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Abstract

eCYBERMISSION Team Name	Bro X 4
Team Grade	8th
Project Start Date	October 8th 2013
Project Finish Date	March 4 2014

Describe your project and explain how you used STEM (Science,Technology, Engineering and Mathematics) to improve your community (250 words or less)

Our project concept was to plan out and construct a safer method to safeguard students and staff in school buildings during tornadoes and or earthquakes. We came up with the idea of placing a set of lockers onto a frame which then allows them to deploy at a 45 degree angle. Students then would take shelter under the deployed lockers which will protect them from falling debris. We came up with this idea after we talked with Sherry Wilson who works at Public Health, and helped create the Platte County Disaster Mitigation Plan. She shared information about the high tornado risk in Wyoming. This motivated us to create a better way to protect the unprotected school faculty and students. Our project uses S.T.E.M ideologies in numerous ways. This project practices the scientific method of testing variables. We had to use our observation skills to see imperfections in the locker system (LSI). Using technology to aid us by using high definition cameras to slow down the debris we were testing on the LSI. Engineering was greatly adopted in or project to create the locker system and make a well built project with a balance between weight, cost, and effectiveness. Mathematics helped find the best angle for the optimal protection as well as build the system. Most schools, including our own, currently only use books to protect the students in an emergency scenario. The LSI would greatly increase the security and safety of children during tornadoes and earthquakes in our community.

Tips for writing your abstract:
-Do not go into too much detail about one certain area- be brief!
-Include a problem statement and/or your hypothesis
-Summarize procedures and the important steps you took to solve your problem
- Briefly discuss your observations and results
-Summarize conclusions and/or next steps
-Do not go over 250 words!
*Please e-mail completed abstracts to swhitsettla>ec bermission.com or fax to 703-243-7177 by April15.

State	Wyoming
Grade	8th
Mission Challenge	National Security and Safety
Method	Engineering Design Process
Students	Csuramsvc (Submitted on: 3/4/2014 1:47:47 PM) 18jmadse (Submitted on: 3/4/2014 1:48:23 PM) 18jstaff (Submitted on: 3/4/2014 1:48:14 PM) EieyoHM (Submitted on: 3/4/2014 1:48:40 PM)

Team Collaboration

(1) Describe the plan your team used to complete your Mission Folder. Be sure to explain the role of each team member and how you shared and assigned responsibilities. Describe your team's process to ensure that assignments were completed on time and deadlines were met.

Our team member Joey Madsen suggested we all come together and assign questions to complete our mission folder. Each team member was to complete their respective sections and then report them to the team. The section you are reading now, Team Collaboration, was typed up with each group member adding their own ideas. Haiden Moody work on the testing prototypes sub-section along with Joey. Jacob Stafford worked on the drawing conclusions sub-section in Engineering Design section. Christian Moody and Jacob Stafford worked on the problem statement and the experimental design together in the Engineering Design section. The sub-section building prototype in the Engineering Design was worked on by every team member using collaboration and teamwork. Joey also work on the Community Benefit with Jacob. We came together as a team to revise the articles to make them the best we can. We then took our papers to our adviser (Mrs. Harnish) to have them revised by an expert on the subject. We all drilled it into each others heads that we need to have this done and revised before we turned this in to be confident we would not regret anything. We also used texting, emails and phone calls to ensure our team had their questions done. We had Mrs. Harnish review each team members articles until we though they were the best they could be. Once this was done we all met up at the eagle nest (actual members, Christian and Haiden's house) to submit all of our sections. We all had our questions on a jump drive so it would be easy to upload the files and documents. We also used a program that allows us to save our files online. This was to ensure we had all our documents and that they were not left at the school. With everything all completed and uploaded we could wipe the dust bunnies from our hands and computers then call it a day.

Engineering Design

Problem Statement

(1) What problem in your community did your team try to solve? Why is this problem important to your community?

1.1. All over the world there are homes and schools being destroyed, ripped apart and left to rot after a cataclysmic disaster. And along with that there are recorded casualties that include students and teacher's lives. In response to schools across the country being wrecked we believe we have a possible solution to aid the students and teachers that are caught in a tornado/storm. This problem is important to our community because in our team's last day of third, fourth, and fifth grade years of school we had tornados. We were then moved to the hall where we then put flimsy books such as dictionaries over our heads to protect ourselves. These books offered little to no protection and could easily gotten torn away as we only were holding on with our hands.

(2) List at least 10 resources you used to complete your research (e.g., websites, professional journals, periodicals, subject matter experts).

Please see the file titled "Ten resources".

(3) Describe what you learned in your research.

3.1. Through our research we discovered that states like Oklahoma have more than 100 tornados a year and 60% of schools there admit to not having storm shelters in tornado valley. (Murphy, 2013). We also learned how to survive in a basic tornado situation if you are caught in a place with no tornado shelter such as an unprepared school or house. (Elliot, 2013).

Experimental Design

(4) Develop a design statement. Be sure to describe what exactly your device should be able to do. Do not describe HOW it's going to do what it needs to do.

We developed the system to better protect students in an earthquake/ tornado disaster in schools by utilizing the common locker. We came up with this idea after we had a tornado go through Wheatland; we were all extremely concerned for our safety and we thought schools could have better protection than text books. We tested our system to the circumstances of a regular school setting in a tornado disaster we found that….

Our System Can:

- Be fully deployed and locked in twelve 12 seconds on typical school floor surfaces.
- It can withstand approximately 400 lbs. of falling weight per locker bank.
- It can withstand tornado force winds of category two hurricane force winds (96 to 110 miles an hour)
- It can protect students from flying debris 50% better.
- Fits five students per locker bank. (one student per locker)
- Students are extremely unprotected from tornado forces in the average American school.
- Modern tornado safety techniques in schools are unsafe and ineffective.

(5) Determine the criteria for a successful solution and identify constraints for your design. Discuss what the device must have in order to accomplish its job and the restrictions of the device (i.e. the size, the cost, the weight, etc.).

We developed this great product from intense brainstorming, building, testing, and evaluating. We started out this project by brainstorming ideas in Lego robotics and we thought of a system that could protect students while utilizing school lockers. We then built a prototype out of Legos. (Out team then designed the plan for the LS1) IT consists of a study frame that is secured to the wall; two long steel channels are bolted to the frame to house the sliding mechanism. This will allow the locker to slide with ease into position. As it slides out it relies on two wheels per locker bank to allow it to slide into position. These are fixed into place at the bottom of the locker bank. We designed a manual locking mechanism to keep the lockers from moving in a tornado situation. The locking mechanism is swung the latched into locking form (see photos) this all folds out into a 45 degree angle which is optimum for deflecting debris. With the help of CME we built the LS1 with a sturdy triangle frame (For ease of show in competition); the locker system has spring loaded handles for easier access for opening the system. When this system is fully deployed it can house 5 people per locker bank (a locker bank being 5 regular sixed lockers). Together all these mechanism make up the LS1 (Locker System 1st design). The locker bank we used is a 5ftx5ftx1ft; they were of a similar design to the ones we have in our school. Some restrictions of the device are that schools sometimes have different lockers. We can combat this by making a series of frames that fit common locker designs. The locker system is also relatively cheap ($100 to $120) and easy to install. Currently we are designing different kinds of this project for not just schools but commercial and residential applications.

(6) Identify the relevant variables you will use to test your prototype or model and explain how you will measure your variables.

When our team was tasked with how to test the locker system, we first figured that the locker system should be easily deployed by the average student and teacher. This is extremely important in a disaster situation when children will have to use the LS1; it is no good if you can’t deploy it. Our first test was to time the deployment with several different people. We concluded that it took an average of twelve seconds to be fully deployed. We wanted to simulate the roof falling down on the locker system. We thought it would be best to put the V-theory to the test and see how much weight it can handle at the same time. For our third variable we drove it down a bumpy washboard road. We went 30, 40, and 50 miles an hour down this road. Each time we checked all joints and connections for signs of wear. When conducting the wind test we went 40, 50, and 60 miles an hour. We checked all connections once again and everything checked out. To simulate the rood falling on the locker we dropped thirty 36 pound and 40 pound cinder blocks from eleven feet up in the air. This is the height of most schools hallway roofs. These did nothing but glance off and smash on the ground. This proved our V-theory worked. The blocks made no dents and just chipped paint. When we dropped pallet we dropped it from the same height of eleven feet. These pallets weighed 66 pounds. Each time we dropped the pallets they would just glance off like the cinder blocks. The most damage came from when we dropped our last pallet and it broke off a lock for the locker. Most lockers have locking mechanisms sunken into the locker so all you would have to do after a tornado is repaint the lockers.

<u>Build Prototype or Model</u>

(7) Develop a design and list the materials you used in your design. Include technologies you used (e.g., scientific equipment, internet resources, computer programs, multimedia, etc.).

We originally designed the LS1 (locker system 1) by using Legos that we work on during our lunch break over several days. We visually designed the locker from scratch. We had a good idea of what we wanted from the V theory that we previously learned about when doing a Lego Robotics project in which we made a curriculum about disasters and what to do in the event of a specific one. Moving along, we finished the model and then gave it to a local metal fabricator. From there the LS1 was created and the model was transferred to paper where revisions could be made easily. Revision such as locks and more safety for anyone under the LS1.

(8) Explain how you built your prototype(s) or model(s)? Include each of the steps in your process.

When we began brain storming ideas of creating the LS1 (locker system one) we thought it was a fantasy and could never be completed. We first came up with the idea of using Legos from a class we were in called Lego robotics. In this class we work with robotics and Legos to make robots and test them at competition. The fact that Lego robotics pieces are so variable lead to us creating the prototype out of Legos. Our team came in at lunch for several days trying to create a design that would operate correctly. We reviewed this design over and over again adding things such as gears for wheels and a more stable base. Our coach made some phone calls and found an old bank of lockers that our school district had in storage. This was the turning point in our project because we realized we could actually create the device. One of our team members was friends with a local engineer whose name is Eli Stone. We took our prototype to his company CME, (Consolidated Manufacturing Enterprise), and our team Bro X 4 then started creating the first LS1.

We started by welding 2 inch square metal tubing into square shaped frame to go around the lockers. At the top corners wheels were added to allow the locker to slide up and down. To secure this frame to the lockers we cut out the top left and right corners of the lockers. We then secured the locker using bolts. At the bottom of the lockers we used metal wheels to allow the locker to be pulled out easier (see picture 6). We then used a U frame for the piece of the LS1 that was to be bolted to the wall, and would allow the locker to slide up and down. To lock the locker in the down position we added a handle with a triangle like piece on the inside. Lastly we added a triangle like frame at the back form stability when the locker was not in use. These of course would not be a part of the lockers when they are installed in the schools. We only needed these to help prop up the lockers while in storage. After looking at the locker at this point, we thought we should come up with a way so that the tornado does not lift the lockers of the ground and snap the frame. After brainstorming an idea we thought a cross bar would be best because it is compact and can hide in the lockers when the lockers are in everyday use. We also thought that there needs to be an easier way to pull out the lockers. So we came up with a spring loaded handle in the front of the lockers to easily pull out. These handles also collapse in to the locker so they will not harm the student walking by in school. When we were going to test this locker we thought of the idea to put plywood on the back to simulate the wall while sitting under the lockers. These help when we sat under the lockers we did not fall through the hole in the back. Our last change was when we put chains on the bars that secure the lockers together so the bars will not get lost when we take the locker apart. This helped us when moving the frame from the testing locations to the storage locations. These bars do not hold the locker to the frame it holds a sort of triangular frame to the back of the lockers frame so it would be easier to store and set up. This triangle frame would be removed when this locker was going to be set up in schools.

Test Prototype

(9) Describe the data you collected and observed in your prototype testing (use of data tables, charts, and/or graphs are encouraged).

Please see the file we uploaded titled "Testing put in charts and graphs".

(10) Analyze the data you collected and observed in your prototype testing. Does your data support or refute your design statement? Do not answer with yes or no. Explain your answer using 'Our data supports/refutes the design statement because...'

If we were to retest the LS1 then we would want to use more diverse materials other than a bulky locker block. There could be possibilities for the system to be adapted to places that could not normally have a locker sitting there. In these places we could see how strong a sheet of stainless steel or steel with requested or common things on top that include: bulletin boards, art display boards, or just the plain sheet that has have a school or company design painted onto the front. But we couldn’t do this type of testing because most forms of stainless steel are expensive and heavy. Shipping and ordering would be expensive. For the effectiveness, we saw great results. The LS1 withstood great amounts of direct force that would normally crush a student by having the object just bouncing off. All of the welds would withstand a force of “70000 “ pounds and the first part that would likely ever fail would be the bolting, which can withstand “ 6800 “ shear pounds and “ 70000“ tensile pounds of force.

(11) Explain any sources of error and how these could have affected your results

Possible failures during testing would likely be that we couldn’t break the darn thing to see its maximum strength! We can look at welds and even take the LS1 to a mechanical engineer to find the weak/breaking points but still do not want to break the model that we haven’t got full blueprints of (the man who man the system for us had just gone with how he best saw the construction done) so we could not get breaking points for 3 variables with 1 system. We believe the tensile strength and welding types will hold true to their expectancies but we cannot be sure until we break the system.

Drawing Conclusions

(12) Interpret and evaluate your results and write a conclusion statement that includes the following: Describe what you would do if you wanted to retest or further test your design. Evaluate the usefulness of your prototype or model. What changes would you make to your prototype or model for the future, if any?

Our data supports our question of ‘Can members of schools be kept safer than they are currently are from natural disasters?’ by showing endurance from falling impacts, shaking and flying debris. When testing the impact that could be withstood, the locker only lost chips of paint in about 2 cm2 bits. The locker suffered no major denting (hardly any at all) when items were dropped, and all welds and bolts were unaffected. When multiple objects were dropped at once (from 11’ in the air) there were identical results. During the shaking test the locker was taken down the interstate and washboard roads at high speeds. First we went down a bumpy road at 20, 30, and 40 miles per hour. We also drove down a smooth road at 60, 70, and 80 miles per hour and there was no damage done to the lockers supports and operated (opening and closing, locking) perfectly after each test. When being tested for the wind test, the lockers completely covered the cardboard dummies with adhesives on them. When grass was blown directly at the lockers nothing reached the cardboard dummies. This was a huge improvement when we tested without lockers and the entirety of the cardboard (3’ wide, 5.5’ tall) was covered in grass stuck onto the adhesives.

Uploaded Files:

- [**View**] **Testing in charts and graphs** (By: 18jmadse, 03/03/2014, .docx)

  This file could not upload because it was in a chart so we had to upload the file here. This answers the question or problem of putting your testing in charts and graphs.

- [**View**] **Ten resources** (By: 18jmadse, 03/03/2014, .docx)

  This is the ten resources we used. We had to upload it so you actually click on the links and view the.

- [**View**] **Pictures of how we built or locker** (By: 18jmadse, 03/03/2014, .docx)

  This is pictures of how we built our locker.

- [**View**] **BroX4 Pictures and Video Links** (By: EieyoHM, 03/04/2014, .docx)

  Has a list of each of our pictures and videos along with links to external hosting sites (YouTube and imgur, as well as a local newspaper source)

Community Benefit

(1) How could your design help solve your problem and benefit your community? Describe next steps for further research/design and how you have or how you could implement your solution in the future.

Our design for the Locker System 1 (LS1) could greatly help the problem in our community of children being unsafe during tornadoes. This will give children a safe place to go during tornadoes and shield them better than hiding under books and tables. The LS1 will then create a safe pocket for children during these tornadoes. The LS1 will withstand a variety of debris from glass and a crumbling roof. This will help greatly as we have had tornadoes in our community almost every year and have very minimal protection. We plan to research and develop a second system that just has a flat sheet of metal that can be implemented in normal houses, banks, and other commercial buildings that have very little protection from tornadoes. This variant could be concealed by a painting, canvas or advertisement. It will be pushed in to the wall and will operate just like the lockers. When we plan to have our lockers implemented in our school we only have to take the locker out of their place, fit them with the frame, and then bolt them back to the wall. This will help reduce the cost of the locker system as we will not have to buy new lockers. Please see our chart of our plan for the next two years.

Uploaded Files:

- [**View**] **Communtiy benifit** (By: 18jmadse, 03/03/2014, .docx)

  This was our chart of what we think we are going to get done in the next two years.

	Testing	Results
Wind Test	Driving down a smooth road at 50 miles per hour	There was no damage what so ever to the locker system. The bolts were not cracked, scared, or broke in any way. The locker remained in its designed position, the side bar kept it from going it the air and exposing the kids it would protect. The locker had not become detached from the frame.
	Driving down a smooth road at 60 miles per hour	The locker remained in its down position due to the cross bar. There were no cracks or damages to the bolts and the lockers had not broken off.
	Driving down a smooth road at 70 miles per hour	Once again there was no damage to the lockers, the bolts suffered no cracks, or scratches. The locker remained in the designed position the whole way and not once did its wheels leave the trailer.
Shake Test	Driving down a bumpy road at 20 miles per hour	The locker was rattled around but never came detached from the frame. The bolts had suffered no scratches and were not broken. The side bar was shaken but still held the locker in place.
	Driving down a bumpy road at 30 miles per hour	The locker was shaken even more but once again the sidebar held the locker in its designated position. The bolts suffered no scaring or scratches along with all of the other parts to the locker.
	Driving down a bumpy road at 40 miles per hour	The locker was shaken the most it ever was but the sidebar still held the locker in the designed position. The locker never came apart from the frame and no scratches were suffered on any of the extremities and bolts.
Impact Test	One 36 pound cinder block (16.33 kg)	When dropped this cinder block did nothing but chip paint and cause a dent. The bolts were fine and so was the frame. (See picture 1)
	Two 36 pound cinder blocks at once (32.66 kg)	These cinder blocks bounced off the lockers and broke on the cement the lockers were sitting on. The only major damage was chipped paint and a small dent. Like before the bolts and frame were all fine.
	66 pound pallet (29.9 kg)	When we dropped the first pallet the only thing that happened was the paint chipped. This pallet then bounder off the lockers and lockers and winded up on the ground.
	66 pound pallet test number two (29.9 kg)	This time the pallet landed on the locker handle and broke it off. There was also some chipped paint but everything else was fine. This will not be a problem with the lockers we have in our school as their handles are indented.

Debris Test		
	Cardboard in front of locker	The hay stuck to the cardboard. This showed how no locker provides little protection from debris.
	Cardboard behind locker	The hay was reflected by the locker and little to none stuck to the cardboard.

Picture of the damage from one cinder block

Picture of the damage from 2 cinder blocks at once

Damage from the first pallet test

Damage from the second pallet test

Cardboard behind locker

Cardboard in front of lockers

Ten resources we used

2.1.1. http://static.ibnlive.in.com/ibnlive/pix/sitepix/05_2013/oklahoma_tornado_new.jpg

2.1.2. Palmer, R. (2013, May 20). Oklahoma city metro area hit with massive tornado. Retrieved from http://www.ibtimes.com/oklahoma-city-metro-area-hit-massive-tornado-updates-1271173

2.1.3. Effon, L. (2013, May 21). Oklahoma tornado deaths revised down to 24, including 9 children. Retrieved from http://abcnews.go.com/US/oklahoma-tornado-deaths-revised-24-including-children/story?id=19222656

2.1.4. FERNANDEZ, M. (2013, May 21). Drama as alarm sirens wailed. Retrieved from http://www.nytimes.com/2013/05/22/us/oklahoma-tornado.html?_r=0

2.1.5. Elliot, M. (2013). Safest Place during Tornado. Retrieved November 4, 2013, from The Weather Channel: http://www.weather.com/video/safest-place-during-tornado-35477

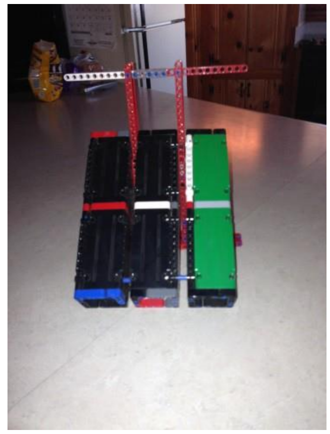
2.1.6. Nye, J. (2013, May 23). 'Oh, my God, I hate this. I hate this': Teacher's incredible video taken INSIDE school of terrifying moment monster tornado bore down on building. Retrieved November 4, 2013, from Mail online: http://www.dailymail.co.uk/news/article-2329618/Oklahoma-tornado-video-Oh-God-I-hate-I-hate-Teachers-incredible-video-taken-INSIDE-school-terrifying-moment-monster-tornado-bore-building.html

2.1.7. Post, H. (2013, May 21). Oklahoma Schools Lacked Consistent Tornado Shelter Rules. Retrieved 11 6, 2013, from Huffington Post: http://www.huffingtonpost.com/2013/05/21/oklahoma-schools-tornado-shelters_n_3314821.html#slide=2487389

2.1.8. Elliot, M. (2013). Safest Place during Tornado. Retrieved November 4, 2013, from The Weather Channel: http://www.weather.com/video/safest-place-during-tornado-35477

2.1.9. Post, H. (2013, May 21). Oklahoma Schools Lacked Consistent Tornado Shelter Rules. Retrieved 11 6, 2013, from Huffington Post: http://www.huffingtonpost.com/2013/05/21/oklahoma-schools-tornado-shelters_n_3314821.html#slide=2487389

2.1.10. Murphy, S. (2013, December 16). Plan for school tornado shelters thwarted by Oklahoma tax cut. Retrieved December 17, 2013, from Chicago Sun-Times: http://www.suntimes.com/news/nation/24407520-418/plan-for-school-tornado-shelters-thwarted-by-oklahoma-tax-cut.html

Picture of the front of the first Lego prototype when it is not deployed. 	Picture of the front of the first Lego prototype when it is deployed 
Picture of the side of the first Lego prototype when it is deployed 	Picture of the side of the first Lego prototype when it is not deployed 
Picture of the wheels that allow the locker system to slide up and down 	Picture of the wheels that the lockers slide on. 

Picture of the unlocking handles so the locker can slide back up 	Picture of the back triangular frame and the plywood backing 
Picture of the brace connected 	Picture of the brace when it’s not connected 
Picture of the front handles 	Picture of the locking bolt for the frame 

BroX4 Pictures and Video Links (external hosting sites)
IMAGES: Imgur.com

VIDEOs: Youtube.com

Team Email: BroX4Team@gmail.com

Links and Description of Links:

http://brox4.imgur.com/all/ *Complete Library.*

http://imgur.com/WPFSKYJ Unlocking Mechanism. This is a bar In the side of the frame that is used to control whether the lockers are in a stable lock or in a free roll. This releases a joint that will enable the lockers to roll up or down, and lock into place once released.

http://imgur.com/B681ZcA The space underneath the lockers when they are deployed. There is enough room to fit up to 5 students of a normal or medium weight range. 6 Students can be under one set of lockers if they see the situation is drastic enough. The angle allows tranquility between a comfortable space for a sitting student and protection against falling rubble/debris.

http://imgur.com/6pD3KOG This is a bolt that secures the frame to any type of mounting system. Ours is attached to a 'display triangle' so that all aspects of the locker can be observed when being tested.

http://imgur.com/QLWdurn: This is a bolt that is used in the pivoting in the top of the lockers. This particular bolt has a tensile strength of 70,000 pounds, meaning that it will require 70,000 pounds of force to make this bolt warp to the point of no repair. The sheer force needed to snap the bolt in half is around an approximate 68,000

http://imgur.com/WxDIW7O: The second locking system is a small arm that reaches across one side of the open ends. The arm swings down and latches onto a bolt using a system that we observed in most folding tables. The design for this is small, simple, and relatively cheap. This locking arm is responsible for keeping the locker from floating up in the high winds of a tornado.

http://imgur.com/1rgsmGx: A demonstration of the spring system in the handles (further explanation for handles below)

http://imgur.com/JussDNg: The handles do not obstruct any movement in the lockers doors. They are hiding in the side grooves and would not cause any snagging if a student walks by them. Handles were wanted to increase the ease of opening and closing the lockers.

http://imgur.com/Ehu54RU: Another view of the handles, this time in their closed position. It offers a small space for fingers to be worked under and then are able to be pulled away from the lockers smoothly.

http://imgur.com/wansAwY: The backboard for our lockers is a sheet of plywood. We used this to measure the amount of students that could fit and to make a distinguishable line between wall and students.

http://imgur.com/eyOipEB Opening the model lockers

http://imgur.com/JlVEAF5 Opening the model lockers

http://imgur.com/radHkQK Opening the model lockers

http://imgur.com/x7MEtDZ : Opening of the LEGO model that was built. This was the model that was taken to Eli Stone of CME and was the base of the all building.

http://imgur.com/G3XIuCr Deployed model

http://imgur.com/6QAsygf Deployed model

http://imgur.com/RQz2R7z : The deployed stage of the model. The angle used in the model was ruled out to be too shallow to offer protection against crushing blows and was made a higher angle.

http://imgur.com/rXLmL0f The model in a closed position

http://imgur.com/Lcmc6k2 The model in a closed position

http://imgur.com/N1KBDVO : The model in a closed position

http://www.youtube.com/watch?v=c8JtO9Q6dD0 : This video shows one of the worst tornadoes our town has experienced. It was spotted about 8 miles of the town and was moving fast. Although it was only classified it was able to rip up irrigation lines and crush cars. It was spotted at 3:15 (exactly when school gets out in our county) and ended an entire hour later. This tornado was a quarter of a mile wide.

Tornado Pictures/ Wyoming Tribute source

http://trib.com/news/state-and-regional/tornado-near-wheatland-causes-at-least-one-injury/article_82a1667e-ccdb-5e46-9b6a-eb7a8659f965.html Source of the photos

http://bloximages.chicago2.vip.townnews.com/trib.com/content/tncms/assets/v3/editorial/5/b5/5b5533f8-cf6e-5d90-a78e-9cb00e65cd98/4fd180a2a0e79.preview-620.jpg A farmer stands next to what used to be a storage unit for grain. His other storage unit (see background) is likely dented from flying objects.

http://assets.nydailynews.com/polopoly_fs/1.1092174!/img/httpImage/image.jpg_gen/derivatives/landscape_635/image.jpg An irrigation tube was ripped from the ground (with other wreckage in the background). In Wyoming, irrigation is our only means of transporting water to the crops and is in-fact one of the reasons the town of Wheatland was founded in 1883 (http://en.wikipedia.org/wiki/Wheatland,_Wyoming) http://youtu.be/SFEbwRPqJ5k : Video showing the sliding and locking of the LS1 prototype. This was our first time ever operating the lockers.

http://youtu.be/xi5FAESNnOY : Video of some of the impact tests we did. The objects are common building materials in heavy amounts dropped from 11 feet in the air. We were lifted up onto a pallet on a forklift

http://www.youtube.com/channel/UCCGBN-5inhGe2sn8jpir9Sg Our YouTube channel

Here is our plan for the next 2 years

6 months from project deadline	We plan to have researched a possible solution to creating the second system. We also plan on beginning to create a prototype for our second system. We also plan to have begun creating a grant for the locker system.
12 months / 1 year	We now plan to have finished our prototype for the second system and begin implementing the first lockers system in to our schools and across the state.
18 months / 1 ½ years	We plan to have finished a solid version of the second locker system and begin implementing them in home and businesses. We also plan to have finished implementing our lockers in our school and be close to finishing implementing them in Wyoming.
24 months / 2 years	We plan to have finished a grant by this time. We also plan to have finished implementing lockers in schools across our state that would like them. We then plan to begin implementing these lockers in the schools in the nation.