A photograph of three fighter jets flying over a vast, arid desert landscape. The jets are in various positions: one on the left, one in the center, and one on the right. The terrain below is a mix of brown and tan hues, with some darker shadows indicating a hilly or mountainous region. The sky is clear and blue.

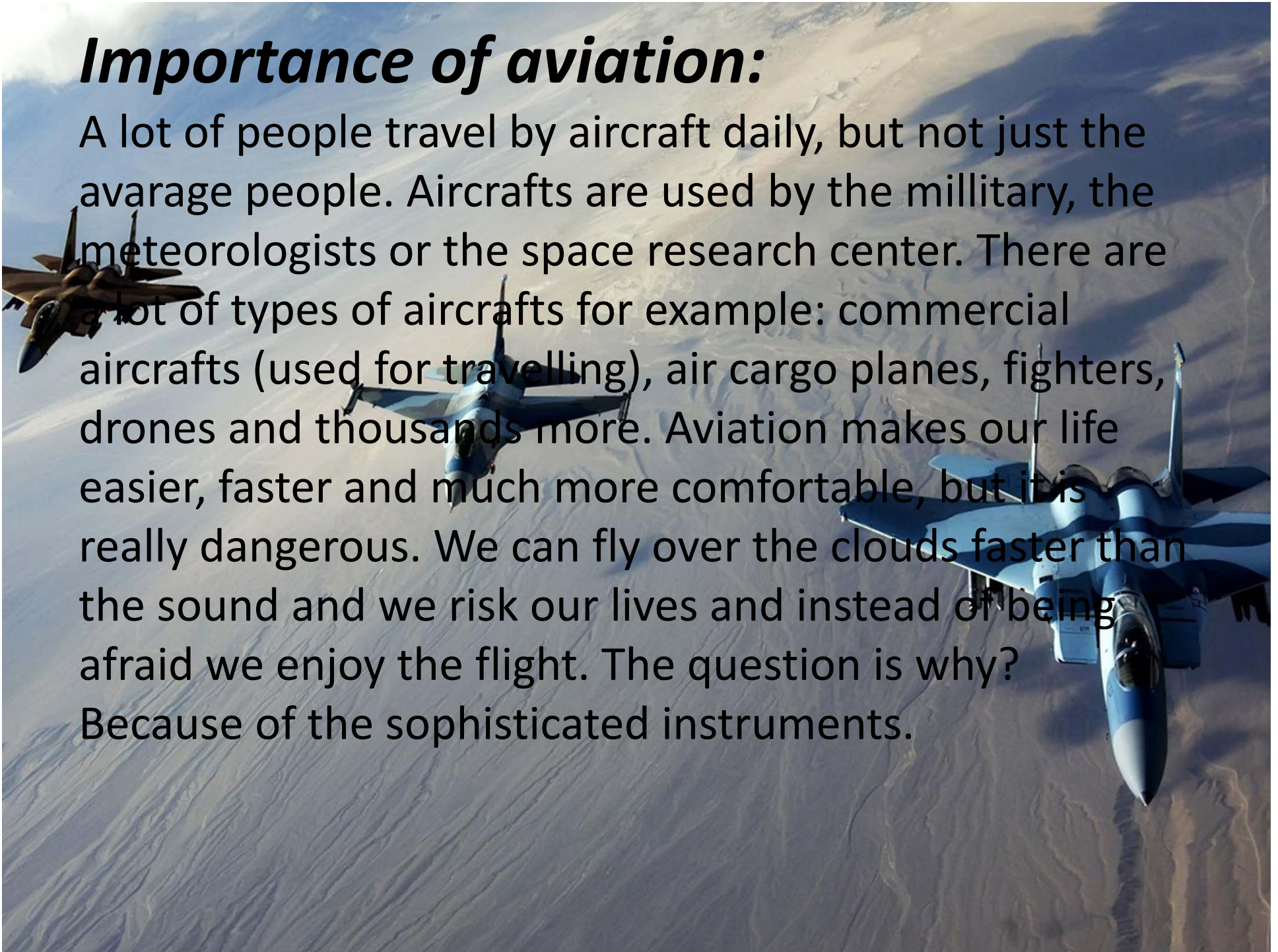
Mechatronic systems used in aviation

Presenter: Varga Ádám

Óbuda University Bánki Donát
Faculty of Mechanical & Safety
Engineering

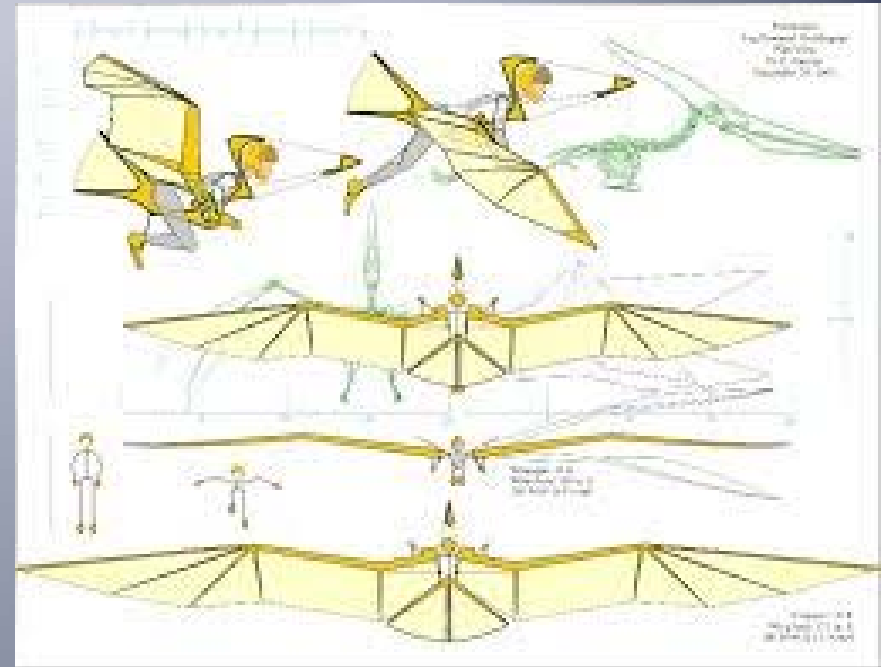
Importance of aviation:

A lot of people travel by aircraft daily, but not just the average people. Aircrafts are used by the military, the meteorologists or the space research center. There are a lot of types of aircrafts for example: commercial aircrafts (used for travelling), air cargo planes, fighters, drones and thousands more. Aviation makes our life easier, faster and much more comfortable, but it is really dangerous. We can fly over the clouds faster than the sound and we risk our lives and instead of being afraid we enjoy the flight. The question is why? Because of the sophisticated instruments.



History:

Leonardo Da Vinci was the first who designed a plane which was a better starting point than others. It wasn't just a wing but it was based on scientific basics. This was the ornithopter.





The Zeppelin

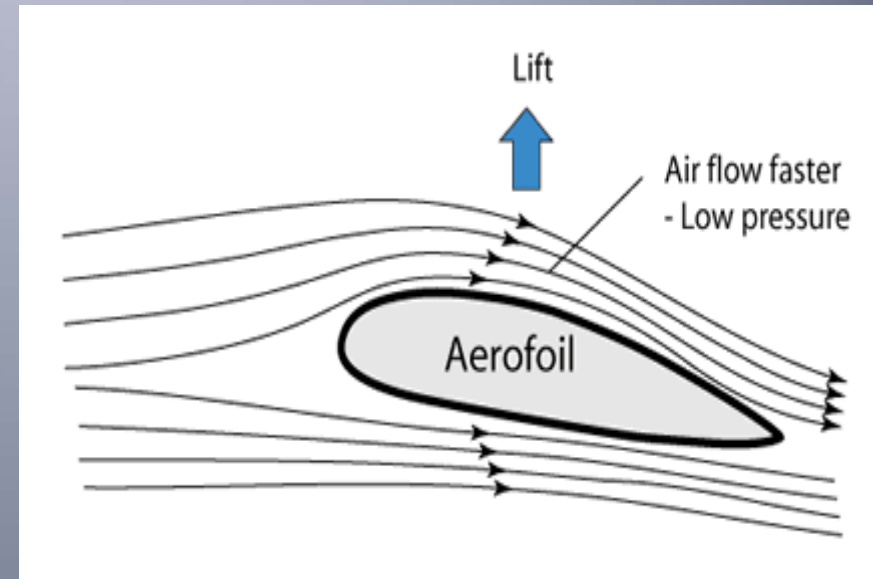
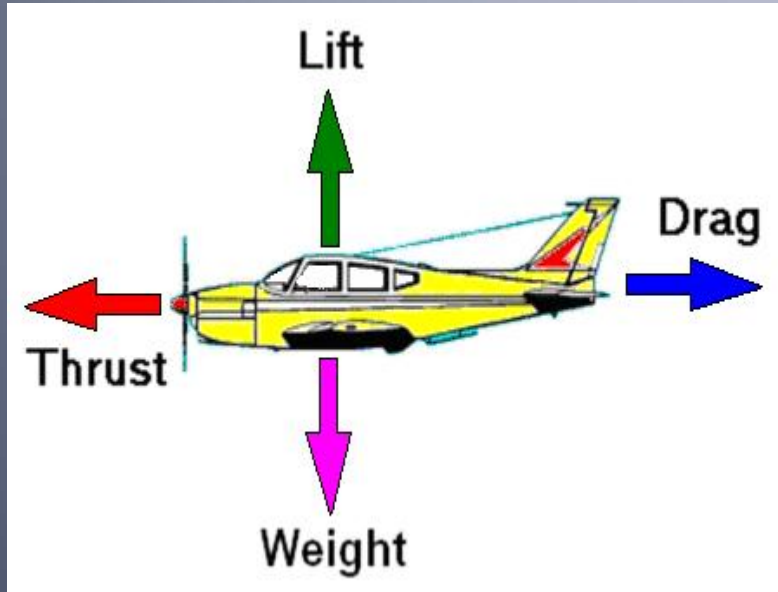


The Wright brothers'
first aeroplane



The first Boeing 247D in 1933

- How does a plane fly?



4 forces are acting on a plane:

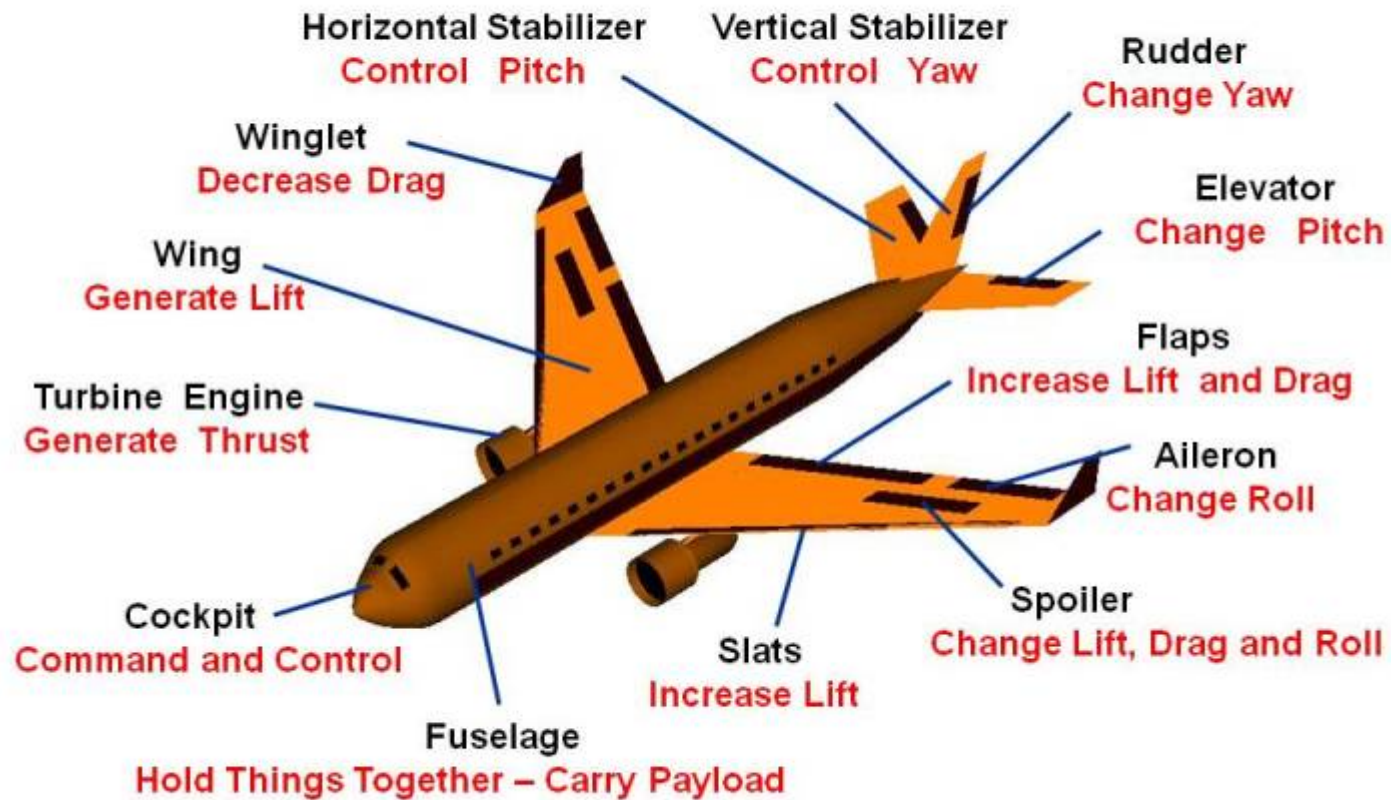
- Thrust to accelerate
- Lift to elevate
- Weight to decrease height
- Drag to slow it down

They must be equal to cause the plane fly steadily. Thrust=Drag, Lift=Weight

To lift the plane the wings have to be curved from above and flat from below.



Airplane Parts *and* Function



Flight Control

Primary controls.-Control column (Joystick) controls the plane's movement up and down, left and right.

- Rudder controls the plane horizontally
- Throttle to speed up the plane

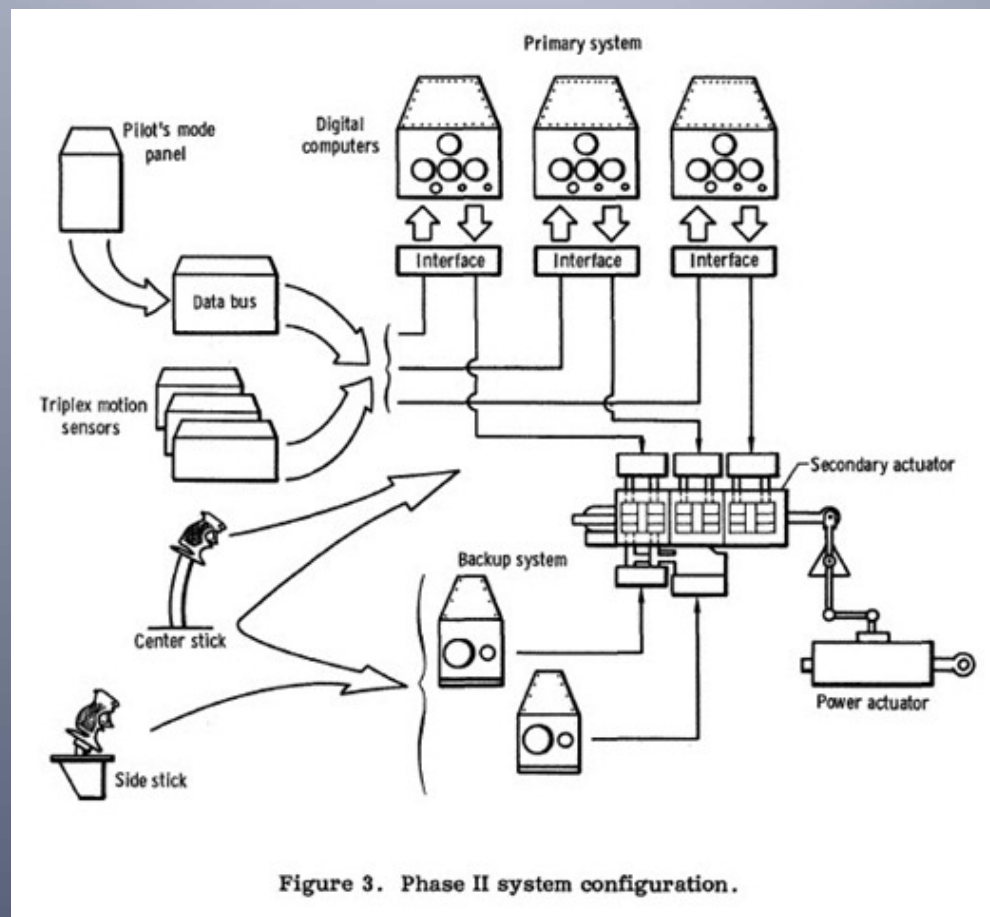
Secondary controls:-Wing flaps

- Slats
- Air brakes
- Spoilers

Flight Control Systems:-Mechanical

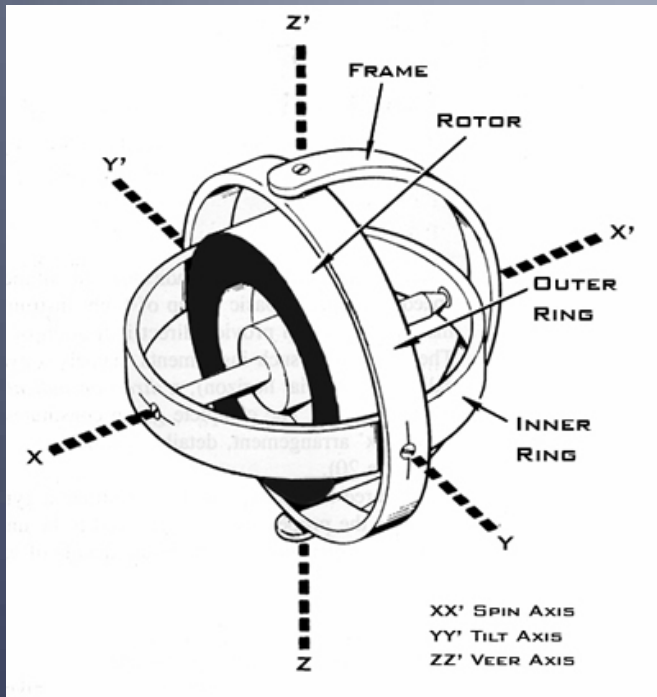
- Hydro-mechanical
- Stick shaker
- Fly-by-wire (FBW).

Fly-by-Wire

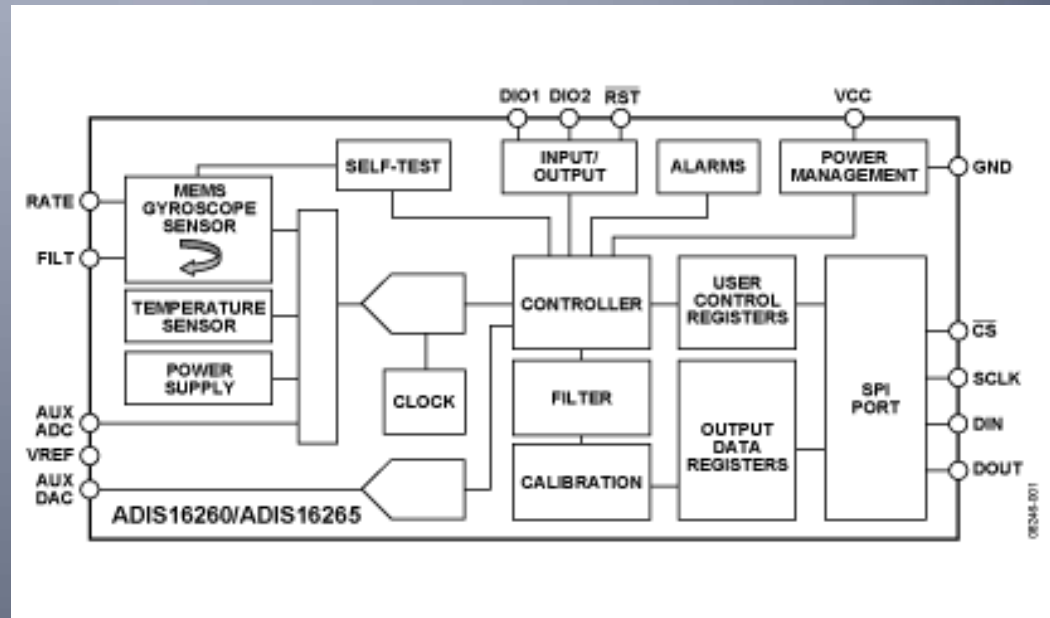


- The system replaces the flight control with an electrical interface. Movements of the plane are converted to electrical signal using a wire and the flight control computer determine how to move the actuators.

Position sensing Gyroscope

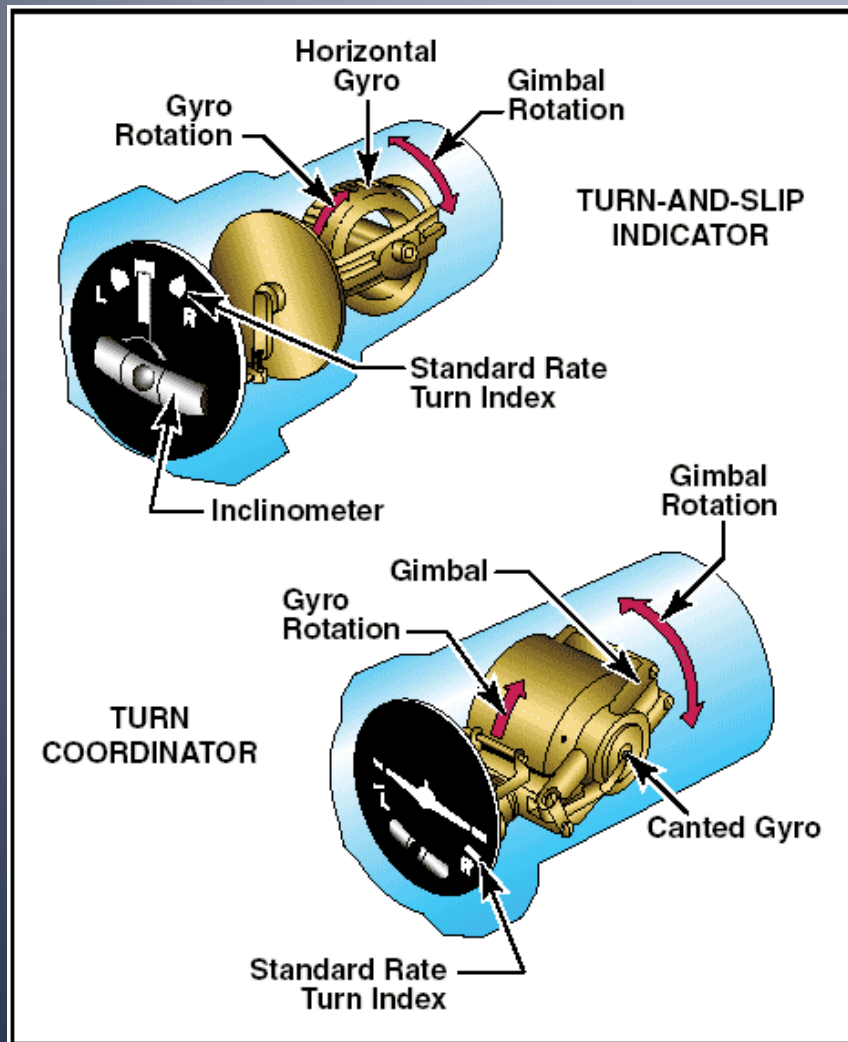


Gyroscope



Digital Gyroscope

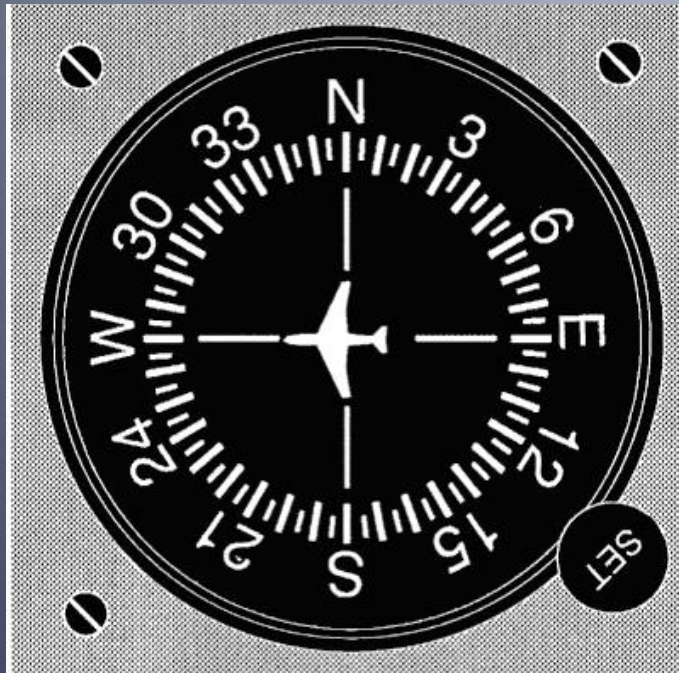
Position sensing Gyroscope



Turn indicator:-Gimbal rotation
-Gyro rotation

Turn-and-slip indicator:-Horizontal
gyro
-Gyro Rotation
-Gimbal Rotation

Orientation



Compass



Global Positioning System

Compass

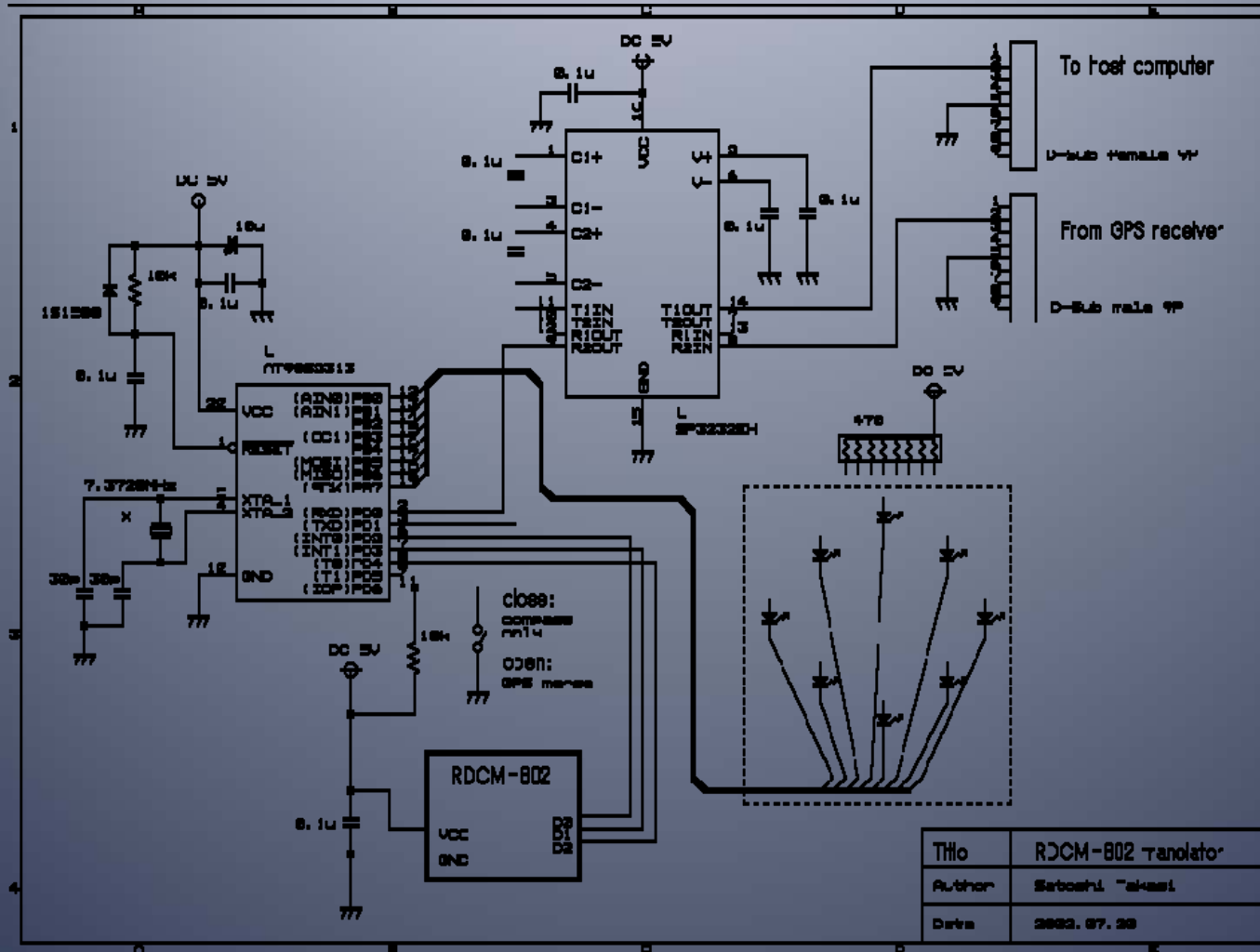


Magnetic compass:
Relative to the North pole.
It can be confused by the
inclination of the Earth's
magnetic pole



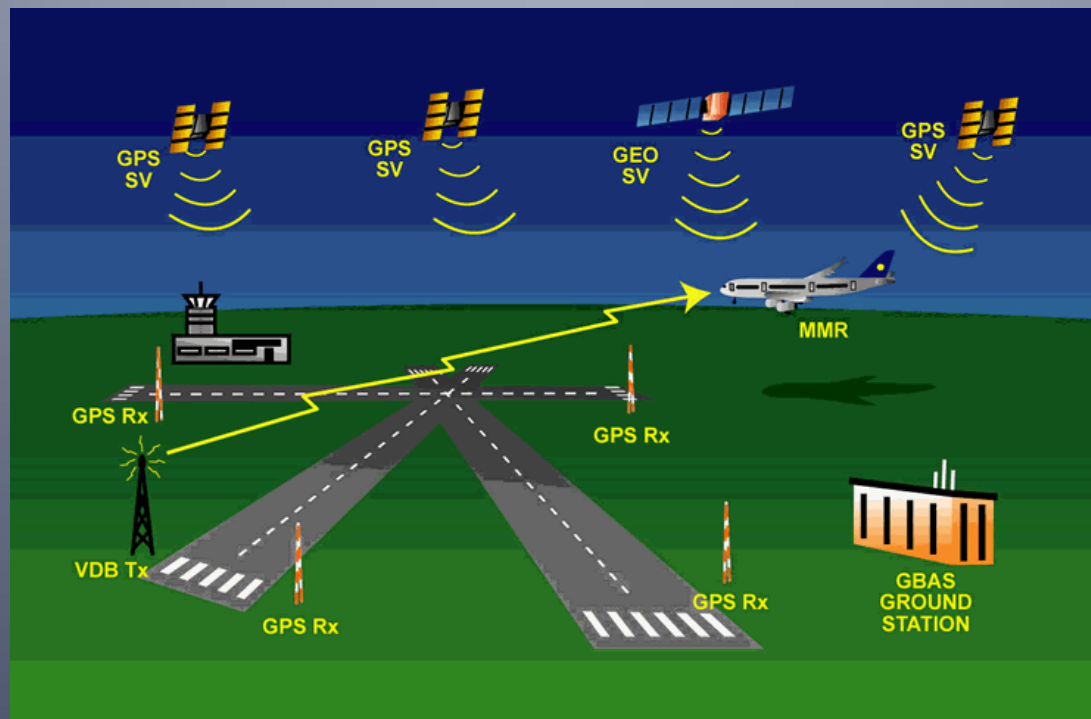
Heading indicator:
Shows the direction
with respect to the
North pole

Digital Compass



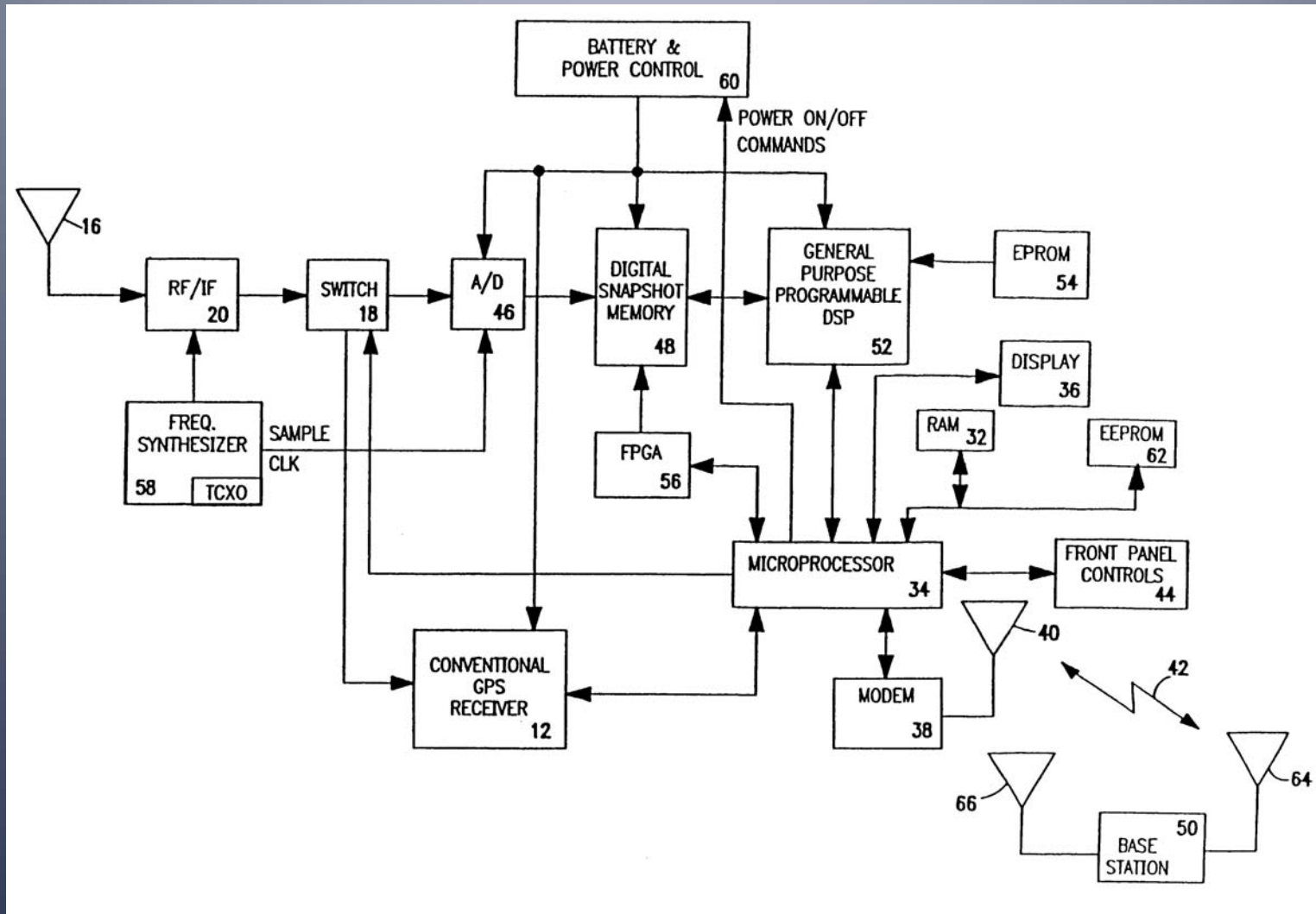
GPS in the air

There are 24 GPS satellites around the Earth and any of them goes round the Earth in 12 hours. Everywhere the minimum number of satellites that can be „seen” from the ground must be 4.



A position can be located very accurately if we have a connection 4 or more GPS satellite.

Method of processing



Unmanned Aerial Vehicle (UAV)

Basic properties: -No pilot onboard

-Remote controlled

-Long range

-Endurance

-Various applications

Applications of „drones”

Weather Drones



The Global Hawk is a weather drone. It studies storms and hurricanes.

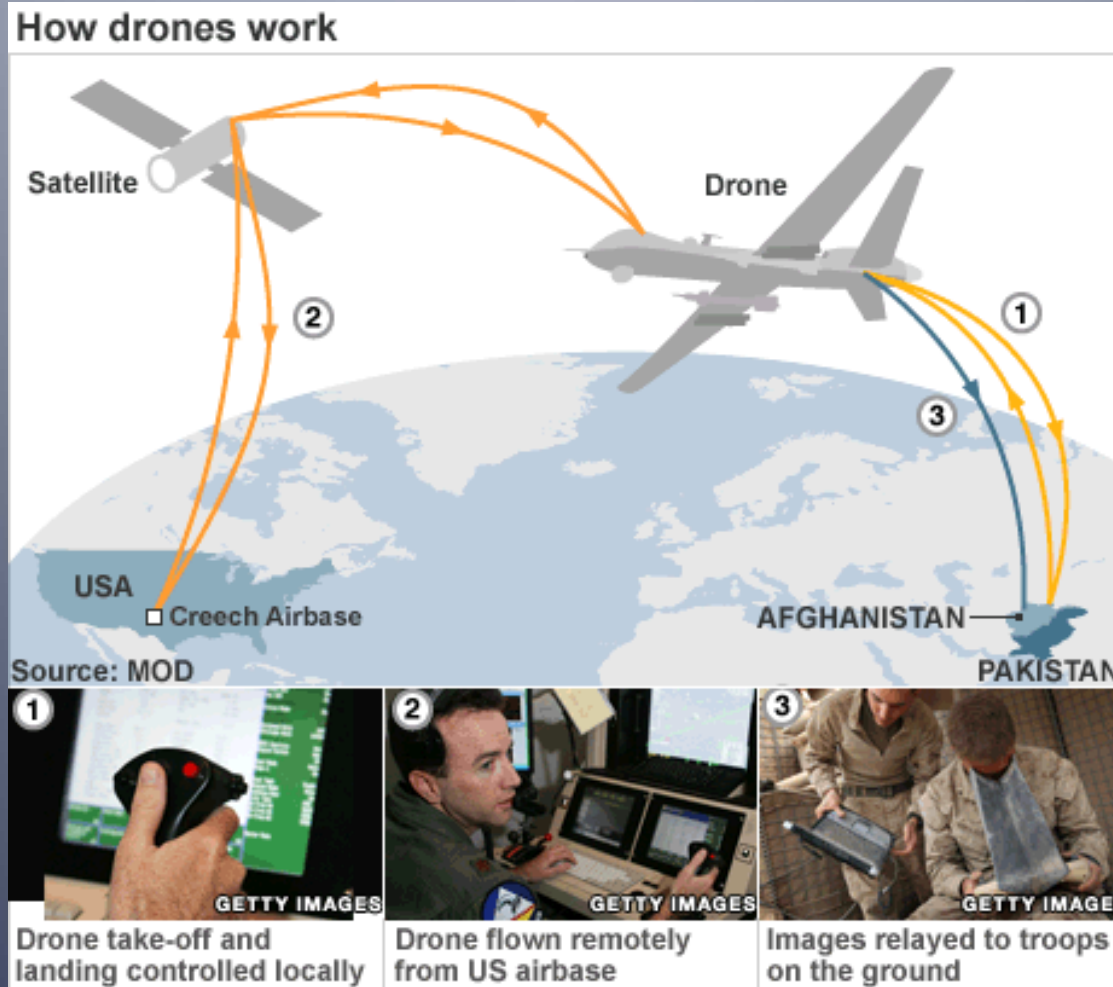
Applications of „drones”

Military Drones



MQ-9 Reaper military drones are one of the deadliest vehicles in the army. It is armed with Hellfire missiles and machine gun.

Applications of „drones”



Applications of „drones”

Commercial drones



They are used for pipeline security, home security, road patrol, filming or anti-piracy. It can be even controlled by smartphone.

References

Journal:

IEEE Industrial Electronics December 2012-Volume 6 Number 4

Internet:

https://www.google.hu/search?q=fly+by+wire+control+laws&source=lnms&tbnm=isch&sa=X&ei=cWyfUuOelqSEyQOVlIC4Ag&sqi=2&ved=0CQcQAUoAQ&biw=1366&bih=605#facrc=&imglii=&imgsrc=6Qv9Wr2F7JNEeM%3A%3BVIXEIRumQDDKMM%3Bhttp%253A%252F%252Fwww.emeraldinsight.com%252Fcontent_images%252Ffig%252F1270760302001.png%3Bhttp%253A%252F%252Fwww.emeraldinsight.com%252Fjournals.htm%253Farticleid%253D1454825%2526show%253Dhtml%3B1629%3B1150

<http://beststockpictures.toinspire.in/index.php?level=picture&id=3260>

<http://www.ct.gov/kids/cwp/view.asp?a=2731&q=330926>

<http://engg-learning.blogspot.hu/2011/03/introduction-to-aeroplane-airplane-is.html>

http://en.m.wikipedia.org/wiki/File:Boeing_247D_ExCC.jpg

<http://www.clipartillustration.com/leonardo-da-vinci-ornithopter-flying-machine-3d-images/>

http://commons.wikimedia.org/wiki/File:The_Wright_Brothers_First_Heavier-than-air_Flight_-_GPN-2002-000178.jpg

<http://longstreet.typepad.com/thesciencebookstore/2009/05/zeppelin-paper-model-1924.html>

<http://www.one-school.net/Malaysia/UniversityandCollege/SPM/revisioncard/physics/forceandpressure/bernoulliprinciple.html>

<http://www.abovetopsecret.com/forum/thread390495/pg1>

<http://astro.u-szeged.hu/szakdolgozok/vegiandras/felhasznalas/helymeghatározas.html>

<https://www.google.hu/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&docid=gQBvjsli7N171M&tbnid=3iUzUNnEng2rvM:&ved=0CAUQjRw&url=http%3A%2F%2Fwww.fortytwotimes.com%2F798%2F63-billion-upgrade-coming-to-us-air-traffic-control-system%2F&ei=3iqjUsPsEYtaswau94DlBw&vrm=bv.57752919.d.bGQ&psig=AFQjCNPjADpi9kvi85fhj-Q3ihGurbPw&ust=1386511365669036>

<http://www.freepatentsonline.com/6725159.html>

http://www.dutchops.com/Portfolio_Marcel/Articles/Instruments/Gyroscopic_Instruments/Theory_Gyroscopes.htm

<http://www.analog.com/en/mems-sensors/mems-inertial-sensors/adis16265/products/product.html>

<http://howcircuits.com/downloads/circuits-and-diagrams/data-acquisition-and-data-logging-schematics/compass.gif>

http://en.wikipedia.org/wiki/File:Group_photo_of_aerial_demonstrators_at_the_2005_Naval_Unmanned_Aerial_Vehicle_Air_Demo.jpg

<http://www.bbc.co.uk/news/business-21432170>

<http://www.bbc.co.uk/news/world-south-asia-10713898>



Thank You for Your Attention
Have a Nice Fly