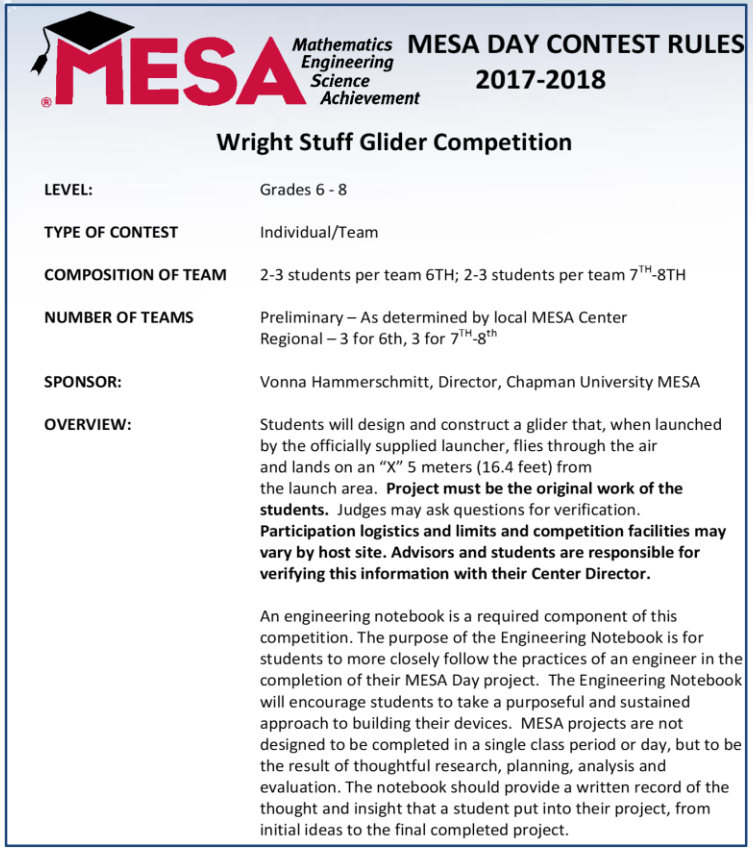
MESA Mathematics Engineering Science Achievement

Wright Stuff Glider
Wright Turn Glider

2017-2018

Wright Stuff Glider ~ Middle School

- Wright Stuff Glider (Middle School)
  - Design and construct a glider, launched by the official competition launcher, to land on a designated target 5 meters from the launch area
  - Engineering Design Notebook

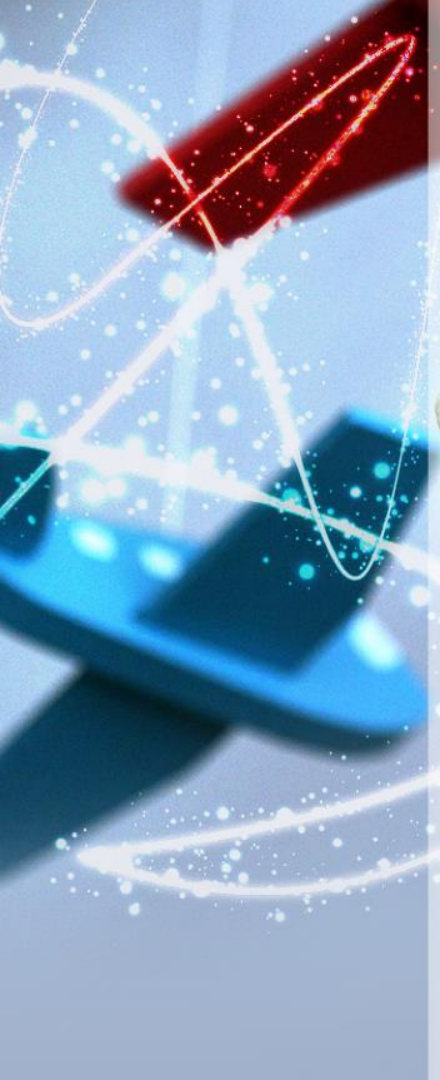


MESA Mathematics Engineering Science Achievement

MESA DAY CONTEST RULES 2017-2018

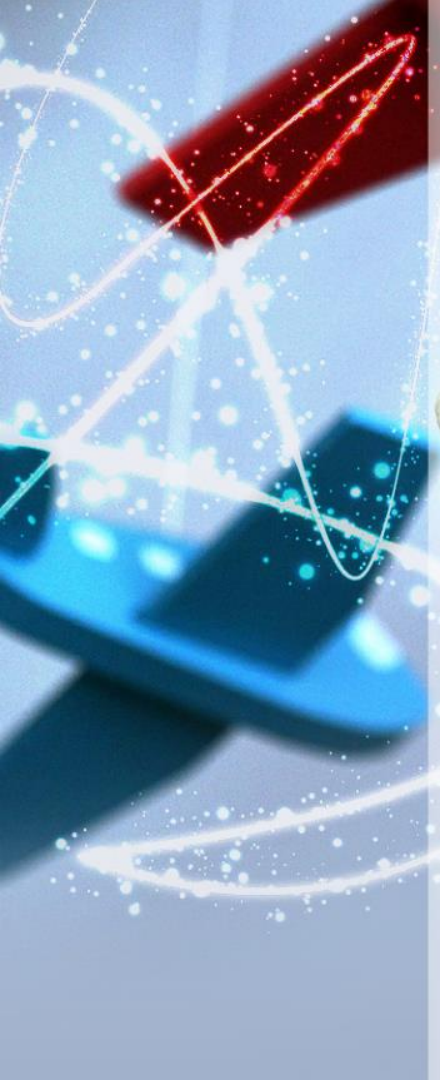
Wright Stuff Glider Competition

LEVEL:	Grades 6 - 8
TYPE OF CONTEST	Individual/Team
COMPOSITION OF TEAM	2-3 students per team 6TH; 2-3 students per team 7TH-8TH
NUMBER OF TEAMS	Preliminary – As determined by local MESA Center Regional – 3 for 6th, 3 for 7TH-8th
SPONSOR:	Vonna Hammerschmitt, Director, Chapman University MESA
OVERVIEW:	Students will design and construct a glider that, when launched by the officially supplied launcher, flies through the air and lands on an "X" 5 meters (16.4 feet) from the launch area. **Project must be the original work of the students.** Judges may ask questions for verification. **Participation logistics and limits and competition facilities may vary by host site. Advisors and students are responsible for verifying this information with their Center Director.** An engineering notebook is a required component of this competition. The purpose of the Engineering Notebook is for students to more closely follow the practices of an engineer in the completion of their MESA Day project. The Engineering Notebook will encourage students to take a purposeful and sustained approach to building their devices. MESA projects are not designed to be completed in a single class period or day, but to be the result of thoughtful research, planning, analysis and evaluation. The notebook should provide a written record of the thought and insight that a student put into their project, from initial ideas to the final completed project.



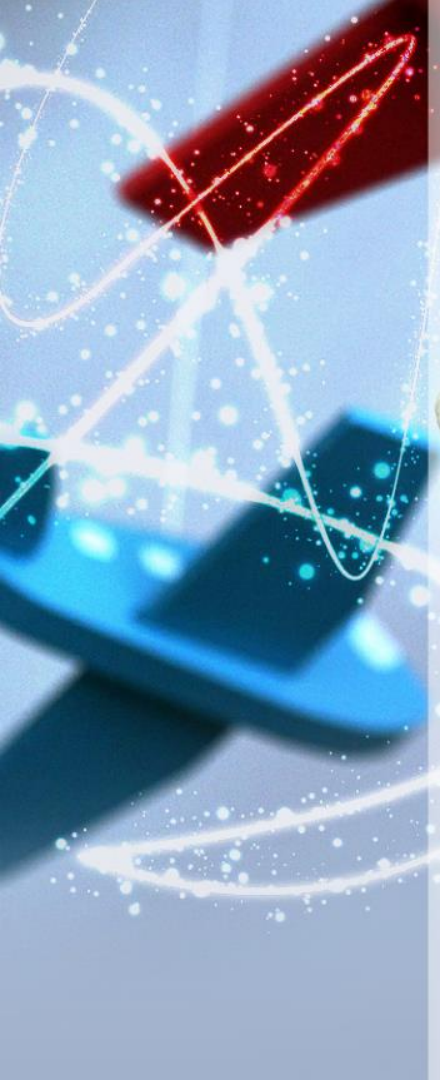
Wright Stuff Gilder ~ Rules

- 2-3 students per team (6^{th}; $7/8^{th}$)
- Materials
  - All legal
  - Withstand launch
- No size or weight restrictions
- Power may only be supplied by the official launcher
- Must be capable of self sustained flight
- No remote control devices



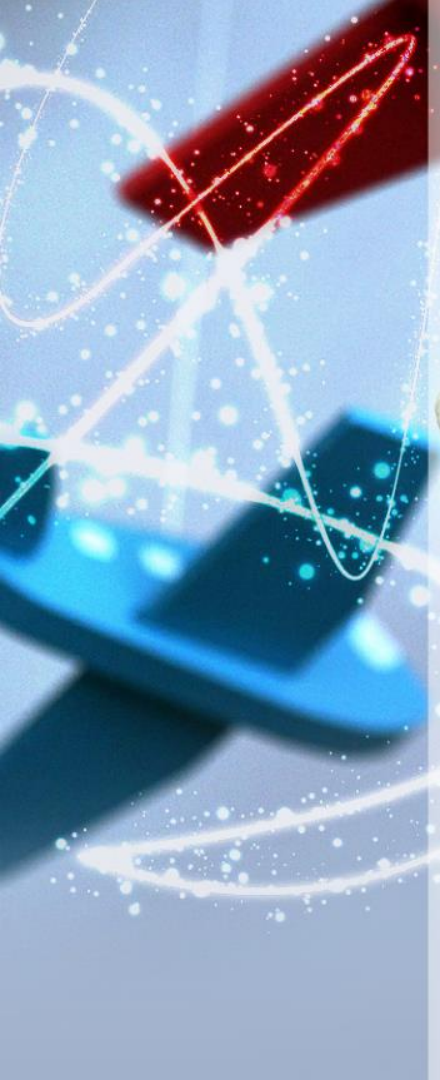
Wright Stuff Gilder ~ Rules

- Must remain intact during flight ***(DQ)***
- Must contain a feature which adapts to the launch hook
- Must be capable of launch using the hook on the launch ramp
- May not alter or damage the launch hook attached to the official launcher
- Designed to not interfere with the slot in the launcher



Wright Stuff Gilder ~ Testing

- Official launcher provided at competition site (specs provided in rules)
- Target marked by an “X” located 5 meters in front of the position where the launch hook stops
- Target 110cm below where launch hook stops
- 5 minute setup w/ 30 second countdown
- 2 official launches (best of)
- Measurement from location glider FIRST touches the ground to the center of the target “X”
- Tiebreaker determined by longest flight time



Wright Stuff Gilder ~ Engineering Design Notebook

- Inside cover properly labeled
- Project introduction (1 page)
- 10 daily entries (with 3 required questions)
- 2 Project sketches
- Applied mathematics
  - Glider speed; d=rt
  - Surface area
- 20% penalty (NOT 10%)

Wright Turn Glider ~ High School

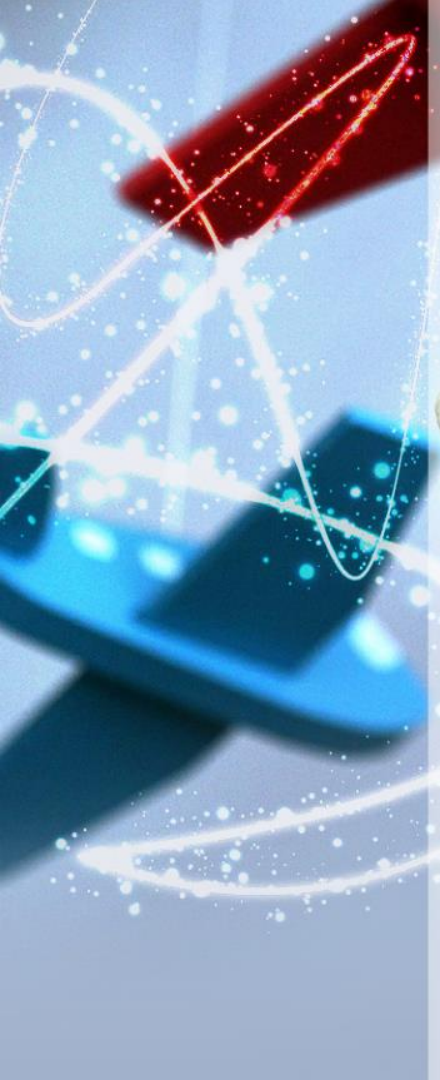
- Wright Turn Glider (High School)
  - Design and construct a glider, launched by the official competition launcher, which makes a right turn and land on a designated target 12.2 meters from the launch area.
  - Engineering Design Notebook

MESA Mathematics Engineering Science Achievement

MESA DAY CONTEST RULES 2017-2018

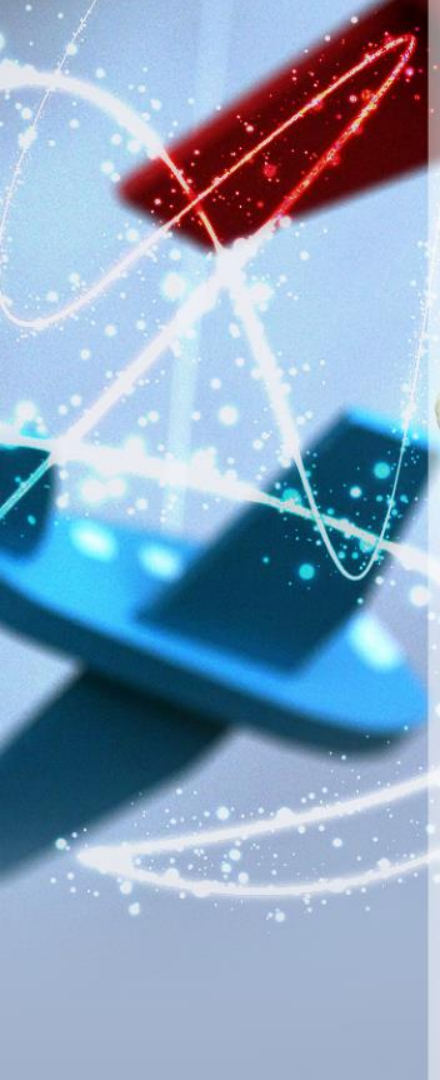
Wright Turn Glider Competition

LEVEL:	Grades 9 – 12
TYPE OF CONTEST	Individual/Team
COMPOSITION OF TEAM	2-3 students per team 9th-10th; 2-3 students per team 11th-12th
NUMBER OF TEAMS	Preliminary – As determined by local MESA Center Regional – 3 for 9th – 10th, 3 for 11th – 12th
SPONSOR:	Vonna Hammerschmitt, Director, Chapman University MESA
OVERVIEW:	Students will design and construct a glider that, when launched by the officially supplied launcher, flies through the air, makes a right-hand turn, and lands on an "X" 12.2 meters (40 feet) from the launch area. **Project must be the original work of the student.** Judges may ask questions for verification. **Participation logistics and limits and competition facilities may vary by host site. Advisors and students are responsible for verifying this information with their Center Director.** An engineering notebook is a required component of this competition. The purpose of the Engineering Notebook is for students to more closely follow the practices of an engineer in the completion of their MESA Day project. The Engineering Notebook will encourage students to take a purposeful and sustained approach to building their devices. MESA projects are not designed to be completed in a single class period or day, but to be the result of thoughtful research, planning, analysis and evaluation. The notebook should provide a written record of the thought and insight that a student put into their project, from initial ideas to the final completed project.



Wright Turn Gilder ~ Rules

- 2-3 students per team (9/10th; 11/12th)
- Materials
  - All legal
  - Withstand launch
- No size or weight restrictions
- Power may only be supplied by the official launcher
- Must be capable of self sustained flight
- No remote control devices



Wright Turn Gilder ~ Rules

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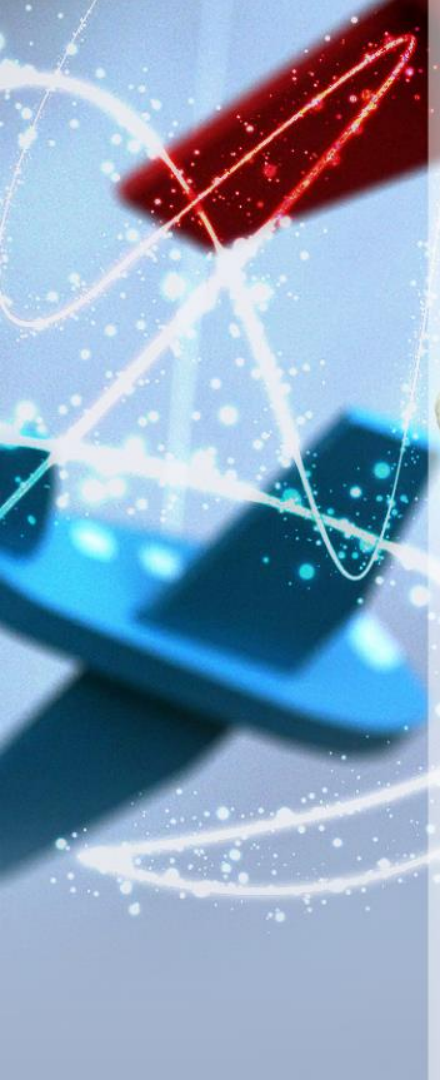
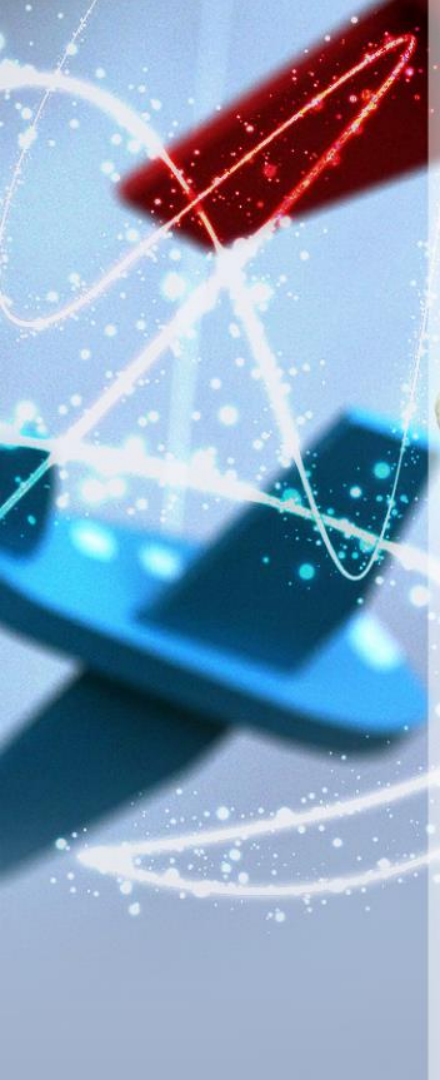


Wright Turn Gilder ~ Testing

- Official launcher provided at competition site (specs provided in rules)
- Target marked by an “X” located 8.6 meters in front of the position where the launch hook stops and 8.6 meters to the right of where the launch hook stops
- Target 110cm below where launch hook stops
- 5 minute setup w/ 30 second countdown
- 2 official launches (best of)
- Measurement from location glider FIRST touches the ground to the center of the target “X”
- Tiebreaker determined by longest flight time



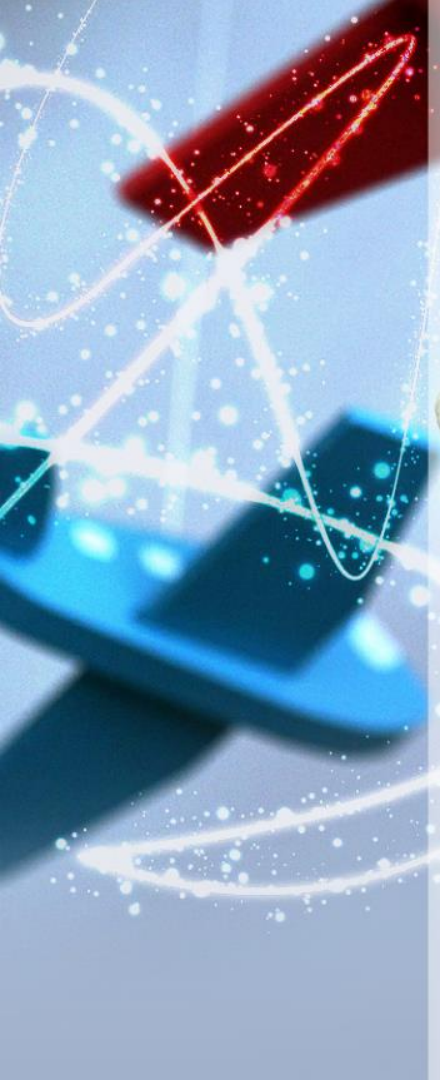
Wright Turn Gilder ~ Engineering Design Notebook

- Inside cover properly labeled
- Project introduction (1 page)
- 10 daily entries (with 3 required questions)
- 2 Project sketches
- Applied mathematics
  - Glider speed; d=rt
  - Surface area
  - Glider efficiency
  - Center of mass
- 20% penalty (NOT 10%)

Curriculum

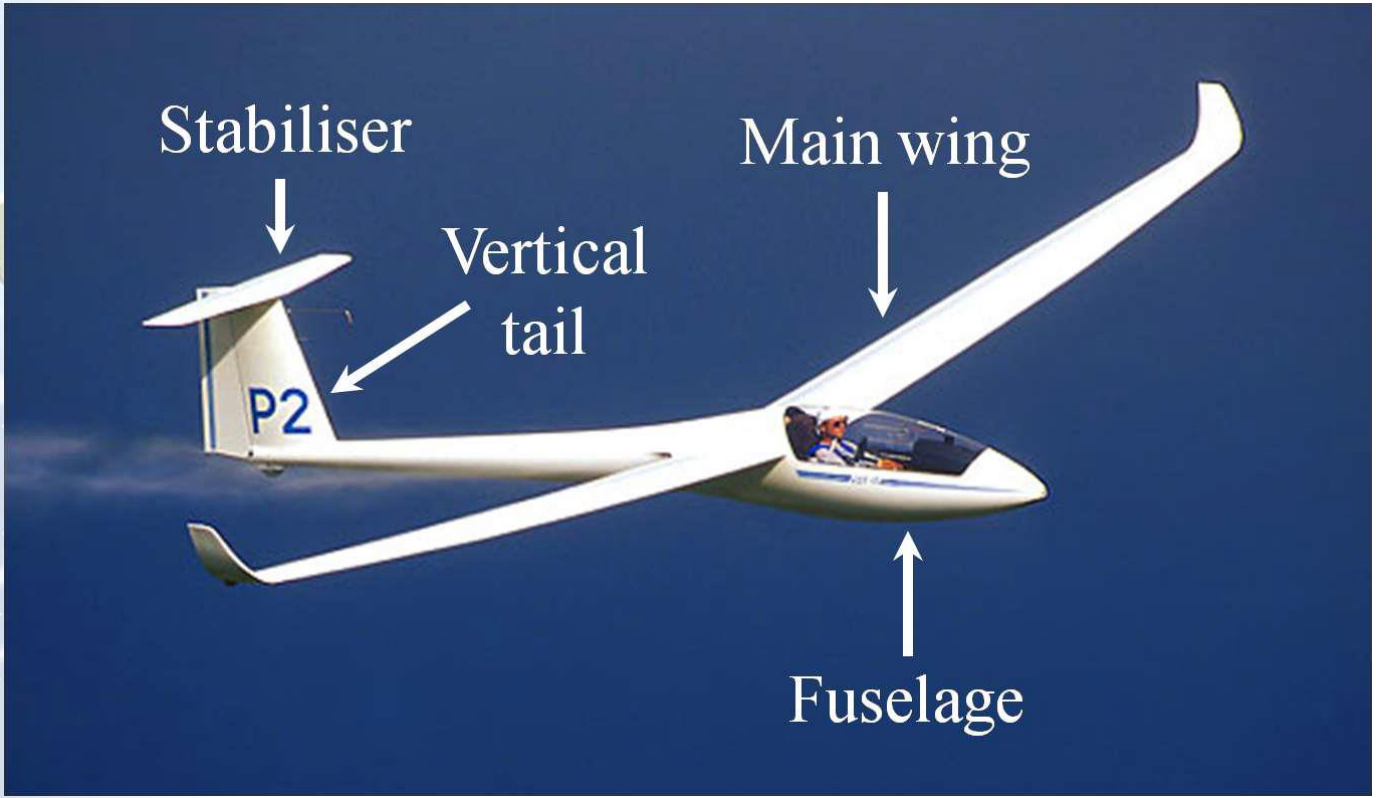
- 2016-2017 & 2017-2018
- Modules
- Standards addressed
- Mathematics Concepts
- NASA Aerodynamics Interactive learning site

Glider Basics



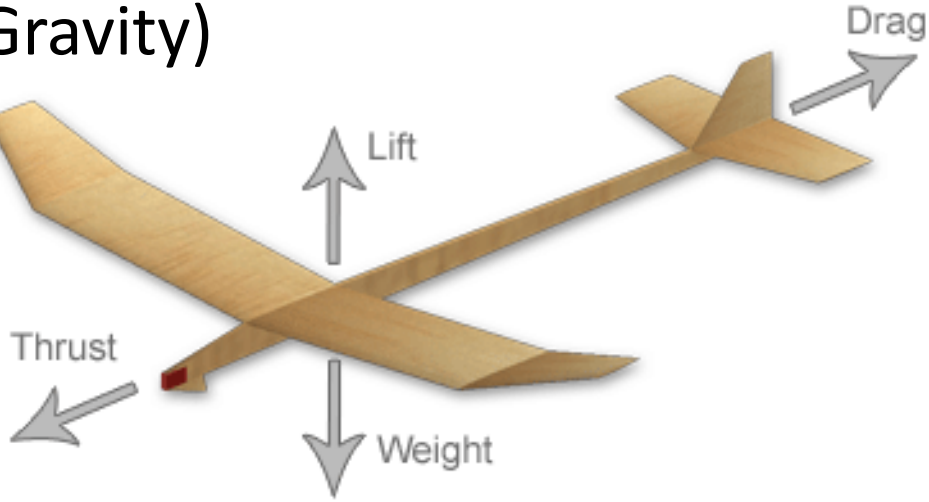
What is a Glider?

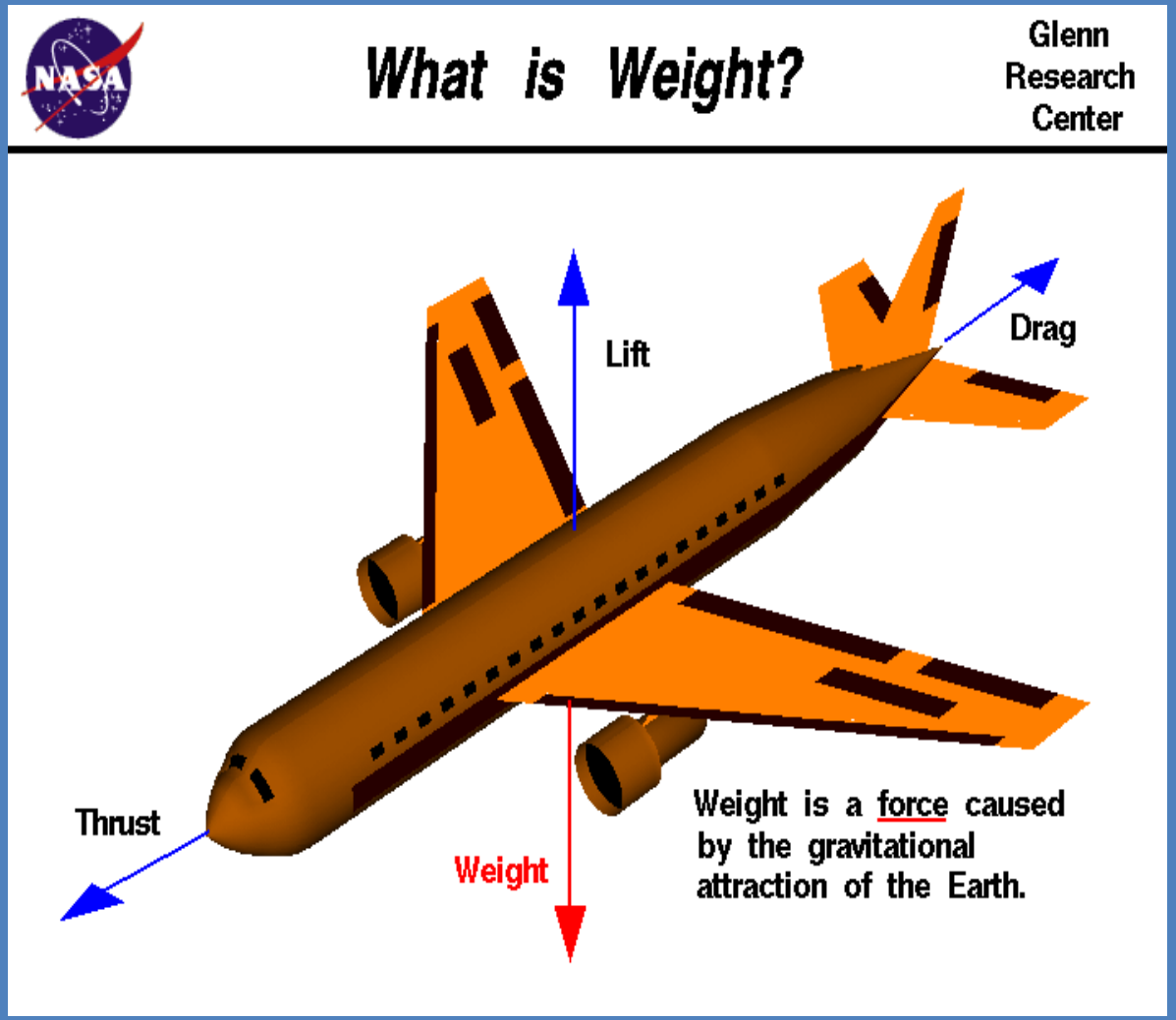
- A light engineless aircraft designed to glide after being towed aloft or launched from a catapult
- 3 Main Parts
  - Fuselage
  - Wing
  - Tail


Stabiliser
Vertical tail
Main wing
P2
Fuselage

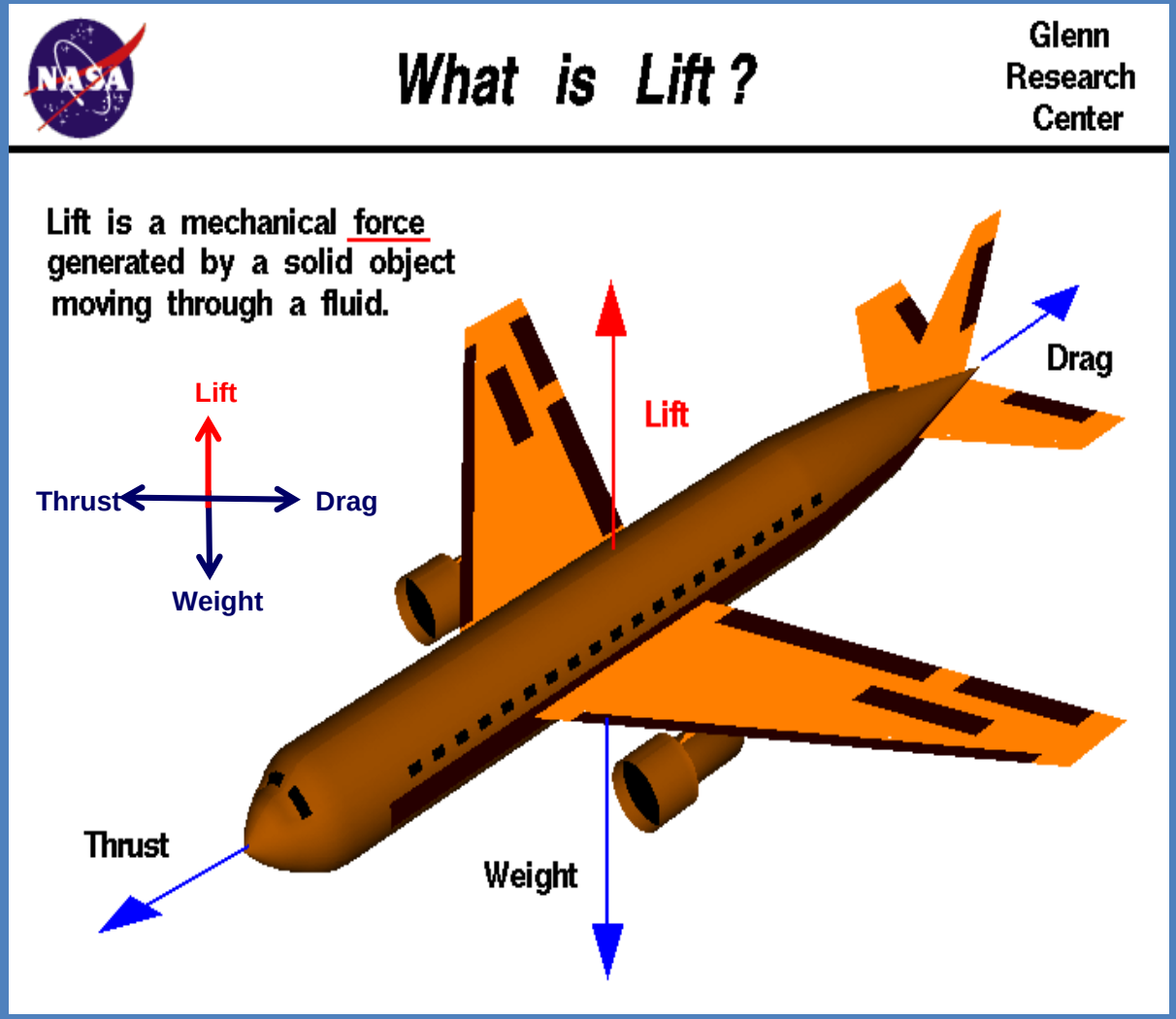
Forces of Flight

- Drag
- Lift
- Thrust
- Weight (Gravity)

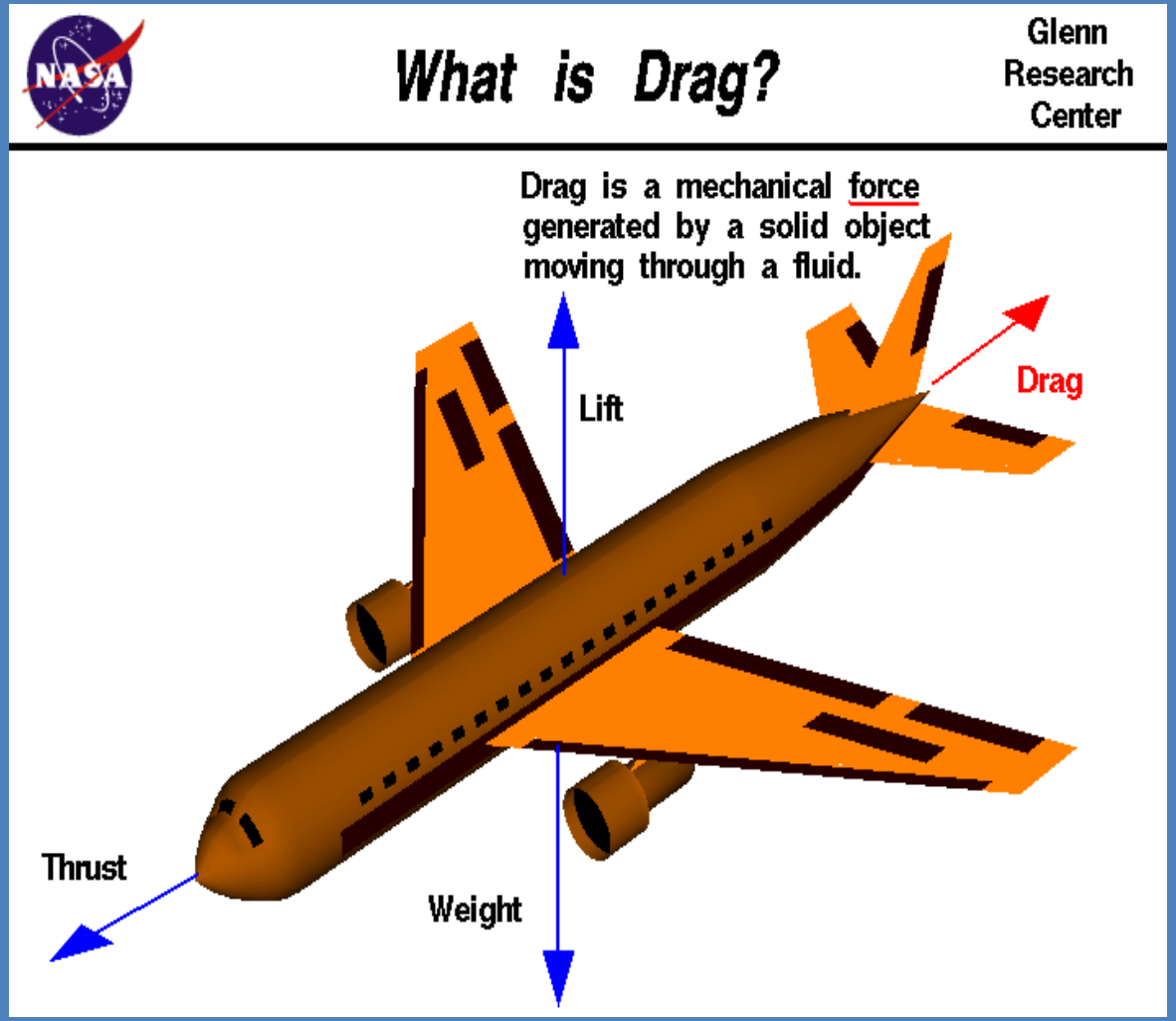




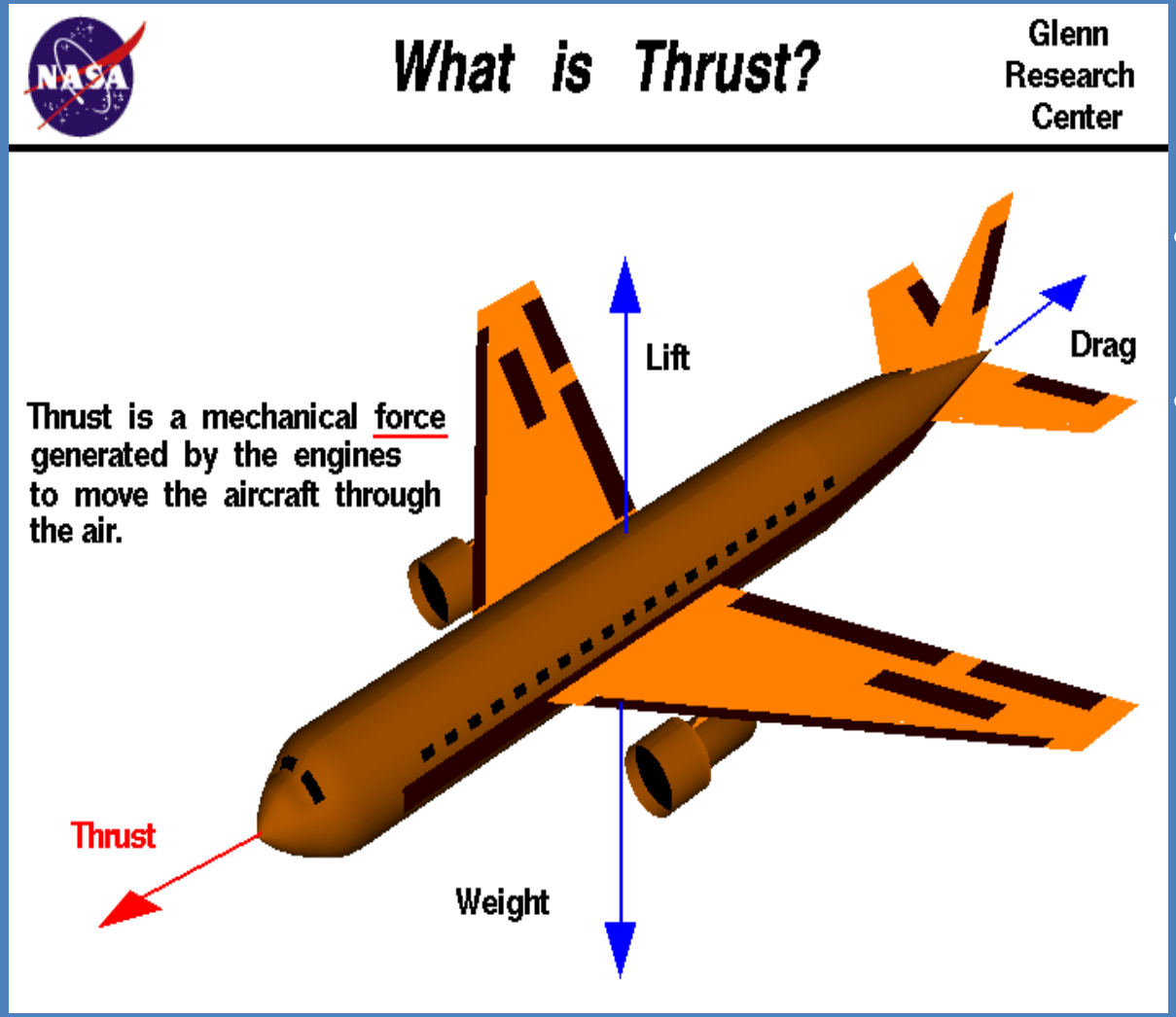
- Force of gravity on the glider
- Direction constant toward center of earth
- Constant in level unaccelerated flight
- Counteracts lift



- Upward force, opposes downward force of gravity
- Created by effects of airflow over wing
- Bernoulli's Principle Slower moving air below the wing creates greater pressure



- Air resistance
- Resist movement of glider through the air
- Created by airplane design or as a product of lift generation

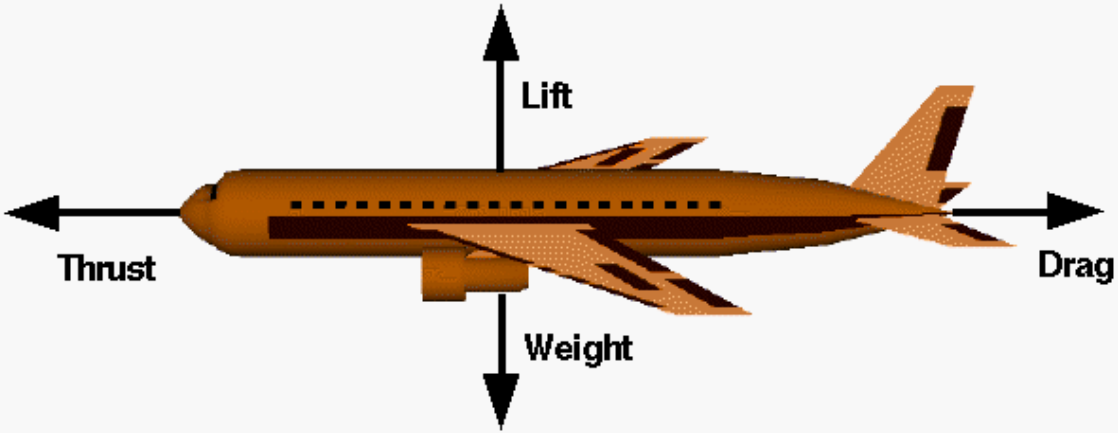


- Forward force opposing drag
- Obtained by outside force (launcher)

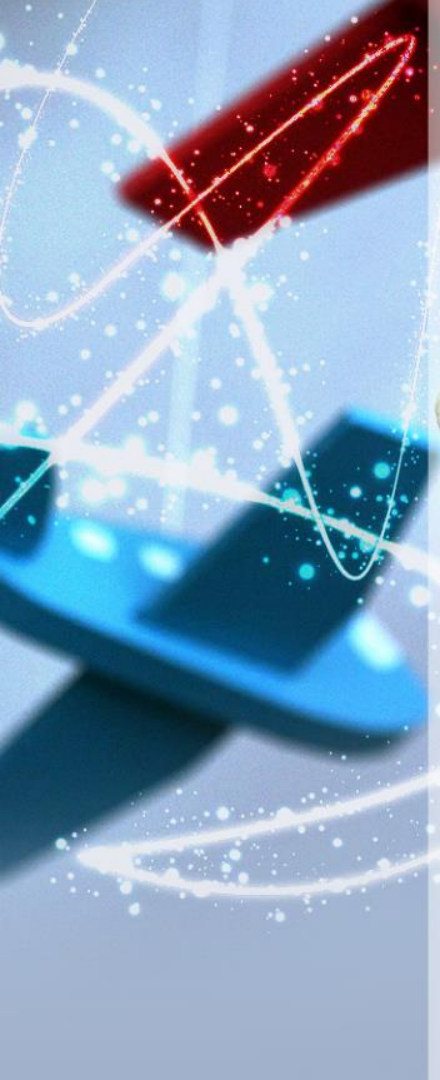
Simplified Aircraft Motion

Unbalanced Forces

Glenn Research Center



Flight Condition	Effect
Lift > Weight	Plane Rises
Weight > Lift	Plane Falls
Drag > Thrust	Plane Slows
Thrust > Drag	Plane Accelerates

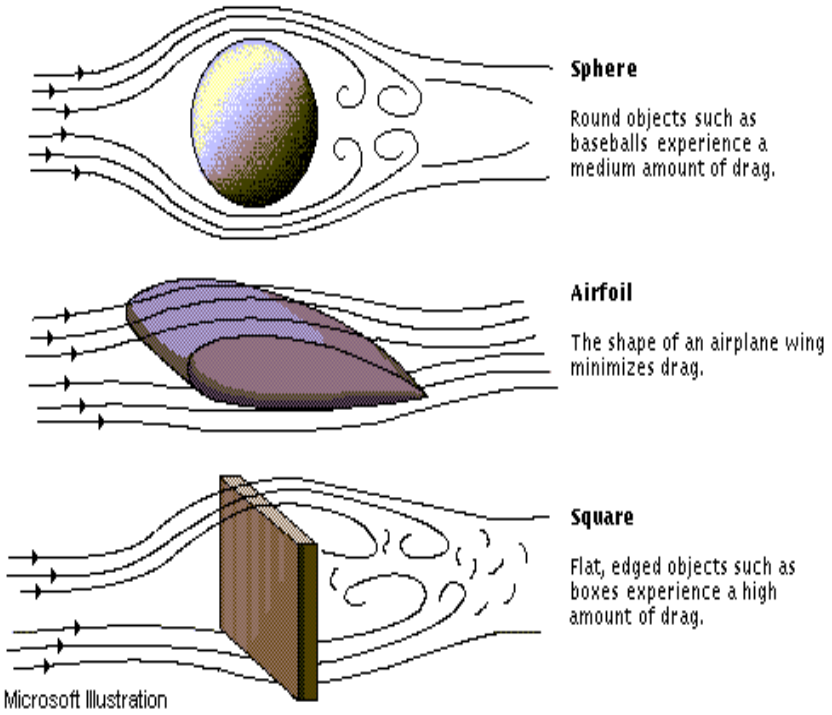


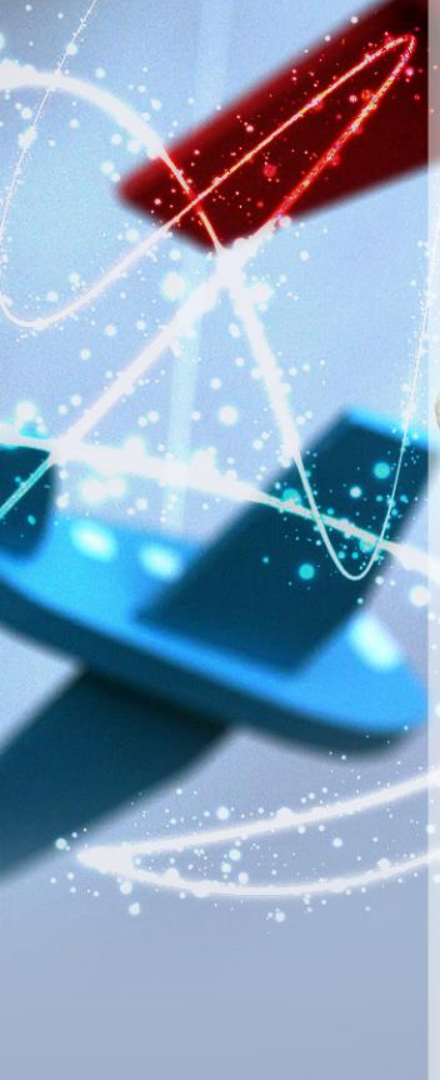
Wing

- It is the most important part of the glider/plane
- When air flows past it, due to the difference in curvature of its upper and lower parts, lift if generated, which is responsible for balancing the weight of the plane, allowing it to fly.

Aerodynamics

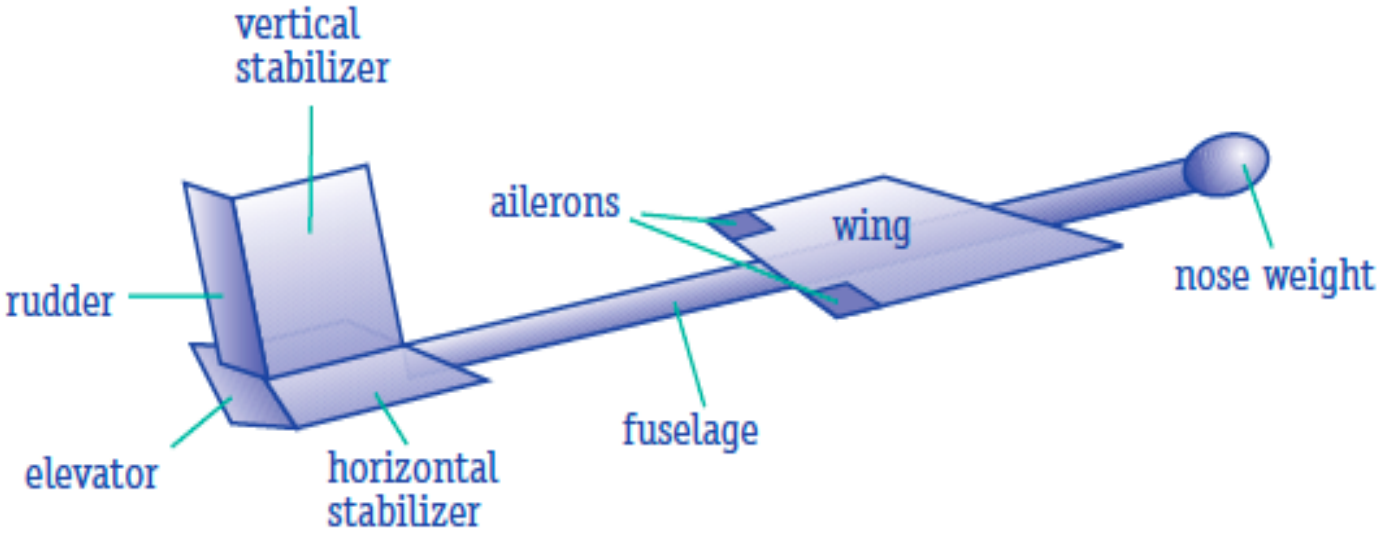
A branch of fluid mechanics that deals with the motion of air and other gaseous fluids

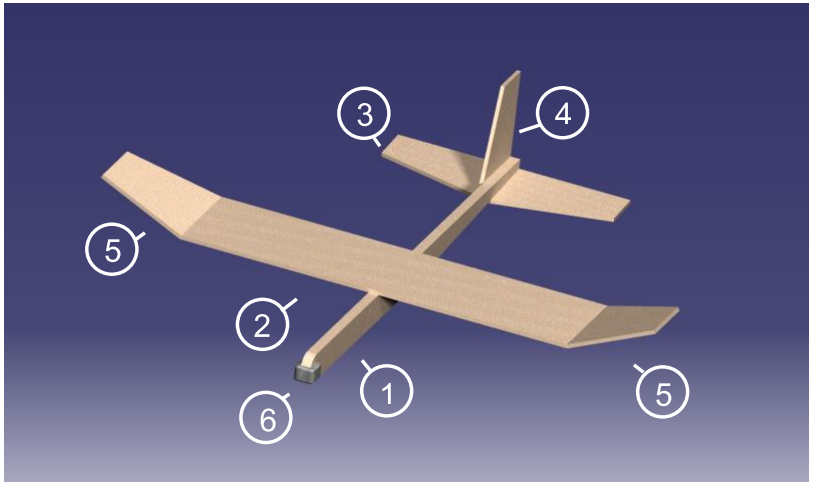




Factors to consider

- Wing size and shape
- Center of gravity
- Airfoil design
- Create drag (wing slats)
- Right Turn
    - Wing position (adjustable?)
    - Weight wings
    - Adjust vertical stabilizer


vertical stabilizer
ailerons
wing
rudder
nose weight
fuselage
elevator
horizontal stabilizer



1) The fuselage. This links all the parts together, provides space for passengers, and supports most of the load when the aircraft is on the ground.
2) The wings. These create the lift, allowing the aircraft to fly. It supports most of the load during flight.
3) The horizontal stabiliser. This helps to make the glider stable in the nose-to-tail direction (pitch), preventing it tipping nose up or nose down.
4) The vertical stabiliser. This prevents the glider twisting side to side (yaw), so it continues in a straight line.
5) The winglets. These helps to make the glider stable in the wing-tip to wing-tip direction, preventing it rolling side to side.
6) Nose weight. This helps to move the centre of gravity forward. This works with the horizontal stabiliser to make the glider stable in the nose-to-tail direction.