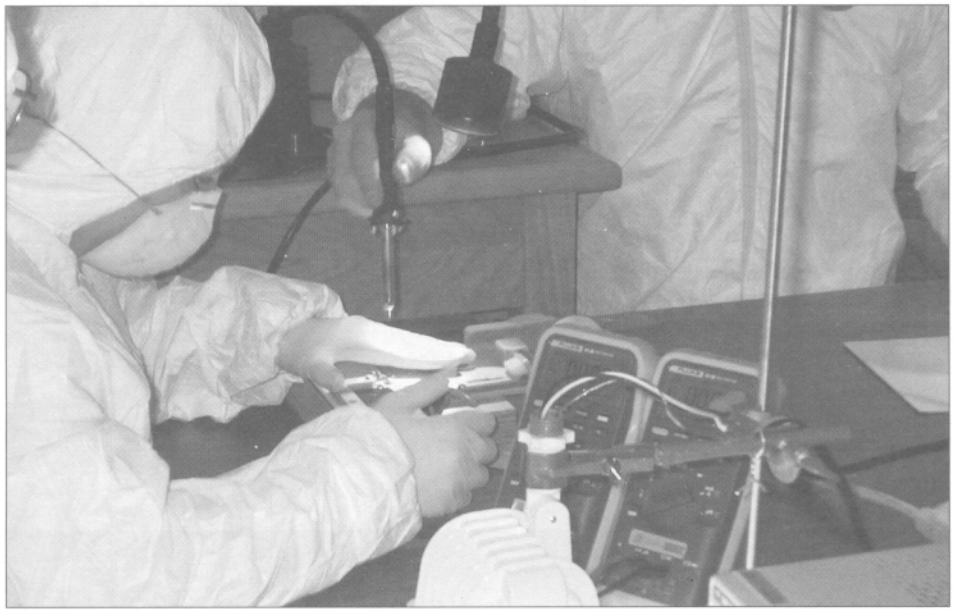
Engineering News

MESSIAH COLLEGE DEPARTMENT OF ENGINEERING • VOL. 6 No. 2 • April 2001

American Solar Challenge



Engineering students assemble the solar cells under "clean-room" conditions.

Team Genesis is eagerly preparing to compete in the American Solar Challenge this coming July. Starting with the basic frame and shell from the '99 car, the team is building Messiah's most powerful and energy-efficient vehicle ever, featuring an entirely new solar array, battery pack, and telemetry system. In past years, the solar array, which collects the sun's energy and converts it into electricity, has been built from single–crystal silicon solar cells, with a peak efficiency of about 14%. Typical power output under ideal conditions was around 1000 watts. For 2001, the team will be racing with a new array that should more than double the output of the 1999 car. New Jersey–based EMCORE Corporation has generously donated 3,000 space-grade solar cells to the Genesis Team, allowing us to build this high-power array. EMCORE has also provided key data on each solar cell they have donated, allowing the array designers to match cells and strategically position each one where it can operate most efficiently on the car.

In addition, Genesis 2001 will be equipped with a new lithium ion polymer battery pack, which provides 10% more storage capacity while slashing the weight of the pack by 60%, compared with the 1999 car. We've made an already light car even lighter and more powerful.

The team has also designed a state-of-the-art telemetry and driver display system that will continuously monitor all the systems in the car, provide key information to the driver with a dynamically reconfigurable display, and radio all the data gathered back to the chase vehicle where it can be analyzed.

With a superior array, premium batteries, and advanced telemetry, Team Genesis should have a significant edge over the competition at the American Solar Challenge this summer. Formerly known as Sunrayce, the American Solar Challenge will be the longest and most difficult solar car race in the world at 2,300 miles in length, with a route that starts from Chicago, Ill., then travels across the great plains, through Death Valley over the Rockies, and ends in Palm Springs, Calif. The race will feature more than 60 corporate and collegiate teams from the U.S. and around the world.

American Solar Challenge

Dillsburg BIC Gift to Dokomoi Ergatai Tricycle Project

The Dillsburg Brethren in Christ Church has provided a gift of more than $6,000 to provide for the design and construction of a personal transportation device for disabled persons in Burkina Faso, West Africa. A hand-powered tricycle is freedom and empowerment for disabled persons in rural Burkina Faso. Tricycles provide mobility to farm, care for family, and commute to school or work. Regretfully, the present design is difficult to maneuver and prone to mechanical failure.

A team of five students is working to improve the hand-powered tricycle now in use. We are designing a tricycle that

(1) reduces use-related injuries

(2) converts human input to forward motion more efficiently

(3) is easier to steer and more stable in turns

(4) has fewer mechanical failures

(5) can be constructed and maintained by the Burkinabe.

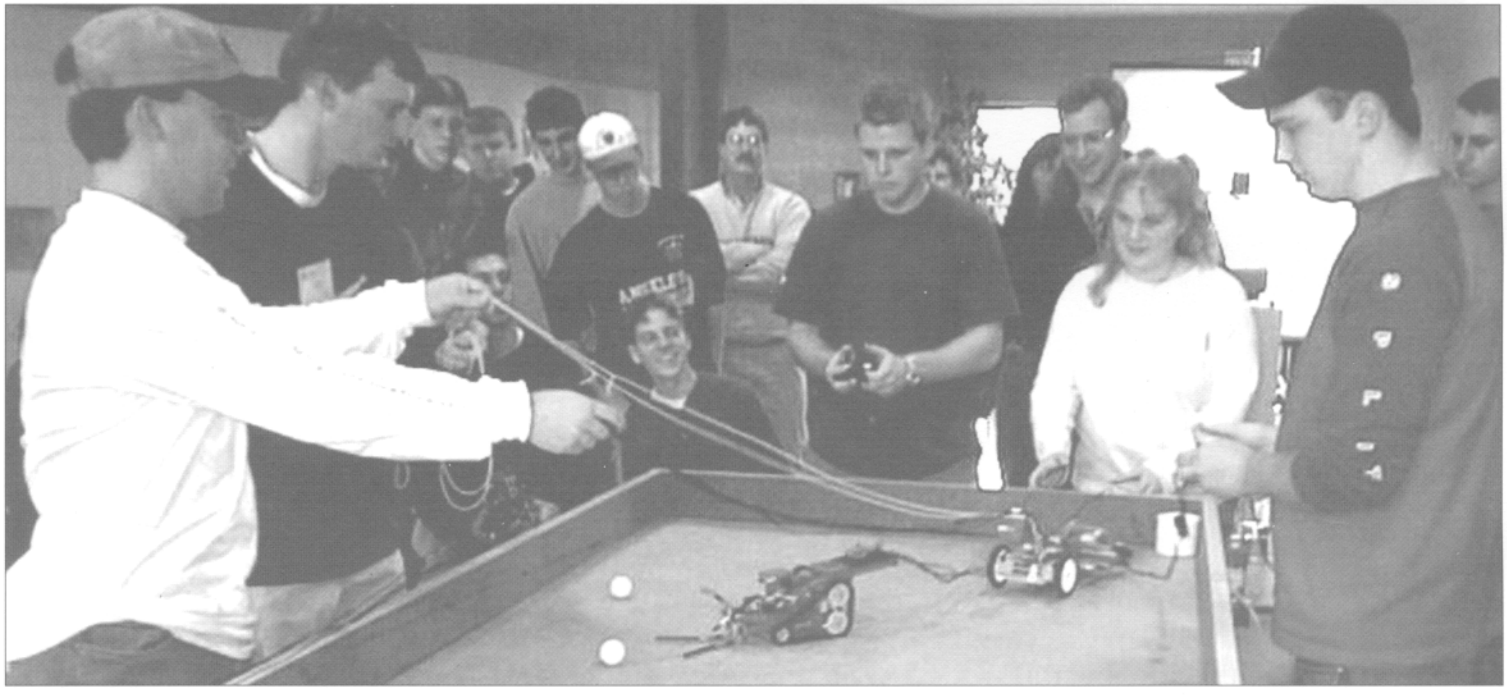
Our goal, however, is not merely to supply a new device. Rather we seek to design something that they can build themselves and eventually improve and make available to others.

In the summer of 2001, Messiah College students will take our designs to Burkina Faso and work with local people to construct prototypes and begin on-site tests. This generous gift made by the Dillsburg BIC Church will provide tools and materials that will enable our clients to construct their tricycles of the new design.

Engineers' Day A Success!

Each year in January and February, high school students gather on our campus to learn more about engineering and to take a closer look at Messiah's program. This years' participants worked in teams to build a machine and compete in our Robo-Basketball competition. They also spent a night with a student host in Messiah College campus housing. Most significantly, they heard from students and professors about opportunities at Messiah College to serve God as an engineer through local and international engineering projects.

Perhaps you or someone you know would like to participate in next year's Engineers' Days. We would be very pleased to add these names to our invitation list. Please forward your name and address to Jean McCauslin by mail, phone, or e-mail, JMcCausl@messiah.edu.



Two New Initiatives for the Collaboratory for Experiential Learning (CEL)

Computer Society International Design Competition (CSIDC) 2001

The purpose of the CSIDC is to encourage students to use new technology. The competition also stresses the ability to specify a product that will fill a need and be capable of being manufactured; the ability to design this product, construct it, and test it. Just as importantly, the competition requires students to develop the skills necessary to work in teams to achieve the desired objective.

Messiah College is one of 75 international schools (34 USA, 41 other countries) to be chosen for this design competition. Messiah's Engineering and Mathematical Sciences Departments have collaborated to get together a four-person team that includes two junior engineering students, a sophomore computer science student, and a first-year computer engineering student. Professor Erikson is the faculty mentor for the team.

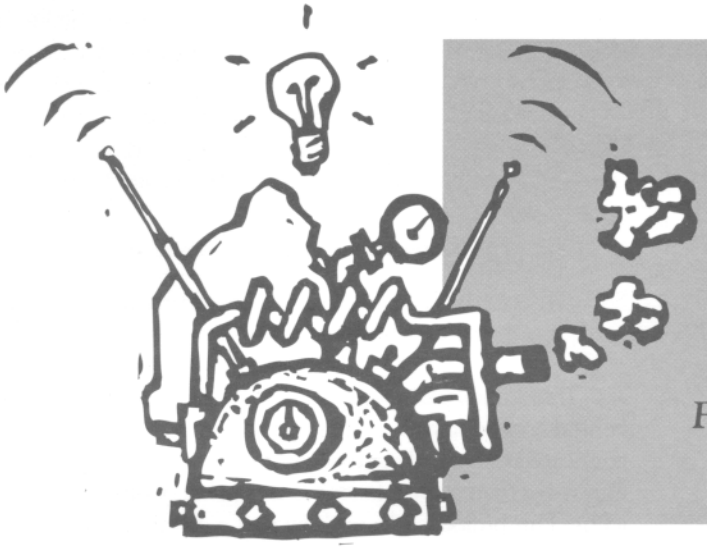
The team has received from the CSIDC sponsors over $2,000 worth of hardware and software that will utilize Bluetooth Wireless Technology in their design. Bluetooth is a new technology that has the potential to revolutionize personal computing by permitting cordless links between systems. The special feature of Bluetooth wireless technology is that it is very small and cheap; the initial range will be 10 m (30 feet) but it can be extended to 100 m (300 feet). Bluetooth uses frequency-hopping spread-spectrum technology to support both point-to-point and point-to-multipoint connections.

The team's project and report are due May 4, 2001. If they are selected for the World Finals to be held in Washington, D.C., the team has a chance of earning up to $15,000 for the team members and $10,000 financial aid for the college.

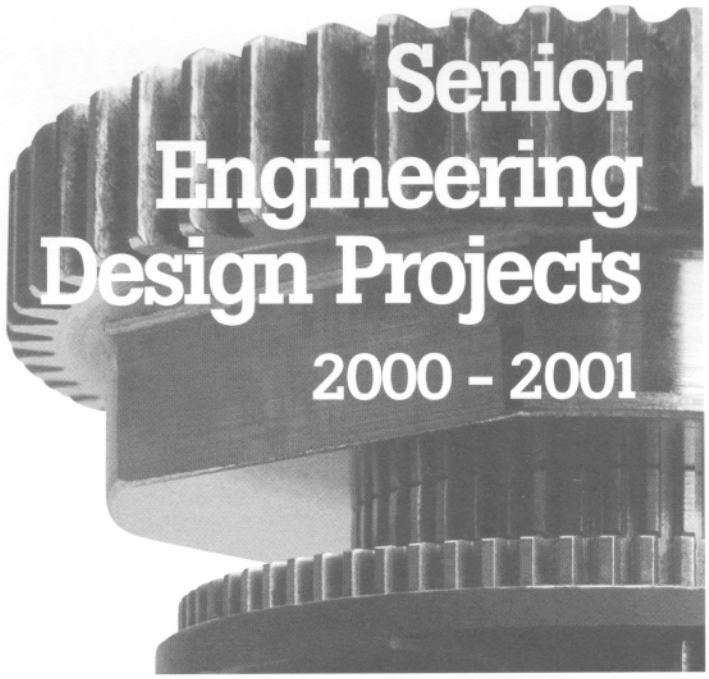
Micro-Dairy

The Micro-Dairy is being sponsored by Sustainable Agricultural Initiatives, Inc., of Smithsburg, Md., which was funded by the United States government through the Sustainable Agriculture Research and Education program. The Micro-Dairy will be designed to be an on-farm milk processing trailer that meets the requirements of the Pasteurized Milk Ordinance. The unit will contain all of the facilities required to milk cows; store, pasteurize, and process the milk into a variety of products including fluid milk, flavored milk drinks, ice cream, and cultured dairy products such as cheese and yogurt. In addition to being used for on-farm retail sales, the trailer could be air-lifted or pulled into disaster areas, refugee camps, or utilized for other humanitarian purposes to provide milk and dairy products for needy people.

Messiah's Engineering Department is developing monitoring and control instrumentation and data storage for the Micro-Dairy. Two junior engineering students have been working on the project since September 2000. Professor Erikson is faculty advisor. The project uses the Lab-View software as part of its instrumentation package. It is estimated that the project will be near completion by May 2001.



You are cordially invited to attend
the final senior engineering design project presentations
on
Friday, May 4th in Frey Hall.
(see details on pages 4–5)



Senior Engineering Design Projects 2000 - 2001

Thirty-two engineering students are involved with 13 capstone projects. These projects represent a wide range of subjects and interests, but a common theme runs through them all: a desire to use engineering to make the world a better place, whether by clearing fields of antipersonnel landmines, designing renewable energy systems, or making improvements in transportation for disabled individuals. Many capstone projects are related to the Charter Projects of the Collaboratory and provide opportunities for new students to collaborate with upper-division students Here is a short review of each design project with its designers.

MTS Upgrade, Engineering Department, K. Letner and G. Frank

This team is designing a new control and data-acquisition interface for the Engineering Department's Material Test System tensile tester. While an upgrade is available from the manufacturer, the cost is high and the upgrade lacks flexibility. This project will produce an interface, both hardware and software, that will increase the usefulness of the tester while making it compatible with other test equipment the department already uses, all at a fraction of the cost of a commercial upgrade. The designers will create the software package to run experiments, based on LabVIEW.

Landmine Detection, Collaboratory,
S. Macpherson and J. Kennedy

This project has grown out of a three-year research project by one of the two students on the team. The purpose is to find new ways of detecting anti-personnel landmines. The project is developing hardware to support the field use of a state-of-the-art chemical vapor detector, the Cyranose, and making comparisons between this device and a trained laboratory ferret, which is part of the ongoing research project.

Landmine Flail, Engineering Department
P. Tasch, K. Heide, and M. Hawkswell

The landmine flail uses chains attached to a rotating drum to strike the ground and either detonate or disable buried landmines. While flails have been used for this purpose for some time, they are expensive and have limited effectiveness. This team is making improvements on the basic design to increase effectiveness and reduce manufacturing costs, so that the machine would be more accessible to people in developing countries.

Landmine Detonator, Engineering Department
N. Burkholder, M. Albrecht, and C. Brubaker

This team has conceived of a new type of device that permits the controlled detonation of previously located anti-personnel landmines. The intent is to produce a machine that will allow remote detonation while containing the blast fragments of an exploding mine. Perhaps the most innovative feature of this design is the use of a Kevlar containment "balloon" which inflates to contain the fragments, much like an automotive air bag.

Genesis Brakes, Genesis Project,
S. Highhouse, S. Moyer, and A. Crouch

The 1999 Genesis solar car employed a highly innovative brake design that allowed the use of optimized aerodynamic wheel fairings. However, the design had several shortcomings that became obvious during the race. The system is being redesigned to correct those problems and improve the overall performance of the system. In addition, the race regulations have changed, necessitating the addition of brake components on both rear wheels, and increasing the required braking performance on wet pavement. In response, the team has designed integrated rear brakes and is also designing an ABS system.

Sailplane Launcher, Engineering Department
D. Danielson and J. Thorpe

Traditionally, sailplanes have been launched either by towing behind another plane or being pulled into the air with a cable connected to a winch or tow car. The latter methods are much less expensive than a tow plane, but is capable of only modest altitude gains. This project seeks to show that a winch mounted on a

vehicle and controlled with a microprocessor can achieve higher altitude gains at lower cost. The microprocessor will monitor the parameters necessary to optimize the climb, while controlling the release of cable from the drum and directing the operator of the vehicle to speed up or slow down. The system has been modeled in software, and the team is currently building a scale model radio-controlled prototype to test the idea without risking life and limb.

Alternative Energy System, Engineering Department
J. Gunning, D. Sieling, K. O'Malley, and E. Sellers

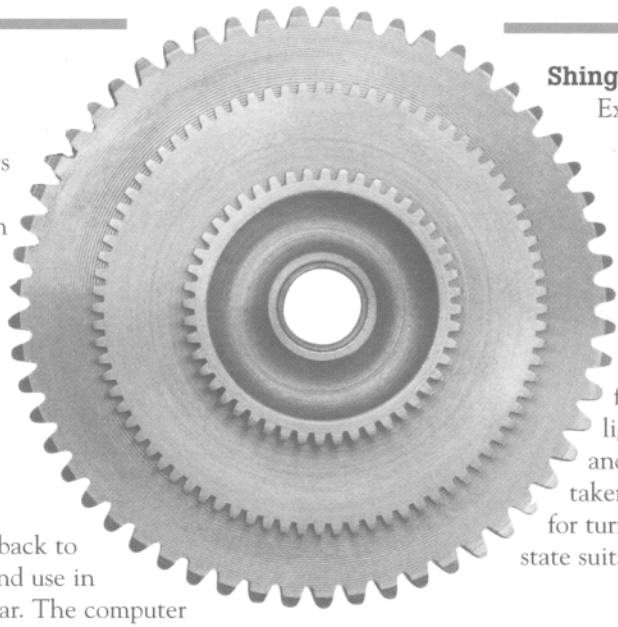
This project involves the design of a hybrid wind and solar electric power generating system to provide supplemental heat and electricity for a three-family, inner-city apartment building in Harrisburg. The team has gathered information about wind and solar energy at the site and has designed a system to gather and store that energy for use by the three families, assumed to consist of four persons each. The overall system consists of a windmill, photovoltaic panel, solar collector for heating water, and a battery storage unit.

Hand-powered Tricycle, Dokimoi Ergatai,
J. Walsh and A. Garrison* *(non-senior)*

This team is redesigning a conveyance currently used by disabled persons in Africa. The current design is simple and inexpensive to produce using locally available parts, primarily from bicycles. However, it suffers from several major design flaws, which result in low efficiency of operation, lack of reliability, and instability. The team is considering changes to the design that will improve its usefulness without dramatically increasing the cost of production or ease of repair.

Genesis Telemetry, Genesis Project
J. Bergey and N. Alger

The telemetry system is in many ways the "cerebral cortex" of the solar car, and it is very difficult to design and build such a system that works effectively and reliably. This team is working on a design that incorporates a handheld computer as the basis for a rugged and reliable system. This computer will access data from all the subsystems on board the car, gathered by a custom data-acquisition system designed and built by the team. Information gathered will be processed and displayed to the driver and also sent back to the chase vehicle for further processing and use in optimizing the performance of the solar car. The computer screen is touch-sensitive, allowing the driver to control the telemetry system by simply touching the screen.



Voice-activated Wheelchair, Engineering Department
J. Widman and B. Garcia

This team is picking up where one of last year's teams left off, designing a wheelchair that responds to pre-programmed voice commands. The previous team was working on a mechanism that would allow the chair to raise, lower, and recline, also under voice command. This year's team is redesigning that mechanism to simplify the design and improve reliability.

Microhydro, Engineering Department
J. Hauser and J. Ross

This project involves the design of a low-head waterpower system for a small-scale electric generating plant, suitable for use in developing countries or remote areas. The team has designed a water wheel and drive system for an electric generator and the associated electronic control hardware.

Hydraulic Ram, Engineering Department
T. Tsuchiya, B. Bedford, and S. Womer

The hydraulic ram is a water pump that uses the energy of the moving water and the "water hammer" effect to pump water without any external source of energy. These pumps have been used for over a century, but with the availability of cheap power to run conventional water pumps in this country, optimization of the hydraulic ram's efficiency has not been carried out. This project seeks to develop a laboratory test bench so that the ram pump can be evaluated and improved. The goal is to produce a pump that can provide an inexpensive and reliable source of water, suitable for developing nations.

Shingle Remover,
External sponsor
T. Grant and A. Sayegh

This team is designing a machine that takes roofing materials as they are being removed from residential housing and grinds them up for transport and recycling. In order to be suitable for the task, the machine must be light in weight, rugged, reliable, and cost effective. The team has taken into account the requirements for turning the roofing materials into a state suitable for effective recycling.

After One Semester

I returned to a college campus after 30 years in industry. It was an adventure to which I had looked forward for many years—retire and find a teaching position. Doing so, I came to Messiah College and began teaching engineering courses last Fall. After one semester, what do I think?

The students I have met are bright, but more than that, they are special. As a group they treat each other very well. The Christian foundation of the mass of students transfers into a human decency that is noticeable and notable.

When I interviewed with the faculty and administration, and also met other staff, again there was the notable. It was in the eyes, eyes that have brightness, a light showing aliveness. When asked by old friends, "What do you think about Messiah?", I have succinctly replied, "it is in the eyes." These people care— they care about what they do, and especially about the students. A semester here has proven they were not putting on a face because I was a candidate. Everyone is helpful and friendly.

My second semester begins very soon. After 30 years away from being formally in the books, it requires a lot of effort on my part, but it is a pleasure. I am glad I am here.

—David Gray

Alumni Correspondence

Darren Schick '95 I just wanted to send you a note to update you on my engineering career. After graduation I found a job for a small manufacturing company in Detroit, Michigan. I have enjoyed my work here and have recently been promoted to Engineering Manager. My experience at Messiah has given me the critical thinking and problem solving skills that have enabled me to handle "real world engineering." Now I am pursuing a master's degree in Manufacturing Systems at Lawrence Technological University. Let me know if you would like more information. Thank for your encouragement and mentoring through my time at Messiah.

Brian '97 and Theresa Seip are the proud parents of Alex Hunter Seip, born on December 8, 2000, 11:15 a.m. at Harrisburg Hospital.

Brian Ondrasik '00 I passed the EIT on my first try. Now I get to take another test, the PE exam, in four more years. Hooray, I think. I wanted to make sure that I told you, so you can see that the engineering department prepared me for it. I also wanted to say that after the first three hours, the next five were all in the strength of God. Thank you for all of your hard work and patience with me. I really appreciate it.

Cover Note: The Engineering Department wants to thank **Amy Bickmore**, a junior graphic design student, for designing our new newsletter logo.

New Administrative Structure by July

Five search committees have been looking for qualified candidates for deans of the five schools that Messiah College is planning to initiate on July 1, 2001, under its new university-type structure. The Search Committee for the School of Mathematics, Engineering and Business (MEB) has been meeting since August 2000 and has invited three candidates to campus over the last several months. The candidates spent two days on campus interviewing with the search committee, the Provost, President Sawatsky, the chairs of the three departments, faculty, and students. Each candidate also gave a presentation open to the entire college on his/her "Vision for the School of Mathematics, Engineering and Business in the 21st Century." Please pray for the various search committees that God's choice for each school's dean is clearly discerned.

New Faces in the Engineering Department

Two new faces can be seen this spring semester in the Engineering Department. Jennifer Engle is teaching ENGR 101, Engineering Graphics, on Tuesday and Thursday nights this Spring semester. She graduated from The Pennsylvania State University with a B.S. in Industrial Engineering (1992) and a M.S. in Business Administration (2000). She has worked for Tyco Electronics as an Industrial Engineer and Associate Product Manager and with Drexel Heritage Furnishings, Inc., as a Production Engineer.

Job Ebenezer also joins the department as our new visiting assistant professor of engineering. Job is a fourth-generation Christian from India. His great-grandparents were converted to Christianity from Hinduism by Reformed Church of America missionaries. His parents were both teachers and his father was an ordained minister. Job came to the U.S. in 1967 after completing two master's degrees: one in mathematics and another one in aeronautical engineering. He completed his Ph.D. in mechanical engineering from the Stevens Institute of Technology in Hoboken, N.J. He taught at the New York Institute of Technology for four years and moved to New Mexico to teach at the University of New Mexico (UNM). He initiated a Village Technology Program at the University of New Mexico to design simple and inexpensive implements and power sources for poor farmers. He left New Mexico in 1980 and worked with a Christian development organization in Madras (now Chenniai) for a year. He came back to the U.S. and took up an administrative position as the director of Technical Vocational division of UNM in Belen, N.M. While he was in Belen, he was asked to design technical programs for the correctional department of the State of New Mexico. He joined the correctional department as the director of Education at the Los Lunas Correctional Facility. After six years of ministering to the inmates, he was called by the Evangelical Lutheran Church in America to direct their hunger education and environmental stewardship program. At their headquarters in Chicago, Job established a rooftop garden on their garage with containers and promoted appropriate technologies for the poor and for earthkeeping. He taught courses in global sustainability at the Au Sable Institute of Environmental Studies and Target Earth's campus in Belize where he met several Messiah College students. When he heard that the engineering department at Messiah was involved in appropriate technology programs and had outreach programs in the inner cities and in Africa, he applied and was appointed as visiting assistant professor of engineering. Job hopes to bring his varied experience to mentor students, especially engineering students, to use their knowledge to work for justice, peace, and earthkeeping. Christ's redemptive work covers all of Creation and all human activities. Christians have a unique opportunity to show the love of Christ through appropriate technologies and earthkeeping activities.

The mission of Messiah College is to educate men and women toward maturity of intellect, character, and Christian faith in preparation for lives of service, leadership, and reconciliation in church and society. Graduates of the Engineering Program will therefore be technically competent and broadly educated, prepared for interdisciplinary work in the global workplace. The character and conduct of Messiah Engineering graduates will be consistent with Christian faith commitments. We accomplish this mission through Engineering instruction and experiences, an education in the liberal arts tradition, and mentoring relationships with students.

MESSIAH COLLEGE

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Address Service Requested

Service Day Project

April 19, 2001

This year the Business/Management and Engineering Departments are collaborating on a project for Service Day. The project deals with improving a vacant lot next to the Silence of Mary Youth Home in Harrisburg. The home is for homeless and at-risk teenage boys and girls. Kelly Brown, a volunteer, is our interface concerning this project. Kelly, a graduate of Penn State, envisions that the vacant lot can be transformed into a garden that will contribute to improvement in quality of life for the youth and all residents of Allison Hill. She is planning to achieve this through: composting, utilizing rain water collection systems for irrigation, making a tool shed from straw bales, building the soil through sheet mulching, and constructing raised-bed frames from discarded wood. Also included are microenterprises: selling flowers and vegetables and vermiculture (worms!). Dr. Robert Kilmer of the Business/Management Department and Professor Erikson of the Engineering Department will help coordinate 20 or so students and faculty in teams to help prepare the lot (for example, clearing debris, leveling the ground with top soil, and cutting weeds), design and build the tool shed, construct fences and framed raised-bed gardens, and help in organizing microenterprises. The youth at the home will be helping as well as some other people in the area.