submarines in the spring and summer of 1918 and were an important factor in the final outcome of the war.

During World War II, Coolidge, became involved in the atomic bomb investigation as a member of President Roosevelt's Advisory Committee on Uranium. As the war wound down, Coolidge took his well deserved retirement, although he continued to be active in the scientific community for years.


At GE, with a 2 MV x-ray tube


The original "Coolidge tube"

Bibliography and additional reading

- *William David Coolidge: A Centenarian and His Work by Herman A. Liebhafsky.*
- *Natl Academy of Sciences Memorial Biography:http://books.nap.edu/books/0309032873/html/1.html*
- *www.harvardsquarelibrary.org/unitarians/coolidge.html*
- *web.mit.edu/invent/iow/coolidge.html*
- *inventors.about.com/library/inventors/blxray.htm*
- *www.geocities.com/bioelectrochemistyr/coolidge.html*

Membership Meetings

Some presentations are now available on our Section web site, check them out at the events tab at www.ewh.ieee.org/r1/schenectady

February 18, 2005:

Vince Socci from On Target Technology Development shown here during his Schenectady Section presentation on Adaptive Product Management. Photo Credits: H. Halstead.

February 17 & 18, 2005
Engineer's Week 2005
Albany Marriott
Sponsored by
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in cooperation with
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January 19, 2005
Brandon's Ritz Terrace
Schenectady, NY
"MRI Magnets"
Presented by: Bruce Amm
GE Global Research Center

December 15, 2004
Brandon's Ritz Terrace
Schenectady, NY
Holiday luncheon

2005 Industrial & Commercial Power Systems Conference

The 40th annual Industrial and Commercial Power Systems Conference (I&CPS) will be held at the Prime Hotel and Conference Center in Saratoga Springs from 8-12 May. Jointly sponsored by the Industry Applications Society and the Schenectady Section, this conference will bring together about 125 professionals in an intense session of committee meetings and technical sessions.

Members of the Schenectady Section have been heavily involved in industrial systems activities for decades. Initially, these functions took place in conjunction with the Winter and Summer General Meetings of the AIEE. I&CPS held its own technical conference for the first time in 1964 in Philadelphia. This year marks the first conference to be held in the New York/New England area and the first time that the Schenectady Section has been its host.

I&CPS has two main functions. It is the source of a very popular series of application standards that are classic references for design, application, and analysis of power distribution systems for industrial and commercial facilities. The so-called "Color Book" series of standards includes thirteen volumes, with a new book scheduled for completion in 2005. The oldest of these, Recommended Practice for Electric Power Distribution for Industrial Plants (the Red Book) originated more than 50 years ago as an industry-based successor to the old GE Industrial Power Systems Data Book. Many of the authors of the Red Book, and of other books in the series, came out of the Schenectady Section.

The second major activity at this conference will be a technical program that holds 29 papers on various topics relating to power generation and distribution. These papers have been written by authors from both industry and the academic world who will be traveling from their homes across the US and Canada and from several countries in Europe and Asia. Four of the papers include contributions from members of the Schenectady Section.

In conjunction with the technical conference, GE Consumer and Industrial will be hosting a free product application seminar on Monday, May 9. The conference will culminate on Thursday with both a tour of the Bethlehem Energy Center and a tutorial on Arc Resistant Switchgear. The tutorial has been accredited for CEUs for those who require continuing education to renew their Professional Engineering Registration; the cost for the tutorial is $75.

Complete details on the conference, including registration information, can be found on the conference web site, http://ewh.ieee.org/soc/ias/icps2005/

Special Summer Issue – New Technologies

We are planning a special Summer issue of *The Current Source* dedicated to profiling new technologies in all areas of electrical engineering in the Schenectady Section. If you, your university, or your company are working on something that will be of interest to the general Section membership, please submit a short article for consideration to the newsletter editor:

Srinivas (Sri) Pillutla
srinivas.pillutla@ieee.org

The deadline for submissions is **May 31, 2005**. We reserve the right to refuse any material of a commercial nature.

Remember the newsletter staff is all volunteers; we need **you** to tell us what is going on out there.

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