Firefly
NASA Project

School Name: **”Tudor Vianu”** National High School of Computer Science

Address: [Personal Information Redacted]

Coordinating Teacher: Ioana Stoica

Students: Botu Alexandru, Adam Vlad and Sebastian Muraru

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FOR EVERYTHING, YOU NEED A MOTIVE:

This project, in its essence, consists of a mix of our thoughts, emotions and beliefs aimed towards the goal of saving life, because as long as awake, this value we assign to life is a path to honor our kind, our roots of humanity. It is a way to answer to our pride as humans and therefore we chose this to be our motivation for the involvement in such a project and for the work that will build it from scratch.
Such a "fuel" led us to our product: <Firefly>, born out of a **Boeing V-22 Osprey** model, the one from which we have learned what a rotorcraft really looks like, crossed with a **C-130 Hercules**, yet possessing much more maneuverability and adapted with the latest technology available. From the later, it inherits the dimensions and capacity, while the abilities come from the former.
This is then how <Firefly> was born as a concept, a promising future aircraft aiming to easily replace older models such as the **C-130 Hercules** or **CH-47 Chinook**. A multi-purpose tool or "jewel" coming from one of the highest virtues of humanity: fighting to save lives. It can perform a wide range of activities and operations: whether the mission means search and rescue, firefighting, transporting supplies, survivors or airlifting heavy objects: <Firefly> is there for you, to make a stand, to fight for a better chance.

1.INTRODUCTION

1.1 A View On The Close-Future

<Firefly> is a well-developed future aircraft, holding the huge advantage providing that it can be built nowadays. The ship is more of an adaptation of our current scientific knowledge, rather than a science-fictional product. It can start serving the goals it was designed for as soon as tomorrow.

1.2 Our Aircraft (FEATURES/ACHIEVEMENTS)

Before viewing the details of <Firefly> our main objectives will be pointed out once again in the form of a table regarding special features of it and the achievements they lead to:

FEATURES	ACHIEVEMENTS
The use of four motors with each motor on an independent wing.	Brings the aircraft a considerable ammount of extra power when all four motors are being used at maximum, providing a better chance of escape out of emergency situations. It also brings the aircraft more stability while flying.
Rotors are mobile (tiltrotor).	This provides the aircraft with 2 states: a first one for lifting and landing, while the second one is to be used for travelling.
Multi-purpose loading bay.	Gives the aircraft a multitude of options regarding what it can carry, as described at paragraph 2.1.3 .
Great inside volume.	Able to offer space for up to 100 passengers or carry up to 3000 cubic metters of water.

2. The Way <Firefly> is Made

2.1.1 GENERAL STRUCTURE

The main body of the aircraft is simply a square shaped cylinder with rounded corners (so as to improve the rotor craft's aerodynamic properties).

From this main corp 2 pairs of wings shot out close to the ends of the craft, with each wing housing one engine (that is 4 engines) and with each engine powering a set of 4-bladed rotors (that is a total of 4 rotors). Each rotor wing will be able to move on a 90 degree interval on the perpendicular plane as to the main body. The wings should be positioned at a 45 degree angle from the horizontal plane of the main body when landing and taking off and parallel to each other when in forward flight. They should be mobile so as to move at the 180 degree interval from the forward section to the back section.

Obviously the propellers will have to be long enough to provide sufficient lift, but short enough so as to make it physically impossible for them to hit each other or the ground (when landing) no matter their positions.

We have noticed that this design does not require a tail-spinner and it will be able to move left and right, up and down, backwards and forwards much like the way a current helicopter does. Thanks to the mobility of the rotors it permits the existence of 2 separate states: one for a quick vertical lift and descent (landing and taking off) and one for literal travel.

The first phase comes in handy in short time-window missions were you have to land quick and get out quicker but more importantly it makes it possible for the rotorcraft to land on water (with the help of the floating materials incorporated in the hull's structure).

The second phase is useful because it will help the plane move horizontally at a much faster rate than any current rotor craft because the combined thrust of the 4 engines is aimed forward and makes forward flight much faster.

When we first envisioned the Firefly in our minds one of us noted that it looked like an WW2 Lancaster Bomber, just that it had 2 sets of wings and that instead of terror it brought relief in it's belly.

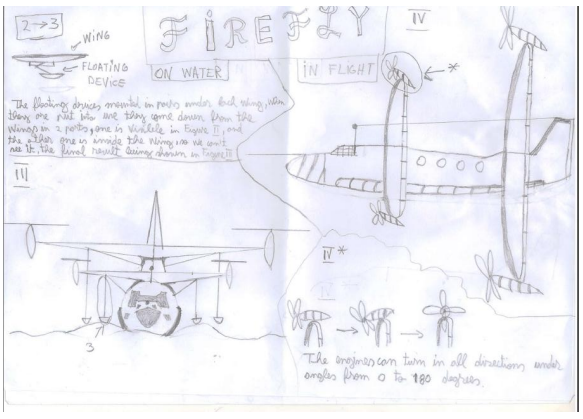
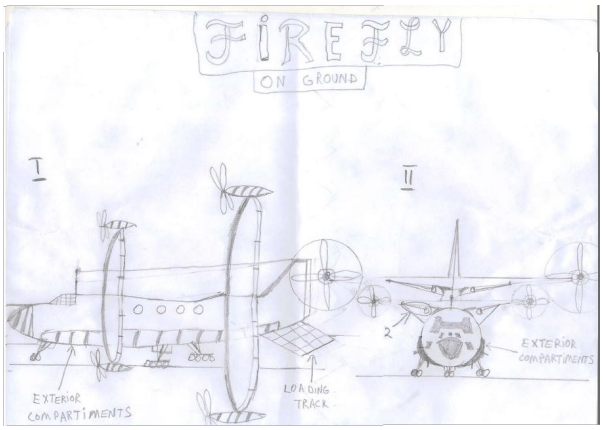


Fig 1. Firefly on water. Firefly in flight.

Fig 2. Firefly on the ground



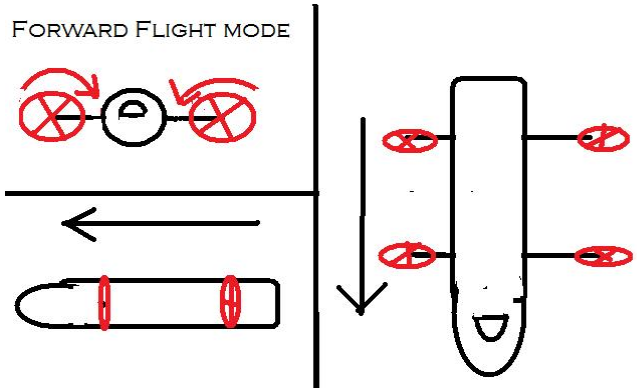


Fig 3. Forward Flight Mode

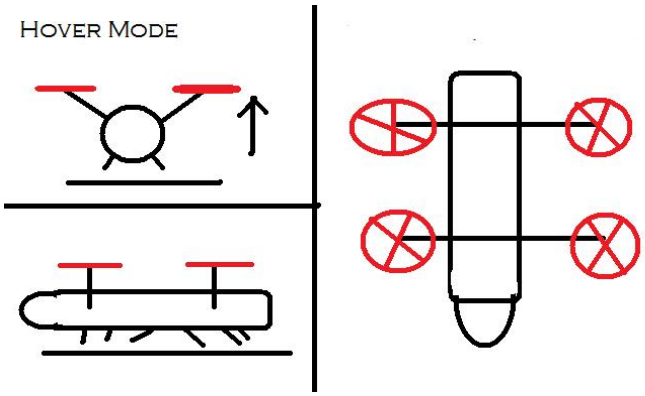


Fig. 4 Hover Mode

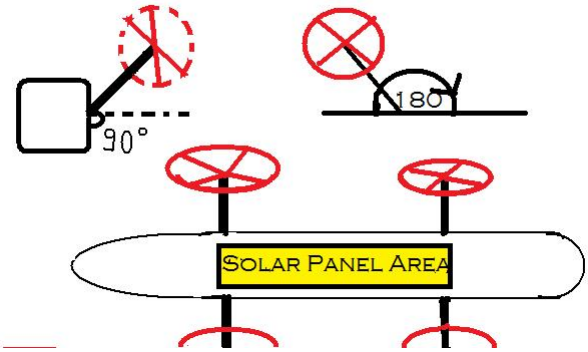


Fig 5. Wing Mobility System

2.1.2 LANDING GEAR

As far as landing gear is concerned we tried to come up with something that could land on a post-earthquake tarmac or water soaked airstrip or a badly maintained highway or even in the middle of a stormy sea.

We thought we solved the "landing on stormy sea" issue with the design and the floating hull but then we noticed it lacked stability. So we came up with neat solution: we decided to place 4 sets of extra compartments under each wing. These compartments are to be filed with air so as to assure that when floating, the Firefly does not roll over on it's belly. These compartments act like 4 extra stability (and we know from our mathematics class that it only takes 3 non-collinear points to assure the stability of a 2D shape) so our total of one large linear floating body and it's surrounding smaller floating bodies will work.

For the other part (the landing on terra ferma part) we opted for using 2 sledge-like arms just like in a regular helicopter. This would allow the rotor craft to land on virtually any type of terrain but the arms would have to be extremely strong and would have to be made from a very strong material like steel or carbon fiber.

2.1.3 LOADING BAY

The loading bay is entirely multi-purpose whether it be:

- water from a water tank or a lake, sea or ocean to put down fires in Greece, California or quite anywhere in the world.

- food, drinkable water or medical supplies for regions hit by earthquakes, famine, plague, floods or war.

- rescuing stranded survivors of a plane crash or sinking ship or refugees right in the middle of a tropical hurricane.

In order to be efficient in all these situation we have decided to opt for a loading track situated at the back which is to be used for loading cargo and boarding passengers.

As well as the track we have decided to implement a pumping system able to take water from the liquid surface the Firefly is sitting on.

2.2 MATERIALS

We agreed to rank carbon fiber as our first option, yet that does not leave out a second possibility of using duraluminum reinforced with a steel hull frame together with aluminum alloys for their lightness and titanium alloys for their thermal stability and strength.

2.3 ENGINES AND FUEL

As previously stated we have decided to incorporate 4 engines to power each propeller.

- Option A: Hydrogen Fuel Cell

An eco-friendly solution which would input enough power and since hydrogen is the future of energy it could be a real long-term solution.

- Option B:Old Fashioned Kerosene

Though it is old fashioned it is not out-dated, and despite being a polluting agent and a derivative of fossil fuel it is a readily available substance which could provide a quick-fix solution.

- Option C: Biodiesel, the Eco-Friendly Fuel

Bio-Diesel based on Jatropha oil, a plant native to Central America proved to be a strong alternative to kerosene in a test-flight made by Air New Zealand in 2008. Bio-diesel is an equivalent of petrodiesel (with 5%less efficiency), yet the results show a substantial reduction of un-burnt hydrocarbons and carbon monoxide.

- Option D: Electric

No matter which solution we choose, we have decided to place solar panels on the top of the airplane for 2 reasons: we believe it to be a very good emergency power-source and it might be used to power-up spent up generators at it's disaster struck destination. But electrically powered engines can be solution, though recharging their batteries might cost valuable time.

- Option E: Matter - Antimatter Energy outputs

This is a very futuristic solution which might yield great results in the future and we like keeping track of it. The ammount of energy released when a particle of matter meets its anti-matter particle is immense, requiring further study for this option to become a possibility.

2.4 DESIGN RANGE

The design range of the Firefly is of 1400 km (860 nm) or even more and since it can store fuel in the floating compartments used for stability it can be even higher.

We consider that the main place to store fuel would be the upper part of the rotor craft.

We also believe that due to Firefly's sheer size and aerodynamic shape, we will be able to counter the effects of wave drag and we will be able to achive a average crusie speed of about 320-350 kts.

The engines are powerful enough to generate speeds as great as 1000 km/h when need arises.

3. General Capabilities

3.1 CREW

1 pilot

1 copilot (the autopilot will make the copilot dispensable)

1 communications specialist

1 mechanic (to fix malfunctions and operate secondary systems like water intake or trap opening)

Total 4

3.2 PASSENGERS

Anywhere from 80 to 100.

3.3 CARGO INTAKE

Huge (can carry 5 or 6 vehicles, vast amounts of supplies and 2000 - 3000 cubic meters of water and it can even be used to carry spaceships up to their launch altitude if necessary).

3.4 SERVICE LENGTH

50 years (if well kept and with proper maintenance even with regular use the Fireflies might still be in operation even well into the second-half of the twenty first century).

3.5 MISSION TYPES

Search and rescue (in any environment), fire fighting (water dumping over burning areas), cargo transport (basically any kind), evacuating people and so on.

3.6 MILITARY APPLICATIONS

Excellent personnel carrier, can carry heavy armored vehicles and it can even be used for the transport of special units in areas other aircraft would not dare to go.

3.7 EXPECTED MARKET AVAILABILITY AND COST

If the global economy recovered by the of 2010 we could be seeing Fireflies in the skies by the summer of 2011 because resources and technologies required for building the rotor craft exist and can be accessed with ease and it's simple design means it can be easily built or even asembled from pieces originally intended for other aircraft, making it a possible solution for second and third world countries situated in disaster prone ares.

4. Conclusion

We live in world were we are all interconnected by trade, culture, politics, factions, affliations as well as roads, bridges, airways and modern communication networks.

What history has shown us is that while bridges break and roads shatter our humanity will compel us to start clearing the rubble, saving the survivors and furthermore rebuild.

What stops us from doing so used to be tyrants, dictators or despots nowadays the only barriers are the ever shrinking oceans and continents, mountains and rivers.We can't move mountains (yet) but we can fly over them.

It is inevitable that in the future we will see many more Super-domes, many more cities like Port-au-Prince and many more shattered beaches like Java. Whether we will be able to foresee those cataclysms or if they hit when we least expect it, we will need something to bring an equilibrum to the world and to intervene fast and efficiently.

Even if we do at some point understand nature and perhaps force it's hand into not unleashing it's wrath upon us one thing will always be relied upon to be unpredictable and certain: human error.

Whether it be earthquake, hurricane, tornado, tsunami, wildfire, volcanic eruption, flooding, epidemic, famine or war someone must bring hope over the wreckage and inspire nations to rebuild.

Whether Firefly will be that "something" or it will make a further step towards finding it, there is only one way to go: UP. And because there is only one way to go... we imagined Firefly!

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