

Policies and Procedures

Electronics Laboratories (F252, F254, F266)

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I. General Comments

A. Labs

F252 – Engineering Resource Room/Capstone Project Lab

This lab is accessible from the main 2nd floor hallway of Frey.

F254 – Electronics Lab (or “Engineering Hang-Out Room”)

This lab is accessible from the main 2nd floor hallway of Frey.

F256 – Equipment Storage Room (home to the Soldering Station and Circuit Board Plotter)

This room is located between F254 and F266. It is accessible from the F254 and F266 labs and from F258.

F258 – Electrical and Computer Engineering (EE/CE) Technician’s Office

This room is also located between F254 and F266, next to F256. It is accessible from F256 and the back 2nd floor hallway of Frey.

F266 – Electronics and FACET Lab

This lab is accessible from the main 2nd floor hallway of Frey.

B. *This is your space*

The electrical labs are here for your use as engineering students. How well the labs work for you will be directly related to how well you take care of them. We will do our best to keep the labs clean and running efficiently, but we cannot do it alone. We need your help. When you follow the policies and procedures outlined here you do a lot to promote professionalism, efficiency, and the quality of the engineering experience here at Messiah.

C. *Respect*

Please respect instructors, administrators, and your fellow students.

- 1) **Respect posted lab hours:** please do not interrupt a lab that is in session.
- 2) **Respect posted rules:** “No Food or Drink in this Lab” means do not eat or drink in the lab. Food and drink can ruin computers and electronic equipment very quickly.
- 3) **Respect the lab atmosphere:** if others are working, speak softly and use headphones if you wish to listen to music.
- 4) **Respect other departments:** please do not steal chairs from other labs.

D. *Research pays off*

“A couple of months in the laboratory can frequently save a couple of hours in the library.”

-Westheimer’s Discovery, as quoted by Dr. David Vader

Do some basic research before you begin your project. It will save you both time and energy.

E. *If you don’t know, ASK*

If you are unsure about anything, the safest thing to do is ask. The EE/CE Technician’s hours are posted on the doors of F256 and F258, and the technician’s other contact information is given at the end of this document. If you cannot find the technician, find an instructor. If all else fails, find another student more knowledgeable than yourself. Sometimes a simple question can save you hours of work or prevent serious damage to you or your project.

II. General Equipment Use Policy

A. Equipment Authorized for Student Use

You may only use equipment for which you have completed training (see section B below). (EXCEPTIONS: Anyone may use LCR meters, capacitance meters, or handheld multimeters without completing a formal training session, although consulting the technician for basic training is still recommended.)

Students may use the following electrical test equipment without special approval:

- Global Specialties ProtoBoards
- Analog Oscilloscopes (located in the Electronics and FACET Lab)
- Tektronix TDS210, TDS220, and TDS1002 Digital Oscilloscopes
- BK Precision Function Generators
- BK Precision Triple Output Power Supplies
- BK Precision LCR Meters
- BK Precision Capacitance Meters
- Fluke and BK Precision Handheld Multimeters
- Soldering Station

The following equipment is available in Frey 266 (Electronics and FACET Lab) for student use, but may not be removed from F266 for any reason:

- LabVolt Base Stations
- LabVolt Multimeter/Function Generator Combo Units
- BK Precision 2522 and 2522B Analog Oscilloscopes
- Extech EH 430 Handheld Multimeters
- Plexiglas Circuit Component Training Boards
- “Black Box” Power Amplifiers

Any equipment not listed above is not available for student use without special approval (see immediately below and section H). The following equipment is available for student use or sign-out but requires instructor or technician approval on a case-by-case basis:

- Tektronix TDS2024 Color Digital Oscilloscope
- BK Precision Model 5492 Bench-top Multimeter
- BK Precision RF Signal Generator
- All Spectrum Analyzers
- High Output DC Power Supplies
- Powerstat variable autotransformers
- Drill Press
- Heat Gun
- LPKF Circuit Board Plotter

Contact an instructor or the EE/CE Technician if you need to use equipment that requires special approval. (EXCEPTION: If an instructor has set up a controlled class experiment using a piece of lab equipment normally requiring special approval, then you do not need additional special approval to use the equipment in the context of that experiment. An example would be the use of a spectrum analyzer as part of a Communications Systems class lab.)

B. Training/Orientation

In order to prevent damage to lab equipment and/or to you, we require that all students complete basic orientation before operating most lab equipment. This orientation has three steps:

- 1) Obtain and read hand-out materials for the equipment you wish to use
- 2) Complete a training session with the technician for that type of equipment
- 3) Complete, sign, and turn in a Safety Sign-off Sheet

Most often this orientation will occur as part of the lab requirement for one of your classes (e.g. ENGR 262, Circuit Analysis). If you wish to use a piece of equipment but have not yet completed an orientation session for it, you should schedule a session with the EE/CE Technician. Speak with the technician directly or send the technician an email containing information about the piece(s) of equipment you wish to train for and available times. (TIP: If several students wish to train for the same piece(s) of equipment, you can save time by scheduling a group training session.)

You are not required to train for all equipment at once. The engineering department will keep your Safety Sign-off Sheet on file so that you can add to it when you train for each new type of equipment.

Equipment not listed on the Safety Sign-off Sheet (e.g. multimeters) does not require formal training. However, such equipment may still require special approval (see part A of this section).

C. Equipment Sign-Out

Mobile electrical lab equipment not requiring special approval may be used within the three electrical labs (F252, F254, and F266) during business hours without being signed out. Any equipment that is not signed out must be returned by the end of the business day.

If equipment is needed after business hours, outside the area of the three electrical labs, or for more than one day, then it must be signed out. A sign-out sheet is located on a clipboard in F256. NOTE: Only equipment not requiring special approval may be signed out in this way. If you need to sign out or use a piece of equipment that requires special approval, contact the EE/CE Technician.

Please return all equipment promptly when you are no longer using it.

D. Tool Boxes

Tool boxes are available for student use. Each toolbox contains wire cutters, wire strippers, screwdrivers, an IC extractor, and various other tools for working with electronics. The tool boxes are located in a cabinet in F254.

Like other equipment, the tool boxes may be used within the three electrical labs (F252, F254, and F266) during business hours without being signed out. Any tool boxes that are not signed out must be returned by the end of the business day.

If electrical tools are needed after business hours, outside the area of the three electrical labs, or for more than one day, then a tool box must be signed out. **Please sign out the entire tool box**; do not take an individual tool from the box. A sign-out sheet for tool boxes is located on a clipboard in F254 hanging on the side of the tool cabinet.

E. Jumper Wires

Jumper wires for project prototyping are located in bins on the shelves in F254. If you move the jumper wire bins from the shelves please replace them before you leave the lab. Out of consideration for your fellow students, do not remove the jumper wire bins from F254 under any circumstances. If you need access to jumper wires elsewhere, take only the wires you need and place them in a separate container.

Please return jumper wires to the appropriate size bin (short, medium, or long). Alternatively, if you do not have time to sort the wires yourself you may place them in the "Returned Wires" bin to be sorted later.

F. Soldering Station

The soldering station is located in F256. When using the soldering station, please follow the posted guidelines. (TIP: The guidelines and a soldering tutorial are also available online on the Department of Engineering's website.) Use of safety glasses while soldering is required. Safety glasses are available at the soldering station for student use.

Please clean and reorganize the soldering station when you are finished soldering.

G. LPKF Circuit Board Plotter

The LPKF circuit board plotter is located in F256. A valid circuit schematic and Ultiboard layout are required before any work can begin milling a circuit board with the LPKF circuit board plotter. If you wish to use the circuit board plotter, first bring copies of the schematic and the layout to the EE/CE Technician for approval.

A technician, instructor, or engineering work-study student must be present (or nearby) any time that the LPKF circuit board plotter is in use. During high-demand times it may also become necessary to use a reservation sheet for the LPKF circuit board plotter. Speak with the EE/CE Technician to schedule a time to use the machine; the technician will inform you if a reservation sheet is in use.

H. Additional Equipment

The Department of Engineering has a number of additional equipment items available for project and class use. In general, this equipment is reserved specifically for certain classes or projects and may not be used by students without explicit permission. Please refrain from using such equipment unless you are participating in a class or lab and have instruction from your professor to use the equipment.

If you have a particular equipment need which you think the department may be able to meet, please speak with the EE/CE Technician to obtain permission to use the equipment.

I. Broken Equipment

If something does not work properly, we cannot fix it unless you tell us. Please let the EE/CE Technician know promptly if the equipment you are using is broken. If the EE/CE Technician cannot be found, please fill out an equipment problem report form and place it in the Completed Forms bin on the door to the technician's office (F258). These forms may be found in wall bins in F254 and F266, or may be downloaded from the Engineering website.

III. Lost or Damaged Equipment Policy

A. Lost Equipment

A student is responsible for any equipment signed out in his/her name for the duration of the time that the equipment is in his/her care. If the equipment is lost or stolen before it is signed back in, **the student is responsible for the full replacement value of the equipment at the time of loss.**

This policy applies both to electrical lab equipment and to other department equipment (such as digital cameras, video cameras, and laptop computers).

B. Damaged Equipment

When a piece of equipment is damaged while a student is using it or has it signed out, **it is the student's responsibility to report this damage as soon as possible to the EE/CE Technician.** Equipment problem report forms are located in F254 and F266 to aid in reporting damaged equipment.

Students will not be held liable for accidental damage to equipment that occurs during normal usage or due to general student inexperience. (Such damage will inevitably occur as part of the learning process.) If, however, the equipment is damaged through intentional misuse or neglect, the student may be held liable for some or all of the repair/replacement cost of the equipment.

Factors which influence the definition of “intentional misuse or neglect” include:

- Whether the student using the equipment was following normal lab procedures at the time when the equipment was damaged
- Whether the student was authorized to use the equipment at the time the equipment was damaged
- Whether the student has been warned previously about equipment abuse or neglect
- Whether or not the student reported the damage to the EE/CE Technician in a timely manner

In such cases, it will be left to the discretion of the EE/CE Technician and the department chair, in conference with the student, to determine the appropriate portion of repair/replacement costs to charge to the student.

IV. Digital Camera Policy

A. Available Camera Equipment

Six digital cameras are available for student or project use:

- (1) Canon A5 Zoom
- (1) Canon A50
- (4) Nikon Coolpix 4600

Each camera is stored in a cardboard box with its various accessories. In addition, an AMC 9-in-1 flash media card reader is available for use in the electrical labs.

B. Camera Equipment Sign-Out

Like other equipment, digital cameras may be used within the three electrical labs (F252, F254, and F266) during business hours without being signed out. The cameras must be returned to F256 by the end of the business day.

If needed after business hours, outside the area of the three electrical labs, or for more than one day, digital cameras must be signed out. **Please sign out the entire camera box**, not individual pieces. The maximum sign-out period for individual students is 1 week. IPC project teams or extracurricular organizations may sign out a camera for longer than 1 week upon completion of a Digital Camera Long-Term Sign-Out form. See the EE/CE Technician for one of these forms if you need to use a camera for longer than 1 week.

If you need more space on the camera memory cards, feel free to delete existing photos. (Conversely, this means that you should remove any photos that you need from the memory cards **before** you return the camera.)

Please return all digital camera equipment promptly when you are no longer using it.

C. Card Reader

The Nikon Coolpix cameras do not require a card reader to connect to the computer, and flash card readers are included in the boxes with the Canon cameras. Therefore, the AMC 9-in-1 card reader does not need to be signed out with the cameras and is not normally available for sign-out. The reader is, however, available for use within the three lab area at any time during business hours. The reader must be returned to F256 by the end of the business day.

Please see the EE/CE Technician to arrange for a special sign-out if you need to use the AMC 9-in-1 card reader outside of the three lab area or after hours.

Please return the card readers promptly when you are no longer using them.

V. Video Equipment Use Policy

A. Available Video Equipment

The Department of Engineering owns two digital video camcorders which are available for project use. Each camcorder case includes the following equipment:

- (1) Panasonic PV-GS500 camcorder
- (1) AC power adapter (with AC and DC power cords)
- (1) Li-ion battery pack
- (1) Remote control
- (1) “Magic Wire” zoom and shutter control
- (1) USB Cable
- (1) RCA/SVideo adapter cable

If you need a DV/Firewire cable for use with the camera, please see the EE/CE Technician.

B. Video Equipment Sign-Out

Use of video equipment is restricted to project teams or organizations only. Individual students may not check out video equipment if the equipment will not be used for project work. The time limit for using the video equipment will be determined on a case by case basis according to the project needs, but in most cases is not to exceed one week. In order to check out video equipment you will need to fill out a Video Equipment Sign-out form. Please see the EE/CE Technician to obtain one of these forms.

Please return all video equipment promptly when you are no longer using it.

C. Editing Video

The Collaboratory owns a video editing computer which may be used to download taped video from the camcorder, edit it, and burn it to another media format (such as a DVD). Use of the video editing computer is governed by the policies of the Collaboratory. Please speak with the Collaboratory manager if you need to use the video editing computer.

VI. Computers, Printers, and the Internet

A. Lab Computer Use

Log in to an engineering lab computer the same way you would log in to a regular lab computer. After logging in, all engineering programs may be accessed through the “Engineering Software” folder on the desktop or via the “Engineering Software” portion of the Start menu. All other programs may be accessed in the normal way by going to the Start menu and selecting “Messiah Programs.”

All normal ITS policies for lab computer use apply to the computers in the engineering labs. These policies are available at

http://www.messiah.edu/offices/its/labs_classrooms/labs/lab_policies.html

B. Do Not Monopolize the Lab Computers

Please log out of your computer station when you leave the lab. It is discourteous to other students to monopolize a computer for hours by remaining logged in when you are away. If you really need to leave a computer program running in the lab while you are not there (e.g. an I-DEAS simulation), please label your workspace clearly and notify the EE/CE Technician. If it becomes necessary to free computers for student use, the EE/CE Technician will log people out of unattended, unlabeled stations.

Do not lock your workstation. If you lock a workstation, the EE/CE Technician may reboot the computer manually. Any unsaved work you have will be lost, because there will be no way for the EE/CE Technician to save your work before a reboot.

C. Using the C: Drive

In the past, engineering students have made it a habit to store important files locally on the C: drives of engineering lab computers. This is a bad habit; **do NOT save important files to the C: drive and expect to come back and find them later.** All computers in F252, F254, and F266 are re-imaged on a set schedule. **Anything stored on the C: drive of these computers will be deleted when the computers are re-imaged.**

Instead, you should think of the C: drive as a temporary storage location for non-critical files. The proper storage locations for your critical files are your K: drive, a removable drive, the P: drive (project drive), or Q: drive space provided by an instructor.

D. Using the P: (Project) Drive

Hard drive space for engineering project teams is available on the P: drive. The P: drive is accessible from the computers in F252, F254, and F266 as well as from the dorms. To use the P: drive you will need the EE/CE Technician to set up a folder for your project. For instructions regarding the access and use of the P: drive, please see the EE/CE Technician.

E. Printer Use

The HP Laserjet printer in F254 is available for black and white printing. Any documents printed to this printer will be charged to your ITS printing allowance. If color printing is required, please select the F245 color printer. Please note that color printing is much more expensive than black and white printing.

F. Department Laptop Computers

The engineering department has six laptop computers available for project use. Students are allowed to check out these laptops for project use only, although exceptions are possible. (Project use includes IPC projects and extracurricular engineering projects.) All laptop sign-outs are approved on a case by case basis.

To sign out a laptop computer you will need to fill out a "Department Laptop Sign-Out" form. Please see the EE/CE Technician to obtain a laptop and a copy of the form.

G. Department USB Flash Drives

The engineering department owns several small USB flash drives that are available for student use. If you would like to borrow or sign out one of these drives, please see the EE/CE Technician.

H. Broken Computers

Please inform the EE/CE Technician of any computers that are not working properly. Also, please inform the EE/CE Technician if the printer is broken or out of toner. If you cannot find the EE/CE Technician in person, please complete a computer problem report form and place the form in the

bin on the technician's office door. The forms are located in F254 and F266, or may be downloaded from the Engineering department website. Again, we cannot fix anything that we do not know is broken.

I. Internet Resources

Internet access is available in the electronics labs, as in all campus labs. Please abide by the ITS Internet use policy and access only appropriate material.

In addition, the engineering department website contains a number of resources for student use, including academic information, links to electronics tutorials, and copies of all major electrical lab forms and policies.

The Department of Engineering website is located at:

<http://www.messiah.edu/departments/engineering/>

VII. Cleanliness and Safety

A. Personal Belongings

Out of respect for others, please do not leave your personal belongings in the way of others when you are not there. If you need to leave your backpack or other belongings in the lab, move them to the shelves or by the wall where they will not be in the way. (EXCEPTION: If you need to be logged in to a computer while you are away, you may stack your backpack and belongings neatly on the table next to the computer monitor you are using. Please also remember to contact the EE/CE Technician about remaining logged in to the computer.)

At the end of the day, any loose items sitting unattended on the lab tables may be moved to the "Lost and Found" shelf.

B. No Food or Drink in the Lab

Because of the risk of damaging computers or other electronic equipment, no open food or drink is allowed in any of the electrical labs.

Food and drink containers (candy bars, Styrofoam food containers, Nalgene bottles, etc) are permitted only if they remain closed and sealed. Please keep closed food and drink containers off the workbenches and away from electrical equipment to minimize the risk of an accident.

C. General Safety Guidelines

Observe the following safety guidelines when working with lab equipment:

- 1) **Use only equipment you are trained to use**
- 2) To reduce the risk of electrocuting yourself, **remove watches, rings, and other metal items when working with live power electronics**
- 3) **When measuring high voltages use only one hand** (if possible)
- 4) When working with static-sensitive components (such as integrated circuits), **wear an anti-static wrist strap**
- 5) **Work in pairs** – always have someone else in the lab with you
- 6) **If you are unsure of a proper procedure, ASK someone** (e.g. the EE/CE Technician)

D. Label Your Unfinished Work

If you have an unfinished circuit prototype on a breadboard or ProtoBoard that you wish to leave in the lab, please label it clearly with your full name and class/project. Unlabelled circuits are subject to disassembly. Place unfinished work on the shelves in F254 while you are out of the lab.

(TIP: In practice, unlabelled circuits are disassembled when the department runs out of ProtoBoards. Thus, just because your circuit has survived a few days unlabelled does not mean it will be safe indefinitely. If someone else needs a ProtoBoard and your circuit is not labeled, it WILL be disassembled.)

E. Clean Up After Yourself

When you are finished working in the lab, please return all tools and materials to the appropriate location:

- 1) Return electronic equipment to the shelves in F256
- 2) Return unused/unneeded components to the appropriate component drawer or to the “Returned Components” bin on the shelves in F254
- 3) Return jumper wires to the appropriate size wire bin (short, medium, or long) (Alternatively, if you do not have time to sort the wires yourself you may place them in the “Returned Wires” bin to be sorted later.)
- 4) Return oscilloscope probes and test leads to the appropriate spot in the wall-mounted racks
- 5) Return stools and chairs to their proper places
- 6) **Clean up your work area**

F. In Case of Emergency

In order to be prepared for any possible emergency you should know the following:

- 1) **Know your emergency numbers** – in the case of an emergency, call 9-911 first, then call x6565 (Public Safety). Finally, please alert the EE/CE Technician in person or by calling x7225. There are telephones in F252 and F254.
- 2) **Know where the fire extinguishers are** – there is one in the front hallway of Frey 2nd across from the door of F266 (Electronics and FACET Lab) and a second in the back hallway near the door of F258 (the EE/CE Technician’s office).
- 3) **Know the location of emergency medical supplies** – first aid and personal protection equipment (PPE) kits are located under the sink in F236 (the faculty lounge). F236 is at the end of the back hallway of Frey 2nd, behind F266.

VIII. Prototyping Tips and Tricks

A. Order of Operations

Most often, circuit prototyping works most smoothly when your design progresses in the following order:

- 1) Schematic
- 2) Simulation (if possible)
- 3) ProtoBoard or breadboard prototype
- 4) Printed circuit board (PCB)

Students who try to go directly from step 1 to step 4 (or worse, directly to step 4 without any schematic), often find their circuits riddled with mistakes and glitches. For this reason, **a schematic is always required before construction of a PCB can begin.** Except when materially infeasible, a breadboard prototype is also required prior to PCB construction.

As stated elsewhere, students are required to submit their schematics to the EE/CE Technician for review before using the LPKF circuit board plotter. This requirement helps eliminate potential design problems before construction begins.

B. Simulate First

Whenever possible, use MultiSim or a similar program to simulate your circuit before construction of a printed circuit board begins. It is a lot easier (and safer) to fix a mistake before you have made a printed circuit board than afterwards.

C. Use Your Resources

At least once as a student you will probably spend hours puzzling over a problem that a little research or a judicious question could have answered in minutes. When you are building your prototype, make use of your resources for design tips. This includes both printed and human resources. Your instructors, the EE/CE Technician, and even older students have probably done something similar to what you are now doing. Don't be afraid to ask for help!

IX. The FACET Lab System

A. How To Get the Most out of FACET Lab

FACET lab is a learning tool, not a magic bullet. In order to get something out of it you must put in some effort. It may be tempting for you to breeze through the labs and guess at all the questions until you get them right, but you will not learn much that way. Instead, take the time to create the circuits and make the measurements that the software requests. You will find that you will learn a lot more when you choose to be an active participant.

B. Getting Started

Your lab instructor will show you specifically how to set up and use FACET boards. However, the general procedure for getting started is as follows:

- 1) Log in to a computer in F266 (the Electronics and FACET lab)
- 2) Obtain the correct FACET board from the cabinets along the back wall of F266
- 3) Insert the FACET board into the base station connected to your computer
- 4) Turn on the FACET equipment
- 5) Double-click the LabVolt icon on the desktop to launch the FACET software

C. Oscilloscope Probes

The oscilloscope probes located at each lab workstation have been calibrated for the corresponding oscilloscopes at each station. In order to keep measurements as accurate as possible, please do not move probes among the stations. If the probes at your station are missing or broken, please inform the EE/CE Technician (in person or via email) and move to a different station.

D. When FACET Is Broken

If your FACET board is not working properly, please do not return it to the cabinet. Instead, give it to the EE/CE Technician for troubleshooting. If you cannot find the technician for any reason (e.g. you are working on a weekend), then clearly label the board as broken and place it on the shelves next to the test leads. FACET Lab problem report forms are available in F266 for this purpose. Place the completed form with the board or give it directly to the EE/CE Technician. (TIP: You may also download this form in PDF format from the engineering department website.) In addition to completing a form, please send a brief email to the technician explaining the problem.

If your FACET base station or software is not working, please inform the EE/CE Technician and move to a different station. If you cannot find the technician for any reason (e.g. you are working on a weekend), then clearly label your workstation as broken so that other students do not try to use it as well. Again, please fill out a FACET Lab problem report form and send an email to the technician explaining the problem.

NOTE: If possible, include specific details about what is wrong on the labels you create and emails you send. This will help the technician solve the problem more quickly. One label that has been used by students in the past is “I need fixed.” This is an accurate but completely useless label. Instead, something like “the 50 ohm resistor in the power transistors circuit is short circuited” is much more helpful.

E. When FACET Is Wrong

The FACET software is not perfect; on occasion it has been wrong. If you believe that you are right and the FACET software is wrong, please notify your instructor or the EE/CE Technician of the problem. If you cannot notify someone immediately, fill out a FACET Lab problem report form. If possible, take a screen shot of the problem and send it to your instructor or the technician via email.

(TIP: While it may seem annoying, notifying the EE/CE technician or your instructor is in the long run much more productive for your learning than simply accepting FACET’s answer and moving on. First, if you are wrong and FACET is right, then the technician or your instructor can help explain why that is so. Second, if you are right and FACET is wrong, wouldn’t you want to know that you are smarter than the computer? Plus, notifying someone will help other students when they encounter the same issue.)

F. When You Are Finished

When you are finished in the FACET lab, remember to do the following:

- 1) Remove all white jumpers, silver posts, and other hardware from your FACET board
- 2) Replace the jumpers, posts, etc. in your workstation box
- 3) Turn off the FACET equipment
- 4) Remove the FACET board from the base station and replace it securely in its original cardboard box
- 5) Return the board and box to the cabinet
- 6) Return test leads to the rack on the wall
- 7) Close the FACET software and log out of the computer

X. Contact Information

A. Electrical and Computer Engineering Technician

The EE/CE Technician is Paul Myers

Phone: x7225 (on campus), 717-796-1800 x7225 (off campus)

Email: PMyers@messiah.edu

Campus Box: 3034 (Engineering Department)

B. Other Important Contacts

Mechanical Engineering Technician: John Meyer, x7101

Engineering Department Chair: Randy Fish, x3300

Engineering Department Administrative Assistant: Jean McCauslin, x7283

Collaboratory Manager: Deborah Tepley, x7226