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The Amphibious Tiltrotor

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Natural disasters have occurred throughout the years and have almost always left the deaths of civilians and many casualties. Rescue aids are the immediate responses to these disasters and are sent from countries around the world. Many rescue vehicles are sent as well in order to bring food and supplies or rescue injured persons and transport them safely to the nearest place where medical aid is offered. The main problem with many of these rescue vehicles is that they don't get there fast enough or they have many limits such as space and weight. So how can these problems be fixed? Aircrafts are the best way to get to areas in need fast so the first step would be fixing and enhancing the capabilities of the aircrafts. Now imagine an amphibious tiltrotor aircraft with the capability to land on water and on land or take off from them as well with a cruise speed of 300 knots and a range of 800 nautical miles. Imagine one that could carry up to fifty passengers and carry enough water to expel on forest fires while airborne.

The 2004 Tsunami

The 2004 tsunami was a natural disaster that "brought more than 230,000 deaths" ("Humanitarian Response"). It hit the countries of Indonesia, Sri Lanka, India, Thailand, Maldives, Malaysia, and Burma with the worst effects and most deaths. Food, water, shelter, and medical aid were all needed and countries worldwide immediately sent help in ships and aircraft. Because it was very difficult for these aircraft and ships to land in the worst hit areas, they had to land in areas that were far from the hit areas. Trucks were then loaded with "forty tones of food, which was how much 2,424 people needed for about a month"("Asia Quake Relief Effort"). However, trucks are not like aircraft, and they took time to get to the needed areas. People were dying because of thirst and hunger the days following the tsunami, and the ground was utterly damaged. The trucks

used in these poor countries to deliver food and water were not at all built for the present situation. Also in rescue operations, trucks could not even help the many people who had been swept away in the water since it was not possible for the trucks to rescue them. Helicopters could rescue these people at sea but it would take quite some time to drop the equipment in order to lift the survivors and many would be too weak, and this kind of rescue would not be too beneficial to them. With the amphibious tiltrotor, the ability to land on water would prove to be very useful to these people. It would also be useful in these kinds of conditions as well since the roads and airstrips had been damaged by flooding or hampered by debris because of its capability to land on water. This disaster had proven that a better aircraft was needed. In this disaster there were three main kinds of aircraft used. One aircraft, for example, was a "Sea King Helicopter with a range of 799 nautical miles and a cruise speed of about 108 knots"("H-3 Sea King"). In the role of a rescue aircraft, it can carry up to "22 survivors with two medical officers" ("H-3 Sea King"). Now the amphibious tiltrotor that had been suggested earlier would have gotten to the areas much quicker and would have carried up to twice as many people as the Sea King Helicopter took. This helicopter not only could carry more aid supplies but could also save many more injured people. For example, in Malaysia the "average number of persons injured was 68,299" ("Humanitarian Response"). Many of these injured had died eventually because aid came too late. Assume that there are about 10,000 people spread on an area on the eastern coast of Malaysia. The nearest campsite with medical help is twenty miles away from there. Now realistically, it is not likely for either helicopter to save those injured persons in one day, yet how many people could have been saved? With the Sea King helicopter, it would take about ten minutes to travel the twenty miles, carrying

twenty-two survivors each time. So in about a twenty-four hour day, it could take about 1,584 survivors or injured persons. However, this is not accurate since these survivors are not likely to be lined up in a single file line and rescue aids would have to go and look for them. It would take some time to get them on board then off. Now with the amphibious tiltrotor, it would take about five minutes to travel the twenty miles. It could take about fifty passengers, twice as much as the Sea King helicopter. So in a twenty-four hour day, it could carry about 6,000 survivors and injured persons as well. Again, this is not accurate because it is not likely for all the survivors to be sitting right next to the tiltrotor. This tiltrotor would not have problems landing on water while the Sea King helicopter would, so the tiltrotor would be the better aircraft since it is built to fit many conditions and can save more lives near the coast as well.

As mentioned earlier it was also vital to deliver food and water to the thousands of people who were left homeless. Assume that the most a person can weigh on the amphibious tiltrotor is 250 pounds. This means that if the amphibious tiltrotor has a capacity for about 50 passengers, then it can carry at least 7 tonnes. “Many of the trucks actually used during the tsunami were small but had a capacity of 20 tonnes”("Asia Quake Relief Effort”), almost more than twice the capacity of the amphibious tiltrotor, so these trucks can most likely take more supplies to the needed people, but the capacity in weight that the amphibious tiltrotor can take is not accurate so it is not for certain that it can only carry about 7 tonnes. However, it is not always based on the capacity a vehicle can take but the speed at which it can go. The highest but safest speed these trucks could go was around 70 mph. As mentioned before, the highest speed that the amphibious tiltrotor can go is about 300 knots, which is about 345 mph. This tiltrotor can go about 5

times faster than the truck. So in reality, though the truck may have had more capacity, the tiltrotor could have taken needed supplies at a much faster rate, which would allow it to provide more for the needed people than the trucks. In situations concerning saving people and delivering aid and supplies, the amphibious tiltrotor showed that it could have had better success compared to the other rescue aids.

Hurricane Katrina

Water landing is an instrumental factor that all aircraft need to be able to accomplish. There have been many incidents that showed how the capability of water landing could have improved many situations by saving more people and getting to them quicker. Hurricane Katrina in August of 2005 was one of the most devastating natural disasters that took place in the United States. There were at least "1,836 casualties and 60,000 people stranded"("Hurricane Katrina.") in New Orleans, Louisiana, an area that was completely damaged by the hurricane. Many of the stranded people were on top of the roofs of various buildings and houses calling for help. "The United States Air Force was what was needed in this catastrophe, and it is still the largest search and rescue mission in the history of the Air Force"("Hurricane Katrina."). Why was the Air Force the only way to rescue civilians and search for stranded people? Hurricane Katrina almost flooded every area along the Mississippi Gulf Coast, south Florida, and New Orleans. It was impossible for the other kinds of rescue vehicles to come because the people were stranded in the middle of the flood. Helicopters were the only way to reach them, but this does not mean that it was easy for helicopters to rescue them. There were hardly any areas where these helicopters could land, so trained persons would be lowered down to areas where the people were stranded so they could bring them back up. As one can already see,

the amphibious tiltrotor could have done an incredible and efficient job in rescuing these people because it has that added capability to land on water. One helicopter, “the HH-65 Dauphin”("Aerospatiale / Eurocopter”), was a helicopter used quite frequently in the search and rescue missions (see “fig. 1”)(“ "Aerospatiale / Eurocopter 365/565 Dauphine EC155 Panther."). Its cruise speed is about 173 mph and has a range of about 547 miles. It has a “capacity of 4,378 pounds”("Aerospatiale / Eurocopter”), about one-third of the capacity the tiltrotor could hold.

Figure 1
HH-65 Dauphin

To search and rescue people, this helicopter would hover over the city and look for survivors. If they spotted any they would come as close as they could to survivors and then drop a rescue basket. The weak and old people who were not able to get into the basket or even move required the crewmen to get off the helicopter to help those people. If the amphibious tiltrotor was one of the helicopters in this area, it could have carried at the most 12,500 pounds, about 250 pounds per person, the maximum weight that the tiltrotor can carry. If 250 pounds were to be exceeded, then it would be difficult for 50 passengers to board the aircraft. The HH-65 Dauphin could have only carried about 18 people if 250 pounds were the limit as well. If it were exceeded then less than 18 persons would have to board the aircraft. However, if the limits were not exceeded, then this shows that the tiltrotor could have once again save many more people at one time than the other aircraft. Of the 60,000 people, 33 500 people were rescued by the helicopters in New Orleans. Suppose that the HH-65 Dauphin and the amphibious tiltrotor were the only kinds of aircraft in the area. After taking survivors, both aircraft were to head to a base in

Shreveport, Louisiana where another aircraft would take survivors to safe places. The distance between those two cities would be 244 nautical miles. In a day from 9 a.m. to 7 p.m., the tiltrotor could have saved 300 people if they return to New Orleans every hour after dropping off survivors at a Shreveport. This time would include time to refuel as well. Now the HH-65 Dauphin would save about 72 persons in a day from 9 a.m. to 7 p.m. This time does include time to refuel as well. If these two aircraft were the only ones in New Orleans rescuing people and Shreveport was the only close place they could drop off survivors, it would take an estimated 4 months for the tiltrotor to save the 33,500 people who had been saved by helicopter while it would take an estimated 16 months for the HH-65 Dauphin. Because the amphibious tiltrotor can land on water, it will rescue survivors at a much shorter time because there is no need of a rescue basket since the helicopter will be able to get closer to the survivors than the other aircraft. In reality, the base where the survivors had been dropped off may have been much closer or even farther, so picking Shreveport is just a way to compare the two aircraft. Also there were many more aircraft so the rescuing of the survivors only took a matter of a few weeks, though that still is a very long time. Supplies and other important aids were also needed and were carried by helicopter as well. Comparing the speeds of the two aircraft explained earlier, the amphibious tiltrotor can carry a larger capacity and has a twice the speed of the HH-65 Dauphin, so food, water, and other supplies could have been reached at a much faster rate than the other aircraft.

The Haitian Earthquake

Earthquakes are one of the most deadly natural disasters as well. It can cause merely shaking of the ground to huge cracks causing severe casualties. Recently a category

seven earthquake had struck the country of Haiti, including the capital Port-au-Prince. “The estimated death toll as of January 21,2010 could be as much as 500,000” ("Haiti says 150,000 bodies buried in graves."), but this number is not including those who are still stuck or dead under the heavy rubble (see “fig. 2”)("Earthquake in Haiti.") and those who are in mass graves far along the city. Help from other countries, including the United States, came more than 16 hours later with aircraft the first to reach there with aid supplies”(Mount, Shaughnessy). However, these aircraft could not land in areas that were the heart of the earthquake where it struck badly the most. Buildings were shattered like glass and there were people everywhere on the streets, making it impossible for the aircraft to land there. So how could the amphibious tiltrotor have helped in a way that would have succeeded much better than the other aircraft? Imagine this tiltrotor having the capability to land on the ground, which could be any type of terrain such as mountainous, rocky, and steep. Most aircraft need a flat surface to land on, but if this newly designed amphibious tiltrotor could land on the rubble in areas in Port-au-Prince where there are not too many people, aid could be delivered to them much faster. Also this amphibious tiltrotor could have the strength that many aircraft lack and it would be great help to those people stuck under the rubble. Many aircraft have a very limited amount of strength to lift such things like concrete and bricks and must be slow with them while carrying them airborne. However, the amphibious tiltrotor’s strength would be able to lift these huge rubble pieces, though realistically not very fast, but just in the amount of time where they can save the children and adults by helping them safely exit from underneath the crushed buildings, homes, and schools. If aircraft were able to do this right now, hundreds could have been saved in the first week, when cries of desperate help could be heard. However, on January

24, 2010, the Haitian government declared that they were not going to search for people under the rubble but now care for the thousands who are homeless and in great need of aid. Though helicopters were trying to lift as much rubble as they possibly could, it would take quite a while just to lift the pieces of one building when there are hundreds of others as well and by the time they get to the later buildings, it will end up being pointless because the trapped people are bound to be dead in that amount of time without food and water.

Figure 2
Torn down buildings in Haitian Earthquake.

One of the first helicopters "to reach Port-au-Prince were the Aero Ambulancia from the Dominican Republic" ("Aid worker says Haiti destruction"). There were armed with "fully loaded medical aids and other supplies"("Aid worker says Haiti destruction"). When they reached Port-au-Prince, they were vital in transporting civilians to camps where they could be treated. It took these helicopters about 90 minutes to depart from the Port-au-Prince airport to Santo Domingo, where the victims were cared for and treated. The safest amount of victims these helicopters can carry are up to two because of their small size and lack of the capability to carry a lot of weight. The amphibious tiltrotor could have reached Port-au-Prince in less than half the time the Aero Ambulancia could, in about half an hour. It also could have carried up to twenty times the victims because of its large space and ability to carry a lot of weight. Much more supplies such as food and water could have been delivered faster and in more quantity. It has been

estimated that “about 100 helicopters are needed in Haiti”(Mujahid) to save all the victims by providing them food and water and carrying the injured ones to areas where help would be provided. However “there are only 19 in Haiti”(Mujahid) as of January 24, 2010, which itself shows why many victims have not been able to be saved successfully and why enough food and water are not able to reach the homeless people. The “Jayhawk-HH-60”("HH-60 "Jayhawk") are some of the many helicopters the “United States had sent to Haiti to deliver supplies and aid victims”("Helicopters in Haiti.")(see “fig. 3”)("Coast Guard HH-60."). Now imagine that if there were 100 Jayhawk-HH-60 helicopters required in the area, though in reality there would probably be more variety, but suppose that those are the only kinds of helicopters there. Now if the amphibious tiltrotor appeared and they were available as well, only about 12 amphibious tiltrotors would be need if they were to save the same amount of people in the same amount of time. That is less than 8 times the amount of Jayhawk helicopters needed and because only 12 amphibious tiltrotors would be needed to save the same amount of persons as the Jayhawks, then 5,000 persons could have been saved if 100 of the amphibious tiltrotors were there, whereas the Jayhawk helicopters could have saved only 600 persons. However, the tiltrotor would also go twice as fast as the Jayhawk, so in the end hundreds more would have been saved in the tiltrotor rather than the Jayhawk. The Jayhawk is only able to carry 6 passengers at one time and has a range of 700 nautical miles. The amphibious tiltrotor can carry up to 50 passengers and has a range of 800 nautical miles. What about the amount of supplies delivered by each? The Jayhawk

Figure 3
Jayhawk-HH-60

helicopter can carry a maximum amount of weight of 7,384 pounds while the amphibious tiltrotor can carry a maximum amount of weight of 12,500 pounds. If ready-to-eat meals were to be transported to Haiti, the maximum amount the Jayhawk could carry is about 4,544 meals. The amphibious tiltrotor could have carried 7,692 meals, almost twice the amount the Jayhawk could have carried. If the Jayhawk were to carry the meals to an area of 200 homeless people, those people could survive about 22 days on it. If the amphibious tiltrotor were to carry the meals to the same amount of people, they could have survived for 40 days, almost twice the amount of the Jayhawk would have provided for. Overall, the amphibious tiltrotor could have done a great deal if it were built in this catastrophic time for Haiti. Hundreds of victims more could have been saved and much more food supplies and water could have been delivered. This event only shows the urgency to build this kind of amphibious tiltrotor with features nothing like any other.

Forest Fires

Forest fires have been a major issue threatening wildlife and the lives of people. Forest fires mostly occur in the western part of the United States and helicopters are the only way to decrease the fires by putting a type of solution on them or showering the fires with water. However, weaknesses in these helicopters are speed and the capacity to carry water. Also, many of these helicopters use chemicals to take out the fire because they weigh less compared to water but damage the natural environment greatly. The amphibious tiltrotor has the ability to siphon water into an internal tank and has a much greater capacity for water than many other helicopters. For example, “the Air Crane Helitanker is a heavy lifting helicopter with a large capacity fixed tank that can hold 9000 litres”("Helicopters."). It has a speed of 100 knots and us able to “self-fill by lowering a

snorker into a suitable water source". The amphibious tiltrotor has a speed of 300 knots, three times the Air Crane Helitanker's speed but carries only about 5,670 litres, which was calculated by the amount of weight it could carry. However, the amphibious tiltrotor would be able to take out the forest fires by water faster than the Air Crane Helitanker, even though it has the same ability to siphon water into an internal tank and can carry less water than the Helitanker it sill has a much higher speed, therefore it will successfully put out the fires at a faster rate. The amphibious tiltrotor does not have to depend on "chemicals to put out fire, which have showed to be extremely dangerous to the environment"(Bolonkin).

Overall, the amphibious tiltrotor will benefit greatly in almost every situation such earthquakes, hurricanes, wildfires, and many other disasters. There are many civil applications that I would like to see in this tiltrotor. For example, when landing on damaged ground such as rubble and debris, the amphibious tiltrotor should have a different technique and form of landing. Instead of the tiltrotor having a normal landing skid, it should have a device that can open up like a spider's legs and land with balance on any surface. These 'spider legs' would have the capability to support the weight and at the same time won't occupy too much room on the landing surface. This would reduce the need to have a lot of space to land. Although it is probably extremely difficult to obtain for small helicopters like the amphibious tiltrotor, but to increase the safety of the civilians, there could be a separate compartment in the back of the tiltrotor where complicated medical treatments could be performed. The floor of this compartment would be different from the rest of the tiltrotor's because it would balance and move in order to keep the people standing on it straight so that medical procedures could be done efficiently. The people standing on this floor would only feel lift off but would not feel being moved side

to side. The amphibious tiltrotor has already proven to be a life saving aircraft and is almost like a ‘superman’ compared to the other rescue helicopters. This tiltrotor would surely provide many advantages if it were ever built.

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