

BioEdSM

Operation Rescue



Second Edition

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Baylor
College of
Medicine

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Characters in this book are fictitious and are not based on any person living or deceased. *Operation Rescue Teacher's Guide* was designed to be used with *A Storm Named Yolanda*, but also may be used as a stand-alone set of inquiry-based lessons.

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Sources for images are listed on page 72.

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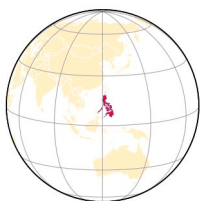
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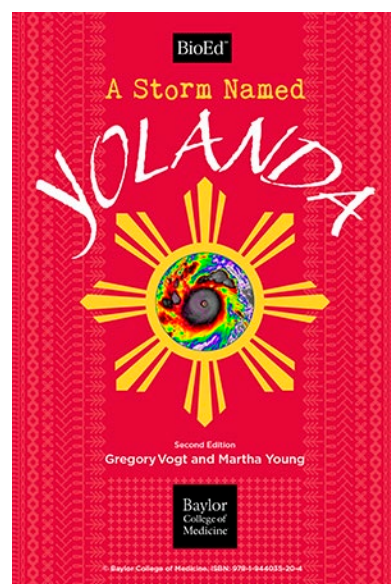
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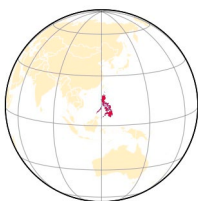
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The *Operation Rescue Teacher's Guide* is designed to be used as a stand-alone teaching unit. Depending on the age of the students, the unit storybook, *A Storm Named Yolanda* also may be used to generate a deeper interest in this subject. Both books are available free-of-charge, in PDF format, at <http://www.bioedonline.org>.



STEM Experiences in the Real World



Solutions to problems in the world usually do not fit neatly into the compartments of life science, physical science or Earth/space science. In fact, until recently, there was little emphasis in the curriculum on teaching students to design solutions to such problems. However,

the Next Generation Science Standards have encouraged the incorporation of engineering design approaches into science teaching and learning. In *Operation Rescue*, students design solutions to address disease risks and provide aide in the aftermath of a powerful typhoon in the western



Nearly a week after Typhoon Yolanda/Haiyan struck the Republic of the Philippines, the city remained covered in debris. World-wide aid organizations worked with coordinated efforts to bring help and aid to survivors.

Pacific ocean using and developing the following Engineering Design understandings.

3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved

Real world problems are complex. The objective of this interdisciplinary unit is for students to learn, through simulation, how people work together to solve a human problem. The simulation brings together science, technology, engineering, mathematics (STEM), and geography in a practical life or death situation. The simulation is based on a real disaster—the massive typhoon that occurred over the Pacific Ocean in 2013.

Student teams plan and mount a simulated aid mission to provide supplies and prevent a possible disease outbreak in an area devastated by the storm. Using borrowed military cargo aircraft, they determine what aid supplies are needed, create a load manifest matching the capacity of the aircraft, and plot the route the plane will take to deliver the supplies. Critical to providing useful aid, teams have to learn about the infectious diseases that have occurred (or might occur) as a result of the disaster to determine what the survivors really need.

Unlike many of the historic great plagues, in which the people in affected areas were mainly on their own, outbreaks of infectious diseases today are met with organized and coordinated efforts. Scientists work in the field and in labs to identify the infectious agents, determine their source, and develop treatments. First responders rescue victims, set up hospitals and temporary housing, provide clean food, water, and clothing. Doctors, nurses, and



USING COOPERATIVE GROUPS IN THE CLASSROOM

Cooperative learning is a systematic way for students to work together in groups of two to four. It provides organized group interaction and enables students to share ideas and to learn from one another. Students in such an environment are more likely to take responsibility for their own learning. Cooperative groups enable the teacher to conduct hands-on investigations with fewer materials.

Organization is essential for cooperative learning to occur in a hands-on science classroom. Materials must be managed, investigations conducted, results recorded, and clean-up directed and carried out. Each student must have a specific role, or chaos may result. The Teaming Up! model* provides an efficient system for cooperative learning. Four “jobs” entail specific duties. Students may wear job badges that describe their duties. Tasks are rotated within each group for different activities, so that each student has a chance to experience all roles. For groups with fewer than four students, job assignments can be combined

Once a cooperative model for learning is established in the classroom, students are able to conduct science activities in an organized and effective manner.

Jobs for students in this unit are described and assigned in Activity 1 (see page 7).

* Jones, R.M. 1990. *Teaming Up!* LaPorte, Texas: ITGROUP.

other medical workers quarantine and treat the sick, and vaccinate the healthy. Long-term efforts gradually restore the local economy and rebuild the infrastructure: roads, schools, hospitals, water distribution and sanitation systems, food services, construction, and communications—and jobs.

Covering huge regions at a time, typhoons are characterized by powerful sustained winds and giant waves that wreak havoc on low-lying land in the South Pacific region. Typically, buildings





A KC-130 Marine Aircraft flies over Guiuan, Eastern Samar Island, the Philippines, on Nov. 18, 2013, as part of Operation Damayan, to deliver relief supplies and evacuate survivors affected by Typhoon Yolanda/Haiyan.

are destroyed, forests flattened, agricultural lands flooded, and people are drowned. But, that is only the beginning. If aid is slow in arriving and people are living in temporary, crowded conditions, infectious disease outbreaks occur. Diseases, like typhoid, malaria, dengue fever, and cholera, normally kept in check by local health systems, spread rapidly because those systems, such as fresh water, sanitation, food access, pest control and construction services and materials, etc., have been destroyed.

Victims of natural disasters need aid as quickly as possible. First responders try to provide resources—food, water, shelter, medical aid and supplies—and much more—to the victims. Distributing these resources saves lives and helps limit potential infectious disease outbreaks. Unfortunately, when a disaster occurs in a remote area or a poor country, desperately needed resources often are inaccessible for days, with help often far away. ■



The Threat of Disease Outbreaks



Diseases are a worldwide problem, and have been so throughout recorded history. We will continue to see infectious diseases in humans and other organisms long into the future. These diseases, also known as communicable diseases, are illnesses caused by biological agents that invade, grow and reproduce inside a host organism. Infectious diseases can be caused by certain viruses, bacteria, fungi, protozoa or multicellular parasites, resulting in a range of short- to long-term, unpleasant or even fatal reactions in the host. Although microorganisms (or microbes) can be agents of infection, it is important to know that most microbes do not cause disease in humans.

Infectious diseases are spread in many ways. In some cases, a person must come in direct contact

EPIDEMIC
An infectious disease affecting a large number of individuals within a population, community or region at the same time.

with contaminated air, water, food, body fluids or animal parts.

In other cases, infectious microbes are transported through the air.

Animals bites from insects such as

mosquitoes, ticks and fleas, or injuries from larger animals, such as monkeys, can transmit serious illnesses. An organism that transmits a disease or parasite to another is called a vector.

Disease causing organisms, or pathogens, can initiate epidemics resulting in widespread deaths, and



In the wake of Super Typhoon Yolanda/Haiyan, a medical provider with the Philippine Army injects medicine into a local Filipino inside a makeshift hospital at the Tacloban Air Field, November 15, 2013.

social and economic upheaval. Infectious diseases can literally change the course of history.

In this unit, we will be learning about human diseases. However, it is important to note that similar mechanisms of infection, illness and even widespread epidemics are observable in all known organisms. The well-documented Irish Potato Famine between 1845 and 1852, for example, was caused by widespread infection and destruction of potato

IMPACTS OF SELECT EPIDEMICS AND PANDEMICS

DATES (AD)	DISEASE OUTBREAK	IMPACTS
541 – 750	Bubonic plague (“Plague of Justinian”)	Killed 50 to 60% of Europe’s population .
1347 – 1352	Bubonic plague (“Black Death”)	Killed 25 million people in Europe.
1518 – 1568	Smallpox and typhus	Brought to the Americas by European explorers; killed 17 million persons in Mexico.
1556 – 1560	First European influenza epidemic	Killed 20% of the population of Europe.
18th Century	Smallpox	Killed 60 million Europeans.
19th Century	Tuberculosis	Killed 25% of adults in Europe.
1918	Spanish flu (form of influenza)	Killed 50 million people worldwide.
Current	Malaria, HIV/AIDS, tuberculosis, diarrheal diseases, respiratory infections	Kills approximately 15 million people per year.

plants by a fungus-like organism. Even microbes as tiny as bacteria can become infected with viruses, which are even smaller disease-causing agents. In fact, diseases simply are part of the wide range of ecological interactions among organisms—all organisms seek sources of energy and nutrients (food) and places to reproduce. Sometimes, unfortunately, these resources are inside another organism and use of the resources results in harm to the host (in other words, disease).

As the world population (currently more than 7 billion people) grows, infectious diseases spread (communicate) more rapidly. Suppose an outbreak of an infectious disease occurs. It may be a historic disease that has reemerged from a remote

PANDEMIC

An epidemic of an infectious disease that has spread through human populations across large regions, countries or continents.

population. It may be a new strain of an existing disease like influenza. Or, it may be something entirely different such as HIV/AIDS, which jumped from animals to humans.

Because of crowding in population centers and fast international travel, such as by airplanes, a disease can spread widely, literally around the world in just days.

Often, a natural disaster triggers the outbreak of an infectious disease in human populations. Nearly

every year, one or more natural events take place that cause massive destruction and loss of human life, directly or in the aftermath. A natural disaster may be an earthquake, flood, volcanic eruption, landslide, tsunami, catastrophic storm (such as a hurricane or typhoon), or drought. Often, large numbers of people become displaced from their homes, and end up living in crowded conditions with poor access to basic needs, such as safe food, shelter, drinking water, and sanitation. These conditions promote the spread of diseases such as cholera, typhoid fever, measles, and hepatitis. When flooding and standing water are present, high numbers of *Aedes aegypti* mosquitoes breed, which can lead to outbreaks of malaria, chikungunya, dengue, and other mosquito-borne illnesses. Vaccines often become the first line of defense for survivors of disasters.

Throughout history and to the present day, hundreds of millions of people have perished because they were in the wrong place at the wrong time. The January 12, 2010 earthquake in Haiti is an example of what can happen. The earthquake destroyed more than 250,000 homes. An estimated 220,000 people died. But the disaster didn’t end when the shaking stopped. In the aftermath, water contaminated with human waste spread cholera throughout the earthquake affected populations. The cholera outbreak continues today in Haiti, where an estimated 8,300 cholera deaths have occurred, and approximately 650,000 more people have been infected and survived.



From Tropical Storms to Super Typhoons



Typhoons are major tropical cyclones that form in the northern Pacific Ocean. Like hurricanes in the Atlantic, typhoons are swirling storms that span large regions, which can cause massive destruction and loss of life if they move over land.

Typhoons are created when a variety of conditions, such as warm sea surface temperatures, high humidity, vertical shearing winds, and low pressure occur simultaneously. They begin as low-intensity storm systems called tropical depressions. These storms have winds that can reach 38 mph (61 km/h) with heavy seas (large waves) that imperil boats and ships. If storms build in intensity and wind speeds climb above 38 mph, they are reclassified as tropical storms. If wind speeds increase above 88 km/h, they

are called severe tropical storms. Once winds top 73 mph (118 km/h), these storms are reclassified as typhoons. In recent years, additional categories have been added to reflect higher sustained wind speeds (see box, p. xi).

The swirling nature of tropical storms, is caused by the effect of Earth's rotation on moving air masses. Swirling or cyclonic motion in fluids is sometimes referred to as the Coriolis effect (or force) after the French scientist Gaspard-Gustave Coriolis who published a paper on similar movements involving water wheels. In the northern hemisphere, this effect causes developing storm systems to swirl in a counterclockwise direction. In the southern hemisphere, cyclonic storms swirl clockwise.



Severe Tropical Cyclone Larry swirled in a clockwise pattern as it moved towards Australia.



Hurricane Rita swirled in a counterclockwise pattern as it passed between the US and Yucatán Peninsula.

USA: THE SAFFIR-SIMPSON SCALE

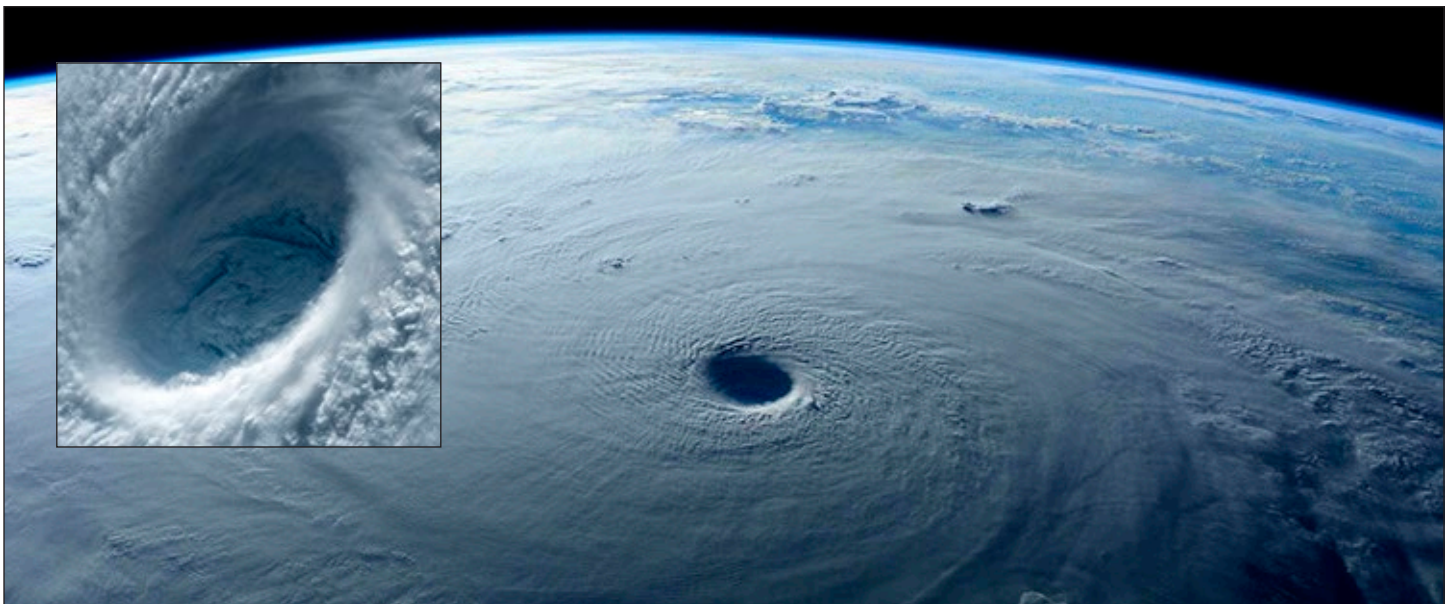
Tropical cyclones that occur in the northern hemisphere of the Atlantic, and Eastern/Central Pacific oceans are monitored by the National Hurricane Center in Florida, or the Pacific Hurricane Center in Honolulu. The agencies use the Saffir-Simpson scale to classify these storms using 1-minute sustained winds. *This scale differs from monitoring scales used elsewhere on the planet.*

US CLASSIFICATION SCALE

CATEGORY	1-MINUTE SUSTAINED WINDS
5	≥ 157 mph (≥ 252 km/h)
4	130–156 mph (209–251 km/h)
3	111–129 mph (178–208 km/h)
2	96–110 mph (154–177 km/h)
1	74–95 mph (119–153 km/h)
TROPICAL STORM	39–73 mph (63–118 km/h)
TROPICAL DEPRESSION	≤ 38 mph (≤ 62 km/h)

Meteorologists, scientists who study weather and climate, carefully track tropical storm development and try to predict how storms will move and evolve. Major tropical storms over the Pacific and the Atlantic tend to move from east to west and often hook to the north when doing so as they approach landfall. Landfall is the point where the storm's center crosses land. Knowing where the storm will go and how powerful it will be when it gets there is vital to the safety of people lying in its path. With adequate warning, people can prepare or evacuate to safer places prior to the storm's arrival.

When seen from space, typhoons cover a broad swath of Earth's surface and have a characteristic spiral shape. Often, the spiral arms, marked by clouds, meet in the middle where there is a small opening, called the eye. In the eye, winds become calm and clouds open to sunlight. While the storm's eye may be tens of kilometers across, it is small



Super Typhoon Maysak, as captured by astronauts on the International Space Station, March 31, 2015. Reported to be 30 kilometers (19 miles) wide by the Joint Typhoon Warning Center, the eye had a near perfect ring of convection swirling around it. The inset photograph of the eye offers an example of the stadium effect, where the eye is larger at the top of the storm than at the bottom—like the shape of a sports stadium or upside-down cone. The effect happens because rising air in the eyewall tends to slope outward, while the air in the eye itself is descending. A typhoon typically form an eye when its storm winds exceed 118 km/h (see “A Storm by Any Other Name” (p. xi). If an eye is growing smaller in diameter, it usually means the storm is strengthening.

in relation to the whole storm, which could span hundreds or even thousands of kilometers.

Tropical cyclones and climate change. Recent weather events, like Typhoon Haiyan/Yolanda and Hurricane Sandy, have raised an inevitable question, “Is there a link between extreme weather and global climate change?” The answer, from scientists worldwide, is yes. The extent of this link will take time to determine, but climate change is real and it is affecting the world weather and climate balance.

According to well-established data, global average surface temperatures for the past three decades have been above the 20th century surface temperature average. In the US, average surface temperatures are 2 degrees F warmer than they were 40 years ago. Extreme precipitation occurs more often in some areas than in the past while other areas experience more and longer droughts. Many of the world’s glaciers are in retreat and contributing melt water, causing a gradual rise in sea level that threatens to flood low-lying coastal areas.

From the standpoint of tropical storms, increased global temperatures mean increased ocean temperatures. High ocean surface temperatures are one of the main ingredients for tropical storm development. Climate models developed by the US Environmental Protection Agency project that the strength of winds associated with tropical storms and the amount of precipitation falling in tropical storms are likely to increase in future decades.

About the typhoon featured in this unit. On November 2, 2013, the Joint Typhoon Warning Center in Honolulu detected a widespread low-pressure area about 425 kilometers east-southeast of the Federated States of Micronesia. The next day, the Japan Meteorological Agency classified this low-pressure system as a tropical depression. As the storm grew in power, it advanced to tropical storm status and was given the Chinese name Haiyan, which is a kind of seabird (called a petrel in English).

The storm continued to strengthen as it moved

A STORM BY ANY OTHER NAME

Tropical cyclones, hurricanes, and typhoons are all the same weather phenomenon. These massive storms are referred to by different names depending on where they occur on the planet. When tropical storms occur north of the Equator over the northwest side of the Pacific Ocean and the South China Sea, they are called typhoons, and are monitored by the Japan Meteorological Agency (JMA).

Located in Tokyo, JMA provides tracking information and typhoon warnings to nations in its region that could be affected. The Republic of the Philippines is located within JMA’s area of responsibility.

JMA CLASSIFICATION SCALE

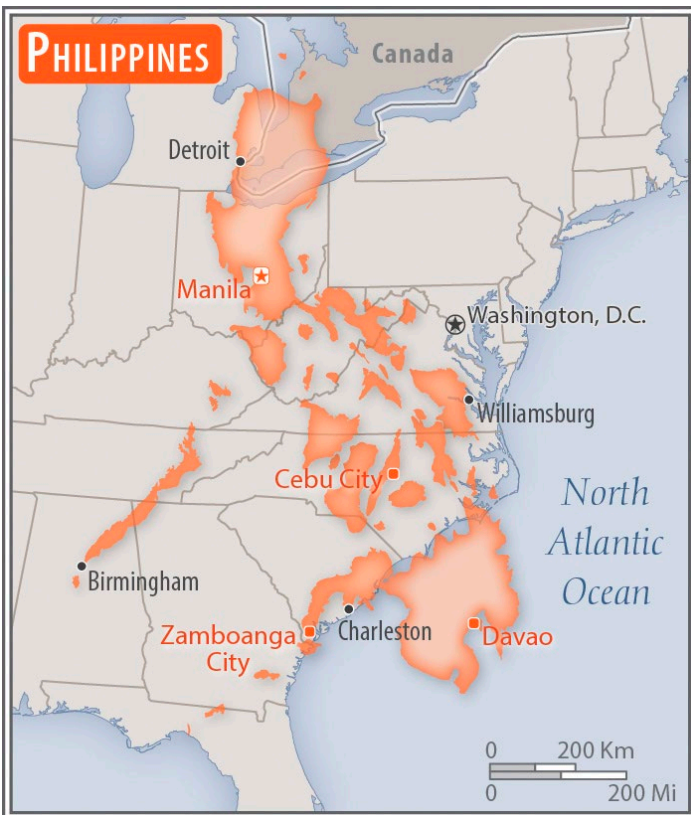
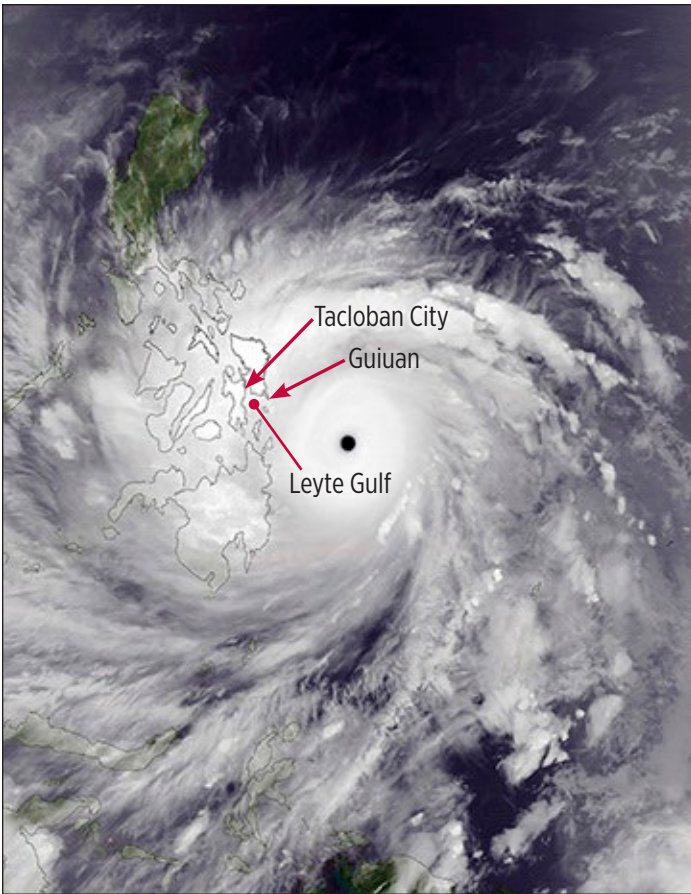
CATEGORY	10-MINUTE SUSTAINED WINDS
VIOLENT TYPHOON	≥ 194 km/h
VERY STRONG TYPHOON	157–193 km/h
TYPHOON	118–156 km/h
SEVERE TROPICAL STORM	89–117 km/h
TROPICAL STORM	62–88 km/h
TROPICAL DEPRESSION	≤ 61 km/h

The island nation of the Philippines has its own local weather monitoring system, called the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). It uses slightly different categories for classifying and naming typhoons. The typhoon named Haiyan by the JMA and the typhoon named Yolanda by PAGASA are one and the same.

PAGASA CLASSIFICATION SCALE*

CATEGORY	10-MINUTE SUSTAINED WINDS
SUPER TYPHOON	> 220 km/h
TYPHOON	118–220 km/h
SEVERE TROPICAL STORM	89–117 km/h
TROPICAL STORM	62–88 km/h
TROPICAL DEPRESSION	≤ 61 km/h

* The JMA and PAGASA updated their classification scales after Super Typhoon Haiyan/Yolanda.



The map above shows the relative size of the Philippines with the US. Compare it with the photo above it which shows the size of Typhoon Haiyan as it approaches the Philippines on November 7, 2013.

westward and appeared to be aiming directly towards the Republic of the Philippines. On November 6, the Philippine Atmospheric Services Administration (PAGASA) assigned its own name to the storm—Yolanda (see “A Storm by Any Other Name,” p. xi). The storm grew even more, with winds eventually reaching sustained speeds of 146 mph (235 km/h), with gusts up to as much as 235 mph (378 km/h)! Yolanda/Haiyan became so powerful, it was ultimately classified as a super typhoon, the equivalent of an Category 5 Atlantic hurricane.

On November 7, Yolanda/Haiyan made its first landfall at Guiuan, a small community on Samar Island and leveled it. The typhoon soon crossed the tiny island and subsequently made landfall on other Philippine islands as it continued westward. One of the hardest hit areas was Tacloban City, which lies at the tip of a funnel-shaped bay in the Leyte Gulf. The storm continued on its track, making its final landfall over Vietnam, then moving northeast into China where it finally dissipated.

As one of the most destructive typhoons in history, Yolanda/Haiyan resulted in the deaths of more than six thousand people. The exact total may never be known, because many victims are still missing. More than one million homes were damaged or destroyed in the typhoon’s wake. In the Philippines alone, damage estimates topped \$300 billion dollars. In low-lying coastal areas, the greatest destruction was due to large and high storm surges consisting of wind-blown waves sweeping on to shore.

Days later, governments and relief agencies from around the world responded to the disaster with supplies and money. Even under the best of circumstances, effective relief efforts take time to organize. Because the Philippines is a country consisting of more than 7,600 islands, relief efforts there were especially challenging. Gradually, drinking water, medical supplies, food, clothing, blankets, tents and tarps, and other necessities began to arrive by ship, and by cargo planes and helicopters. Early estimates indicated that full recovery from the storm could take more than ten years. ■



Introduction to the Mission



OVERVIEW

Students are introduced to the mission, become organized into teams, and begin planning for a disaster relief cargo flight. Time: One 45-60 minute session

Operation Rescue begins with a real-life disaster. In 2013, a super typhoon smashed across the Philippine islands and surrounding region. Millions of people were affected through injury or loss of access to basic services and shelter; and

many thousands lost their lives. In spite of worldwide mobilization efforts to provide aid, it was weeks before all of the populated islands and their remote villages could be reached.

This unit engages students in a simulated relief



The typhoon made first landfall on Guiuan, Eastern Samar Island in the Philippines. Initially, only helicopters could bring aid to survivors.

mission to the disaster site. The simulation begins with the assembly of student teams, who are challenged with the goal of mounting a supply operation to the modern city of Tacloban (pronounced Tahk-LOW-bahn) on the Philippine island of Leyte (pronounced Lay-tee). Tacloban City was cut off from assistance for several days after the typhoon struck. The Tacloban airport, with its single 7,000 foot (2,134 m) runway, was severely damaged and unusable for the first three days after the typhoon moved westward off the island. When the airport did open, it was accessible only by turboprop (propeller style) planes and helicopters, but not by jets.



A sign on the main road into Tacloban City and the surrounding devastation seven days after Typhoon Yolanda struck, highlights the immensity of need.



The Tacloban airport was inoperable for a time. Many headed there, hoping to escape the devastation.

The student teams will be members of an imaginary non-governmental humanitarian aid organization called First Responders International or FRI. The FRI teams each will be assigned the task of planning an emergency supply aid mission to Tacloban. Teams will plan to deliver a planeload of medical and other supplies in the shortest time possible. Student teams will select appropriate supplies for loading on a cargo aircraft. Using Google Earth's Earth Pro software, they will plot the shortest possible route from Houston, Texas, to Tacloban City, the Republic of the Philippines. The simulated mission will end with a debriefing in which each team explains its choices of supplies, and the route and flight schedule it designed.

The selection of supplies will be based on the perceived needs of the affected people in Tacloban. Teams will have to learn which supplies are needed, with a particular focus on resources related to specific potential disease outbreaks. Teams will conduct research and answer many questions before it is “wheels up” on the aircraft. Some of these questions are: *What do the disaster victims need most? What diseases are likely to break out? What are the causes of these diseases? What are symptoms of the diseases? What are possible treatments?* Answers to these questions and more will challenge the teams and determine the supplies they ultimately select for loading on the cargo aircraft.

DISASTER

Calamitous event, especially one occurring suddenly and causing great damage, hardship or loss of life.

The unit allows students to work together as they conduct the following investigations.

- Teams will use the Internet or other sources to research the Republic of the Philippines and Tacloban City, and create passports for each team member.
- As natural disasters often trigger diseases, teams will investigate the symptoms, effects, causes, and treatments of cholera, dengue fever, leptospirosis, malaria, measles, tetanus, tuberculosis, and typhoid fever and make a presentation to the class on one disease.

- Getting to the disaster site will require students to learn about the capabilities of a C-130 Hercules cargo aircraft (load capacity, flight range, air speed, etc.). They will use this information to plot a route to Tacloban, based on the flight range of the huge cargo aircraft, weather conditions, and international airspace restrictions.

Several intermediate stops will need to be designated because a C-130 cannot fly directly from Houston to the Philippines. The plane will have to stop at airports within plane's flight range maximum of 1,438 miles (2,314 km), and airports with runways that are at least 3,000 feet (914 m) long

The aircraft's air speed will need to be factored in as well, to determine how long it will take to arrive at each intermediate stop. Air speed is the same as ground speed if there isn't any wind. Head and tail winds will affect the aircraft's speed and, therefore, its range. Head winds reduce the range of the aircraft and tail winds increase its range.

- To plan their route on a world map, teams will use Google Earth's Earth Pro software as their flight atlas, and calculate air travel time for each segment, factoring in refueling time. Team performance will be based on choosing an effective goal to help the storm victims; how well they meet their goal; how much cargo they carry; and how fast they deliver it to the disaster area. Each team will construct its own flight plan.
- Teams must decide what supplies to take on their mission. The decision should be based on what supplies are needed most. They can include supplies required for the treatment of cholera, dengue fever, leptospirosis, malaria, measles, tetanus, tuberculosis, and typhoid fever, as well as wounds and burns. In other words, what is needed to care for the sick and prevent further spread of infections?
- Each team will select and load five pallets of



Most survivors in Tacloban City were left with only the clothes they were wearing. The rest of their belongings were swept away by the storm surge.

supplies and equipment. The total weight of the supplies and the pallets themselves must not exceed 35,000 pounds (15,876 kg). The pallets are designed to be carried by the C-130 Hercules turboprop aircraft. Pallets each weigh 500 pounds (227 kg), and the cargo they carry can weigh up to 6,500 pounds (2,948 kg), bringing the total weight of each pallet and its cargo up to a maximum of 7,000 pounds (3175 kg). Each team will create a cargo manifest and construct cargo containers for load planning.

- Teams will “fly” the mission to the disaster area and make adjustments to the flight route as weather and other flight advisories dictate.

At the conclusion of the unit, each team will make a post-mission team presentation (debriefing) explaining the team's aircraft load plan (items carried and total weight), the air route, and the length of time it took to drop the supplies to waiting aid workers on the ground. Teams can use posters or presentation software such as PowerPoint® or other programs to explain their missions.

MATERIALS

Teacher

- Computer and projector, interactive white board, or World map hung on a wall
- News articles, both in print and online, about recent natural or man-made disasters around the world

- Google’s Earth Pro software, downloaded and installed (see “Setup”)

Per Team of Four Students

- Copy of “First Responders International” page

Per Student

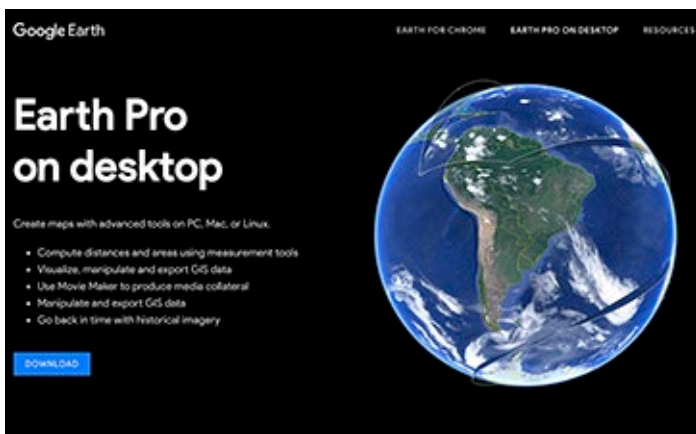
- Copy of the “Mission Overview” page
- Notebook, journal or folder
- Paper for individual assignments and notes

SETUP

The *Operation Rescue Teacher’s Guide* is designed to be used as a stand-alone teaching unit. Depending on the age of the students, the unit storybook, *A Storm Named Yolanda* also may be used to generate a deeper interest in this subject. Both books are available free-of-charge, in PDF format, at <http://www.bioedonline.org>.

Prior to class, find and download several news articles about Typhoon Haiyan (locally called Yolanda) and its impact on the Philippines. Print copies of the articles for students, or display the articles using a projector or smartboard. Be aware that some images may not be appropriate for the classroom.

Ensure that Google’s Earth Pro software program is on your computer and on the computers to be



used by your students. If you need to install the software for the first time, follow the directions under “Resources.” Earth Pro is not needed for this lesson, but you will need to be familiar with its operation prior to Activity 6 (see activity for details).

1. Introduction to the Mission

Practice using the program’s navigation controls by finding your school’s location and the location of Tacloban City, Philippines. Also practice using the magnification controls to enlarge the local view.

PROCEDURE

1. Write the word, “disaster” on the board. Ask students to think about and record their definitions of the word “disaster” in their notebooks. With help from students, create a list on the board of kinds of natural and man-made disasters that affect communities, countries, or even entire regions of the planet. Examples include natural phenomena such as earthquakes, landslides, volcanic eruptions, floods, tornadoes or hurricanes that sometimes impact human populations. Man-made disasters result from hazards, such as transportation accidents, chemical spills or leaks, and nuclear/radiation accidents.
2. Next, ask students to think of any recent natural or man-made disasters. Have students share their ideas. Ask students, *How did you find out about the disasters?* [for example, Internet, television or radio, print news, word of mouth, living through it] Discuss what was done to help the victims. Project or distribute copies of news stories about current disasters from around the world. Make a list on the board and add other examples to the list, if necessary. Major broadcast networks, such as the BBC or CNN, or the websites of newspapers, such as *The New York Times*, are reliable sources of stories to share with students.
3. Explain that in November 2013, a major disaster occurred in the Republic of the Philippines, halfway around the world. Tell students that they will be placed in the roles of responders to this emergency situation—which could happen again in a similar coastal area in the Philippines or elsewhere on the planet.
4. Have students take notes as you read the “News Alert.” You also may want to project the page in front of the class.

5. Tell students that they will be joining in an international relief effort to select, load and deliver supplies to the affected region. They will be forming teams of four to plan their mission.
6. Distribute copies of the “First Responders International” page (one per team), for students to complete. Allow students to form their own group of four, or assign them to groups, based on the makeup of your class.
7. Distribute the “Mission Overview” page (one per student). Discuss the information that will be completed by each group over the course of the next several lessons.
8. Continue the briefing with the mission details. Have students keep Mission notebooks, folders, or journals with the mission requirements, and research and planning efforts. Team members will participate jointly in all activities and act in all roles, but each member also will keep additional information in his or her own notebook specifically related to his or her individual responsibilities within the team.

RESOURCES

1. Download and install Google’s Earth Pro software (free) for PC, Mac, or Linux onto your computer and on any student computers.

Google Earth Pro Software

<https://www.google.com/earth/desktop/>

Double-click the downloaded file and follow instructions to install the software. You may need administrative privileges to install the software. Contact the campus technologist or IT representative if needed.

Launch Earth Pro by double clicking its icon in



the Applications folder (Mac); or on the desktop or in the Start menu (PC).

2. Use the online CIA World Factbook as a reference for information about the Philippines and the surrounding region. This US Government site provides demographic, environmental, economic, and political information for more than 100 countries around the world. It also features printable maps. The World Factbook Website and additional news resources are listed below.

The World Factbook

<https://www.cia.gov/library/publications/the-world-factbook/>

To reach the map section on the site, click on the “References” tab and select “Regional and World Maps.” Of special use to the teams will be the physical and political world maps, and the physical maps of Asia and Oceania.

BBC

<http://www.bbc.com/>

CNN

<https://www.cnn.com/>

Time

<http://time.com/>



News Alert

Super Typhoon Haiyan, a Category 5 storm, has struck the Philippines, bringing with it high winds and heavy rains with multiple areas affected by storm surge. The Visayas region has been particularly hard hit. Millions of Filipinos have lost electrical power and communications, more than one million homes have been damaged or destroyed, massive numbers of buildings and trees are down, streets blocked with debris, and vital life-saving services, such as medical aid, food, clean drinking water and sanitation systems are down.



People who were injured or burned during the storm or its aftermath need immediate medical attention. Those with chronic health conditions, such as diabetes and high blood pressure, have no access to medications. Thousands of people already have died, and the number of injured and sick continues to rise.

Flooded areas in this region promote the growth of mosquitoes that are carriers of infectious diseases, including malaria and dengue fever. The loss of functioning sanitation systems has led to surface waters contaminated with human and animal waste, and the bacteria that can cause typhoid fever, cholera and leptospirosis. Tetanus is of concern for those with wounds from the collapse of buildings and flying debris. The total loss of human life is projected to dramatically rise as untreated infectious diseases spread.

A tremendous amount of help is desperately needed as soon as possible. Currently, relief personnel and supplies are arriving via ships and helicopters. Work to clear airport runways is underway. Romualdez Airport in Tacloban City is not expected to open for international airplanes for four days. ■



Mission Overview

Each team independently will complete the following tasks over the next few weeks.

1. Read about and select individual team member positions using a “First Responders International” (FRI) form. Create a team name. Record the information.
2. Prepare a passport and add documentation of skills for international travel as part of a disaster relief team.
3. Learn about the location to which you will be providing assistance: Tacloban City, Leyte Island, Republic of the Philippines.
4. Learn about the following diseases: Cholera, dengue fever, leptospirosis, malaria, measles, tetanus, tuberculosis, and typhoid fever. What are the symptom and causes of each disease, and what is the recommended treatment protocol and/or vaccinations available?
5. Determine what kinds of relief supplies are needed for basic human needs as well as for fighting disease outbreaks across the city.
6. Undergo navigation training using tools found on the Internet.
7. The Air National Guard is loaning a C-130 Hercules cargo aircraft to FRI for the mission. Determine which supplies your team will transport and follow space requirements based on the aircraft.
8. Plot a route for the C-130 Hercules aircraft to carry the supplies from Houston, Texas, USA, to Tacloban City, Leyte Island, Republic of the Philippines.
9. Debrief once the mission is concluded.



First Responders International

Team Name

Positions

Captain/Pilot

- Commands the aircraft upon takeoff.
- Double checks the route plotted by the navigator.
- Approves any in-flight route changes.
- Participates in the selection of relief supplies.

Medical Officer/Physician

- Determines what medical equipment and supplies are needed for the mission to prevent and control disease outbreaks.
- Serves as team expert on infectious diseases.
- Participates in the selection of other relief supplies.

Navigator/Co-pilot

- Identifies airports suitable for fuel or other in-flight stops and calculates flight times.
- Plots the final route.
- Reviews weather and other flight advisories and informs the pilot if changes are necessary.
- Participates in the selection of relief supplies.

Engineer/Loadmaster

- Supervises the division of the supplies among five pallets based on the capability of the aircraft.
- Participates in the selection of relief supplies.

Team Member Roster

Captain/Pilot



Navigator/Co-pilot



Medical Officer/Physician



Engineer/Loadmaster





International Travel Documents



OVERVIEW

Students learn about international requirements and create their own travel documents (First Responders International passport). Time: One 45–60 minute session

As part of their mission preparation, each student will create his or her own “First Responders International” travel passport. Passports are official government issued documents that certify a person’s identity and citizenship, which permits a person to travel from one country to another. In this case, students will create simulated identification documents that provide evidence that they are team members of the First Responders International aid group.



To protect students’ privacy, no information about place of residence or citizenship is included in these simulated travel documents.

The passports also will be used to show proof of proficiencies for the mission, that each team member has specific knowledge of disease risks, treatments, and which vaccinations are appropriate for themselves and for the survivors awaiting

aid in Tacloban City, Leyte Island, Republic of the Philippines.

Students also will provide information that they know how to use Google’s Earth Pro application software, and have passed the Navigator’s exam, along with other required training/skills. Templates of all certification icons for the unit has been provided for you to distribute as activities are completed. Students will need to bring their passports to each class for the remainder of this unit.

MATERIALS

Teacher (see Setup)

- Digital camera and printer to make a photographic head shot of each team member. See “Setup” for complete instructions and options.
- White card stock (for cover/identification page)
- White copy paper

Per Team of Four Students

- 2 copies of the passport cover/identification pages copied front-to-back on white card stock (p. 11–12)
- 4 copies of the blank page copied front-to-back onto white paper (p. 13; one page per team member)
- Folder to serve as a team “Mission Folder” to hold forms and mission materials
- Glue stick or clear tape, and stapler
- Metric ruler
- Pair of scissors
- Set of different colored markers or pencils

Per Student

- Copy of the blank template page (see Setup)
- Folder for individual student research materials and certification training icons
- Printed materials listed above to assemble into individual passports

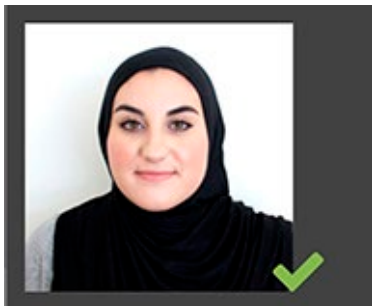
SETUP

Have students work in teams of four.

Photocopy pages 11 and 12 front-to-back on one sheet of paper (2 copies per group). Have student groups cut out the cards using the solid outer lines as a guide, and fold the cards in half (one per student). Students will glue or tape their photos where indicated on the identification side of the spread. An illustration showing the size of the photo and how it must be positioned has been provided.

On the day of class, use a digital camera to take a individual head shot photo of each student. Photos need to be taken against a white background to avoid shadows. Final size of the printed photo must be 3.5 cm x 4.5 cm (1.378-in. x 1.77-in.). If needed, use Microsoft Word® or PowerPoint® to resize the photos. Print the photos on a color printer.

Usually, hats are not allowed for travel photos.



However, a head covering is permissible for religious reasons. The material must be pulled back so that the entire face is visible (see photo, above). Glasses are not to be worn for the photos,

unless it is a medical necessity.

Optional: For purposes of this activity, a copy of current class photo will suffice. Or students may bring in a photo from home. If this is not possible have students draw a picture of themselves at the correct size.

Have students trim their photos and glue them to the spot provided on the interior page.

A template with blank pages has been provided. To save paper, make another blank “original” from page

13 and photocopy front-to-back onto one sheet of paper. Give each student one copy of the page.

Prepare a sample passport ahead of time to show students.

PROCEDURE

1. Begin the activity with a whole class discussion. Ask the class if any students have traveled to a country outside the United States. Have students raise their hands. Of the students that responded, “yes,” ask, *Did you have to present any identification or paper forms to enter another country?* Let students share their experiences.
3. Explain that even emergency responders must have proper identification and certifications of various types to board an airplane when going to a specific country. Tell them that each student will prepare his or her own First Responders International passport.
4. Have students share materials within their groups to make the passports. Once photos have been made and printed, students will need to do the following.
 - a. **Passport cover/Identification page.** Cut out each of the large rectangles on both sheets to make four passports (1 for each team member). Fold along the center and crease it. (The identification page will be on the inside.)
 - b. **Blank pages.** Cut out the blank pages and fold in half to make a crease. Each student should have 2 blank passport sheets.
 - c. **Assemble the passports.** Close the cover/identification page. Staple the folded blank pages to the back of the passport. New blank pages may be created and added as needed.
5. After each student has completed assembling the his or her passport, have them fill in the requested information and glue their photographs on the sheet where indicated.
6. Tell students to bring their passports, and mission folders to class each day. ■

First Responders International

HUMANITARIAN AID GROUP



TEAM NAME



First Responders International

HUMANITARIAN AID GROUP



TEAM NAME



First on the ground.



Signature of Bearer

FIRST RESPONDERS INTERNATIONAL

Last name

First name

Date of birth (month/day)

Date of issue / Date of expiration

Team name

ENDORSEMENTS

First Responders International. Relief mission to Tacloban City, Republic of the Philippines. Certification of specialized skills enclosed.



First on the ground.



Signature of Bearer

FIRST RESPONDERS INTERNATIONAL

Last name

First name

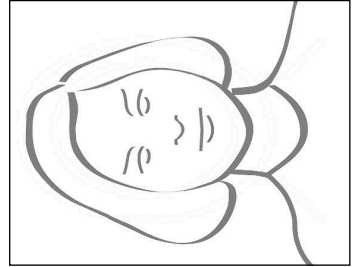
Date of birth (month/day)

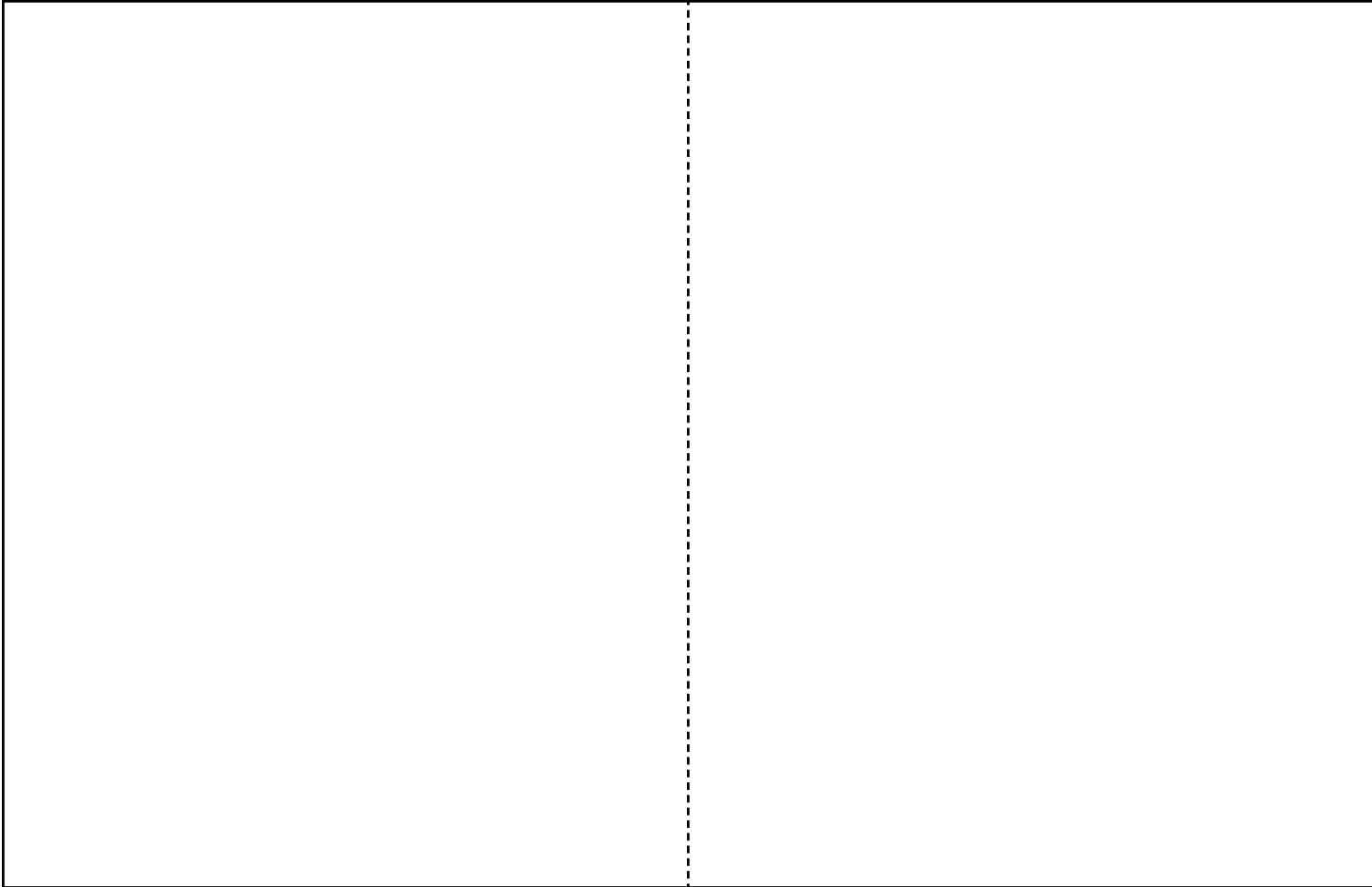
Date of issue / Date of expiration

Team name

ENDORSEMENTS

First Responders International. Relief mission to Tacloban City, Republic of the Philippines. Certification of specialized skills enclosed.







Destination: Tacloban City



OVERVIEW

Students learn about their rescue mission destination, the Republic of the Philippines. Topics include language, government, natural resources, climate, food, geography and history. Time: Two or three 45-60 minute sessions

Before they begin planning their mission, student teams will need to gather information about their destination, the Republic of the Philippines, and the Filipino (or Pinoy) people. This data will provide a basis for learning about diseases that might occur, and give insights into the needs of the people they are attempting to assist.

Using the Internet, student teams will research, compile and present information about the island nation, which are summarized for you (see page15).

MATERIALS

Teacher

- Computer and projector, interactive whiteboard or World Map posted on the wall
- Set of certification icons

Per Team of Four Students

- Glue, clear tape and/or stapler
- Pair of scissors
- Poster board or large sheet of poster paper
- Several colored markers, pencils and pens

Per Student

- Access to a computer and printer
- Copy of “Map of the Philippines” page
- Notebook, journal or folder, and passport

SETUP

Just prior to class, use an online mapping program

3. Destination: Tacloban City



San Juanico Bridge connects Tacloban City, Leyte Island to the island of Samar. Super Typhoon Haiyan made its first landfall at Guiuan on Samar Island.

(such as Google Maps) to locate the Philippines and zoom the map out, so that students can see the location of the Philippines relative to the US and other countries around the world. Project the map on the whiteboard, or use a world map hung on a wall.

Make certain that students have access to “student safe” search engines in school or at home prior to gathering information from sources on the Internet.

PROCEDURE

1. Have students sit with their teams for today’s mission briefing. Tell students that they will be

discovering more about their destination before beginning to plan their aid missions.

2. Point to the world map and show the location of the Philippines. Using the map legend, show students how to estimate the distance from their

current location to the center of the Philippines. OR invite two students to use the map legend to estimate the distance. [The distance is approximately 8,500 miles (13,679 km) from Houston, Texas, for example.]

SUMMARY: REPUBLIC OF THE PHILIPPINES

LANGUAGE A large variety of individual languages are spoken. The official languages are Filipino (based on a language called Tagalog) and English. Spanish and variations of Spanish also are spoken. The Philippines is the third-largest English-speaking country in the world.

GOVERNMENT The Philippines has an elected president, a Congress with elected representatives and two bodies (Senate and House of Representatives), and a judicial branch. The president at the time of the disaster was Benigno S. Aquino, III. The capital city is Manila on the island of Luzon. Some islands remain independent administrative regions with control over their culture and economy. Though it remains part of the Republic, Tacloban City, on the island of Leyte, is one of those areas.

NATURAL RESOURCES The republic is rich in mineral resources, particularly gold, nickel and copper. The archipelago (island group) has 2,400 species of fish, and almost 10,000 plant species. More than half of the plant species are found only in the Philippines. Half of the country's land is forested. Important crops include rice, corn, sugarcane, abaca (native species of banana harvested for its leaf fibers, sometimes called Manila hemp, Cebu hemp or Davao hemp) and tobacco.

CLIMATE The climate is tropical, and usually hot and humid. Average temperatures range from 70°–90° F (21–32° C). Most areas receive heavy rainfall in summer/early fall.

FOOD Food reflects the history of the Philippines and includes dishes of Polynesian, Hispanic, Chinese, and American origins. Fish, rice, pork, chicken, and tropical fruits/vegetables are important components of the many stews that are typical of the cuisine.

GEOGRAPHY AND TIME ZONE The Philippines is an archipelago of more than 7,600 islands, located between 116° 40', and 126° 34' E longitude and 4° 40' and 21° 10' N latitude in south-eastern Asia. The collective land area is about 115,831 mi² (300,000 km²; about the size of Arizona). The islands are volcanic in origin, and many are mountainous with tropical rainforests. The time zone is PHT (Philippine time; GMT + 8).

HISTORY Before the arrival of the explorer, Ferdinand Magellan, various indigenous groups of Pacific and Asian origins inhabited the islands. Spanish colonization began in 1585, and the country received its name in honor of King Philip II of Spain. Spanish rule united the islands. After the Spanish American War, control of the islands was transferred to United States. The Republic of Philippines became an independent nation in 1946, but suffered considerable turmoil under dictator Ferdinand Marcos from 1965–1986. Since 1986, the country has been a republic.



The flag depicted above is the official flag of the Republic of the Philippines. The sun emblem represents the strides made toward progress and civilization by the Filipino people.

Each of its eight primary rays represents a Philippine province.

Each star represents one of the country's three main island groups—Luzon, Visayas and Mindanao.

3. Ask students if they know anyone who has lived in or traveled to the Republic of the Philippines. Give students time to answer. Follow by having students share what they already know about the country. Finally, ask, *Do you think it is possible to provide effective emergency assistance without knowing very much about a country and its citizens?*
4. Tell students that each team will use library or Internet to collect necessary information about the Republic of the Philippines and its inhabitants. Each team will research a different topic and will present the information to the other teams as a poster, which will remain available in the classroom. Assign or allow each team to pick a different topic from the following.

LANGUAGE

NATURAL RESOURCES

FOOD

HISTORY

GOVERNMENT

CLIMATE

GEOGRAPHY AND TIME ZONE

5. Distribute copies of “Map of the Philippines” page. Allow the teams one to several days to

compile their assigned information and prepare their presentations. Students may conduct their research during class time, or you may assign the research and poster preparation as homework.

6. On the day of the presentations, have each group explain the findings presented on their poster

to the rest of the class. If you use the posters to provide a grade, consider the following elements: overall appearance (20%); depth of information (30%); accuracy of information and evidence of research (30%); clarity of presentation to class, including evidence that all team members contributed to the information presented (20%).

7. Provide each student with a dated certification icon signifying that each has completed course training about the Philippines. Have students glue or tape the icons into their passports. ■

DID YOU KNOW?

The Philippines was one of the founding members of the United Nations.



Map of the Philippines

Situated in the western Pacific Ocean, the Republic of the Philippines consists of about 7,641 islands that are categorized broadly under three main island groups from north to south: Luzon, Visayas, and Mindanao.

Luzon is the economic and political center of the nation. The nation's capital is the City of Manila, located on Luzon's largest island, which also is called Luzon.

Luzon

City of Manila, Luzon Island
Capital City of the Republic of the Philippines

Tacloban City, Leyte Island

Guiuan, Samar Island

Visayas

Mindanao

 <p>_____</p> <p>date</p>	 <p>_____</p> <p>date</p>	 <p>_____</p> <p>date</p>	 <p>_____</p> <p>date</p>
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Disease Threats in the Disaster Zone



OVERVIEW

Students investigate disease outbreaks that are likely to occur in Tacloban City following typhoon Haiyan/ Yolanda. They learn to identify the symptoms of cholera, dengue fever, leptospirosis, malaria, measles, tetanus, tuberculosis, and typhoid fever. They also learn about the causes of these diseases, treatments, precautions, and remedies necessary to prevent infectious diseases from growing into epidemics. Time: Two or three 45-60 minute sessions

Many infectious diseases pose threats after natural disasters, because of flooding, overcrowding in temporary housing facilities or lack of sanitation and clean water. Typhoid fever and cholera, for example, can be contracted anywhere on Earth. They are bacterial diseases that are acquired by ingesting food or water contaminated with the feces of an infected person. Both are endemic diseases maintained in a population through person-to-person transmission. Leptospirosis, another bacterial disease, often is spread in flood waters contaminated by animal waste

Malaria and dengue fever are primarily tropical diseases, because they are transmitted by the bites of infected mosquitoes. A mosquito becomes a carrier of these diseases by biting an infected person. The disease is then passed on when the mosquito bites someone else. People living in tropical climates can be infected by malaria or dengue fever at any time. Infections of these two diseases are rare in geographic areas with cold winters. Cold weather cuts down the size of mosquito populations and thereby reduces the number of organisms (vectors) able to spread the infection.

Some infectious diseases, such as measles and tuberculosis, which spread from person to person,



Malaria and dengue fever are transmitted through the bites of infected mosquitoes. Having a mosquito control program is paramount to helping keep infectious diseases at bay after a disaster.

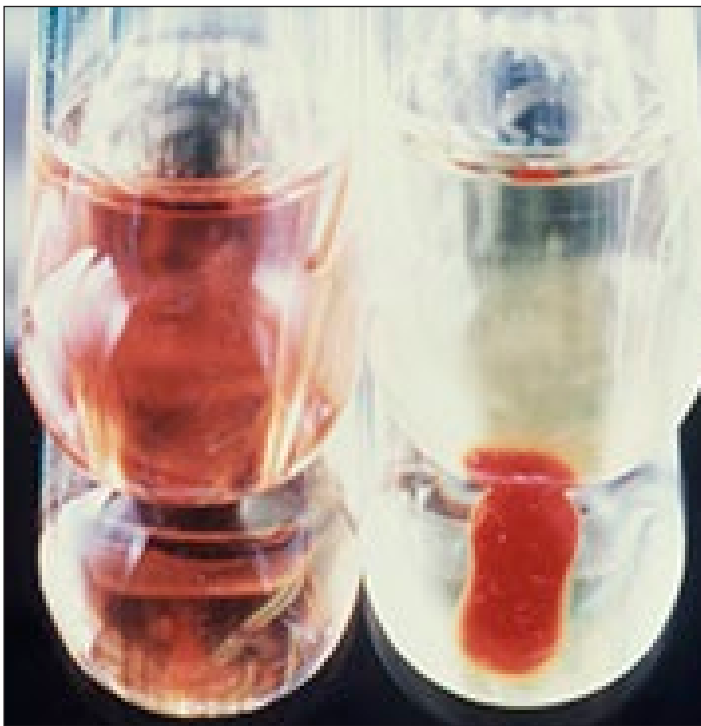
become widespread when many people are housed in close proximity to one another.

As many as 100 million people are infected with dengue fever annually, but the disease usually does not kill the victims. Typhoid fever affects about 22 million people annually with about 6,000 cases occurring in the US each year. Only about one percent of the victims die from typhoid fever but if the disease is untreated, the mortality rate can increase to as much as 30 percent. About 220 million cases of malaria occur each year, with a mortality rate

at more than 660,000 people worldwide. Detailed information on the diseases students will investigate is provided below for you, the teacher.

CHOLERA: Bacterial Infection

Cholera is a diarrheal illness caused by the infection of the intestine with the bacterium *Vibrio cholerae*. About one in five infected persons will have profuse watery diarrhea, vomiting, and leg cramps. Rapid loss of body fluids leads to dehydration and shock. If cholera is untreated, death can occur within hours. Three to five million people around the world become infected with cholera every year, and more than 100,000 individuals die from this infectious disease.



The white, rod-shaped particles in the blood sample on the right are *Vibrio cholerae* bacteria, which cause Cholera.

The cholera bacterium is found in water or food sources that have been contaminated by feces from infected persons. Places with inadequate sewage treatment, poor sanitation, and people who have poor personal hygiene are especially susceptible to cholera outbreaks. If a disaster occurs, such as a typhoon or

hurricane, even areas that normally are not at risk from this disease can have outbreaks, because of the breakdown of public sewage systems and water supply systems.

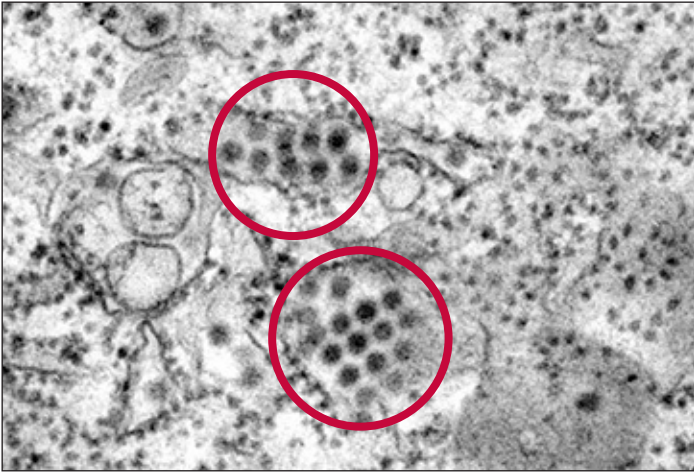
The onset of cholera is usually sudden—about one-half to five days after initial ingestion of the bacterium. Once the number of bacteria in a person's intestine has grown to about one million cells, symptoms appear, which include severe watery diarrhea, vomiting, severe leg cramps, exhaustion, electrolyte deficiency (electrolytes are chemicals such as potassium and calcium that regulate muscle and nerve function), sunken appearance of eyes, cold clammy skin, and wrinkled hands and feet.

The primary treatment for cholera victims is to have them drink lots of clean water to maintain hydration. In severe cases, intravenous rehydration is necessary. Victims may require ten percent of their body weight in fluid replacement in the first few hours of treatment because an infected person may lose three to five gallons of water. Foods high in potassium like bananas, will replace lost electrolytes. Ringer's lactate, a solution with added potassium, is often administered. Antibiotics, like doxycycline, erythromycin, and tetracycline are useful for shortening the time of infection. Zinc supplements have helped with the duration and severity of diarrhea in children. With quick and proper treatment, 99% of cholera victims recover.

DENGUE FEVER: Viral Infection

Dengue fever, also known as O'nyong-nyong fever and breakbone fever, is a virus-caused disease spread by mosquitoes. The *Aedes aegypti* mosquito found in tropic and sub-tropic regions is considered the primary carrier of the Dengue virus. The mosquito species is a daytime feeder. Every year, between 50–100 million people worldwide contract dengue fever.

Dengue fever usually is a painful, flu-like disease that affects all ages of people, but generally is not fatal. However, some people develop severe dengue, which is characterized by heavy bleeding and respiratory distress, which can be fatal if not quickly



The tiny round shapes in the image above are dengue virus particles, which invade and destroy blood cells.

treated. The virus that causes dengue has four distinct, but closely related forms (serotypes), all of which cause dengue and severe dengue. A person is more susceptible to developing severe dengue if they previously were infected by one of the other forms of the virus.

The mild version of dengue fever begins with a sudden high fever, ranging as much as 104 degrees–105 degrees Fahrenheit, four days to one week after the infection. In 2–5 days after the start of the fever, a red rash appears over most of the body. A second rash that looks like measles follows the first rash. The victim’s skin becomes very sensitive to touch and the victim is very uncomfortable. Other symptoms include fatigue, headache (especially behind the eyes), joint aches, muscle aches, nausea, swollen lymph nodes, and vomiting.

Severe dengue, also known as dengue hemorrhagic fever, is a much more serious version of the disease. Along with the typical symptoms of dengue, additional ones appear including persistent vomiting, severe abdominal pain, and difficulty breathing. This marks the beginning of a 24- to 48-hour period when the smallest blood vessels (capillaries) become excessively permeable (“leaky”), which may lead to failure of the circulatory system and shock, followed by death, if circulatory failure is not corrected. In

addition, the patient has a tendency to bruise easily, bleed from the nose or gums, and suffer internal bleeding.

There is no specific treatment for dengue fever. Water and other fluids should be administered if there are signs of dehydration. The fever itself can be treated with acetaminophen. Avoid aspirin and ibuprofen, because they may increase bleeding problems. After a week or so, the fever goes away.

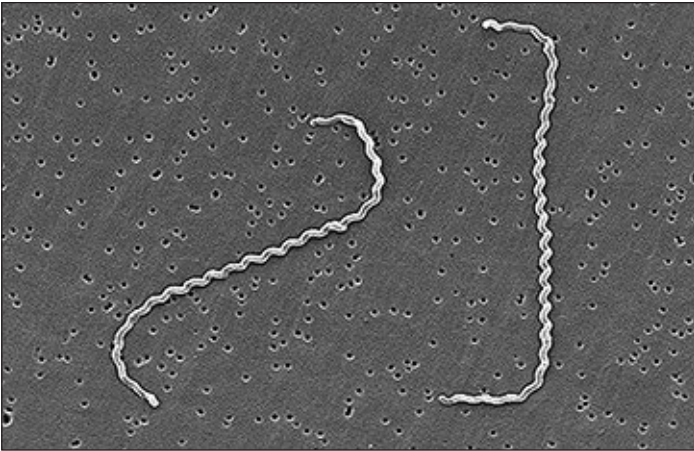


An *Aedes aegypti* mosquito feeds from its human host. *A. aegypti* is a known vector of several viruses that affect humans, including dengue fever, chikungunya, West Nile, yellow fever, and Zika. It is considered one of the most wide-spread mosquito species globally.

Prevention of dengue is best accomplished by eliminating breeding places for mosquitoes, such as covering rainwater storage containers, pet and livestock watering troughs and bowls, and boats, pails and old tires that can collect water. Mosquitoes use these places to lay their eggs. Window and door screens, and mosquito netting for beds are effective prevention strategies.

LEPTOSPIROSIS: Bacterial Infection

Leptospirosis is a disease that infects both humans and animals that is caused by the bacteria *Leptospira*. It can cause a wide range of symptoms and is sometimes mistaken for other diseases. Some victims may be asymptomatic, meaning that they carry the disease, but do not exhibit any of the symptoms. Without treatment, leptospirosis can lead to kidney



Leptospira bacteria are spiral shaped and can be found in waters used for recreational sports.

damage, meningitis, liver failure, respiratory problems, and death.

Pathogenic *Leptospira* bacteria live in the kidneys of a large variety of mammalian species and are excreted into the environment with the urine. Leptospirosis is contracted in humans by having contact with the urine from infected animals, which can be found in water, soil or food. Cattle, pigs, horses, dogs, rodents, and wild animals can have the disease but not show any symptoms. The number of infections rises with exposure to contaminated water due to flooding from major storms or broken pipes.

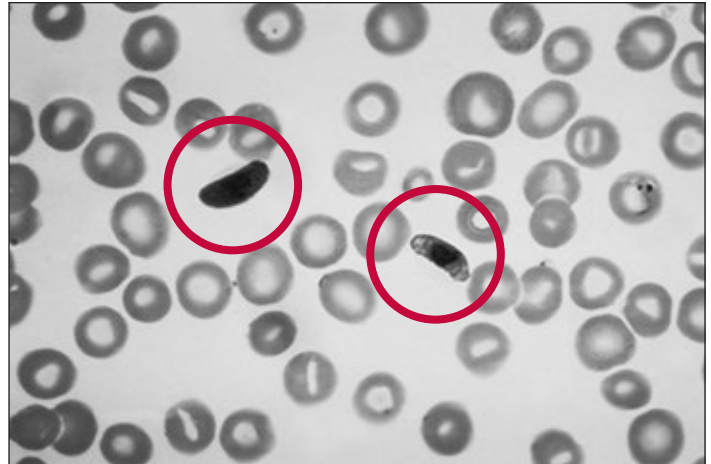
The incubation period between contact and symptoms is between 2 to 30 days. Symptoms of leptospirosis include high fever, headache, chills, muscle aches, jaundice (yellow skin and eyes), abdominal pain, diarrhea, and rash.

Leptospirosis is treated with antibiotics, and death is rare. People with severe symptoms may be treated with intravenous antibiotics.

MALARIA: Protist Infection

Malaria is caused by *Plasmodium* parasites. It is a type of microorganism called a protist, and it looks like a microscopic worm. Four *Plasmodium* species (*P. falciparum*, *P. vivax*, *P. ovale* and *P. malariae*) cause diseases in humans.

Transmission of the *Plasmodium* parasite to



Shown above are *Plasmodium falciparum* parasites within infected blood cells. *P. falciparum* is responsible for roughly 50% of all malaria cases.

a human happens through a bite by an infected *Anopheles* mosquito. Once inside the body, the parasite travels the bloodstream where it enters blood cells and rapidly multiplies. When a different mosquito bites the human victim, the mosquito becomes infected with the parasite. In this way, the malaria parasite spreads among the mosquito population, which, in turn, passes the disease on to other humans.

The onset of malaria usually begins one to four weeks after a mosquito bite, with a feeling of sudden coldness followed by chills, high fever, and sweating.



The aggressive female *Anopheles* mosquito shown above is so engorged with human blood that the blood is leaking out of its body.

Other symptoms may include weakness, mild jaundice (yellow appearance to the skin), increased respiratory rate, enlarged spleen and liver, muscle or back pain, dry cough, anemia, blood in urine, and low blood pressure. The disease can be fatal.

Malaria is very rarely contracted in the US and other temperate areas because of strong mosquito eradication programs. Annually, about 1,500 people in the US contract the disease. Worldwide, more than 216 million cases of malaria occur annually accompanied by about 655,000 deaths. About 3.3 billion people live in areas at risk for acquiring malaria. Ninety-one percent of all malarial deaths occur in the region of Africa.

Treatment includes administering drugs derived from the Chinese Qing Hao plant (*Artemisiae annua*, or the drug artemisinin), and bark from the South American cinchona tree (*Cinchona officinalis*, or the drug quinine). *Anopheles* mosquitoes feed primarily at night. Prevention consists of mosquito control such as avoiding mosquito bites through the use of insect repellents, using insecticide-treated mosquito netting in sleeping areas, spraying of indoor insecticides, and spraying oil products on standing water to kill mosquito larva (wrigglers) that complete part of their life cycle there.

MEASLES: Viral Infection

Measles, also known as rubeola, is an extremely contagious respiratory disease caused by a single-stranded RNA virus of the genus *Morbillivirus* and the family *Paramyxoviridae*. Humans are the only carriers of the measles virus. Symptoms include low to moderate fever, runny nose, sore throat, red eyes, cough, white spots in the mouth, and skin rash that can spread over the entire body. Tiny white spots may appear inside the mouth in two to three days. In three to five days, a reddish brown rash will appear on a victim's face that works its way down the body to the feet. After a few more days, the fever subsides and the rash fades.

Although usually not fatal, about one victim in 100 dies from measles complications. It is estimated



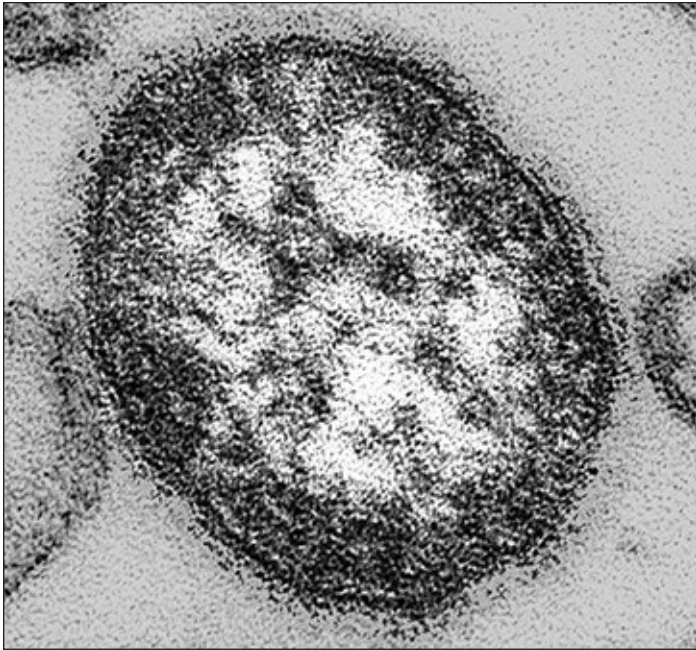
Photographed early in 2014 in the Manila, this baby was in a hospital with measles (rubeola). After Typhoon Haiyan, the Philippines experienced a large measles outbreak. According to the CDC, about one out of 10 children with measles also gets an ear infection, and up to one out of 20 gets pneumonia.

that 164,000 people around the world die from this disease every year. About one in 20 children suffering from measles also will get pneumonia. Many fewer will contract more serious diseases such as encephalitis. Measles can cause pregnant women to have premature births or miscarriages.

Measles can be prevented with a vaccine, and it is rare in parts of the world where vaccination coverage is high. The virus lives in the nose and throat of the infected person. It can spread to others through coughing and sneezing. The virus can remain infectious in the air or on contaminated surfaces for up to two hours after an infected person has left the area. A person unprotected by the measles vaccine nearly always catches the disease. Infected people can spread the disease to others for up to four days after the rash appears.

Measles outbreaks are common in unprotected regions that have suffered a major disaster such as a typhoon. Refugees are crowded together in buildings where contagious diseases can quickly spread from person to person.

The primary treatment for measles is to give infected persons fever reducer medicines, such as



This thin-section transmission electron microscopic image reveals the ultrastructural appearance of a single measles virus particle.

acetaminophen. Aspirin should never be given to a child because the risk of Reye's syndrome, a rare but sometimes fatal disease, can occur. The patient also should receive fluids to avoid dehydration. Continued fever beyond two days after the onset of rash is an indication of complications. Antibiotics may be administered if a bacterial infection, such as pneumonia, occurs. Pneumonia accounts for six out of ten measles associated deaths.

TETANUS: Bacterial Infection

Tetanus is a serious disease caused by the bacterium, *Clostridium tetani*. Spores of bacteria are everywhere in the environment, including soil, dust, and manure. The spores develop into bacteria when they enter the body, usually through broken skin, usually through injuries from contaminated objects. The usual ways of contracting tetanus are wounds contaminated with infected dirt, feces or spit; puncture wounds, like a nail or needle; burns; crash injuries; or injuries resulting in dead tissue.

Survivors of major calamities, such as hurricanes or

floods that destroy buildings, are at high risk because of injuries sustained during the event. Tetanus does not spread from person to person.

The incubation period from injury to illness is usually between 3 and 21 days, though it can range from one to several months, depending on the kind of wound. Most cases appear within 14 days.



Shown above is an injured survivor of Typhoon Haiyan. Buildings were torn apart, creating deadly airborne projectiles and dangerous objects underneath rushing waters.

Tetanus produces painful muscle stiffness and can be deadly. Symptoms include jaw cramping and sudden, involuntary muscle spasms with painful muscle stiffness all over the body, as well as headaches, trouble breathing and swallowing, fever and sweating, changes in blood pressure and heart rate, and seizures.



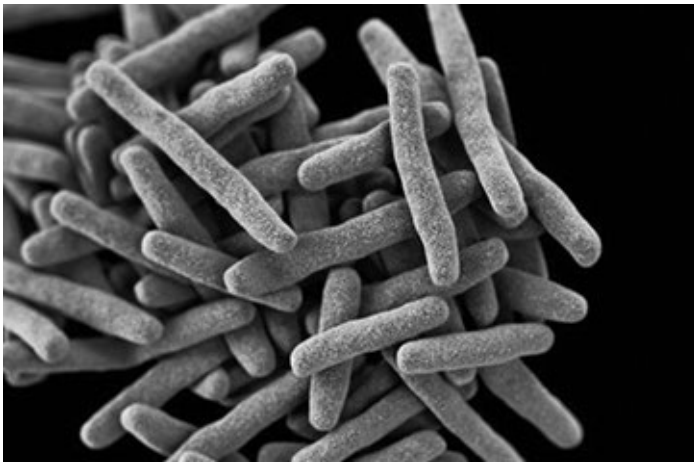
Clostridium tetani bacteria are shaped like tiny tennis rackets.

Those with tetanus require immediate treatment with human tetanus immune globulin (TIG), aggressive wound care, drugs to control muscle spasms, antibiotics, and supportive care. A machine to help a person breathe may be required during treatment.

The best way to avoid tetanus is to be vaccinated against it before becoming infected.

TUBERCULOSIS: Bacterial Infection

Tuberculosis (or TB) is a disease that usually attacks the lungs, and is caused by the bacterium, *Mycobacterium tuberculosis*. It is transmitted when an infected person sneezes, coughs, speaks, or even sings, and spreads the bacteria to nearby persons. Worldwide, more than nine million cases of TB occur annually and about one million people die each year



SEM showing the exterior surface of a drug-resistant form of *Mycobacterium tuberculosis* bacteria.

from the disease.

Many people who are exposed to TB never become sick because their immune systems are able to fight the bacteria to stop them from multiplying. However, people with weakened immune systems, such as those with HIV infections or diabetes, will develop the disease. Following natural disasters, people gather at crowded relief centers where tuberculosis infection can become a major problem. Under these conditions, people become exposed to many different diseases with the result that their physical condition can

weaken, making them prime candidates for infections.

Symptoms of TB include severe cough, chest pains, coughing up blood or sputum, weakness and fatigue, weight loss of appetite, chills, fever, and night sweats.

Treatment for TB involves administration of a combination of several drugs over a period of six to nine months. People having TB must complete the treatment regimen as prescribed, otherwise the TB bacteria will remain alive in their bodies, and they may become resistant to medications and harder to treat.

TYPHOID FEVER: Bacterial Infection

Typhoid fever is caused by the bacterium *Salmonella typhi*, which lives only in humans. Persons with typhoid fever carry the bacteria in their bloodstream and intestinal tract. In addition, a small number of persons, called carriers, recover from Typhoid fever, but continue to carry the bacteria. Both ill persons and carriers shed *S. typhi* in their feces (stool). The disease is spread through contact with food or water contaminated by fecal matter or sewage. Victims exhibit sustained high fevers. If left untreated, mortality rates can reach 20%.



Salmonella typhi bacteria forms toxins that can cause septic shock and death. It is different from the non-typhoidal bacteria, *Salmonella enterica*, which results in food poisoning.

You can get typhoid fever if you eat food or drink beverages that have been handled by a person who is shedding *S. typhi*, or if sewage contaminated with the bacteria gets into the water you use for drinking or washing food. Therefore, typhoid fever is more

common in areas of the world where hand washing is less frequent, and water and food is likely to be contaminated with sewage.

Once the bacteria are eaten or drunk, they multiply and spread into the bloodstream. The body reacts with a rash of red spots on the abdomen and chest. Other symptoms include abdominal tenderness, agitation, bloody stools, chills, confusion, difficulty paying attention, delirium, hallucinations, nosebleeds, severe fatigue (slow, sluggish lethargic feeling), and weakness.

Typhoid fever can usually be successfully treated with antibiotics and fluid intake. Death may result if it is not treated. About 400 cases occur each year in the US, and 75% of these are acquired while traveling internationally. Typhoid fever is still common in the developing world, where it affects about 21.5 million persons each year.

Typhoid prevention consists of ensuring safe water and food supplies.

MATERIALS

Teacher

- Projector or interactive white board to display the “News Article” (p. 28)
- Set of certification icons for distribution to each student at the conclusion of the activity (p. 30–31)

Per Team of Four Students

- Access to a computer and printer
- Chart paper or access to PowerPoint® or Keynote® presentation application software
- Copy of “Medical Briefing Report”
- Copy of the WHO Report: *Public Health Risk Assessment and Interventions Report: Typhoon Haiyan Philippines* available

Per Student

- Copy of the “News Article” (p. 28)
- Notebook, journal or folder, and passport

Optional

- If computer access is an issue, disease information cards have been provided for you to distribute to students (see p. 32–33)

4. Disease Threats in the Disaster Zone

SETUP

Just prior to class, use an online mapping program (such as Google Maps) to locate the Philippines and zoom the map out, so that students can see the location of the Philippines relative to the US and other countries around the world. Project the map on the whiteboard, or use a World map hung on a wall

Download and print copies of *Public Health Risk Assessment and Interventions: Typhoon Haiyan Philippines* (one per group), or let them read it on their computers (available at <http://www.bioedonline.org/lessons-and-more/focus-on-stem/operation-rescue/>).

Depending on the age and maturity of students, or in the event that computer access is unavailable, photocopy, cut out and distribute the “Disease Information Cards (p. 32–33) as part of step 3 (see “Procedure, p. 27).

CAUTION

Make certain that students have access to “student safe” search engines in school or at home prior to gathering information from sources on the Internet. You may wish to preselect websites containing information about diseases as several websites contain images that are inappropriate for or disturbing to some students. (See “Resources,” p. 27.)

PROCEDURE

1. Use a projector or interactive whiteboard to display the news story, “Community efforts necessary to prevent dengue outbreak in Tacloban City.” Read or have students read the first few paragraphs. Students will learn that the first cases of dengue fever occurred in the storm refugee population in Tacloban City shortly after the storm. Since dengue is endemic to the area, large outbreaks of dengue and other diseases could happen at any time.
2. Ask students, *How many of you have heard of dengue fever? How about leptospirosis? Do you think it will be important to know about the diseases that might affect the storm victims?* Conduct a

brief discussion with students. Point out that knowledge of the treatments and preventive measures are essential to making good decisions on what medical and other supplies should be chosen for delivery by the relief flight.

3. Assign each team a different disease to research. Each team's members will become experts in the causes, symptoms, preventive measures and treatment, and mortality rate of the assigned disease. The diseases are: cholera, dengue fever, leptospirosis, malaria, measles, tetanus, tuberculosis, and typhoid fever. If you have additional student groups, the following diseases also may be included: dysentery, shigellosis, hepatitis, meningitis, and/or chikungunya.
4. Have teams conduct their research online (see "Caution" p. 26 and "Resources," right), and the WHO report to produce a briefing report to present to the other teams. The report should consist of a written briefing page and some sort of graphic display such as a poster or electronic presentation (e.g., PowerPoint®). Give each team a copy of the briefing report format to guide their research. Post a list of approved websites for their research or bookmark the sites on student computers. Students will include the sources of their information in their presentations. If computer access is not available, teams may use the short disease description cards to begin their research.
5. After teams have prepared their reports and presentations, hold a disease familiarization conference. Permit each group 5 to 10 minutes to report on what they learned about the assigned disease. If more than one team has been assigned the same disease, allow those teams to cooperate in giving the briefing. Have students in other teams take notes during each briefing. When the briefings are completed, open the conference for questions.

6. Finally, have students refer to their notes to determine whether there are immunizations available for any of the possible diseases threats.
7. Have each student label one of the pages in his or her passport with the title, "Disease Briefing." Below the title, they should list the diseases on which they have been briefed. Have them note if the disease can be treated with antibiotics, if the disease can be prevented with a vaccine, or if the disease can only be managed with supportive care. Present each student with a dated certification icon to document that he or she is familiar with the diseases that may affect individuals in the disaster location. Also provide students with an icon to indicate he or she knows which vaccinations to take and/or have on hand for the mission. Have them glue or tape both icons into their passports.

RESOURCES

1. The US Center for Disease Control and Prevention (www.cdc.gov) provides accurate information on all infectious diseases. Have students use the alphabetical index at the top of the main CDC web page to locate information about their assigned diseases, or use the search box in the upper right hand corner. The site contains information in English and Spanish.
2. Additional comprehensive health websites with easy to use search functions are given below.

Medline Plus

<http://www.nlm.nih.gov/medlineplus/>

US National Library of Medicine

<http://www.nlm.nih.gov/>

World Health Organization

<http://www.who.int/en/>

Students may search the health topics list at the WHO website, or use the search box in the upper right hand corner of the home page. ■



News Article

Community efforts necessary to prevent dengue outbreak in Tacloban City

By Consuelo B. Alarcon

Republic of the Philippines, Philippine Information Agency

TACLOBAN CITY, Leyte — With the continuous downpour of rains in many typhoon-stricken areas in Region 8 particularly in Tacloban City, the Department of Health has repeatedly asking for community involvement for fear of a possible dengue fever outbreak.

During Tuesday's Regional Disaster Risk Reduction and Management Council Meeting held at Leyte Sports Development Center, Department of Health Region 8 Director Jose Llacuna reported that from January 1 to 14, an increase number of dengue fever which is totaled to 56 has alarmed the local health authorities in the region.

Within two weeks, most of the reported cases come from Tacloban City which was recorded at 26 while the municipalities of Babatngon has registered 21 cases, 3 from Palo, 2 from Macarthur, and 1 each from Dulag, Alang-Alang and Carigara, all from the Province of Leyte.

However, Llacuna did not mention any reported cases in other areas for the first two weeks of this month.

Aside from the heavy downpour of rains due to low pressure area off Mindanao region, other contributing factors could be uncollected

garbage still scattered in interior places that may serve as breeding sites for mosquitoes and the presence of adult mosquitoes carrying the virus.

Llacuna has explained that the tendency to spread the disease is great when there are too many adult mosquitoes.

Hence, the health official is calling everyone to observe the so-called **4-S** namely **Search** and destroy the breeding sites of mosquitoes, **Seek** early consultation when one get a high fever for two or more days to prevent death, **Self-protection** method by using long sleeves, pajamas or anything that could cover the body of a person and lastly, **Say** yes to fogging.

Ordinarily, fogging is not being advised by health experts as it contains chemicals that may endanger the health of the people especially those with lung problems. But, in this extraordinary times after super typhoon Yolanda has devastated most areas in the region, fogging is being recommended but with caution that should be done by the technical people only as it may also harm the health of the people. ■

TEAM NAME



DISEASE NAME

Medical Briefing Report

Complete the sections below based upon the disease you researched. Use the back of this sheet if you need more room.

1. **Cause**

2. **Symptoms**

3. **Prevention**

4. **Treatment**

5. **Other facts**, such as infection rate (how many people get the disease), mortality rate (number of deaths from the disease), where it occurs (location/geography), etc.

 _____ date	 _____ date	 _____ date	 _____ date
 _____ date	 _____ date	 _____ date	 _____ date
 _____ date	 _____ date	 _____ date	 _____ date
 _____ date	 _____ date	 _____ date	 _____ date
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CHOLERA



Cholera (kol-er-uh) is an acute diarrheal illness caused by infection of the intestine by the bacterium, *Vibrio cholerae*. Each year, there are an estimated 3–5 million cholera cases worldwide, resulting in more than 100,000 deaths. The infection often is mild, or even without symptoms. However, approximately 5% of cholera cases are severe, characterized by profuse watery diarrhea, vomiting and leg cramps. In these patients, rapid loss of body fluids leads to dehydration and shock. Without treatment, death can occur within hours.

Treatment: The goal is to replace lost fluids and electrolytes with a simple rehydration solution, oral rehydration salts. The solution is available as a powder that can be reconstituted in boiled or bottled water. Without rehydration, approximately half of cholera patients die. With treatment, the number of fatalities drops to less than 1%.

DENGUE



Dengue (deng-gee) fever is caused by any one of four closely related dengue viruses, which are transmitted to humans by the bite of an infected *Aedes* mosquito. It is estimated that there are more than 100 million cases of dengue worldwide each year. Symptoms include a high fever, severe headache and pain behind the eyes, in joints, muscles and bones, rash and mild bleeding (such as nose or gums bleeding). Generally, younger children and those with their first dengue infection have milder symptoms than do older children and adults.

Treatment: There is no specific medication for a dengue infection. Persons who may have dengue should use pain relievers with acetaminophen, avoiding those that contain aspirin, which can increase the bleeding risk. They also should rest, drink plenty of fluids and consult a physician. Patients who experience worsening symptoms (e.g., vomiting and severe abdominal pain) within 24 hours after the fever declines should go immediately to the hospital.

LEPTOSPIROSIS



Leptospirosis (lep-toh-spahy-roh-sis) is a disease that infects both humans and animals. It is caused by *Leptospira* bacteria. Some victims may be infected but not show any symptoms of the disease. Those who do show signs of the disease may have high fever, headache, chills, muscle aches, jaundice (yellow skin and eyes), abdominal pain, diarrhea, and rashes. These can easily be mistaken for other diseases. Leptospirosis is contracted (caught) by contact with the urine from infected animals. This can happen when flooding and major storms disrupts normal drainage. The infection can lead to kidney damage, meningitis, liver failure, respiratory problems and death.

Treatment: The infection can be treated with antibiotics.

MALARIA



Malaria (muh-lair-ee-uh) is a serious, sometimes fatal disease caused by a *Plasmodium* parasite that commonly infects *Anopheles* mosquitoes. People bitten by these mosquitoes can become very sick with malaria, which typically includes high fevers, shaking chills and other flu-like symptoms. Malaria can be deadly, but illness and death usually can be prevented with treatment. About 3.3 billion people live in countries and territories with the greatest malaria risk. The World Health Organization estimates that in 2010, malaria caused 219 million clinical episodes, and 660,000 deaths worldwide.

Treatment: There are about four common antimalarial drugs used today. The history of antimalarial medicine has been a constant struggle between evolving drug-resistant parasites and the search for new drug formulations to combat them. In many parts of the world, resistance to the disease has rendered many drugs ineffective.

MEASLES



Measles (mee-zuh lz) is a respiratory disease caused by the *Morbillivirus* (also called measles virus). Some people also know the disease as rubella. The measles virus normally grows in cells that line the back of the throat and lungs. It spreads through the air by breathing, coughing or sneezing, and is so contagious that any unimmunized child exposed to it will probably get the disease. The illness is characterized by fever, runny nose, coughing and a body-wide rash. Measles outbreaks are more likely and dangerous when many people are forced to live in close quarters, which often is the case after a natural disaster.

Treatment: There is no direct treatment, but over-the-counter medications such as acetaminophen, ibuprofen or naproxen help to relieve the fever that accompanies measles. Aspirin should be avoided for children as there is a risk for Reye's syndrome, a rare but potentially fatal disease. Measles can be prevented by the combination MMR (measles, mumps and rubella) vaccine.

TETANUS



Tetanus (tet-n-uh s) is a serious disease caused by a bacterial toxin, *Clostridium tetani*. Tetanus produces painful muscle stiffness and can be deadly. In children, tetanus begins with headache, jaw cramping and muscle spasms. The bacteria that cause tetanus are found in soil. They can enter the body through a skin puncture, a burn or an animal bite. Tetanus does not spread from one person to another.

Treatment: There is no cure for tetanus, but vaccines can prevent infection. Treatment for those with tetanus consists of wound care, medications to ease symptoms and supportive care.

TUBERCULOSIS



Tuberculosis (too-bur-kyuh-loh-sis), or TB, is caused by bacteria called *Mycobacterium tuberculosis*, and it generally affects the lungs, though it can affect any other organ of the body. The bacteria is spread when an infected person sneezes, coughs or even speaks. Many people who exposed to TB do not become sick because their immune systems are able to fight off the bacteria. However some people develop the disease. Following natural disasters as people gather at relief centers, TB can be easily spread. Symptoms include: sever cough, coughing up blood, chest pain, weakness, fatigue, weight loss of appetite, chills, fever and night sweats.

Treatment: Generally TB can be treated with antibiotics that must be taken from 6 months to two years. However some infections are resistant to the medications and are more difficult to treat because some people stop taking their medications. It is important for people to use and complete their medications to minimize the spread of drug-resistant forms of the bacteria.

TYPHOID



Typhoid (tahy-foid) fever is a life-threatening illness caused by the bacterium, *Salmonella typhi*. It is estimated that approximately 5,700 cases occur annually in the United States. Most infections (up to 75%) are acquired while traveling internationally. Typhoid fever is still common in the developing world, where it affects about 21.5 million persons each year. You can contract typhoid fever if you eat food or drink beverages that have been handled by a person shedding *Salmonella typhi*; or if sewage contaminated with *S. typhi* bacteria gets into drinking water, or water used to wash food. Thus, typhoid fever is most common in places where hand washing is less frequent and water is likely to be contaminated with sewage.

Treatment: Typhoid fever usually can be treated with antibiotics. However, antibiotic-resistant bacteria are a growing problem in the treatment of typhoid, especially in the developing world.



Crises Planning



OVERVIEW

Based on the information presented by teams during their disease briefings, each team selects basic needs, a disease, or a set of diseases they will address through their mission. Each team creates a supply list. Time: One to two 45–60 minute sessions

Many organizations, such as the International Federation of Red Cross and Red Crescent Societies, Heart to Heart International, Médecins Sans Frontières/Doctors Without Borders, United Nations International Children’s Emergency Fund (UNICEF), and the World Health Organization, provide humanitarian relief to people worldwide who are impacted by natural disasters. Most of these organizations are able to respond very rapidly to emergencies that affect large numbers of people because they already are prepared to bring standard relief supplies and aid before an event happens, such as for a tropical storm or volcanic eruption.

For example, UNICEF airlifted water purification tablets, medical kits, nutritional supplements, tarps, and “blue buckets” (containing a blanket, hand soap, tooth brushes and other basic items), and began a large scale measles immunization campaign in Tacloban City shortly after the typhoon struck.

In this activity, students will apply their new knowledge about diseases and select a goal for their relief flight related to disease prevention and health.

MATERIALS

Teacher

- Projector or interactive white board, or World Map hung on a wall

Per Team of Four Students

- Copy of *Four Months After Typhoon Haiyan, Philippines: Progress Report*, UNICEF



Power, water and sewage systems were completely destroyed in Tacloban City and other areas of the country. Shown above, two U.S. Marines distribute potable water to survivors.

- Copy of “Mission Goal and Relief Supplies Checklist” page

Per Student

- Notebook, journal or folder, and passport

SETUP

Prior to class, find one or more video stories produced by UNICEF about the crisis in the Philippines, such as the following.

2015 UNICEF Tap Project

<https://www.youtube.com/watch?v=-G3BfoSK6GM>

UNICEF USA: What’s Inside the Blue Bucket?

<https://www.youtube.com/watch?v=zRtTCp2kvcs>

If you are not able to access YouTube in your school, download the videos in advance, by pasting the URLs above into a free web service such as SaveFrom (<http://www.savefrom.net>) and KeepVid (<http://www.keepvid.com>).

Download *Four Months After Typhoon Haiyan, Philippines: Progress Report* from BioEd Online. Make one copy per team). <http://www.bioedonline.org/lessons-and-more/focus-on-stem/operation-rescue/>

Note: Student teams will need their completed student sheets for Activity 7, “Designing and Constructing Payloads.”

CAUTION

Make certain that students have access to “student safe” search engines in school or at home prior to gathering information from sources on the Internet. You may wish to preselect websites containing information about diseases as several websites contain images that are inappropriate for or disturbing to some students.

PROCEDURE

1. Remind students that they just have learned about disease threats to people living in areas affected by Typhoon Yolanda. Mention that they learned there are many different ways to prevent diseases in emergency situations. Ask students for examples of ways to reduce the spread of infectious diseases (provide clean water; vaccinate people against measles/other diseases; treat infected people with antibiotics so that other people do not become ill, treat wounds).
2. Show the video stories. Both videos were prepared by UNICEF and describe relief efforts in the Philippines. Conduct a short discussions of the problems that were addressed in each of the stories.
3. Provide each team with a copy of “Mission Goal and Relief Supplies Checklist,” and *Four Months After Typhoon Haiyan, Philippines: Progress Report*. Have the students think about

the disease information that was presented by each of the teams. Then, have each team decide on a goal for their mission. The goal might be related to preventing or treating a disease or group of diseases, or to improve a condition that contributes to disease. Examples include targeting mosquito borne illnesses by bringing insect nets, insect traps, repellents and tents; selecting a particular disease like measles and supplying vaccines or other related medical supplies, and educational materials about the disease; or choosing to focus on the basic needs of the people caught in the situation.

4. Once each team has selected the disease or needs to address, have them brainstorm possible supplies that might be necessary for their mission. Compare this task to creating a shopping list. Assist teams in making their selections. For example, ask them, *What should be done to prevent mosquito bites?* (personal repellents, mosquito netting for beds, sprays, etc.). *What can be done to improve water supplies?* (water filters, disinfection tablets, chlorine, etc.). Students may want to conduct additional research about the kinds of supplies needed, by visiting the websites of international relief organizations, such as the ones listed under “Resources,” below (see “Caution,” left column).
5. Have teams put their checklists in their notebooks for later planning of the flight manifest.

RESOURCES

Heart to Heart International

<http://www.hearttoheart.org>

International Federation of Red Cross and Red Crescent Societies

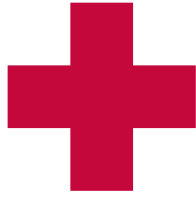
<http://media.ifrc.org/ifrc/>

Médicines Sans Frontières/Doctors Without Borders

<http://www.doctorswithoutborders.org>

United Nations International Children’s Emergency Fund (UNICEF)

<http://www.unicef.org>



Mission Goal and Relief Supplies Checklist

1. Describe the goal of your relief mission in the space below.

2. Rank the supplies that would help you to accomplish your goal with "1" being the most critical. Include specific supplies that you would include in the spaces provided. You may continue to adjust this list as you plan your mission. Use the back of this sheet if you need more room to list specific items.

RANK	AID TYPE	SPECIFIC ITEMS	
_____	Bottled drinking water	_____	_____
_____	Clothing and blankets	_____	_____
_____	Food	_____	_____
_____	Medical chest (refrigerated)*	_____	_____
_____	Medical supplies	_____	_____
_____	Mosquito defense	_____	_____
_____	Portable hospital	_____	_____
_____	Portable latrines	_____	_____
_____	Other	_____	_____

* Refrigerated medical chests come loaded with medicines, vaccines and any other items that need to be kept cool.



Using Web-based Navigation Tools

OVERVIEW

Student teams will learn how to use the Google Earth program with specific emphasis on controls and techniques for plotting an air route for their Tacloban City aid mission. Time: Two to four 45-60 minute sessions

Google's Earth Pro software is a photograph and satellite image database of planet Earth that is available on the Internet. Millions of pictures from space and from the ground have been stitched together to create an interactive world globe. Enter a location anywhere around the world and the program rotates a world globe to the exact location and zooms in to a bird's eye view.

Using a variety of simple tools and controls, it is possible to show roads, names, borders, buildings, businesses, and even current cloud cover. Location can be selected by entering the name and country of the location or by its geographic coordinates. Like

Internet map programs, a set of directions can be generated by entering the starting location and the destination. The Ruler tool can be used to determine the distance between points. These and other controls make Earth Pro a highly effective geographic teaching and research tool.

In *Operation Rescue*, Earth Pro is the primary planning tool for the route plan. Students will use it to locate airports within the flight range of the C-130 Hercules aircraft and confirm that the airports have sufficiently long runways for safe landings and takeoff. In this activity, teams will learn how to use the Earth Pro software program, then take and pass a navigator certification exam.



Capt. Jake Morgan, a U.S. Air Force C-130 aircraft navigator, monitors radio traffic on approach to Tacloban City Airport, Nov. 18, 2013.

MATERIALS

Teacher

- Projector or interactive white board to demonstrate the functions of Earth Pro software.
- Copy of "Navigation Training" pages (p. 39-43)
- Pair of scissors
- Set of certification icons for distribution to each student after he or she has passed the exam with a score of at least 80 points (p. 47)

Per Team of Two Students

- Earth Pro software installed on a computer.
- Set of "Navigation Training" page and four modules (p. 39-43)

- Tape (clear) or glue sticks

Per Student

- Copy of the “Navigator Certification Exam” and Navigator Certification Exam Key” pages (p. 44–46; see “Setup”)
- Notebook, journal or folder, and passport

SETUP

Prior to class, follow the directions below to install Google’s Earth Pro software (free) for PC, Mac, or Linux systems onto your computer and on computers the students will use.

Google’s Earth Pro Software

<https://www.google.com/earth/desktop/>

Double-click the downloaded file and follow instructions to install the software. You may need administrative privileges to install the software. Contact the campus technologist or IT representative if needed.

Launch Earth Pro by double clicking its icon in the Applications folder (Mac); or on the desktop or in the Start menu (PC). Practice using the program’s navigation controls by finding your school’s location and the location of Tacloban City, Philippines. Also practice using the magnification controls to enlarge the local view. Refer to the four modules (p. 40–43) for instructions.

Have the program open on student computers prior to class.

Have students work in teams of two within each established group of First Responder International teams. Allow time for each team member to practice and become comfortable using the software tools.

Note: Do not distribute the “Navigator Certification Exam Key” sheets until after students have completed the “Navigator Certification Exam” (Item 1, Part 2).

PROCEDURE

Part 1. Navigation Training

1. Use a projector or interactive white board to
6. Using Web-based Navigation Tools

demonstrate the functions of Earth Pro software, then allow students explore the software tools on their own.

2. Provide each team of two students with a set of “Navigation Training” pages, which include four training modules. Give students enough time to complete and practice with the tools in each module. When all students are ready, proceed to Part 2.

Part 2. Navigator Certification Exam

1. Distribute copies of and have students take the certification exam (one per student).
2. After students have completed the exam, distribute copies of the “Navigator Certification Exam Key” page. Have students score their own exams. To pass the exam, each student needs to earn 80 points.

Have students revisit the appropriate training module or modules for incorrect items. Or, have students who have passed the exam assist those that need help through peer mentoring.

3. When all teams score 80 or higher on the exam, they are ready to proceed with the activity.
4. Have student teams place their completed modules, exams and personal score sheets in their notebooks.
5. Instruct students to write “Navigation Certification” on a blank page in their passports.
6. Provide each student with a dated icon signifying that each has had navigation training and passed the Navigator Certification Exam. Have students glue or tape the icons into their passports.

RESOURCES

Find help and learn more about Google’s Earth Pro software at the following website.

Help with Google Earth Pro for Desktop

<https://support.google.com/earth/?hl=en#topic=7364880>



Navigation Training

TEAM MEMBER

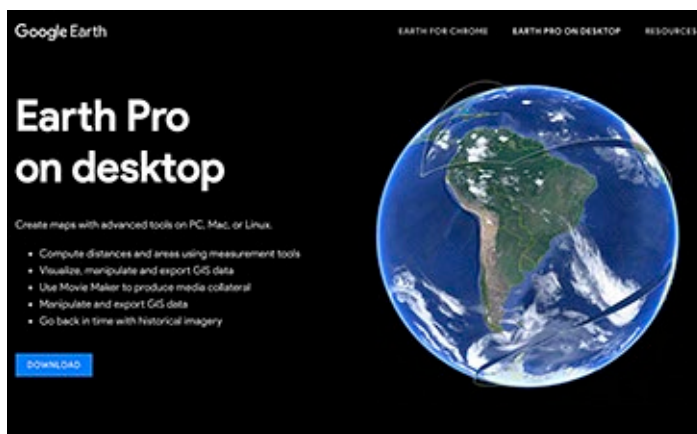
Part 1

Before planning your mission as members of the Operation Rescue team, you need to become proficient with Google's Earth Pro software. Earth Pro provides the tools needed to plan the shortest and most efficient air route for your C-130 Hercules aircraft rescue mission. An overview of the training modules explains the controls and functions of Google's Earth Pro software.

- An introductory window appears when you open the program. It shows planet Earth against a background of stars. A small window may appear over the Earth with a tip for using the program. Read the tip and close it.
- Along the left side of the window, across the top, and on the upper right side are controls which will allow you to display the borders of countries, roads, place names, and additional information.
- At the top left, are search controls where you enter addresses, names, or geographic coordinates that will take you to the place you are looking for.
- The menu bars along the top have special commands, such as a ruler for measuring distances.
- The top right has the controls for moving the Earth view on the screen and for zooming in or out.

Part 2

You will need to pass the Navigator Certification Exam with a score of 80 or above before you can plan the route for the actual Mission.





Module 1

Basic Navigation Tools

Instructions. Follow the instructions below to become familiar with basic navigation tools available in Earth Pro software. Work together, then separately and practice using the controls until both of you understand and know how to use the tools.

1. The upper right corner of the program has a circular compass for determining direction. The small V shaped arrowheads moves the direction the north mark (N) points on your screen or by pushing the “r” key.

Try clicking and holding one of the arrowheads as you drag it around. Watch what happens to Earth as you do this. You can return the N mark to the top by clicking on it and dragging it to the desired place.

2. The circle below the compass enables the Earth image to rotate in any direction. Click on the arrows and watch what happens.
3. The vertical bar with the “+” and “-“ signs is a sliding control. Move the slider up or down to zoom toward or away from Earth. Try it.
4. The Hand control appears when you move your mouse over the picture of Earth. The fingers are open until you click and hold the mouse. You can drag the image of Earth in any desired direction and it will rotate.

Start the Earth rotating and then release the mouse. The Earth image will keep rotating for a short while in that direction. To stop it, click the mouse again.

5. The final control is a small figure of a person. It doesn’t appear until you zoom almost to the surface of Earth.

Click and hold on the person and then drag the person to a particular place you are interested in seeing closer.

The view will take you to street level. If any pictures of that location are available, you will be able to explore them and even turn in circles to see in all directions. Not all places have been photographed from the ground. Google adds pictures periodically.

When you want to go back to the view from above, click on the Exit Street View button to the upper right.

6. Practice using the tools until both of you can easily operate them.

Note. Use the back of this sheet to describe any observations, tips or discoveries you made about how to navigate around Earth.



Module 2

How to Find Specific Places

Instructions. Follow the instructions below to become familiar with searching and locating different places on the planet. Work together, then separately and practice using the controls until both of you understand and know how to use the tools.

1. Go to the upper left corner to the word Search. Type in “Grand Canyon.”
provide a starting and a stopping address. Earth Pro will display a road map with the route and distances calculated for you. Get directions from your home to another city in the US.
2. Click “Search” and you will be taken to the Grand Canyon National Park. Use the slider control at the right to zoom in and zoom back. The canyon will be in view. Use your mouse to explore the canyon.
On the lower left of the screen is a menu marked “Layers.” Click on the Photos button. Hundreds of tiny squares appear on the image of the canyon. Click on any of them to see photos taken by park visitors.
3. Find the place where you live. Type your street address, city and state, and click “search.” Go to Layers again and click on roads to see street names.
4. The “Get Directions” tool requires that you
5. Practice finding additional locations in the US and other countries on Earth.
6. The “History” function provides you with a list of your previous searches.
Select one of your previous searches and go to it. Change the starting location from your home to another city. Do not change the destination city.
7. Practice using the tools until both of you can easily operate them.

Note. Use the back of this sheet to describe any observations, tips or discoveries you made about how to find specific places.



Module 3

Special Controls

Instructions. Follow the instructions below to become familiar with special controls available in Earth Pro. Work together, then separately and practice using the controls until both of you understand and know how to use the tools.

1. The lower left of the computer window shows a set of controls that add features to Earth Pro, such as places (cities and other features), roads, current weather and much more. Explore these controls and find out what they do.

Just to the right of the Search command is a small menu bar with controls that are important for the Mission.

2. Using the push pin button to pick out a route for Mission to follow. Click on the button. You will see a push pin on the screen with a flashing box surrounding it.

A window will open where you are asked to give the location a name.

Give the push pin a name. Click and drag the push pin to the desired location and then click OK in the window. The name of the push pin will appear beneath the Search area under My Places.

The push pin tool will come in handy when identifying potential airports you can use on

your rescue missions. It makes it easy to find them again.

If you wish, you can delete push pins from they are listed under My Places, or add more push pins. Practice placing and removing push pins.

3. The Ruler is used to measure distances between two points. When you click on it, you get two choices. “Line” is used for measuring the distance between two points. “Path” is used for measuring distances between several points on a long trip. You can choose the measuring units you want to use. Practice measuring distances between points on Earth.

As you identify airports for potential landing points in your rescue mission route, use the Ruler to measure how far apart the takeoff and landing airports are from each other. Both must be within the range of the C-130 Hercules aircraft (1,438 mi).

4. Practice using the tools until both of you can easily operate them.

Note. Use the back of this sheet to describe any observations, tips or discoveries you made about how to use the special controls.



Module 4

Latitude and Longitude

1. Latitude and longitude lines create a grid pattern like a graph that is used by navigators to find specific points on Earth's surface. Latitude lines run east and west parallel to Earth's equator. Longitude lines run from the north pole to the south pole, and back to the north pole on the opposite side of Earth. Latitude and longitude are very similar to the grid patterns of cities. When you describe a location, you might say something like "at the corner of 5th and Main streets." Latitude and longitude does the same thing, but with numbers instead of names.
2. To see latitude and longitude lines on Earth Pro, go to View in the top menu bar and select Grid. Observe how the lines are numbered.

Latitude lines (horizontal) start at the equator. For locations north of the equator, the lines are called north latitude lines and they are measured in degrees from 0 at the equator to 90N at the North Pole. Locations south of the equator are referred to as the south latitude lines, and they go from 0 at the equator to 90S degrees at the South Pole.

Longitude lines (vertical) begin in England

at the Prime Meridian and go west and east until they meet at the opposite side of Earth. East longitude lines range from 0 to 180W degrees, and west longitude lines go from 0 to 180E degrees.

3. To be more precise with locations, latitude and longitude degree lines are subdivided into minutes and seconds. This is similar to the way we tell time, using hours, minutes, and seconds. Using degrees, minutes and seconds provides very accurate locations on Earth.

Type the following in the Search box (*be accurate*), then click on the Search button.

N38 53 52.8 W77 02 11.04

Where did these coordinates take you?
(Hint: The President lives there.)

Congratulations! You have successfully completed navigation training using Earth Pro software.

Before taking the Navigator Qualifying Exam, review the instructions and your notes. If you have time, explore more of planet Earth using Earth Pro software.

Note. Use the back of this sheet to describe any observations, tips or discoveries you made about finding and using latitude and longitude tools.



Navigator Certification Exam

Instructions. Read each question below. Record the letter of the statement or phrase that best answers each question. Do not enter “Points” earned at this time.

1. Find Houston Hobby Airport. (Hint: Use the Earth Pro Search command to find it.) Locate the runways at the airport. Which runway is longer? (10 points)

A. Runway 12L 30L
B. Runway 4 22
C. They are both the same length.

Answer

Points

2. In what country is the city of Reykjavik? (5 points)

A. Ireland
B. Iceland
C. Russia

Answer

Points

3. How many runways does Reykjavik airport have? (5 points)

A. 2
B. 3
C. 4

Answer

Points

4. How many miles away is Reagan Washington National Airport from Houston Hobby Airport? (10 points)

A. 780 miles
B. 1025 miles
C. 1215 miles

Answer

Points

5. In which direction from the center of Washington D.C. is Reagan Washington National Airport? (10 points)

A. North
B. South
C. East
D. West

Answer

Points

6. You have landed your C-130 Hercules aircraft at Reykjavik. Your next planned stop is Oslo, Norway. The airplane has a maximum range of 1,438 miles. Can you make it to Oslo from Reykjavik? (10 points)

A. Yes.
B. No, it's too far.
C. You must stop in London to refuel before continuing to Oslo.

Answer

Points

7. What is the first country you come to directly east of Reykjavik? (5 points)

A. Sweden
B. Norway
C. Denmark

Answer

Points



Navigator Certification Exam

8. In which direction is the United States from Reykjavik? (10 points)

- A. Northwest
- B. Northeast
- C. Southwest
- D. Southeast

Answer

Points

9. Your C-130 Aircraft is in Lisbon, Portugal. You plan the following route to the city of Muscat, Oman.

- Lisbon, Portugal, to Rome, Italy
- Rome to Ankara, Turkey
- Ankara to Kuwait City, Kuwait
- Kuwait City to Muscat, Oman

What is the total distance of your trip from Lisbon to Muscat? (20 points)

- A. About 2800 miles
- B. About 3550 miles
- C. About 4100 miles

Answer

Points

10. Knowing the maximum range of the C-130 Hercules, can your aircraft fly from Los Angeles, California to Honolulu, Hawaii? (5 points)

- A. Yes
- B. No

Answer

Points

11. What do you find when your travel to the following coordinates? N36 O 56 W114 44 17 (10 points)

- A. The Statue of Liberty
- B. The United States Capital
- C. The Great Wall of China
- D. The Hoover Dam

Answer

Points

12. Find Tacloban City, Philippines. How close is this region to the Equator? Hint: Turn on the Grid. (5 points)

- A. About 11 degree north of the Equator
- B. About 9 degree south of the Equator
- C. About 7 degrees north of the Equator
- D. About 16 degrees south of the Equator

Answer

Points

TOTAL POINTS












Navigator Certification Exam Key

Instructions. Use the Key below to self-score your exam.

1. Fill in the “Points” box found underneath each question on your Navigator Certification Exam pages with points earned for correct answers. Leave the “Points” box blank for incorrect answers.
2. Add all points earned and record in the box “Total Points” underneath the last exam question on the last page of the exam.
3. You must earn 80 points to pass the certification exam.
4. If you have not earned at least 80 points, repeat the module or modules which address the area or areas in which you need additional practice.

Question	Correct Answer	Points Earned
1	C	10
2	B	5
3	B	5
4	C	10
5	B	10
6	A	10
7	A	5
8	D	5
9	C	20
10	B	5
11	D	10
12	A	5

 _____ <u>date</u>	 _____ <u>date</u>	 _____ <u>date</u>	 _____ <u>date</u>
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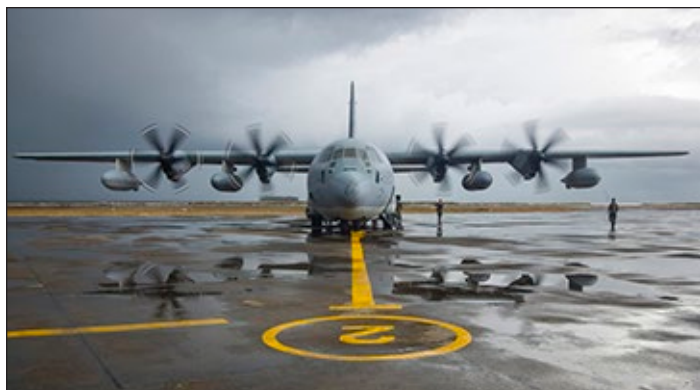
Designing and Constructing Payloads



OVERVIEW

Student teams will select the aid items their C-130 aircraft will take to the disaster site. To do so, they will not only need the information they collected in their notebooks during Activity 5, “Disease Threats in the Disaster Zone,” but will also need to know the capabilities of the C-130. In this activity, teams will learn about the aircraft, and how it carries and deliver supplies. Teams will construct model payload pallets and containers for holding the supplies, and use these scale models to plan for loading arrangement. Time: Two or three 45-60 minute sessions

The C-130 Hercules aircraft is a four-engine turboprop (turbine engine with propellers) military transport that first entered service in the 1950s. It is a versatile aircraft with many cargo transport capabilities. The C-130, which has more than 40 variations, is used for troop transport, cargo



A U.S. Marine Corps C-130 Hercules aircraft prepares to transport evacuees from Tacloban City airfield in the Philippines, Nov. 14, 2013. Many types of aircraft brought relief equipment and supplies from countries around the world, with coordinated staging areas, such as Clark Air Base north of Manila. *Note:* Supplies and access to immediate healthcare also came by ship to Tacloban, for example, via the U.S.N.S. George Washington, and the medical ship, the U.S.N.S. Mercy.

delivery, medical evacuation, airborne assault, search and rescue, aerial firefighting, aerial refueling, and, as in the mission for this activity, humanitarian aid.

The C-130 has an open interior or bay, much like a warehouse. Tracks in the bay floor permit large pallets to slide in through a ramp/rear door. Up to 5 large pallets, with a total weight (pallets and cargo) of about 35,000 pounds (15,876 kg), will fit inside. Once locked to the floor tracks, the ramp/door is closed and the mission can begin. Depending upon the mission, the plane can land at an airport for unloading, or drop its cargo with parachutes in undeveloped areas. For the latter, the rear door/ramp opens in flight and small drogue (drag) chutes pull the pallets out from the bay. Larger chutes open for the drop to the ground.

In this activity, teams’ cargoes will be parachute-dropped. (In the Philippines, cargo also was transferred to a staging area, then land vehicles or helicopters for final delivery.)

MATERIALS

Teacher (see “Setup”)

- Computer and projector, interactive white board or World Map posted on a wall



Airmen load equipment onto a Humvee at a staging ground in Guam (left). Prepared vehicles are loaded onto aircraft and used to reach remote areas. When landing a large aircraft is not an option, multiple parachutes are used to air drop equipment, vehicles and/or supplies.

- Link to or a downloaded version of the video, Air Force Personnel Load a C-130, from the Royal Australian Air force (<https://www.youtube.com/watch?v=VupecG2Kk9M>)
- Sidewalk chalk and yardstick
- Set of certification icons for distribution to each student at the conclusion of the activity (p. 61)

Per Team of Four Students

- Ballpoint pens
- Clear tape
- Copy of “Mission Brief: C-130 Hercules Aircraft” and “Cargo Manifest” pages (p. 51–53; see “Setup”)
- Copies of the “Load Pallets” on cardstock (p. 54–55; see “Setup”)
- Multiple copies of the nine cargo containers printed on card stock (p. 56–60)
- Pair of scissors
- Rulers or straight edges
- Completed copy of “Mission Goal and Relief Supplies Checklist” from Activity 5, “Crisis Planning”

Per Student

- Notebook, journal or folder, and passport

SETUP

If YouTube is not available in your school, download the video prior to class.

You also will need to make samples of the supply containers for display and for the students to use.

Special trucks are used to load pallets onto the C-130. Once each pallet is loaded it must manually be moved into position and secured before take-off.

Print the container templates on cardstock. Assemble one of each type for a demonstration and tape closed. Use a ruler to draw a straight line with a ballpoint pen to score the folds. This will make assembly easy and accurate.

Optional: A 48-in. x 34-in. (122-cm x 86-cm) scale model of a C-130 is available for free download at BioEd Online. It can be printed on a wide-format printer and laminated for extended use. (<http://www.bioedonline.org/lessons-and-more/focus-on-stem/operation-rescue/>)

Important: When printing templates on cardstock, be sure to open Adobe Acrobat’s print options for each file to ensure the “Shrink to Fit” option is *unchecked* in the PDF file. Each supply container is scaled to fit the scale model of a C-130 aircraft.

PROCEDURE

1. Show students the video, Air Force Personnel Load a C-130. Ask students if they ever have seen a similar type of airplane, and allow a short discussion.

2. Provide teams with the mission brief page about the C-130 Hercules Cargo Aircraft. Have them read and discuss it. Have them identify information critical to their mission (range, number of pallets, total cargo capacity). If time permits, allow teams to learn more about the aircraft through the resource sites. When finished, teams should include the briefing pages in their notebooks.

Tip: To help students visualize the C-130 aircraft and its payload space, use sidewalk chalk and mark off the actual size of the payload space on a playground area. The cargo bay (payload space) is a rectangular shape, 10 ft x 45 ft x 9 ft (3 m x 14 m x 2.7 m) in size. Each pallet is 10 ft x 9 ft (3 m x 2.7 m) without considering height.
3. Have teams meet and discuss and identify what supplies should be included in their cargo plan based on the team's "Mission Goal and Relief Supplies Checklist." Their plan should include supplies specific to their team goal and the needs of the people based on their ranking. Have teams use the pallet manifest forms based on the ranked priority on the checklist. The list will determine how many containers they must make.
4. As described under "Setup," prepare samples of the cargo containers for display. The patterns for each container should be printed on cardstock paper. Use clear tape to assemble one of each type. Use a ruler to draw a straight line with a ballpoint pen at the folds. This will make folding easy and accurate.
5. Exhibit the different containers. Each container has a description of its total weight. The small squares on the patterns represent one square foot. These marks will be useful in deciding how to stack the containers on the pallets. The total stack and pallet cannot weigh more than 7,000 pounds (3,175 kg) and cannot be more than 8 feet high (2.4 m). Containers may not extend beyond the edges of the pallets. An individual pallet with only its cargo straps and netting

weighs 500 pounds (227 kg). As a result, the combined container weight (of all of the containers in the aircraft) may be no more than 6,500 pounds (2,948 kg). Depending upon what teams include in their cargo manifest, individual pallets may weigh considerably less than 7,000 pounds (3,175 kg).

6. Give each team the patterns for five cargo load pallets to cut out, and a set of supply container templates, which they will cut out and assemble into boxes. Demonstrate the procedure. Based on their supply list, students will determine which types and sizes of containers to create.

Tip: Have students try larger containers first, because they are easier to assemble. Place extra copies of supply container pages in a central location for teams to use as needed.
7. When teams have constructed sufficient containers, have them arrange them on the pallets in the way they think best to achieve the maximum amount of cargo per pallet without exceeding height requirements.
8. At the completion of the activity, teams should place their loaded pallets in a place where they will not be disturbed. Present each student with a dated certification icon that he or she has completed load master training. Have students glue or tape the icons in their passports.

RESOURCES

Learn more about the C-130 Hercules and its variations at the following Websites.

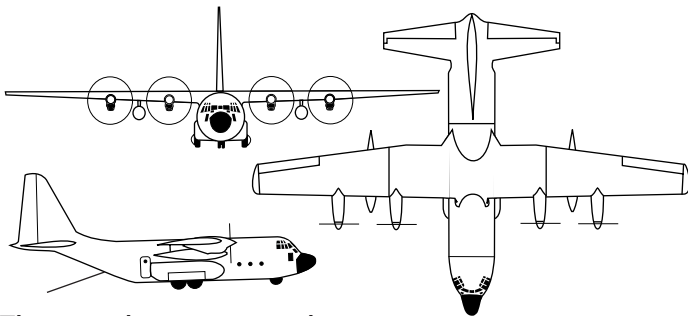
- http://en.wikipedia.org/wiki/Lockheed_C-130_Hercules
- <http://www.lockheedmartin.com/us/products/c130.html>
- <http://www.af.mil/information/factsheets/factsheet.asp?id=92>
- <http://military.discovery.com/tv-shows/great-planes/videos/great-planes-c130-hercules.htm> ■



Mission Brief: C-130 Hercules Aircraft



This C-130 landed at Romualdez Airport once the runways were cleared of debris. Notice the unloaded cargo, the crushed vehicle and debris in the foreground. It was several days after the typhoon hit before large aircraft could safely land.



The rear door opens to become a payload loading ramp.

The Lockheed Martin C-130 Hercules aircraft is a versatile and reliable cargo aircraft. It is used world-wide for air lift missions by the U.S. Air Force, Air National Guard, and other branches in the military. It is capable of being flown into and out of rough, dirt landing strips in remote

DETAILS

Length	97 ft, 9 in. (29.8 m)
Wingspan	132 ft, 7 in. (40.4 m)
Engines	4 turboprop engines (Allison T56-A-7); 16,800 total horse power
Cargo bay length	45 ft (13.7 m)
Cargo bay width	10 ft (3 m)
Cargo bay height	9 ft (2.7 m)
Pallets	5 loaded pallets
Rear loading ramp length	10.25 ft (3.1 m)
Normal payload weight	45,000 lbs (20,412 kg)
Speed	345 mph (555 km/h)
Distance needed for landing or takeoff (called Ground Roll)	3,000 ft (9.14 m)
Range (maximum distance the aircraft can fly before refueling)	1,438 miles (2,314 km)

areas of the world. The aircraft can handle heavy loads, transporting vehicles, resupplying Antarctic research stations, transporting troops, and carrying emergency aid relief equipment and medical supplies to disaster areas around the planet.



Cargo Manifest

Instructions

Review your team’s completed “Mission Goal and Relief Supplies Checklist.” Your cargo manifest should include supplies based on the ranking you assigned to them on the checklist. Discuss and identify what supplies to list/add to your team’s “Cargo Manifest.” This list will determine how many and what kind of containers you must make to fit on 5 cargo load pallets. Include as many fully-loaded pallets as possible to get the maximum number of relief supplies to survivors. Record the total weight of all pallets in the box on page 2 of this Cargo Manifest.

PALLET 1

Item	Box weight (lbs)	Number of boxes	Boxes total weight (lbs)
Pallet, cargo rings, cargo nets, straps	—	—	500

Total weight of Pallet 1 _____

PALLET 2

Item	Box weight (lbs)	Number of boxes	Boxes total weight (lbs)
Pallet, cargo rings, cargo nets, straps	—	—	500

Total weight of Pallet 2 _____



PALLET 3

Item	Box weight (lbs)	Number of boxes	Boxes total weight (lbs)
Pallet, cargo rings, cargo nets, straps	—	—	500

Total weight of Pallet 3 _____

PALLET 4

Item	Box weight (lbs)	Number of boxes	Boxes total weight (lbs)
Pallet, cargo rings, cargo nets, straps	—	—	500

Total weight of Pallet 4 _____

PALLET 5

Item	Box weight (lbs)	Number of boxes	Boxes total weight (lbs)
Pallet, cargo rings, cargo nets, straps	—	—	500

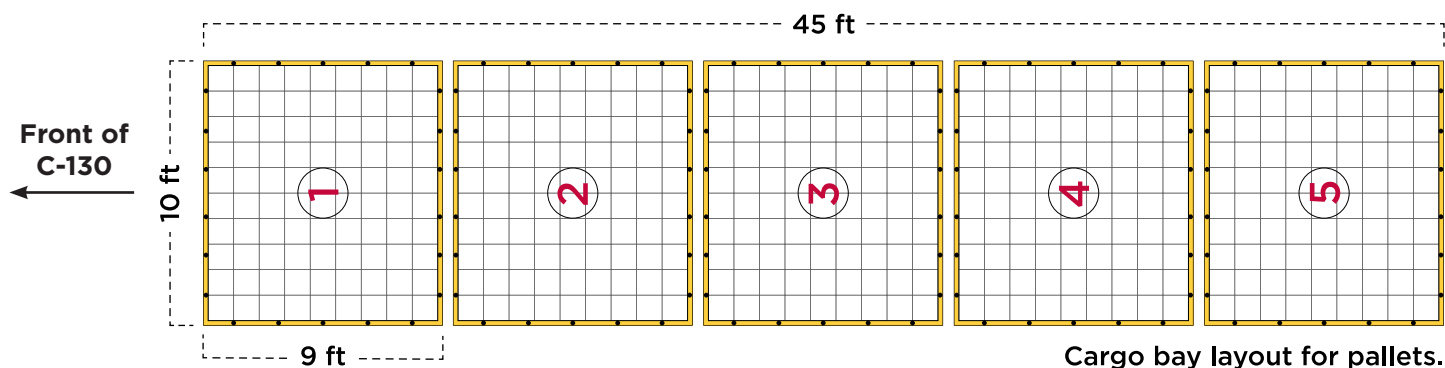
Total weight of Pallet 5 _____

Record the total weight (lbs) of your team's cargo.



Load Pallets

You will decide which and how many cargo containers to put onto each of five load pallets. You may mix container types on pallets. Keep in mind all aircraft restrictions (see below).



AIRCRAFT RESTRICTIONS

Load Pallet Weight

Each pallet comes with 22 rings (shown as black dots) for tie-down straps and nets to hold the cargo in place. One set of these weighs 500 pounds, which must be included in the total weight for each load pallet.

For example, if you load 6,500 pounds of cargo containers (equipment and supplies) on one pallet, the total weight of the load pallet will be 7,000 pounds ($6,500 + 500 = 7,000$).

Cargo Containers

Each container of supplies and equipment is marked with dimensions and weight.

Total Cargo Weight

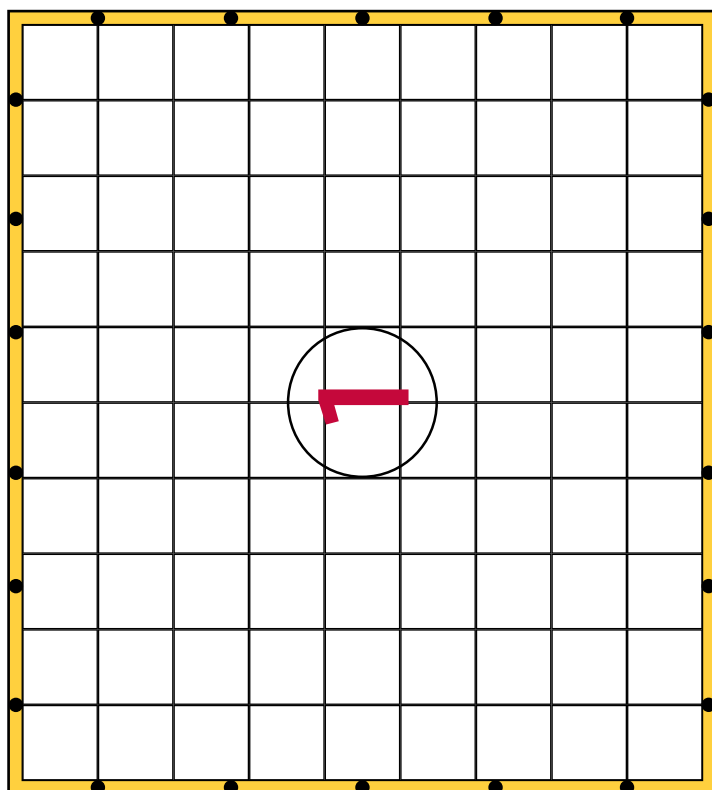
The maximum total cargo weight (5 pallets with cargo containers) to load on the aircraft is 35,000 pounds.

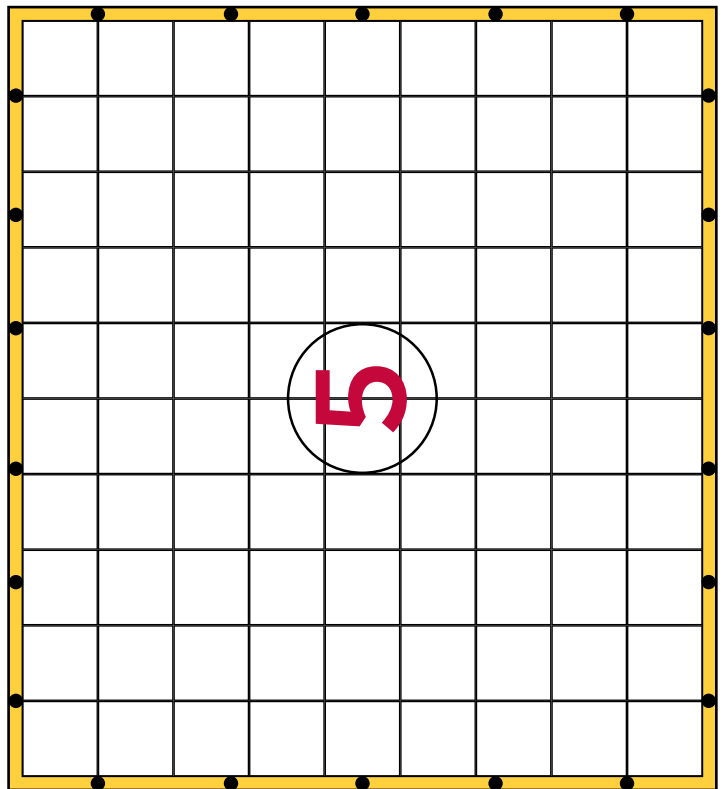
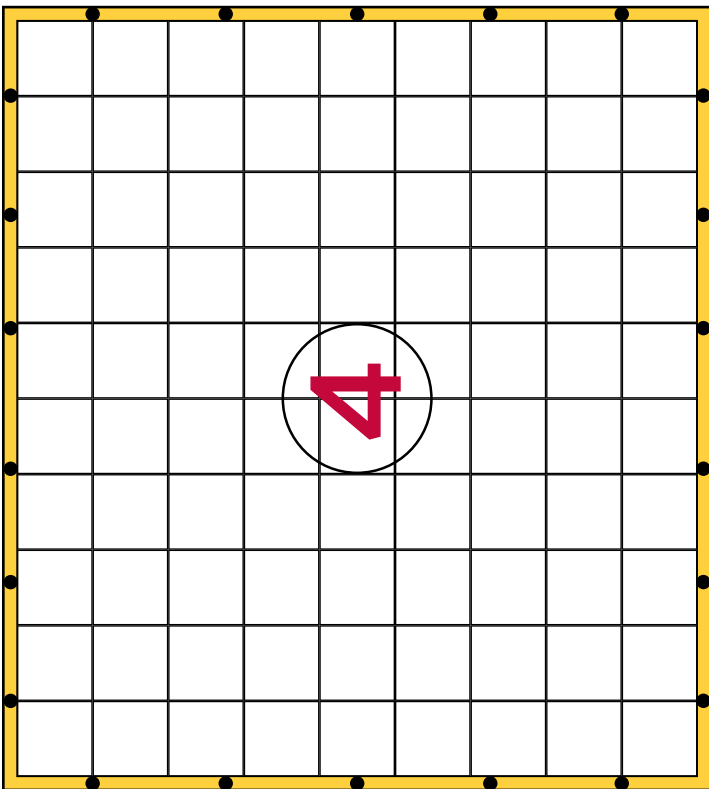
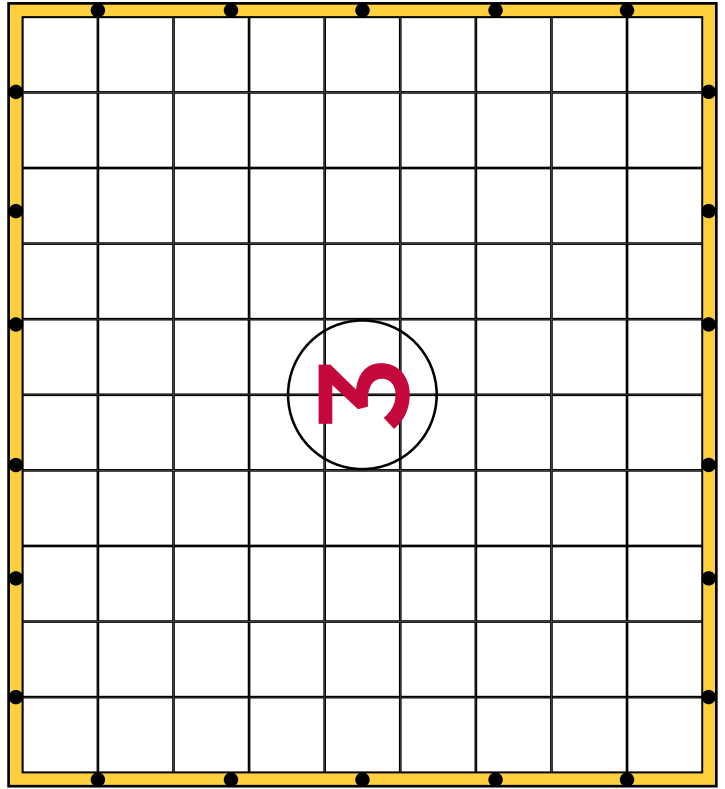
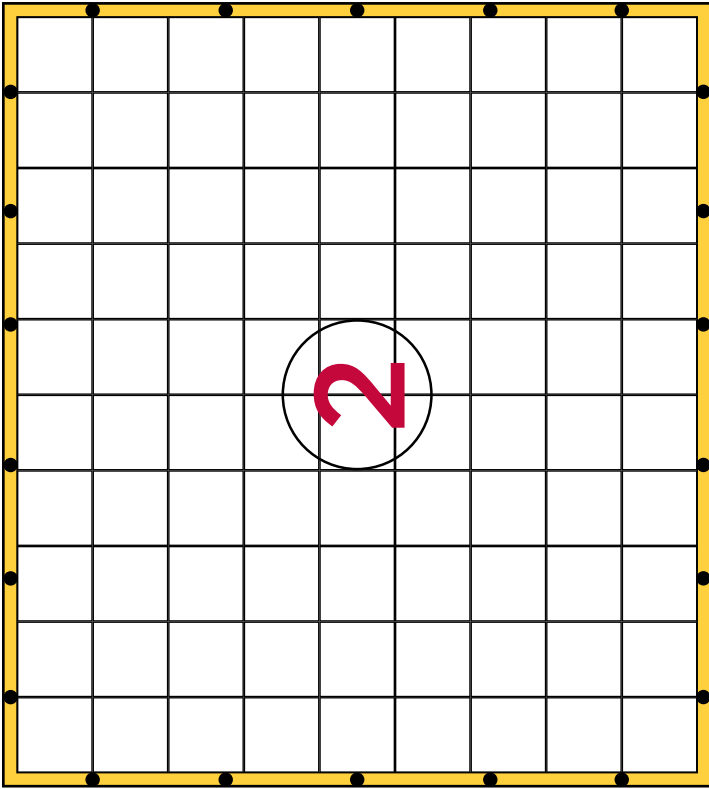
Maximum Height

Cargo containers can be stacked up to a maximum of 8 feet.

SCALE

Each white square on the large load pallets is 1 cm x 1 cm in size. Each centimeter equals 1 foot.

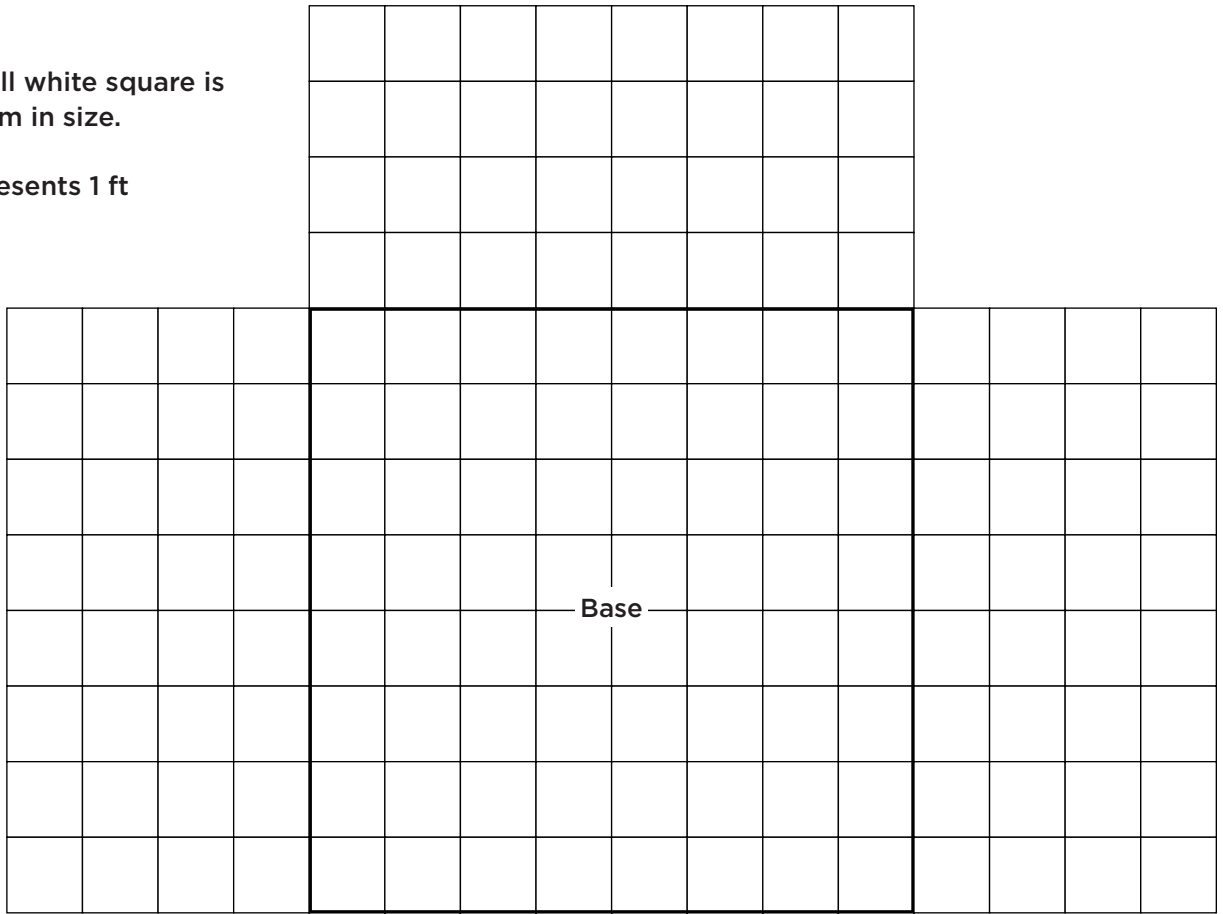




SCALE

Each small white square is 1 cm x 1 cm in size.

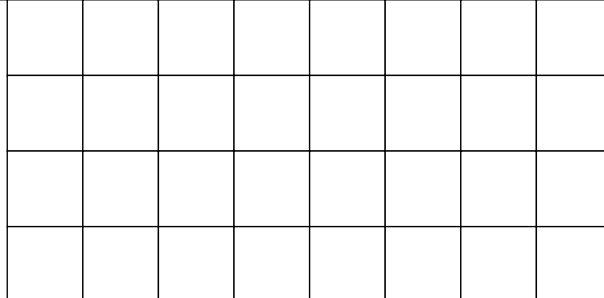
1 cm represents 1 ft



INSTRUCTIONS

1. Cut out the flattened container.
2. Score and fold down on the heavy lines that mark the base.
3. Tape the sides of the container together, so that the grid pattern is on the outside.
4. Score and fold the lid down. Tape the container closed.

Note: You will need the information on the lid of each container for the rest of the activity.



PORTABLE HOSPITAL
(Need 3 Containers for 1 Hospital)

Content(s)	
Autoclave	IV Stands
Flooring	Lights
Generator	Litters (cots)
Instruments	Refrigerator
Instrument trays	Tents

Dimensions:
8 ft x 8 ft x 4 ft

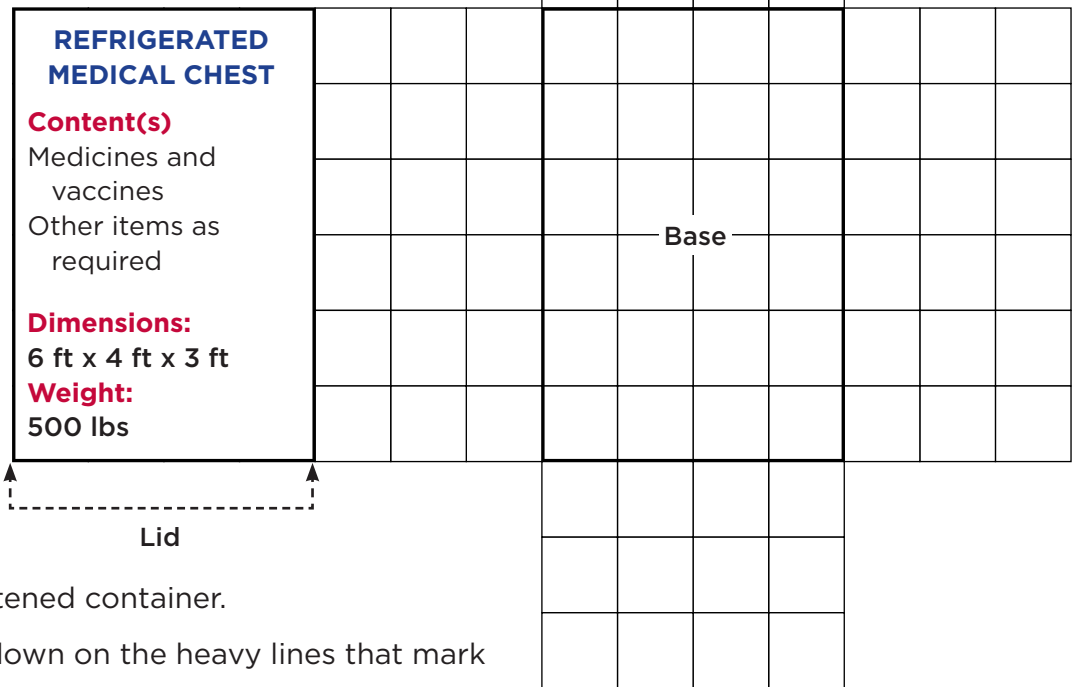
Loaded Weight:
1,500 lbs



SCALE

Each small white square is 1 cm x 1 cm in size.

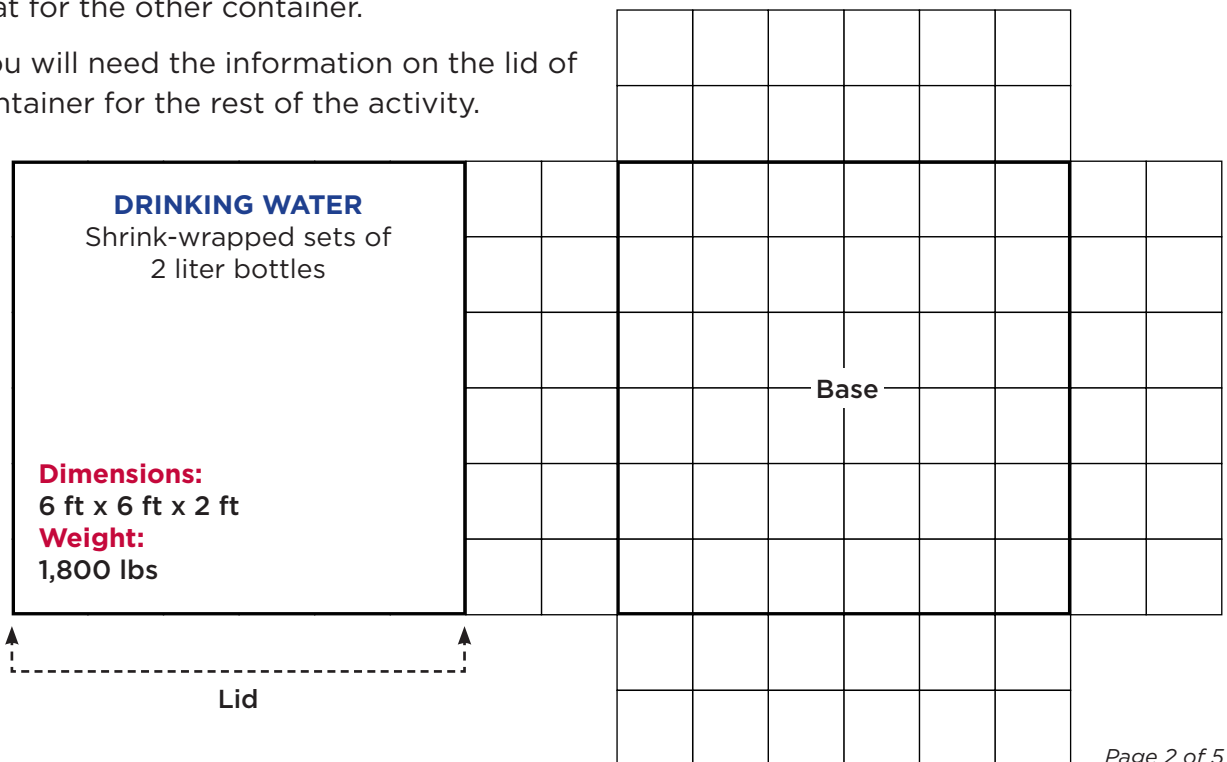
1 cm represents 1 ft



INSTRUCTIONS

1. Cut out one flattened container.
2. Score and fold down on the heavy lines that mark the base.
3. Tape the sides of the container together, so that the grid pattern is on the outside.
4. Score and fold the lid down. Tape the container closed.
5. Repeat for the other container.

Note: You will need the information on the lid of each container for the rest of the activity.



INSTRUCTIONS

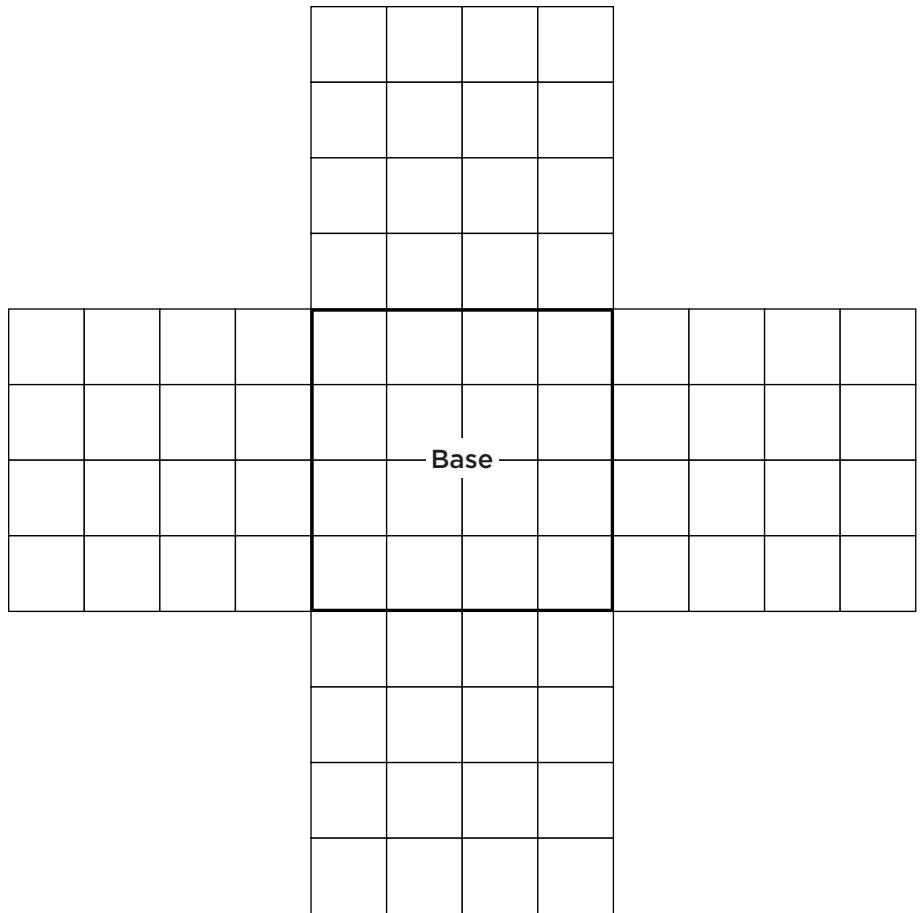
1. Cut out one flattened container.
2. Score and fold down on the heavy lines that mark the base.
3. Tape the sides of the container together, so that the grid pattern is on the outside.
4. Score and fold the lid down. Tape the container closed.
5. Repeat for the other container.

Note: You will need the information on the lid of each container for the rest of the activity.

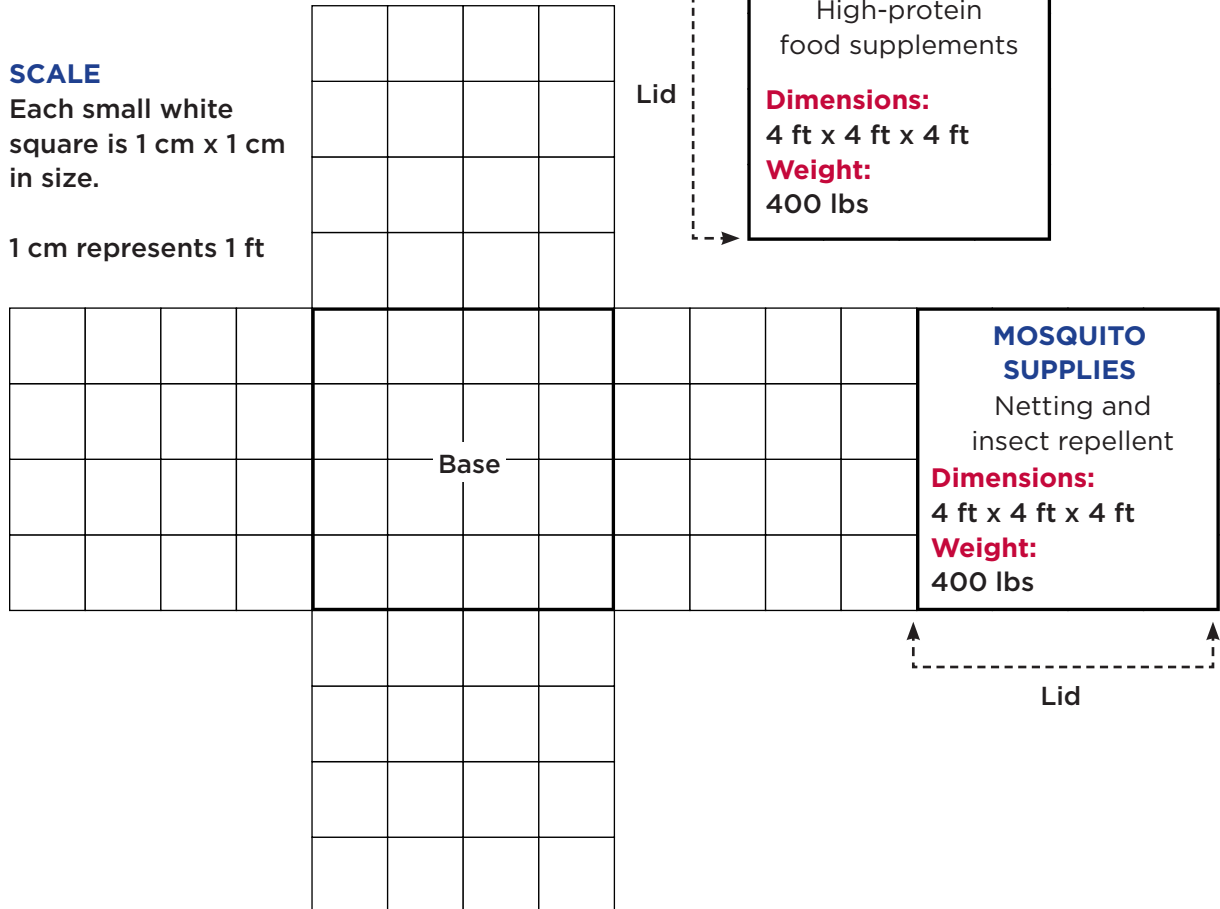
SCALE

Each small white square is 1 cm x 1 cm in size.

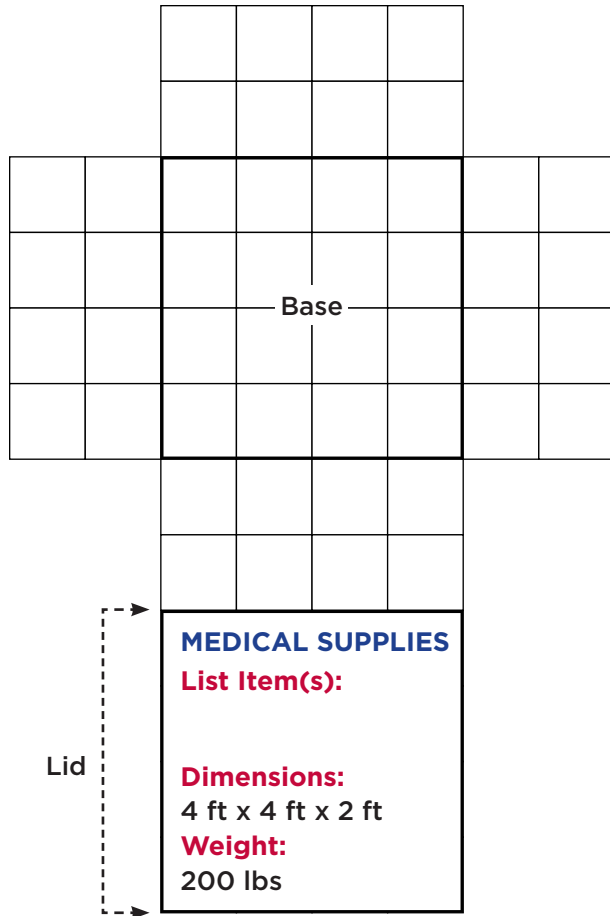
1 cm represents 1 ft



FOOD
 High-protein food supplements
Dimensions:
 4 ft x 4 ft x 4 ft
Weight:
 400 lbs



MOSQUITO SUPPLIES
 Netting and insect repellent
Dimensions:
 4 ft x 4 ft x 4 ft
Weight:
 400 lbs



INSTRUCTIONS

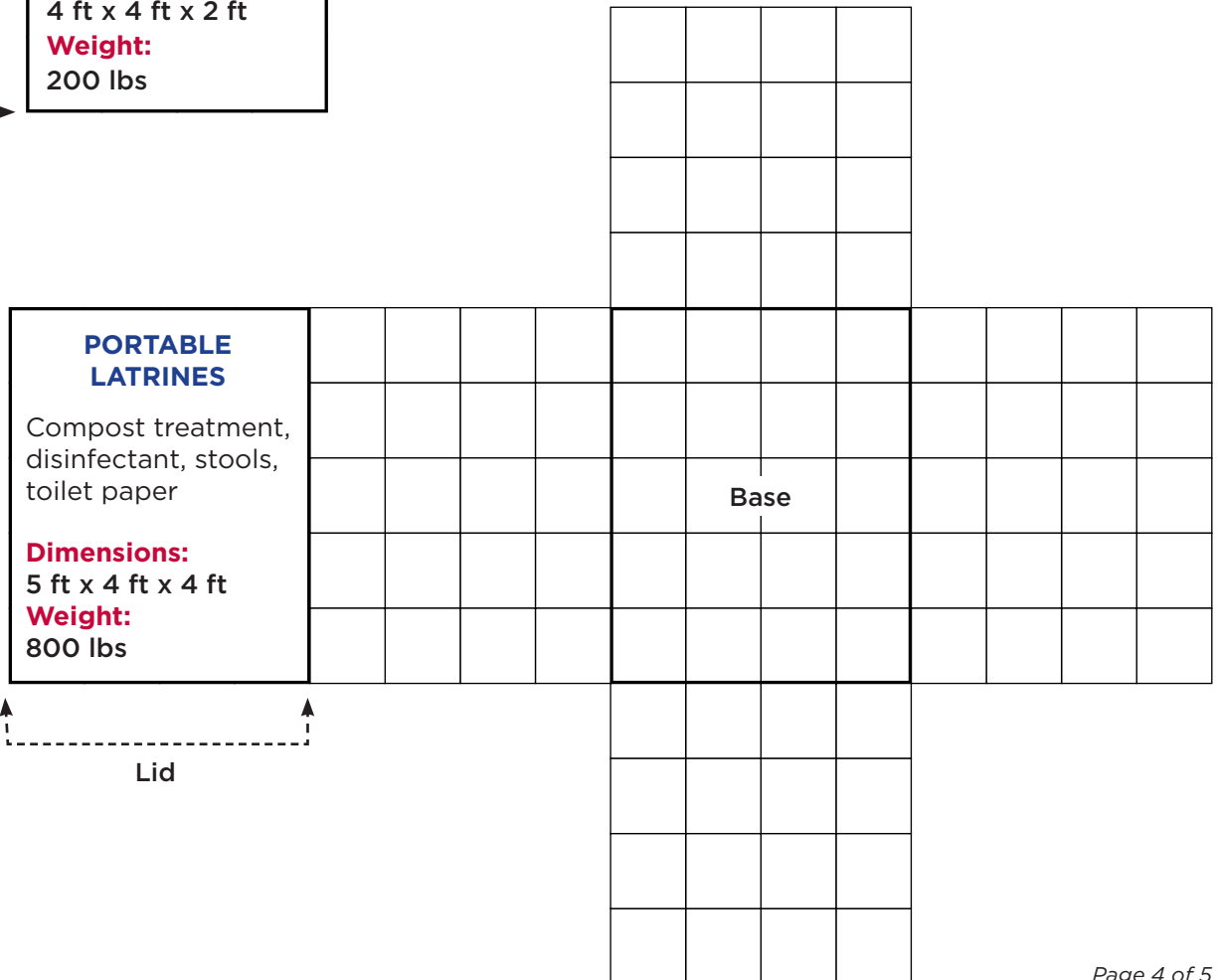
1. Cut out one flattened container.
2. Score and fold down on the heavy lines that mark the base.
3. Tape the sides of the container together, so that the grid pattern is on the outside.
4. Score and fold the lid down. Tape the container closed.
5. Repeat for the other container.

Note: You will need the information on the lid of each container for the rest of the activity.

SCALE

Each small white square is 1 cm x 1 cm in size.

1 cm represents 1 ft



INSTRUCTIONS

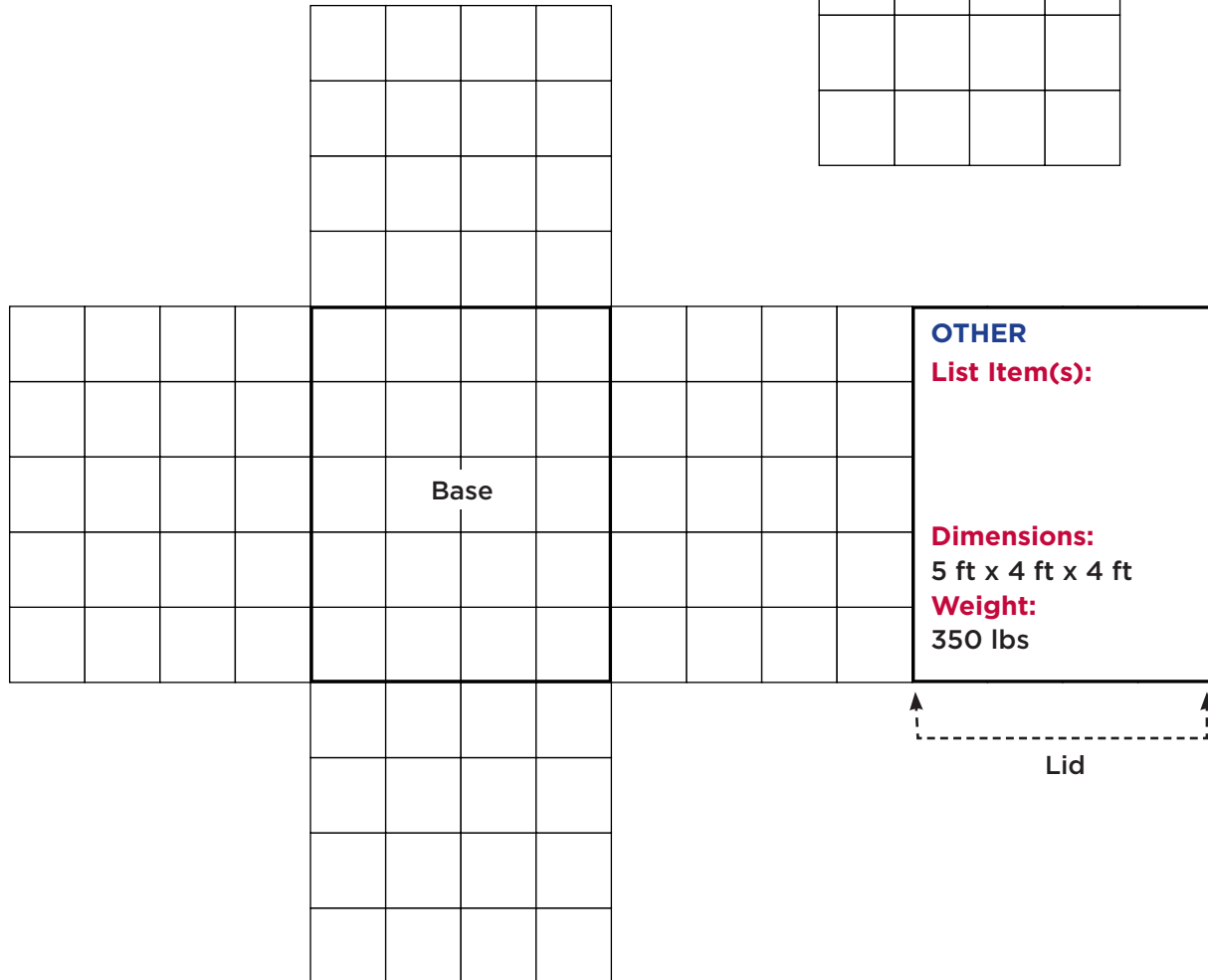
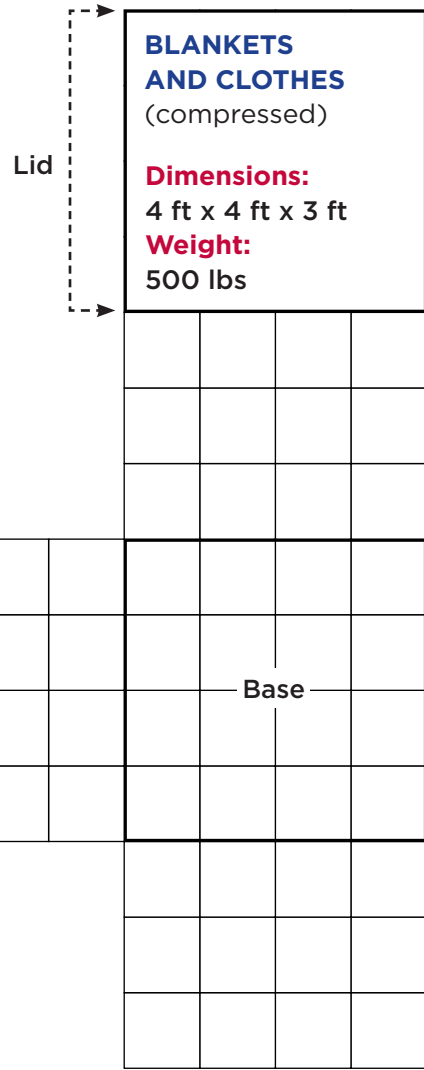
1. Cut out one flattened container.
2. Score and fold down on the heavy lines that mark the base.
3. Tape the sides of the container together, so that the grid pattern is on the outside.
4. Score and fold the lid down. Tape the container closed.
5. Repeat for the other container.

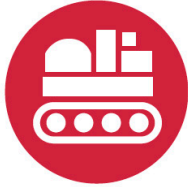























Note: You will need the information on the lid of each container for the rest of the activity.

SCALE

Each small white square is 1 cm x 1 cm in size.

1 cm represents 1 ft



 _____ date	 _____ date	 _____ date	 _____ date
 _____ date	 _____ date	 _____ date	 _____ date
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 _____ date	 _____ date	 _____ date	 _____ date



Create a Flight Plan



OVERVIEW

Using Google Earth, each team will create a flight plan for their rescue mission. Time: One to two 45-60 minute sessions

Flight plans are documents filed by pilots with aviation authorities prior to the start of their trips. The plans include departure airport, estimated flight time and destination airport. For flights that must stop for refueling or other reasons, the flight plan will list all departure airports, flight times and destinations. Plans also include the purpose of the flight, cargo, estimated passengers (if

any), and details about the aircraft itself.

In this activity, students will complete a flight plan which will be used as a guide as they choose air routes and estimate the total time of their flight from Houston, Texas to drop relief supplies by parachute above Tacloban City Airport, the Philippines. The plan used here is a type of spreadsheet that has spaces for the information teams will need to collect.



The originating airport for the mission flight in this unit is the William P. Hobby Airport, located in Houston. One of two international airports in the city, its three-digit International Air Transport Association (IATA) code is HOU. To find additional IATA codes, visit <http://www.iata.org/publications/Pages/code-search.aspx>.



Yolanda made landfall early on Friday, November 8, 2018. Tacloban City Airport’s communication facilities, radar equipment, tower, and terminal were heavily damaged or destroyed. It partially reopened on Monday, November 11. Shown above are volunteer air traffic controllers and US service members working inside the control tower to ensure the safety of humanitarian aircraft landing and departing from the airport. .

It will be used as part of the presentation teams will give in the final activity, “Mission Debriefing.”

MATERIALS

Teacher (see “Setup”)

- Copy of “Flight Advisory Cards” on cardstock and cut into 8 individual cards (p. 67)
- Set of certification icons for distribution at the conclusion of the activity (p. 68)

Per Team of Four Students

- Access to Google’s Earth Pro software
- Copy of “Operation Rescue: Create a Flight Plan” and “Flight Plan” pages (p. 64–65)
- Copy of “World Map” (p. 66)

Per Student

- Notebook, journal or folder, and passport
- Pencils and markers

Optional

- Calculators

SETUP

Cut out the Flight Advisory Cards. Fold and shuffle the cards then place them in a jar or small box. If you have more than four teams, make extra copies

of the cards. Try to avoid giving each team the same card(s). Have students work in their teams of 4.

Load Google’s Earth Pro software on student computers prior to class. (See Activity 6. “Using Web-based Navigation Tools” for complete information about the program.)

Google’s Earth Pro Software

<https://www.google.com/earth/desktop/>

PROCEDURE

1. Hold a group meeting with the teams. Have teams summarize their progress. At this point, teams will have studied the symptom, causes, and treatments of possible infectious diseases. They will have identified a potential problem they would like to help solve through their medical relief mission, and learned how to use Google’s Earth Pro program. They will have learned about the capabilities of the C-130 Hercules aircraft and how cargo is loaded. Teams will have selected the supplies they will be taking to the disaster zone and constructed mockups of the pallets and supplies containers.

- Tell students that it is time to plan the air route. Remind the teams that their objective is to deliver humanitarian aid to Tacloban, Philippines in the shortest time possible.
- Distribute the flight plans. Make a copy of the plans for projection to show how the plans are completed. Explain the plan abbreviations. Show how to calculate flight time (divide AD—actual distance by 345 mph to get the time it will take to fly that distance. Remind teams that the total time (TT) is the sum of the flight time (FT) plus the ground refueling time (GRT). Give an example to show how this is done. An example is provided below. Refer to page 65 for a list of abbreviations.

Solving for Time

$$\text{Time} = \frac{\text{distance}}{\text{speed}}$$

AD: The actual distance from Airport A to Airport B is 1,160 mi.

AGS: 345 mph

Divide 1,160 mi. by 345 mph = 3.36 hrs.
Convert the decimal into minutes by multiplying 0.36 x 60 = 21.6

Time: 3 hours 21.6 minutes

Total Time: 3 hours, 21.6 min. + (GRT)
30 min. (or TT = 4 hours, 21.6 minutes)

- For their planning, students will first determine the best overall route to Tacloban. Then, they will complete the detailed segment information for each stage of the flight plan, as described below.
 - Teams select a destination (DES) airport. They record the location and then record the AD or air distance (DES or destination).
 - Teams determine what the flight time (FT) to

the airport will be. See example above.

- Last, teams calculate the TT or total time for the segment. This includes the sum of the FT or flight time plus the standard GRT or ground refueling time. (See example in step 3, above.)

The above process is repeated for the next stop along the way. The DES location from SEG 1 (segment 1) is entered on the next line under ORIG (origin) and the new DES is selected. The other values are calculated and the next DES is selected and so on until the final destination is reached.

The last step is to add all the TT values to come up with a flight time for the entire mission from Houston to Tacloban, Philippines. At this point, they will be ready for “departure.”

- Have teams begin planning their routes.
- Just before departure, give each team one or more flight advisories that inform them of current conditions. They will have to determine whether or not the conditions require some adjustment in their flight plans and act accordingly.
- When teams are finished with their routes, advise them that there has been a flight advisory: Iran and North Korea will not permit flights over their country even for humanitarian missions. Go around the room and have teams draw an additional flight advisories from the jar or box for their team. Teams should read the advisory carefully. If the class or team advisory affects their flight plans, they should make the necessary adjustments or allowances. If the advisories do not affect their plans, they should complete the plans as is.
- Distribute copies of the “World Map” page. Ask students to mark their final route on the map. Have the teams save their completed flight plans for presentation to the class as part of the final activity, “Mission Debriefing.”



Operation Rescue: Create a Flight Plan

MISSION : Transport 35,000 pounds of medical and other disaster relief supplies from Hobby Airport, Houston, Texas, United States, to Tacloban, Leyte Island, Republic of the Philippines. Cargo being flown in a C-130 Hercules aircraft with five Load Pallets. Combined total weight of pallets is 35,000 lbs. Proceeding to the Tacloban Airport in the shortest time possible. The supplies in the pallets are urgently needed by medical and relief teams assisting survivors following the devastation caused by Typhoon Yolanda/Haiyan. Survivors have been without clean water, food and medical treatment for days. The airport is now cleared for arrival of C-130 aircraft. Timing is critical.



1. Use Google’s Earth Pro software and your knowledge of the C-130 aircraft to plan your route from Hobby Airport to Romualdez Airport.* There is no direct route to your final destination. You will need to locate airports where you can land to refuel. Each successive airport may be no further than 1,438 land miles from the previous airport.
2. After determining the *shortest*, most direct route, record each segment of the journey as you move from one airport to the next to your final destination. You may or may not fill in all 9 lines of the form. A list of abbreviation codes used on the Flight Plan sheet is provided to the right.
3. When your team has completed the form, notify your teacher.

Note: At any time, a flight advisory or advisories may occur which could affect your official Flight Plan. If it happens, make adjustments to your flight plan.

CODE	DESCRIPTION
SEG	The segment is one complete flight from ORIG to the DES.
ORIG	Origin is the location where a flight segment begins.
DES	Destination end segment is the airport where the C-130 will land at the end of a flight or a flight segment of a longer flight. If a segment, the DES then becomes the ORIG for the next segment.
AD	Actual distance between airports (flight segments)
AGS	Actual ground speed, or how fast the C-130 travels over Earth’s surface. With no wind, the C-130’s maximum ground speed is 345 mph. If flying into a wind, subtract the wind speed from the AGS. For example, flying into a 50 mph wind reduces the AGS by 50 mph. The AGS becomes 295 mph.
FT	The actual flight time between airports during particular segments is calculated by dividing the AD by the AGS (actual distance by ground speed of the aircraft).
GRT	Ground refuel time is the time required to refuel the plane and prepare it for takeoff for the next flight segment. (30 minutes)
TT	Total time is the total time required for a SEG. Add the GRT to the FT to arrive at TT.

4. Use a pencil to make a dot on the first ORIG location and final mission DES location. Mark a dot for each refueling stop. Connect the dots with a line to show the entire route.

* Daniel Z. Romauldez Airport is also referred to as Tacloban City Airport, or Tacloban Airport. Its airport code is TAC

FLIGHT PLAN

FIRST RESPONDERS INTERNATIONAL

Purpose: Humanitarian Aid to the Philippines

Team



Captain/Pilot



Navigator/Co-pilot



Engineer/Loadmaster



Medical Officer/Physician

SEG number	ORIG airport/country	DES airport/country	AD miles	AGS mph hrs.	FT hours:minutes	GRT minutes	TT hours:minutes
1	Houston-Hobby TX/US				: : min.	30 min.	: : min.
2					: : min.	30 min.	: : min.
3					: : min.	30 min.	: : min.
4					: : min.	30 min.	: : min.
5					: : min.	30 min.	: : min.
6					: : min.	30 min.	: : min.
7					: : min.	30 min.	: : min.
8					: : min.	30 min.	: : min.
9					: : min.	30 min.	: : min.
10		Tacloban City/PH			: : min.		: : min.

Total time to deliver relief supplies

: : hrs.

FINAL FLIGHT PLAN MAP

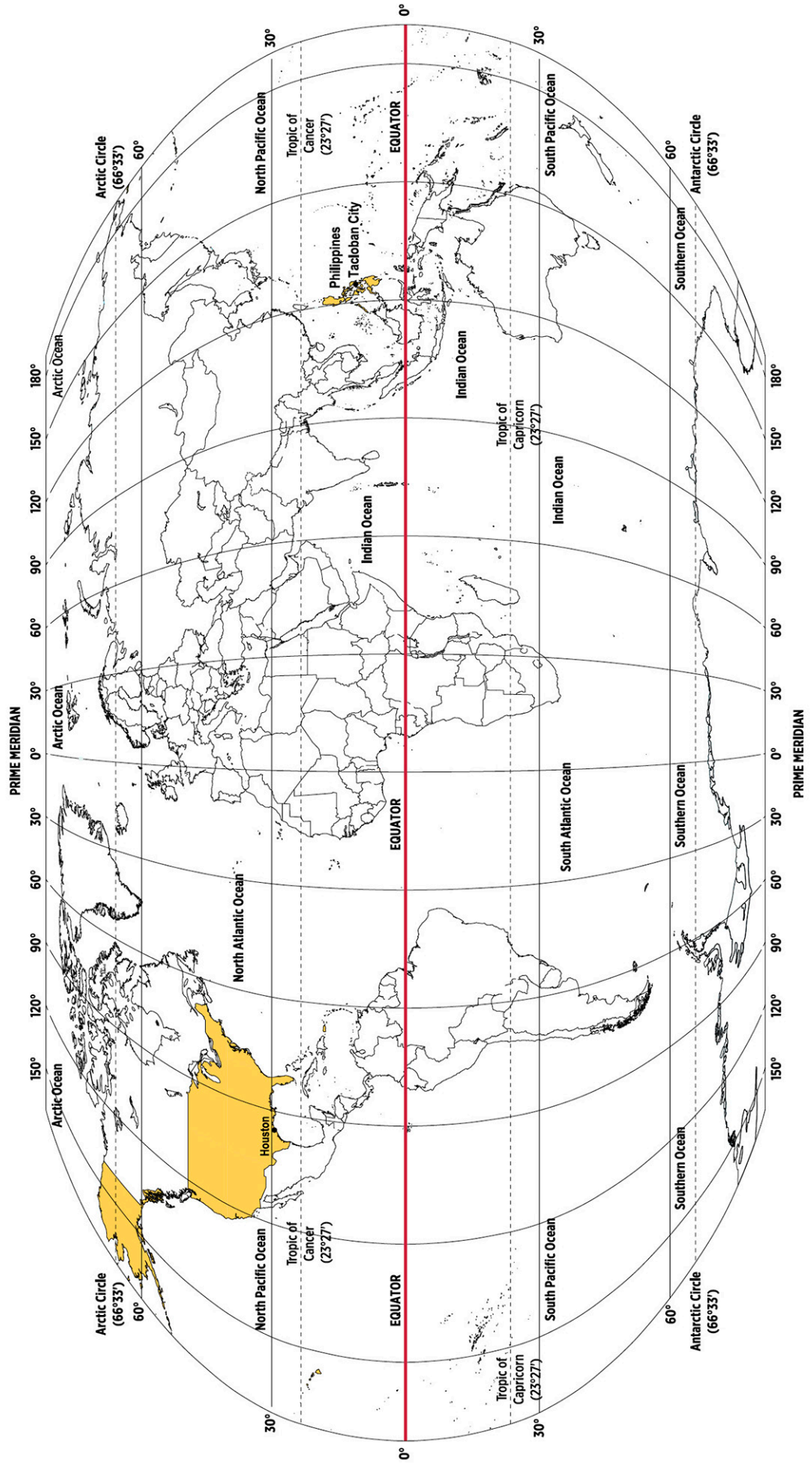
FIRST RESPONDERS INTERNATIONAL

INSTRUCTIONS

Use a pencil to make a dot on the first ORIG location and final mission DES location. Mark a dot for each refueling stop. Use a marker to connect the dots with a line to show the route.

Team _____

WORLD MAP



Note: The ocean areas shown are approximate. For more information, visit https://en.wikipedia.org/wiki/World_Ocean.

*** FLIGHT ADVISORIES ***

*** FLIGHT ADVISORY: INDONESIA ***

The Sinabung volcano in Sumatra, Indonesia is experiencing volcanic ash eruptions. A large ash plume is spreading east from the volcano that could clog aircraft engines. Aircraft approaching the Philippines should avoid flying closer than 7 degrees north latitude to the equator.

*** FLIGHT ADVISORY: NORTH ATLANTIC ***

A wide-scale cyclonic weather system has centered over the North Atlantic Ocean. East winds of 25 miles per hour will affect from North America to Europe. Head winds will reduce actual ground speed by 25 miles per hour. Plan on extra flight time and possible re-routing to closer airports within the shortened aircraft range.

*** FLIGHT ADVISORY: CHINA ***

A spate of regional thunderstorms has slowed airport operations across coastal China. Inbound aircraft to Chinese airports (Beijing, Shanghai, Hong Kong, Fujian, Jinsha, and Zhangzhou) will be asked to delay their landings by 30 minutes to give the storms time to move on.

*** FLIGHT ADVISORY: NORTH PACIFIC ***

A large cyclonic storm system has developed over the Pacific Ocean at longitude 150W and latitude 40N. Aircraft are advised to stay 1,500 miles from the center of this storm system.

*** FLIGHT ADVISORY: MIDDLE EAST ***

Recent civil wars in several east coast African countries has made aircraft over flights dangerous. It is recommended that foreign aircraft avoid flying over countries on the east African coast south of the equator.

*** FLIGHT ADVISORY: SNOW STORM ***

A snow storm has closed all airports in Belgium, the Netherlands, Denmark, and northwestern Germany.

*** FLIGHT ADVISORY: JAPAN ***

Recent earthquake activity has disrupted airport operations in Tokyo. The airport is usable but fuel deliveries have been slowed. This has delayed air travel from Japan and from all connecting Japanese airports. Refueling delays will increase GRT to 2 hours.

*** FLIGHT ADVISORY: ROME, ITALY ***

An emergency landing of a commercial aircraft in Rome, Italy has backed up air traffic in Italy, Portugal, Spain, and Turkey. Fortunately, no injuries occurred during the emergency. Add 2 hours to the GRT at all airports in these countries because of congestion.

 _____ date	 _____ date	 _____ date	 _____ date
 _____ date	 _____ date	 _____ date	 _____ date
 _____ date	 _____ date	 _____ date	 _____ date
 _____ date	 _____ date	 _____ date	 _____ date
 _____ date	 _____ date	 _____ date	 _____ date
 _____ date	 _____ date	 _____ date	 _____ date



Mission Debriefing

OVERVIEW

In this concluding activity, teams present their experiences and results to be evaluated and compared with the results of other teams. Time: One to two 45-60 minute sessions

A key part of any large humanitarian mission is the post mission debriefing. Conditions on the ground often challenge the best-laid plans. Knowing what worked and what didn't and why a particular plan didn't work is essential to the success of future efforts. Mission debriefings originated with the military. Pilots and soldiers would be asked questions progressively about what happened during

a particular operation. The questions would seek to learn how effective the operation was and, most importantly, what could be done better.

Mission debriefings are used for many applications. Astronauts, after their return from space, are questioned about every activity performed in space. Debriefings are also part of established therapy for the victims of disasters, such as hurricanes and



First responders often endure traumatizing situations themselves as they provided aid to children and adults, like those shown above, who had to sit on the floors of aircraft to fly away from the destroyed city of Tacloban.

earthquakes. Talking about what happened helps people organize their thoughts about what they experienced and put them into perspective. Even the workers on humanitarian operations, people who were not present during the actual disaster event, find debriefings comforting because they can share, and hopefully, let go of some of the traumatic situations they may have encountered.

The advantages of a debriefing session following a humanitarian mission are many.

- Places events in their logical order.
- Clears up misconceptions and rumors.
- Identifies strategies that worked.
- Identifies inefficiencies and ineffective strategies
- Collects tips and lessons learned.
- Acknowledges the accomplishments of the aid workers.
- Provides aid workers with a sense of purpose and accomplishment.

CAUTION

Make certain that students have access to “student safe” search engines in school or at home prior to gathering information from sources on the Internet. You may wish to preselect websites containing information about diseases as several websites contain images that are inappropriate for or disturbing to some students. (See “Resources,” right.)

MATERIALS

Teacher

- Whiteboard and markers

Per Team of Four Students

- Materials to create presentations (either electronic and/or art materials)
- Completed load pallets with containers from Activity 7

Per Student

- Notebook, journal or folder, and passport

PROCEDURE

1. Have teams create a debriefing presentation consisting of details on the supply load they chose, how they packed it, and the route they designed to deliver the emergency supplies. In particular, they should address what supplies were packed to treat the problem they identified.

Teams may create electronic presentations (such as PowerPoint® or other presentation software) or use posters and charts. Each team’s model pallets should be included in their presentation.

2. Hold a humanitarian aid conference where all teams make their presentations and answer questions.
3. Create a list on the board to compare team outcomes. For example, which team delivered the supplies in the shortest time and with the shortest miles flown—and met their goal?
Congratulate all teams on their planning and execution. Discuss unique aspects of each team’s approach: most interesting problem to be solved, most comprehensive solution to the problem, most efficient packing strategy, fastest flight plan, most creative adjustments to the flight plan, etc.
4. List and discuss local and international aid organizations. Some organization are non-profit, while others are faith-based. Ask students, *What do they do? How are they funded? What kinds of careers are there in humanitarian aid organizations?* Go to organization websites and explore their mission, strategies and volunteer opportunities. If they have career opportunities listings, review job descriptions and requirements.

RESOURCES

In addition to world-wide governmental military forces, the following are highly-efficient and well-known catastrophic relief organizations.

American Red Cross

<http://www.redcross.org>

Direct Relief

<https://www.directrelief.org/>

International Rescue Committee

<http://www.rescue.org/>

Médicines Sans Frontières/Doctors Without Borders

<http://www.doctorswithoutborders.org>

Oxfam International/America

<https://www.oxfamamerica.org/>

United Way/Houston

<https://www.unitedwayhouston.org/>

World Health Organization

<http://www.who.int/>

Sources

Cover image: Cropped photo of volunteer aircraft controllers and U.S. service members courtesy of the U.S. Marine Corps/Lance Cpl. Anne Henry.

- p. iv. Photo of damage in Tacloban City courtesy of Caritas Ireland (Trócaire)/Eoghan Rice. CC-BY-2.0.
- p. vi. Aerial photo of Guiuan courtesy of the U.S. Marine Corps/Lance Cpl. Luis A. Rodriguez III.
- p. vii. Photo of a Philippine Army healthcare worker treating a patient courtesy of U.S. Marine Corps/Sgt. Jonathan Wright.
- p. ix. Satellite image of Tropical Cyclone Larry courtesy of NASA Goddard Space Flight Center, MODIS Rapid Response Team/Jeff Schmaltz. Satellite image of Hurricane Rita courtesy of NASA Goddard Space Flight Center, MODIS Rapid Response Team/Jacques Desclotres.
- p. x. Satellite images of Super Typhoon Maysak courtesy of NASA Johnson Space Center/Astronaut Terry Virts.
- p. xii. Satellite image of Super Typhoon Yolanda/Haiyan at near peak intensity, courtesy of NASA MODIS LAADS Web, HDF file processed by Supportstorm. Illustrated composite map courtesy of the U.S. Central Intelligence Agency, The World Factbook.
- p. 1. Aerial photo of Guiuan with Sea Hawk helicopter courtesy of the U.S. Navy/Peter Burghart.
- p. 2. Aerial photo of the damaged Tacloban Airport courtesy of the Special Operations Command Pacific/Spc. Andrew Robertson, U.S. Army. Photo of Tacloban street with sign courtesy of Caritas Ireland (Trócaire)/Eoghan Rice. CC-BY-2.0.
- p. 3. Photo of two boys walking in front of a damaged vehicle courtesy of the CDC.
- p. 4. Screenshot of Google's Earth Pro on Desktop: <https://www.google.com/earth/desktop/>
- p. 5. Screenshot of The World Factbook webpage. <https://www.cia.gov/library/publications/the-world-factbook/>
- p. 6. Photo of young survivor with IV bag courtesy of U.S. Marine Corps/Sgt. Jonathan Wright. Photo of damage and water in streets courtesy of the UN.
- p. 9. Photo of passport © Alexey Ivanov. Licensed for use.
- p. 10. Sample passport photo courtesy of the U.S. State Department.
- p. 14. Photo of San Juanico Bridge connecting the islands of Leyte and Samar © Byron Alcantara. CC-BY-2.0.
- p. 15. Illustration of the Philippine flag courtesy of Mike Gonzalez. Public domain.
- p. 17. Map of the Philippines © Iryna Volina. Simplified by M.S. Young. Licensed for use.
- p. 19. Photo of serviceman testing for mosquitos in Tacloban courtesy of the U.S. Military.
- p. 20. Photo of blood sample courtesy of the CDC.
- p. 21. SEM of dengue virus particles and photo of *Aedes aegypti* mosquito courtesy of the CDC/James Gathany.
- p. 22. SEM of *Leptospira* bacteria courtesy of the CDC/Janice Haney Carr. Microscopic image of *Plasmodium falciparum* parasites courtesy of the CDC. Photo of *Anopheles* mosquito courtesy of the CDC/James Gathany.
- p. 23. Photo of baby with measles courtesy of the CDC.
- p. 24. TEM of a measles virus particle, photo of Typhoon Yolanda survivor, and microscopic image of *Clostridium tetani* bacteria courtesy of the CDC.
- p. 25. SEM of a drug-resistant form of *Mycobacterium tuberculosis* bacteria courtesy of the CDC/James Archer. SEM of *Salmonella typhi* bacteria courtesy of the CDC/Janice Haney Carr.
- p. 34. Photo of Marines distributing water courtesy of the U.S. Marine Corps/MC3 Jonah Z. Stepanik.
- p. 37. Photo of navigator Capt. Jake Morgan at his post courtesy of U.S. Air Force/2nd Lt. Jake Bailey.
- p. 39. Screenshot of Google's Earth Pro on Desktop: <https://www.google.com/earth/desktop/>
- p. 48. Photo of a C-130 aircraft preparing for take-off courtesy of the U.S. Marine Corps/MC3 Ricardo R. Guzman.
- p. 49. Photo of Airmen loading equipment onto a Humvee courtesy of the U.S. Airforce/Sr. Airman Marianique Santos. Photo of truck with pallet courtesy of the U.S. Marine Corps/Lance Cpl. Austin Schlosser. Photo of servicemen moving a pallet in place courtesy of the U.S. Marine Corps/2nd Lt. Jake Bailey.
- p. 51. Photo of C-130 aircraft courtesy of the Commission of Audit, Republic of the Philippines. Illustrations of a C-130 aircraft from different views courtesy of Jetjones. CC-BY-3.0.
- p. 62. Aerial photo of William P. Hobby Airport, 2007, courtesy of AuburnPilot. Public domain.
- p. 63. Photo of volunteer aircraft controllers and U.S. service members courtesy of the U.S. Marine Corps/Lance Cpl. Anne Henry.
- p. 68. Illustrated world map courtesy of the CIA World Factbook. Simplified and colorized by M.S. Young.
- p. 70. Photo of evacuees aboard aircraft courtesy of the U.S. Navy/2nd Lt. Jake Bailey.

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