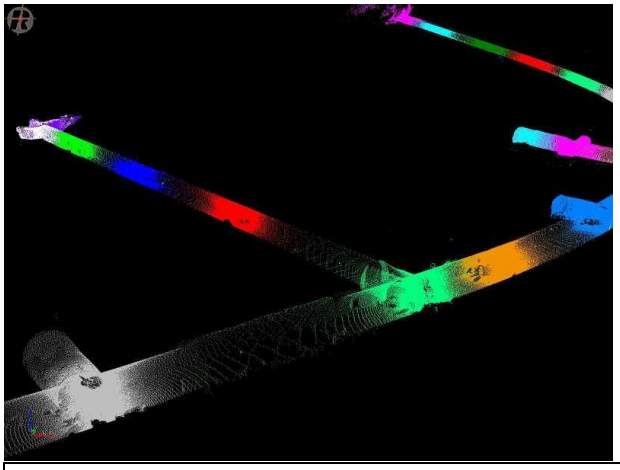
Week Five (July 10 – 15, 2016) Report

Updated August 7, 2016

Week five, which began on Sunday July 10th, kicked off the field work component of the program where the students were able to use the knowledge they gained in Freeport, TX using GPS and LiDAR technologies. The morning contained a buffet-style breakfast that was included with the stay at the Jinxiu Yangtze River Commercial Hotel. After breakfast, all students, engineers, and professors, met in the lobby where they then boarded the bus and headed to the scan sites for the day. The group headed east along the main road G209, before branching off onto the smaller streets towards the CUG Landslide Exploration and Monitoring Tunnel. Frantic demolition was taking place all around and above the tunnel, as citizens are being evacuated and relocated to a more stable area. The CUG in site monitoring and observation tunnel was built in 2010 and consists of a main tunnel that spans approximately 908 meters, with multiple branching tunnels that allow for a unique underground view of the Huangtupo Landslide. Before starting the survey, large fans within the tunnel were turned on to effectively air out gases and particles that could have built up in the air. Meanwhile, the students set up the reflectors and LiDAR equipment to scan the entrance of the tunnel. This proved to be a little bit of a challenge as it had started to rain, however, the equipment was protected by students taking turns holding up an umbrella over the scanner and the laptop. After finishing the scan outside, the LiDAR was moved inside the tunnel to continue the scanning process. Three traffic cones with reflector tape were used as tie points for each scan. Three traffic cones were continuously moved forward as the group proceeded throughout the tunnel. By noon, a total of 31 scans had been completed and the students were ready for lunch. They traveled back to the hotel where a few students found local places to eat while others ate the buffet at the hotel. Soon after lunch and a short rest, a small group of students went back out to scan the Huangtupo landslide between the third and fourth valley. The scan site was higher in elevation on the mountain along a bridge located on the southern boundary of the Huangtupo Landslide. LiDAR scans using a single tie point and GPS antennas were completed over two bridges overlooking the lush green landscape below. Late in the evening, the students traveled back to the hotel for a night of rest.

Left: Group of Students, Engineers and Professors in front of the Landslide and Ground Water Observation Tunnel. From left to right: Engineer Li, Engineer Huang, Fangjie Li, Dr. Zhou, Jennifer Welch, Benjamin Miller, Valerie Smith, Janice Navarro, Jacob Kratavil, Katherine Sorrows, Wanda Crupa, Wen Guo **Right:** Lidar VS-2000. The students would attach a GPS that acted as both the antenna and receiver to the top of the LiDAR. -



Left: Completed model of the Landslide and Groundwater Observation Tunnel **Right:** Shasta in the Landslide and Groundwater Observation tunnel. The traffic cones were used as tie points and can be seen in the background

The next morning, July 11th, four of the students ate the breakfast buffet and prepared to leave for the morning scans. The bus weaved through tight roads up the mountain to the same location as the previous afternoon above the Huangtupo landslide. Here, the students setup the scanner and a single reflector along the side of a bridge in order to further scan the landscape below. The students were able to enjoy the beautiful view of the area while waiting for the scans to finish. After completing three scans, the group took the equipment down the side of the mountain along a road that was scattered with debris consisting of rocks and dirt from the moving landslide. The scans down into the landslide proved to be challenging to obtain, however thanks to the engineers, no setup of the reflector or GPS antennas was necessary. Instead, a more efficient method of overlaying the scans by using distinct landmarks as tie points was used; no GPS data required. In one of the scan sites, the students had to walk across a board with the heavy equipment to get the right spot on a roof to scan the landslides. The group had to walk around crops and uneven sloped land at times with heavy vegetation in order to reach the location

Left: Students and engineers crowd around the scanner across the Yangtze River in order to scan the Huangtupo Landslide located on the opposite bank. **Right:** One of the many abandoned buildings being demolished in the Huangtupo Landslide area

need to cover blank area in the dat. After completing several scans through the rough terrain, they made their way back up the steep mountain and back into the air conditioned bus to get

some relief from the heat. They then made their way back through the twisting roads to the hotel for some rest and a well-deserved lunch. Most of the students ate at a small local restaurant across the street and then went back to their hotel rooms for some rest. Meanwhile, the remaining four students rode a taxi to the local hospital as three of the students felt very sick overnight. The hospital in Badong is very different from the American style hospitals. The three sick students had to present their passports to the front desk and pay 7 CNY (that's about $1.25 in American money) to see the doctor. After paying, they waited for an elevator to take them to the fourth floor. When the elevator arrived, crowds of people struggled to exit and enter the doors simultaneously. The elevator was so cram-packed that people were on their tippy toes trying to acquire more space, and you could feel the breath of the surrounding people on your neck and face. As more people tried to cram into the elevator Jennifer screamed "NO" at them. The doors would not close and two people exited the elevator. Finally, the doors closed and after a seemingly endless elevator ride, the students exited on the fourth floor. They entered a room where there were two doctors sitting at their desks. There was an old couch and two additional chairs where patients were being evaluated. Each student sat in the chair and the doctor asked them questions, which Feng LI and Jennifer translated back to the students. Several Chinese people in the hallways crowded into the room and began taking pictures of the American students as they were examined. The doctor ordered blood work and stool samples from each of the three students. Again, the lab tests had to be paid for in advance, so the students waited as Feng Li paid for the tests on the first floor. After the students paid, they waited in line on the third floor to have their blood drawn. There were many people in line and an elderly Chinese man cut in line in front of the American students while waiting. They let him stay but quickly learned they must stand closer to the person in front of them to prevent cutting. A couple of the students were afraid of having their blood drawn and Jennifer tried to comfort them as best as possible given the circumstances. After both samples were given and left for processing in the labs, students waited for their results in the third floor hallway

Top: Doctor discussing results with students while smoking under a "No Smoking" sign **Bottom:** Sick students waiting in the hospital looking at the long line they would have to wait in to get their blood drawn. From left to right: Valerie Smith, Janice Navarro, and Robert Abel

on the floor. A female nurse passed by and began yelling at the students. They were then moved into an air conditioned room. Soon after they were moved, a prisoner in heavy chains was escorted down the hallway by two security guards where the students had been sitting. When the tests results came back they were escorted by Feng Li to the doctor who was back on the fourth floor. There was only one doctor when the students went back; He sat under a “No Smoking” sign and smoked a cigarette as he read their results. As the doctor read their results, a curious audience grew around the doctor, as they were intrigued with what the Americans were doing in their hospital. The students were all diagnosed with dysentery and he requested that two of the three students stay at the hospital for 2-3 days. The students refused to stay and were then given prescriptions to help with the high fevers and stomach problems. The prescriptions were filled at the hospital on the first floor and then they traveled back to their hotel by taxi before noon. In the evening, scans were completed further down the mountainside within the boundaries of the Huangtupo landslide. The scans were next to buildings that had been demolished or abandoned. The group came back late that evening and again went to the restaurant across the street as it had started to become a popular place for the group to get a tasty, warm meal.

On July 12th, the group of healthy students went back out in the morning across the Yangtze River to scan a new landslide area called the Hangshibao landslide. The students that went to the hospital the day prior were still too sick and contagious to risk going out into the field for the day. The scans were preformed from across the Yangtze River along the shore of the water. The weather was extremely hot and humid compared to the days prior. The mosquitoes were also merciless. Once they finished the morning scans, the group went back to get some lunch from the local restaurant. In the afternoon, only two students went out to the field and drove to a bridge over the first valley on the east side of the Huangtupo landslide. The remaining

University of Houston PHD Student Lin Xiong and Beijing University of Technology PHD Student Wen Guo set up the scanner to complete LiDAR scans.

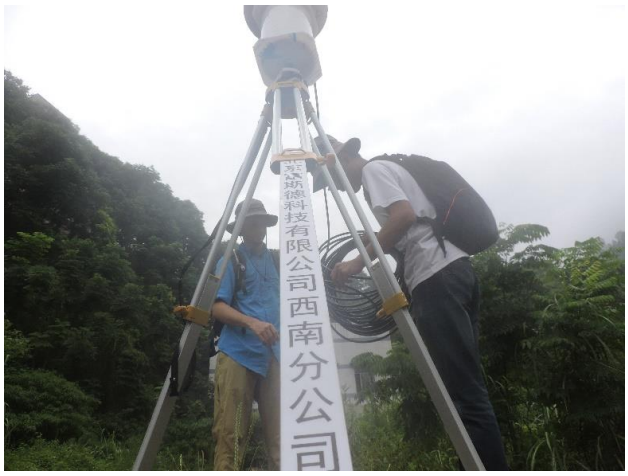
students were resting, recovering, or working on different projects and paperwork. The rain began to heavily pour, and the group that was out for the afternoon had to wait a while until the weather cleared up to complete the scans in the area. Same as the previous days, no reflector or GPS equipment was used to scan the area. After completing a few scans on the bridge, the team progressed up the mountain into the demolition zone. The group was able to acquire data from the top of tall buildings, most of which were currently being torn down, getting full coverage of the valleys that were missed from the scans further up the mountain. After a long day, the group headed back to the hotel for a well-deserved rest.

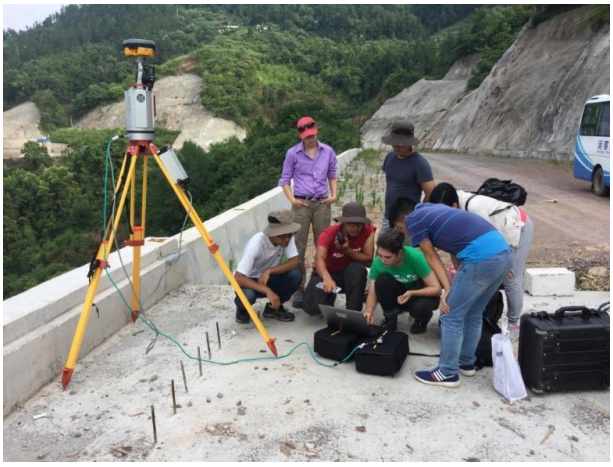
A road under construction located on the bridge near the 4th trench of the Huangtupo landslide. Several scans were completed on this bridge.

Wen Guo setting up the reflector and configures the GPS along the Yangtze River.

July 13th started off with the routine buffet breakfast provided by the hotel. The students had to prepare extra clothes and umbrellas before getting onto the bus as it was forecasted to be a very cloudy and rainy day. The scanning for the day was done inside the boundaries of the Huangtupo landslide, located further east of the site from the previous afternoon. The first scan position was on the roof of an apartment building in an area of the landslide where many people still resided. While a group of students were preforming the LiDAR scans from the roof, the remaining students went off in search of potential scan sites that could be used either the same day or the next. As the day went on, the weather started to clear and warm up. The students were stopped a few times due to heavy demolition occurring in the area, and the local government making sure that they were safe and were registered in their town. The surveying locations led

the group down a road further east into the city and then down a steep slope, where a scan on a bridge further down the mountain over the Huangtupo Landslide was completed. There, the group was able to see fast-moving river water with some rapids on the side of the mountain, creating a





Top Left: Students setting up a reflector. **Top Right:** PHD Student Lin Xiong teaching students Wanda Crupa and Katherine Sorrows how to conduct a LiDAR scan while engineers observe. **Bottom Left:** One of many scan sites across the Yangtze river. **Bottom Right:** Dr. Wang, PHD students Lin Xiong and Wen Guo, and Benjamin Miller prepare to scan the outside exit of the CUG tunnel.

beautiful view. The surveying progressed to different parts of the area and even to the top of another building. When the morning scans were completed, everyone loaded onto the bus and headed back to the hotel. The students were given the rest of the day off to relax and stay healthy. Students spent their time writing in their journals, relaxing, or going to stores near the hotel for food.

For July 14th, only one student was able to go out with the other research assistants and engineers due to the rest of students either being sick or becoming sick. Another student was taken to the hospital to get checked and receive medication, where Jennifer and Fungjie accompanied for translation and assurance. This time, the hospital was not as crowded but they did see a dog roaming the hallways of various hospital floors as well as more prisoners in chains escorted by guards. More medication was prescribed and they returned back to the hotel for rest. The group that went out to scan spent their time inside the boundaries of the landslide on the eastern side of Huangtupo landslide. They needed to return to this region for scans as a result of

Left: Students wait for scan to complete along the Yangtze River. **Right:** Students Wanda Crupa and Jennifer Welch observe as Katherine Sorrows learns about the LiDAR remote from Ph.D student Lin.

some missing areas, “holes”, in the data. The group started higher up on the mountain and then worked their way down along the road, taking scans along their way. When they reached the bottom of the mountain, they were then met by the bus and taken back to the hotel. While the group was out scanning, the students that stayed back rested and caught up on their journals in their rooms. The survey group came back a little after noon and had lunch across the street before they went back out for the evening. The evening group went to the second valley and found a bridge to scan from in the area. The group worked their way down to the river surveying along the way. This trip was met with some difficulty due to the steepness of the slope and the large number of mosquitoes swarming the area. After completing a couple of scans along the shore, they went back to the hotel for the night. During the evening everyone that was feeling well had dinner across the street at the restaurant, while the sick students stayed in and made food that they could digest easier.

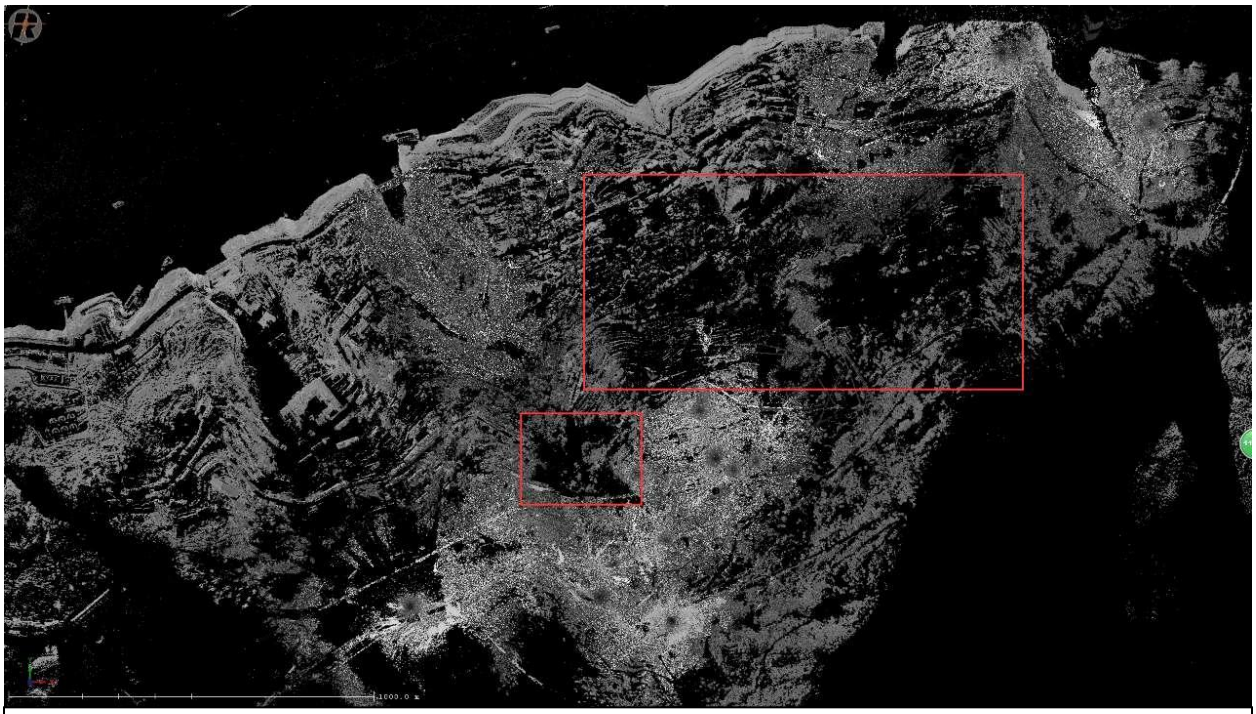
UH Geology and Geophysics Student Benjamin Miller in the Badong County Hospital bang examined by a doctor

On July 15th, some of the students went out to get a few more scans around the Hangshibao landslide. This would complete all of the scans needed for the project. Some of the sites where the LiDAR had to be setup were in an active construction site. The students were told to wait outside while engineer Huang and two graduate students Lin and Wen went in to complete the scans. The group continued down the road scanning the last couple spots needed on the Huangtupo landslide. After completing remaining scans, the group went back to the hotel.

The group was given time to get lunch and relax. In the afternoon, some students stayed behind to learn LiDAR data processing skills with Lin, including basic data filtering and Coarse Registration used to overlay the non-GPS scans over the larger base map with GPS data. The rest of the students went out with professors Dr. Jin Wang, Dr. Zhao, and Dr. Zhao's niece, where they visited the Huangtupo landslide study sites in order to see firsthand the damage it has caused. They visited the study sites from the opposite side of the Yangtze River where they could see the synthetic aperture radar system (SAR) that had been setup to collect data on the Huangtupo landslide. They also made a short stop to have a view from a different angle to see the remaining survey areas. Later that evening, everyone gathered together and went out for a dinner to say thank you to the engineers for helping in the field and to welcome the Dr. Wang and Dr. Zhao. The restaurant looked like it was made from wood and had many traditional Chinese decorations that were pleasing to look at. Dinner consisted of many plates of vegetables, different meats, and a delicious bean soup (Figure 23); the service and food were both exceptional. After dinner, everyone went back to the hotel for the night and rested for the next day.

Top Left: Dr. Guoquan Wang, Ben Miller, Dr. Zhao's niece, Dr. Zhao, Dr. Jin Wang, and Jennifer Welch look out over the Yangtze river. **Top Right:** Dr. Guoquan Wang, Ben Miller, Dr. Zhao's niece, Dr. Zhao, Dr. Jin Wang, and Jennifer Welch inspect the SAR setup for monitoring the Huangtupo landslide. **Bottom Left:** The construction site of the new CUG field camp in Badong county **Bottom Right:** Dinner with Dr. Zhao and Dr. Jin Wang included plates and cups with Chinese letters meaning happiness and money.

A last thank you dinner for engineers and welcome dinner for Dr. Wang and Dr. Zhao consisting of many vegetable dishes, various meats and a soup. Traditional Chinese paper cutting decorations can be seen on the table as well as traditional Chinese cups and bowls



LiDAR scan of the Huangtupo landslide area. The red boxes indicate areas where there are gaps in the data. More scans will be needed in these areas to fill in those gaps.

June 16th was an off day for most students to prepare for the long trip back to Wuhan on Sunday, July 17th. One student went with Dr. Wang and Dr. Zhao to the CUG tunnel site under the Huangtupo landslide and the CUG basecamp that is currently under construction where students will stay in the following two years of this program. The new facility will feature a dorm building, canteen, classrooms, and a basketball court. The basecamp location is very close to the Yangtze River and will serve as a great location for the following years of field work. While within the CUG tunnel, they learned about the structure of the overlying sediments, the overall movements of the landslide, and were able to see the damage within the chambers of the side tunnels. In 2010 when the side tunnels were created, they were comprised of straight and even walls. Today the tunnel curves and has an uneven surface down its walkway. The students that remained at the hotel met up with Lin in the late morning to learn more data processing skills and go over what they had learned the previous day. Each student was given an opportunity to work on the computer with his guidance and practice Coarse Registration. After their lesson, the group headed across the street from the hotel for a meal at the restaurant the team had frequented throughout the week. For the rest of the day, everyone packed and finished up some final tasks, such as doing laundry and finding last minute gifts to bring back home. That evening some of the students joined the new professors and Dr. Bob Wang for dinner to commemorate collecting all the data. After dinner, a group of students headed back to the hotel to finish up packing, while the rest of the group went for a walk down towards the Yangtze River. Here, the students joined in local dance and Tai Chi groups and were warmly welcomed by all (Figure 25). After many pictures and a few hugs with their new friends in Badong, the group headed back to the hotel to prepare for the long journey back to Wuhan.

Local Badong dance group dancing in a square alongside along the banks of the Yangtze River.