Engines Lab Research on Algae-Based Biodiesel Fuel

It is always something new and interesting with Bryan Willson and his colleagues at the Department of Mechanical Engineering’s Engines and Energy Conversion Laboratory (EECL). Willson, the lab director, is performing research on growing algae and converting it to biodiesel fuel. In previous editions of the ME newsletter, we provided stories about the EECL work to provide bolt-on conversions for two-stroke engines in motortrikes used in the Philippines and elsewhere. Those devices greatly reduce two-stroke engine emissions. Now, we have the opportunity to discuss a research area that is likely to produce biodiesel fuel in an energy-efficient way, perhaps as efficient as mining fossil fuels, but instead will soak up carbon dioxide and use energy from the sun.

The EECL now is engaged in a multidisciplinary research venture that involves Solix Biofuels, a Fort Collins company that owns much of the technology being developed. Last June, the EECL started with a 50-milliliter algal culture from a species of algae found in the North Sea that, under the proper circumstances, can produce high amounts of lipids in their bodies. The EECL has now countless trillions of algae cells. They are growing them in long rows of flexible transparent tubes arranged to allow for continuous mixing of the algae to encourage efficient photosynthesis of carbon dioxide and energy from the sun. The algae are being grown in the photosynthesis

Mechanical Engineering Class of ’56 Enjoys Reunion

In October 2006, College of Engineering alumni visited campus during homecoming/family week. In conjunction with CSU activities, the College held its annual 50+ Year Homecoming Reunion Dinner on October 7. About 20 alumni, who graduated 50 or more years ago, enjoyed an evening of conversation and sharing memories with classmates. Participants also were treated to a presentation highlighting campus life at CSU in the 1930s, ’40s, and ’50s. Mechanical Engineering alumni were well represented by Bob Walker, Ralph Marker, Orval Jones, Don Bueche, and Mel Black from the class of 1956. Pictured here are the College of Engineering graduating class taken in 1956. There are just three MEs in the picture as indicated in the photo caption.

Orval Jones worked for many years at Sandia National Labs. Bob Walker founded and operated an aerospace company and now owns the Flagg Ranch near Yellowstone National Park. Ralph Marker spent 30 years with NASA, the Air Force Academy, and the Department of the Interior and just completed 20 years with Dynamic Solutions.

Left to Right Back Row: William Ashcroft, Robert Walker (ME), Joy Holdeman, Gilbert Johnson, Paul Brown, Orval Jones (ME), and William King. Front Row: Leland Gilbert, Ronald Hughes, and Ralph Marker (ME). Not Pictured: Mel Black (ME) and Don Bueche (ME).
Mr. Robert Anderson (B.S.M.E. 1943), who achieved noteworthy career successes and significantly impacted the educational experiences of past, current, and future CSU engineering students, passed away on October 28, 2006.

Mr. Anderson was born in Nebraska on November 2, 1920, and after earning his bachelor’s degree in mechanical engineering at CSU, he served as a captain in the Army field artillery until 1946.

In 1946, Mr. Anderson began working with Chrysler Corporation as a graduate student in the Chrysler Institute of Engineering; he earned a master’s degree in automotive engineering two years later. He held several engineering positions with Chrysler before joining Rockwell International Corporation in 1968 as a corporate vice president and president of the company’s Commercial Products Group. He was named a corporate vice president and chief operating officer in 1970. He served as Rockwell’s chairman and chief executive officer before retiring in 1988 and was then appointed as chairman emeritus.

Mr. Anderson has also served in leadership positions for numerous national and international organizations. For example, in 1983, President Ronald Reagan named Mr. Anderson to the Presidential Commission on Industrial Competitiveness, which was a panel of 21 labor and academic leaders who were charged with improving the nation’s ability to compete in the world marketplace. In 1966, Colorado State University conferred on Mr. Anderson an honorary Doctor of Laws degree and named him the Honor Alumnus for the College of Engineering. In 1985, he received CSU’s William E. Morgan Achievement Award.

As a financial supporter of the Department of Mechanical Engineering and the College of Engineering, Mr. Anderson played an instrumental role in establishing the College of Engineering’s Rockwell/Anderson Assistant Professorship and the Anderson Computer Lab.

Mr. Anderson is survived by his wife, Diane, and two children, Dr. Robert Anderson Jr., of Blaine, Washington, and Kathleen “Kit” Thomas of Vancouver, British Columbia; two stepchildren, Keri Anderson of Brentwood and Erin Anderson of Tarzana; and four grandchildren.

Calendar of Events

Student Competitions:

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<tr>
<td>3/23-25</td>
<td>SAE Aero Design West</td>
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<tr>
<td>4/13-15</td>
<td>ASME Human Powered Vehicle</td>
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<tr>
<td>5/1-3</td>
<td>SAE Formula Hybrid Competition</td>
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<tr>
<td>5/16-20</td>
<td>Formula SAE Race Car Competition</td>
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<tr>
<td>7/1-10</td>
<td>World Open RoboCup Rescue Robot League</td>
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ME/College of Engineering/University Events:

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<th>Date</th>
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<td>4/13</td>
<td>E-Days and ME Senior Design Practicum</td>
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<tr>
<td>4/13</td>
<td>MEAP Board Meeting, Rooms 214-216 LSC</td>
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<tr>
<td>4/14</td>
<td>Alumni Green and Gold Gala</td>
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<tr>
<td>4/27</td>
<td>ME Prof. Harry Edwards Retirement Reception</td>
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<tr>
<td>5/11</td>
<td>Undergraduate Commencement, Moby</td>
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Algae-Based Biodiesel Fuel
(continued from page 1)

mode, but some are able to grow in the dark as well – called the hetero-
trophic mode. In that case, the algae get their energy from sugars or other
dissolved organic matter in their growth environment. Clearly, solar
energy is a better way to go – after all, it is free as compared to sugars.
However, this introduces the pos-
sibility of using the algae to remove
organics from wastewater.

In order to get at the lipids, the
algae have to be “stressed” at just the
right time and for the right amount
of time. Stress them too much and
their growth rate is significantly
reduced. The process of stressing
them makes them produce lipids
inside their bodies, and at this point,
the harvesting process can begin.
One common technique for stressing
algae is to deplete certain nutrients
from the growth media.

The lipids are similar to vegetable
oils and cholesterol in our blood
streams. The stuff is made up of
long carbon-chain molecules that
are highly cross-linked with glycerin
elements. It is gooey stuff. The algae
cells have to be burst open, and
then solvents, such as hexane, can
be used to dissolve the lipids. Then,
进一步 refining is necessary to finally
produce diesel fuel.

So, how much fuel can be
expected? An average of about 30
percent of the produced mass can be
made into fuel, but what about the
rest? It turns out to be useful stuff as
well. It can be feedstock for making
ethanol and methanol, and much of
it is protein, which can be made into
feed for livestock.

Willson estimates that algae
can produce about 7,000 gallons
of biodiesel each year per acre.
That compares very favorably with
biodiesel production from canola of
about 100 gallons per year per acre or
from palm of about 600 gallons per
year per acre.

The research team includes Solix
engineers and scientists, ME students
(graduate and undergraduate), and
students and faculty from other
departments. They plan to produce
the first gallon of diesel fuel some-
time in the summer of 2007. They
are not planning a big diesel station
at the EECL just yet, but there may
be a few of them around not too far
into the future.

ME Displays at the 2007 National
Western Stock Show

The ME Department sponsored exhibits at the
recent National Western Stock Show, held in Denver,
Colorado, on January 14 and 15, 2007, continuing
the College of Engineering tradition of showcasing the
educational and research opportunities at CSU.
Pictured below and to the right are some of the ME
Department displays.

Class of ’56 Reunion
(continued from page 1)

International. Mel Black spent his career
with General Electric in the power generation
equipment sector working in engineering,
sales, and management activities related to
steam turbines, gas turbines, nuclear steam
supply systems, and turnkey power plant
projects.

Following are some photos taken at the
Reunion.

2007 COE Career Fair

The ME Department joined the
College of Engineering (COE) for
the COE Fifth Annual Career and
Internship Fair on February 20, 2007,
at CSU. More than 100 companies
and agencies from across the United
States, recruiting engineering majors
for full-time positions and summer
internships, participated in the event,
which included 57 companies seeking
ME and Biomedical Engineering
students. A total of 720 students
attended the event (198 were MEs) and
met with potential employers to gain
insight into company culture and ask
questions they may not feel free to ask
during formal interviews.

This year’s event was tremen-
dously successful – attendance by both
employers and students more than
doubled since last year’s fair. If your
company is interested in attending
the 2008 COE Career and Internship
Fair, please contact John Haines,
Engineering Career Liaison, at (970)
491-6220 or e-mail: john.haines@
colostate.edu.
Dr. Harry Edwards Retires

Harry Edwards

Dr. Edwards receives his 40-year service award from CSU President Larry E. Penley.

Dr. Edwards studies surface properties of silver iodide for cloud seeding – University of Arizona Laboratory, November 1965.

D r. Harry Edwards joined the CSU ME Department in 1966 as an assistant professor of mechanical engineering, coming from the University of Arizona, where he was finishing his Ph.D. work in physical chemistry. Edwards immediately was active in research and publishing upon his arrival and became engaged in research on the amounts and effects of silver in the atmosphere. In those early years, he collaborated with faculty members in ME and in other departments on problems associated with the physics and chemistry of cloud processes leading to precipitation.

In 1970, he became the principal investigator (PI) of a large multidisciplinary project funded by the National Science Foundation and known as the lead project researching environmental contamination by lead. This project provided much of the definitive research done in the United States dealing with lead in the environment resulting from automobiles burning leaded gasoline. Lead, also present in paint and other sources, became known to have serious deleterious effects on human health and later was largely removed from the products and materials.

Edwards later became the PI of the Waste Minimization Assessment Center (WMAC), a project funded by the Environmental Protection Agency (EPA) that dealt with reducing waste in manufacturing processes. In this context, waste includes solid, liquid, or gaseous waste streams as well as wasted energy. With the assistance of student teams, hundreds of visits to companies and agencies were made to conduct waste minimization audits and provide recommendations to improve manufacturing and other processes to minimize waste production. Their work was well received, and most of their recommendations were implemented.

As time went on, the center took on a broader set of objectives, and it became the Industrial Assessment Center (IAC) funded by the Department of Energy. The IAC continued audits of plant sites to minimize waste but also to maximize productivity. Both the WMAC and IAC provided many opportunities for our undergraduate students to work in an important subject area, gain practical experience in an industry setting, and do real hands-on engineering work. Many students found an excellent start to their careers because of their experiences in this activity.

Edwards’ work has been recognized by numerous awards including U.S. Department of Energy, Industrial Assessment Center Service Award (two times); City of Fort Collins Award for Eight Years of Service on City of Fort Collins Air Quality Advisory Board; Colorado Governor’s Colorado Pollution Prevention Award; Engineering Deans Council Award, Colorado State University; and numerous others.

Edwards has always been among the top teachers in our department, known for excellent lectures, tough examinations, high standards, and a dry wit. He taught classes at all levels ranging from the freshman level to the advanced graduate level. ME subjects included thermodynamics, air pollution control, pollution prevention, and engineering design. He also taught thermodynamics, chemistry of the atmosphere, and air pollution measurement in the Department of Atmospheric Science and quantitative chemical analyses in the Department of Chemistry as well as pollution prevention at the University of Denver, an evening course, for a period of 10 years starting in 1991.

Of his students and career at CSU, Edwards says, “Of all my duties at CSU, those that gave me the most satisfaction involved working with students in the classroom and in the research laboratory. I shall always be grateful for the opportunities that CSU gave me to work with such bright, energetic, and dedicated students. Additionally, I am grateful for the opportunities that various sponsored projects provided to work with some of the most creative and productive faculty members at CSU.”

Edwards also volunteers for service in the community. From 1994 to 2001, Harry served on the City of Fort Collins Air Quality Advisory Board. This board provides recommendations to City Council on issues that affect air quality in the community. Since 2002, Harry has served on the City of Fort Collins Citizen Review Board (CRB); he was elected chairperson in 2006. The CRB reviews internal investigations arising from complaints involving police officers.

Edwards, an avid pistol shooter, participates in various local and regional target-shooting matches. His awards include first place in the Colorado hunters’ pistol class A state championship in 1994, first place in the Colorado small-bore hunters’ pistol class A state championship in 1995, and first place in the Columbine Pistol Club indoor match in 1998. He reloads center-fire ammunition and recently assembled a new small-bore target pistol fitted with a lightweight high-tech barrel, a match trigger, and an electronic holographic sight.

Harry and his wife, Marilyn, are planning their retirement and the opportunities that it brings to travel and enjoy living in Colorado including playing tennis at high altitudes, which they have enjoyed on courts in Breckenridge, Silverthorne, and Durango.

The Department is planning a retirement party for Edwards on April 27, 2007, from 3 to 5 p.m. in the Lory Student Center University Club. Please attend if you can and catch up on old times with Harry.