



Partnering with PACTEC at the home office and on the field

by Harold Underwood

Partners in Technology International (PACTEC) has emerged over recent years as a subsidiary of Mission Aviation Fellowship (MAF). PACTEC works to support a nation's effort to build the capacity of its leaders to relieve human suffering, using tools such as aviation and communication technology (see also www.pactec.org). During August 2004, representatives of PACTEC presented their vision and met with members of the School of Mathematics, Engineering, and Business on Messiah College's campus to explore partnership possibilities. Excited by opportunities in my area of interest, I was referred to PACTEC's senior communications consultant Dave Pedersen, and pursued correspondence with him by e-mail. Based on suggestions by Dave Pedersen, a plan emerged involving my travel first to the Home Office of PACTEC in Redlands, Calif., for training on internet connectivity via satellite link, followed by observation and field work at the PACTEC center in Kabul, Afghanistan. This project received joint support from the Messiah College Collaboratory for Strategic Partnerships and Applied Research and from PACTEC. In this article, I hope to share some of what I learned, and encourage other faculty and students to consider projects and/or internships with PACTEC that address the situation in Afghanistan as well as other locations where similar needs exist.

My class at Redlands included two PACTEC installers with experience in Afghanistan, Walter Greenwood and David Ellis. Our training involved a two-week course designed to better understand, install, and maintain very



Figure 1: Satellite dish installed as VSAT internet link on PACTEC office building at Redlands, CA
Bottom left to right: Elias, Walter Greenwood, David Ellis, Harold Underwood; Top: Dave Pedersen.

small aperture terminal (VSAT) systems for internet connectivity. Training materials were provided by the Global VSAT Forum (GVF) and the course was conducted by Dave Pedersen. With MAF, and then with PACTEC since 1995, Dave has served with his extensive radio skills and knowledge in Democratic Republic of Congo, Rwanda, Mali, Albania, and most recently, central Asia. Currently stationed at headquarters in California, Dave works on developing a single satellite platform and VSAT service that PACTEC and its clients can use anywhere in the world. VSATs work to establish internet connectivity, especially in remote locations where access would otherwise be unavailable. As

an immediate and practical application of the training, our class, under Dave's direction, installed a VSAT link and WLAN access point at the PACTEC home office building in Redlands, for demonstration, training and test purposes [Figure 1]. After troubleshooting and testing the system, we found that it worked! Using the WLAN utility of my Pocket PC, I "e-mailed home" with the good news. For tsunami disaster relief, PACTEC has now replicated this VSAT and WLAN setup [Figure 2] at two locations in Indonesia (Meulaboh and Banda Aceh) for internet cafes to assist Samaritan's Purse and other aid agencies presently working in that area.

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From the home office in Redlands, I traveled to a PACTEC field office in Kabul, Afghanistan. In a brief highlight on Afghanistan (Nation Builder News, August 2004), PACTEC describes “the health, education, social, shelter, nourishment and environmental need of the Afghan people [as] . . .staggering. Over half of the 28 million people have been displaced. Millions of land mines threaten the safety and lives of those who return home—and some return to find their shelters and farmlands destroyed. Institutions are full of orphans and the disabled.” Though the country has stabilized considerably since its most recent conflict, great needs continue to exist. My 10-day

visit was enough to reveal the meager living conditions available for a majority of Afghans in Kabul, a city of 2.5 million living within space suitable for about 800 thousand. As more Afghans seek refuge here, some resort to mud hut shelters on steep slopes of an inner city mountain, making the daily collection of water a difficult chore for the children [Fig. 3].

During my stay in Kabul, I learned firsthand how the PACTEC Comm group works. Joining its expatriate and Afghan staff, primarily with PACTEC’s Tim Smuck [Fig. 4], I observed and helped handle several service calls and one request for new VSAT installation. The

Comm group sells, installs and maintains VSAT systems (about 80+ so far throughout Afghanistan) handling all aspects of hardwired and wireless LANs for dozens of non-government organizations (NGOs) doing humanitarian development. During my visit, service calls included IT troubleshooting at the Adventist Development and Relief Agency (ADRA), International Assistance Mission (IAM), and a stop at the house now occupied by a new PACTEC family. The latter involved rewiring backup batteries to a charger-inverter so as to restore this site as a critical bridging point for the “Karte Se” wireless network relied upon by all PACTEC (rented) residences in that part of the city.



Figure 2: VSAT with WLAN monopole above flat roof



Figure 4: Tim Smuck with PACTEC’s Cessna in the hangar at the Kabul airport



Figure 3: Afghan pedestrians in Kabul with residences along the steep slopes in the background

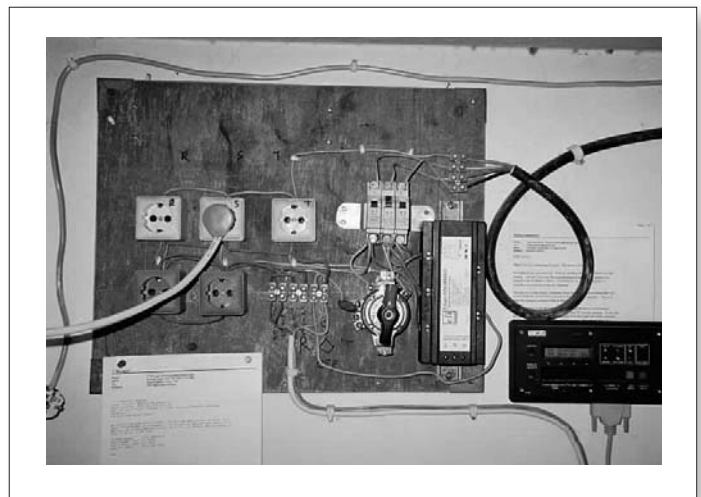


Figure 5a: Power board with circuit breakers, switch for phase selection and surge suppressor.

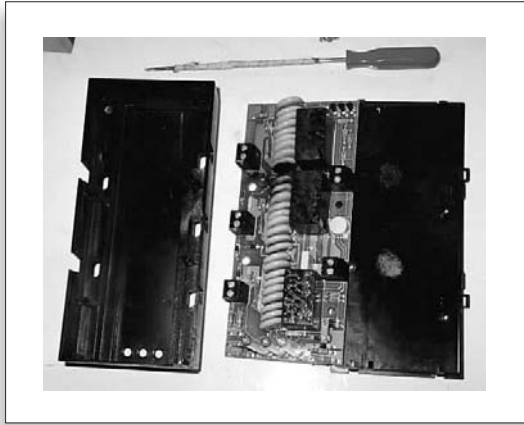


Figure 5b: Capacitors of surge suppressor burned by over-voltage from city power

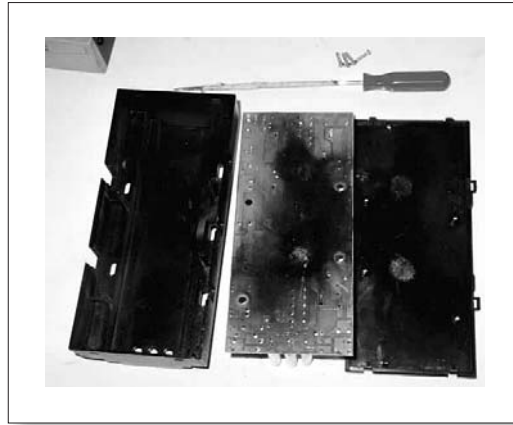


Figure 5c: Circuit board of surge suppressor smoked by over-voltage from city power

While PACTEC has its office in a part of Kabul where city power is available (220V/50 Hz 3-phase poorly and unequally regulated; best phase picked on a daily basis! [Figure 5]), all PACTEC residences presently exist on the un-powered side of Kabul (as a result of battle damage). Thus, residences rely exclusively on diesel generators with battery backup for any electricity. Diesel- and kerosene-fueled stoves heat rooms at the office and in residences.

In order to observe rural Afghanistan, a site survey had been planned in a part of Afghanistan known as “Lal.” A site survey is the first step in PACTEC’s response to a request for VSAT installation. As is standard procedure, a Cessna [Figure 4] would fly us to the site. However, the Kabul airport lacks radar and adequate snow removal equipment, while the Lal airstrip enjoys even less support. As a result, snowfall in the area on the morning of the intended flight prompted PACTEC’s pilot to keep the Cessna grounded as a reasonable precaution due to the unsuitable conditions. Thus, the site survey at Lal would have to wait for another day when weather would permit, after my short visit.

As weather conditions and other variables can change during flights already in the air, PACTEC pilots use their own HF radio to report their flight coordinates (time and location) to the home office in Kabul, recorded there by hand. However, PACTEC pilots and staff would love to have (and specifically recommended) a

better flight tracking system that puts their flight coordinates onto an area map, visible on a laptop and/or even accessible via the web by spouse and family. Such a system seems to suggest an excellent project opportunity for a Messiah College student team.

Once a year, Afghans enjoy a holiday they call Eid-e Qurban, to celebrate when Abraham brought Ishmael (as they believe) to the mountaintop, and the Lord intervened by providing a lamb. Afghans celebrate Eid by sacrificing a lamb (delivered by taxi in some cases!) and have a feast with the family. As a result of this holiday during my visit, PACTEC gave its daily staff a three-day weekend. During this time, as usual, city power switches on in order to provide some electricity to the Afghan guards working at night and over the holidays. On the first day back from the break, office staff discovered it had a problem on its hands. Sometime during the break, city power apparently delivered a severe voltage transient enough to rupture cell phone chargers plugged in all over the building. While damage could have been worse, a surge suppressor on the power board in the comm area had been blown [Figure 5], and two of three 25A circuit breakers for the three-phase system had faulted to a short circuit condition! An event like this underscores the need for adequate protection against poorly regulated and unpredictable electric power, a problem in Afghanistan and other developing nations. Presently, volt-

age stabilizers available in Afghanistan typically utilize a variable transformer, adjusting for fluctuations on the primary side by means of motorized control. Unfortunately, motorized adjustments of the step-down transformer are often too slow to track erratic changes around 220 volts on the input side, causing problems to anything connected on the output (secondary) side. Other models use a relay-switched, stepped transformer; while switching much faster, these do not provide as fine a control. The purpose of the stabilizer is to adjust the input voltage that fluctuates over a wide range such as 120-250 volts AC to the desired 220 volts. Although not guaranteed to protect against the most severe voltage transients, a better (e.g., electronic) voltage stabilizer was specifically suggested to me as a possible project for our students.

While Afghanistan has stabilized considerably since its most recent conflict, serious social and spiritual needs continue to exist among the people. Those of us willing to contribute our technical and professional skills have a unique opportunity to contribute, and would do well to partner with PACTEC, already developing a reputation for quality work in several nations otherwise closed to Christian work and witness. PACTEC has an established internship program for those who wish to participate. Please contact the author for more information on internship contacts at PACTEC.

Joseph, project manager

by Robert Clancy

Our project: whose is it anyway? Is it ours and God helps us or is it God's and we help Him? For a different perspective, let's go back 3,800 years and revisit the Genesis story of Joseph, the son of Jacob.

Study groups sometimes look at this story from either a family dynamics or a humble behavior standpoint: Jacob failed to properly love his wife, Leah, and then Joseph boasted to his brothers about the substance of his dreams. Such groups consider both of these the basis of his brothers' deadly jealousy. I want to draw a bigger and different picture.

Consider for a moment the original narrative being staged on the floor of the Giant Center. Just before the curtain rises, let us slip over into God's box and see the business from His viewpoint. First, God purposed to save many lives from death by starvation.

Next, God was continuing a plan that he disclosed to Abraham over a hundred years earlier: to make for himself a nation for his name. He chose an isolated and safe place where assimilation or intermarriage would not be likely, a place where this nation would grow from only 70 to perhaps two million in 430 years. That place was the land of Goshen in Egypt. There's more.

It is astonishing but God also wanted to transfer virtually everything in Egypt personally into the hands of Pharaoh. All the wealth of Egypt and most that of the surrounding countries would be going to Pharaoh. In addition, all the real property. In addition, all individual Egyptians would give themselves up willingly to Pharaoh as slaves; and all this to buy food and avoid starvation. But there's still more.

In 430 years to the day, God would present His nation to the world in a way so undeniable and dramatic that it would bring glory to his name and be a testimony to His power and righteousness to every nation forever, though nations would forget and need to be reminded.

Only now, enter Joseph, the teenage dreamer. Thirteen years before Joseph went to work for Pharaoh, he was apprenticed as a shepherd to four of his older brothers.

The brothers did some unspecified thing about which Joseph ratted them out to their father, Jacob. Later, he dreamt two self-inflating dreams and shared them with his family. One was about sheaves, and one about the sun, moon and stars. During this time, his brothers were being totally alienated.

Joseph left for his role in Egypt under the most compelling circumstances. No missions committee screening, no cross-cultural preparation, no briefing on or understanding of his future role and certainly no agricultural administration training or even any fund-raising.

A two-year timeout in jail with some serious practice interpreting dreams were part of his on-the-field preparation. I imagine that his two years in jail were a time for learning both language and culture. He did not sin, but I imagine he was constantly intent, waiting on God for grace to get past the next day or hour.

Joseph received both his position as a combination prime minister and secretary of agriculture then needed to formulate his project plan. It is significant that immediately following assumption of his role, he began to travel throughout Egypt. We can know that for the first seven years, grain prices plummeted. I believe he worked to hype production to its highest level in order to maximize Pharaoh's 20 percent portion and he also purchased grain in the market. In my imagination, I can see him offering seed grain and pressing for more planted acreage to effect a greater harvest.

When Joseph was 39 years old, his family came back into view with a visit to buy grain. Less than five years later, his family moved to Goshen. Joseph prewarned them all to say they were traditionally shepherds and desired to herd sheep by themselves in Goshen. The goal was to stay away from population centers.

Joseph superbly achieved project completion. There was never a question about whose project it was: it was God's and he was helping. The goal and its success were God's obligation while his goal was faithfulness alone.

Spring '05 snippets

by Carl A. Erikson, Jr.

Every six years the Accreditation Board for Engineering and Technology (ABET) sends a team of evaluators to review (and hopefully renew) accreditation of our BSE engineering program. This year, all three concentrations (computer, electrical and mechanical) will be reviewed. We have submitted the request for evaluation visit documentation and have begun gathering information for the self-study, due at ABET by June 30. During the summer months, ABET selects an evaluation team. Then, sometime during the fall semester, evaluation team members spend several days on campus examining all our course assessment data and facilities, talking with students, staff, faculty, and administration, looking for confirmation of the self-study document. If everything is found acceptable, sometime during the following year, the accreditation will be approved for another six years.

A new departmental display for the National Engineers' Week display at Colonial Mall between February 20–26 was completed, based on the holistic education theme: knowledge (the "head"), passion (the "heart"), and service (the "hands/feet"). The BSE and general education curricula are included under the knowledge portion. Faculty and mentoring relationships are shared as a way of developing a passion, while service learning/co-curricular projects, both locally and overseas, are displayed. The holistic education theme will also be used as part of open house presentations throughout the semester.

As part of a pilot program for the Integrated Projects Curriculum (IPC) and in conjunction with the Introduction to Engineering course, arsenic water filters were developed for India, Nepal, and Bangladesh. Eleven first-year students and one sophomore spent approximately two months researching the countries and finding appropriate ways to reduce ground water arsenic levels of 150 parts per billion (ppb) to below the World Health Organization standard of 10 ppb. All three filters used recycled materials, cost under \$15, and were successful in reducing the arsenic level to below 10 ppb.

Water quality research in Burkina Faso

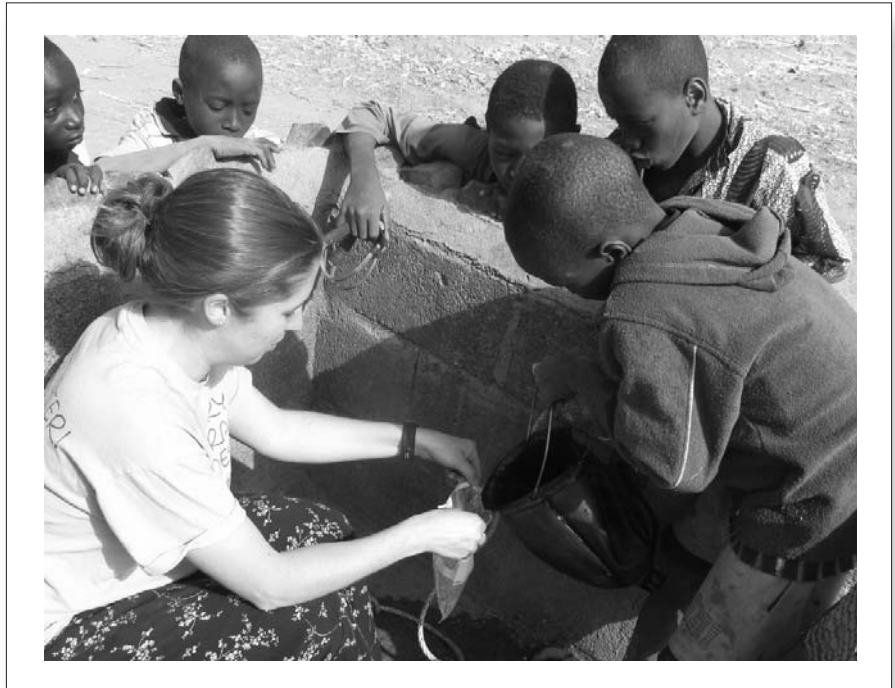
by Jessica Felter '05

In September 2004, Water For The World (WFTW) merged with Dokimoi Ergatai (DE), two Messiah College organizations passionate about appropriate technology in developing countries. WFTW has worked with the Mennonite Central Committee (MCC) in Guatemala to install water purification systems, while DE has primarily worked with Serving in Missions (SIM) in the rural village of Mahadaga, Burkina Faso. In an effort to further cement the new relationship between DE and WFTW, I had the chance to represent WFTW on the most recent trip to Mahadaga during this past January term.

Burkina Faso, located in the Sub-Saharan region of West Africa, has extremely dry and sandy soil, rather resistant to growing a wide variety of crops. However, cotton is one crop that does thrive in the region. Thus, cotton provides a great source of income to the local people and allows them the privilege of being able to provide for themselves and their families. In an effort to have the largest crop yield possible, many farmers have started using various pesticides (including endosulfan, cypermethrin, abamectine and fenvalerate) on their cotton to keep insects and other pests from destroying it. Protecting crops may seem prudent at first, until one realizes that almost all of these pesticides have been banned from developed countries, including the United States, due to being harmful to human health or potentially fatal.

Since many of the farmers who use the pesticides have not been educated about their proper use, they often unknowingly abuse the chemicals. In our month in Burkina Faso we learned that farmers not only neglect to wear proper masks and gloves when applying the pesticides, but many also wash their pesticide containers in the local streams. One stream in particular is a significant source of water for the community and dead fish were seen floating in the stream during this past wet season. Running water contamination is a major concern that needs to be addressed, and on a deeper level, fears exist that pesticides on cotton fields seep into the water table, potentially affecting a majority of wells in the village.

I performed many tests on various water sources in Mahadaga to determine what type



Jessica Felter '05 collects a water sample from a well in Mahadaga, Burkina Faso with the help of a young local boy.

of water filtration system would best suit the area. Since I lacked the more expensive laboratory equipment needed to accurately test for these pesticides, I was unable to definitively determine the extent of their infiltration into the region's water sources. However, I found that each water source tested failed to meet the EPA standards for bacteria (that cause much sickness in the village). When asked why they kept drinking the same water, knowing that it made them sick, one family replied, "We don't have a choice; it is the only water available to us. We either drink the water and get sick, or we don't drink the water and we die."

In light of these findings, WFTW plans to further research the pesticides used, and hopes to develop a system that could be installed in Mahadaga on a future trip. This system would most likely consist of a series of polypropylene-spun filters followed by a UV light, though the possibility of using a reverse osmosis system is also being discussed. Both of these types of systems would likely be effective in reducing the number of bacteria colonies to within EPA limits and removing any existing pesticides from the water.

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Genesis II Solar Boat prepares for 2005 competition

By Stephen Osborne '05



Team members Kurt Stabler '05 and Fred Yutzky '05 work on reducing drag by re-shaping the leading edges of the existing carbon fiber hull.

The past semester has been a busy time for members of the Genesis II Solar Boat Racing Team. Since its fourth place finish in the '04 International Solar Splash Competition, the team has worked hard to improve its entry for the next race. By optimizing the craft's performance in all three portions of the race (sprint, slalom, and endurance), the team hopes to improve on its previous standing and become the 2005 Solar Boating World Champions. Design work has been completed on many of the craft's updated systems, and the challenging construction process has begun.

Electrical team members worked dili-

gently throughout January on a new solar array to power the boat through the endurance portion of the race. The array construction utilized many advanced multi-junction solar cells, chosen for the high performance they've demonstrated on the International Space Station and other satellites. In addition to these efficient solar cells, the array will automatically align itself with the sun, providing the boat with the maximum power available from the solar radiation striking the array. Monitoring systems will also calculate the power level of the array, controlling the speed of the boat to optimize its performance in the two-

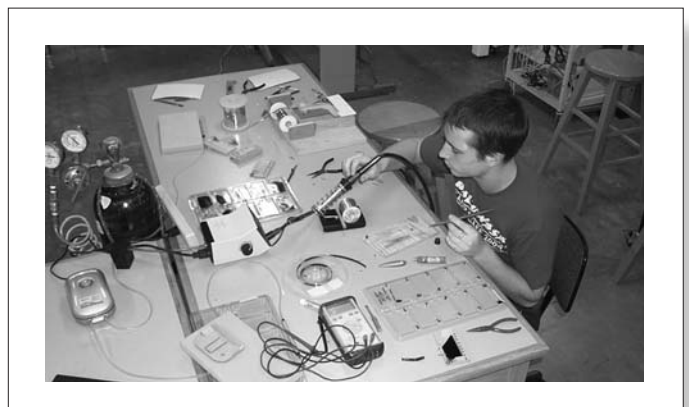
hour endurance race. After a very respectable second-place finish in the endurance race last year, the team anticipates an even better result with these new systems in place.

Members of the hull team have also been busy working to improve the boat's hydrodynamics. New drive-units that articulate much like traditional outboard motors will reduce drag by eliminating the need for rudders. A complete redesign of the main carbon fiber structure of the boat has now been completed, and is being constructed at a rapid pace. The new shape will make it much easier to connect the solar array and new drive-units to the boat, adding stability during the slalom and sprint events. A new unique propeller design promises the advantage of being lightweight yet exceptionally strong and durable, by virtue of its construction with a new "B-staging vacuum infusion" assembly procedure.

After working persistently throughout the fall, team members look forward to another productive semester. Construction will be nearing completion in less than two months, when testing and optimizing the boat can begin. We look forward to an exciting few months as we see how our new designs affect performance of the craft. You may watch our progress and get more information at www.messiah.edu/genesis, or join our e-mail list by submitting a request to genesis@messiah.edu.



Team member Stephen Osborne '06 uses the hot nitrogen soldering iron to make final connections on a string of several solar cells.



Electrical Team member Drew Bryden '06 operates the hot nitrogen-soldering gun to attach connections to bypass diodes used to improve the solar array's performance.

Electrical engineer's description of a Christian's week

By Carl A. Erikson, Jr

Engineers are always making physical or mathematical models and using analogies in their work; for example, a mathematical model could be a formula such as Newton's Second Law, $F=ma$, where Newton reputedly saw an apple fall to the ground and tried to predict other such events with the formula. However, sometimes actual scaled models of machines or equipment are made and tested. Such things as scaled airplanes, bridges, and city skyscrapers are often tested for wind effects on the designs before building the actual system. Analogies represent a similarity or correspondence between members of one set and serve as a basis for creation of another form. A ruler represents a simple analog in that the markings on the ruler correspond to a standard length, and you compare this length in measuring the length of other things.

Since I am an electrical engineer who is a Christian, I thought it would be appropriate to give an engineer's model of a Christian's week in an analogous form using the components that I use in my discipline, i.e., resistors, inductors, capacitors, etc.

The way that I would like to do this in this newsletter is to briefly explain the main technical function of each component, then introduce its spiritual analogy, and finally give some biblical references to support my thinking. I will also show the electrical schematic symbol for each component.

Let's start with Sunday morning.

SWITCH—This is a device which turns on or turns off a circuit or another device, such as a light switch. A person must physically throw the switch into the correct position for the desired result. In other words, the person must make a deliberate effort to use the switch.

A Christian must do the same thing on Sunday morning. After the Saturday concert, soccer game, or late date, it would be very easy to stay in bed instead of going to church. However, I believe a

Christian should throw the switch, i.e., makes a deliberate effort to get up and get ready to go to church to worship God. He or she is activating the new week in a positive way.

Several Scriptures can be given here to demonstrate this deliberate effort:

I Chronicles 22:19 *Now set your mind and heart to seek the Lord your God.* Notice the word "seek." It's a deliberate intention. It's an action word.

Colossians 3:12 *Set your affection on things above, not on things that are on earth.* Notice the word "set". Again, it is a deliberate action. I must set my mind, heart, my whole being on God. I must throw the switch On and not Off as a Christian.

GENERATOR—This device produces an electrical energy source. An example would be a battery. The battery gives the spark or energy to make another device work such as a transistor radio.

As a Christian, my source of energy for the week is often initiated in Sunday School and Worship Service. These services give me the "spark" to live for God during the coming week and help me obtain the more abundant life. It is here I meet God and His people.

Several Scriptures give examples of worshipping God in His House and the results from doing this:

Psalm 111:1 *I will give thanks to the Lord with my whole heart, in the company of the upright, in the congregation.*

Psalm 122:1 *I was glad when they said to me "let us go to the house of the Lord."*

Hebrews 10:25 *Not forsaking the assembling of ourselves together, as the manner of some is.*

Psalm 27:4 *One thing have I asked of the Lord that will I seek after: that I may dwell in the house of the Lord all the days of my life, to behold the beauty of the Lord, and to inquire in his temple.*

Here is an example of a rundown battery being revived. In Psalm 30, David is at the dedication of the temple.

Psalm 30:11–12 *Thou hast turned for me my mourning into dancing; thou hast loosed my sackcloth and girdled me with gladness, that my soul may praise thee and not be silent. O Lord, my God, I will give thanks to Thee forever.*

DIODE—This is a device that allows the electrical current to travel in only one direction, forward. In other words, once you set the switch to ON and the battery gives the energy, the current goes only in one direction. It can't be reversed, or breakdown occurs.

The spiritual analogy is this: I am traveling on one way to heaven. I can't look back. I must keep my eyes on Jesus and not forsake Him as I traverse each week. If I don't, breakdown is likely to occur.

Scriptures to reflect on include:

Luke 17:32 *Remember Lot's wife.*

Jeremiah 2:19 *Your wickedness will chasten you, and your apostasy will reprove you. Know and see that it is evil and bitter for you to forsake the Lord your God.*

John 15:6 *If a man does not abide in me, he is cast forth as a branch and withers: and the branches are gathered, thrown into the fire and burned.*

Now I will look at the rest of the week, initially beginning with Monday and going through Wednesday. Because each day may contain similar circumstances, I will only mention the components once for each day.

to be continued in the next issue . . .

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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.

Far from Grantham

By *Kenneth Hoch '05*



Kenneth Hoch '05 with Milata

I was definitely out of my element. I was an ocean away from the Grantham, and its tedious scholarly activity, sitting in a handicap center in Burkina Faso, West Africa. Before me sat Milata, a twenty-something young woman suffering from cerebral palsy. Milata was spending the day testing an electric tricycle to see if Dokimoi Ergatai (Messiah's student service organization) could build her an electric tricycle. Engineers and French-speaking Africa—I, a Christian ministries and English double major, was definitely out of my element!

Milata had a severe case of cerebral palsy, leaving her confined to a mat nearly all day. Her aging mother couldn't lift her into a wheelchair, and all the other family members wanted nothing to do with her. I thought, before meeting Milata, that such a young woman would approach the world with somber eyes. Milata proved me wrong. She engaged everything that she could, tilting her head to not miss a single person's eyes. She wanted to perceive and interact with anything and everything. Milata was definitely out of her element. She was away from her mat.

Milata and I conversed all morning. She exclaimed, "I am happy you are visiting me!" Soon, I ran out of questions to ask, but I didn't want to leave Milata. Our translator suggested music, so Milata saw her first guitar. I sang with Milata, as she rejoiced in being human. She wasn't all smiles though. At one point in our conversation, Milata asked, "Why am I not healed?" The physical therapist could only answer, "We don't know; we can only hope and pray." The question resonated with me. With all our technology, all our faith, and all our engineering knowledge, what could we do for Milata? Could we have the faith to tell Milata to "take up her mat and go home?" The electric tricycle seemed like a perfect fit for Milata, but who will lift her into the chair? The technology waits to be developed. Is anyone willing to step out of his or her element and take his or her classroom knowledge an ocean away? If you do, tell Milata thank you for bringing me so far from Grantham.