Glenn Research Center

7 JULY 06

Interactive Educational Software and Websites

Tom Benson

Thomas.J.Benson@nasa.gov

OUTLINE

- Background
- Examples of Free Educational Software
- Examples from Beginner's Guides
- Current Efforts
- Future Plans
- Questions / Answers

MOST IMPORTANT SLIDE

Glenn Research Center

http://education.grc.nasa.gov/

Under: Related Multimedia

Beginner's Guide to Rocketry

Beginner's Guide to Aeronautics

Re–Living the Wright Way


70
75
80
85
90
95
Computational Fluid Dynamics
Netscape: Parts of Airplane
File Edit View Go Communicator Help
Back Forward Reload Home Search Guide Print Security Stop
Bookmarks Netsite: http://www.lerc.nasa.gov/WWW/IFMD/airplane/airp
Internet Lookup New&Cool
Airplane Parts Definitions
Lewis Research Center
Vertical Stabilizer
Control Yaw
Rudder
Change Yaw (Side-to-Side)
Horizontal Stabilizer
Control Pitch
Elevator
Change Pitch (Up-Down)
Wing
Generate Lift
Flaps
Change Lift and Drag
Jet Engine
Generate Thrust
Aileron
Change Roll (Rotate Body)
Spoiler
Change Lift and Drag (Rotate Body)
Cockpit
Command and Control
Fuselage (Body)
Hold Things Together (Carry Payload - Fuel)
Slats
Change Lift
An animated version of this slide is also available.
This slide shows the parts of an airplane and their functions. Airplanes come in many different shapes and sizes. The airplane on this slide is a turbine-powered airliner.
FoilSim
File Options Help
Airfoil View Panel
Side View
Plotter View Panel
Lift (newtons)
Angle of Attack (Degrees)
Airfoil Input Panel
Airspeed
Altitude
Angle
Thickness
Camber
Area
Lift
Play Ball
Reset
Save Data
Print Data
ZERO GRAVITY
SURFACE TENSION
HIGH INJECTION VELOCITY
TANK PRESSURE CONTROL EXPERIMENT
IN-STEP
BOEING • NASA LEWIS RESEARCH CENTER • STS 43-1991
NASP
An Investment In Aerospace Superiority

OBJECTIVE

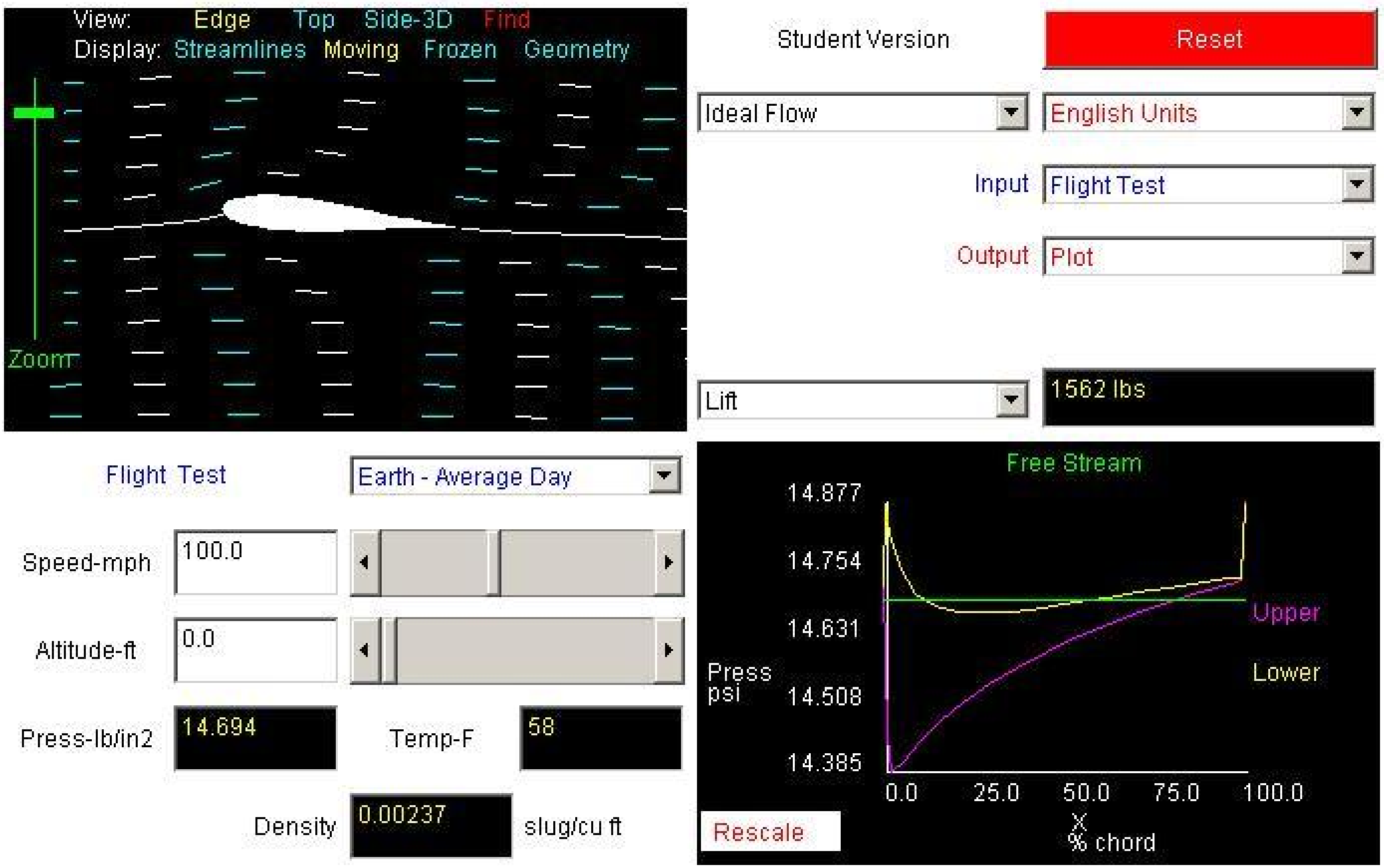
- Use computer technology and student interest in airplanes and rockets to introduce and demonstrate science, technology, engineering and math.

- Develop educational materials for use by teachers.

- Use the Internet for world–wide distribution of NASA software and educational materials.

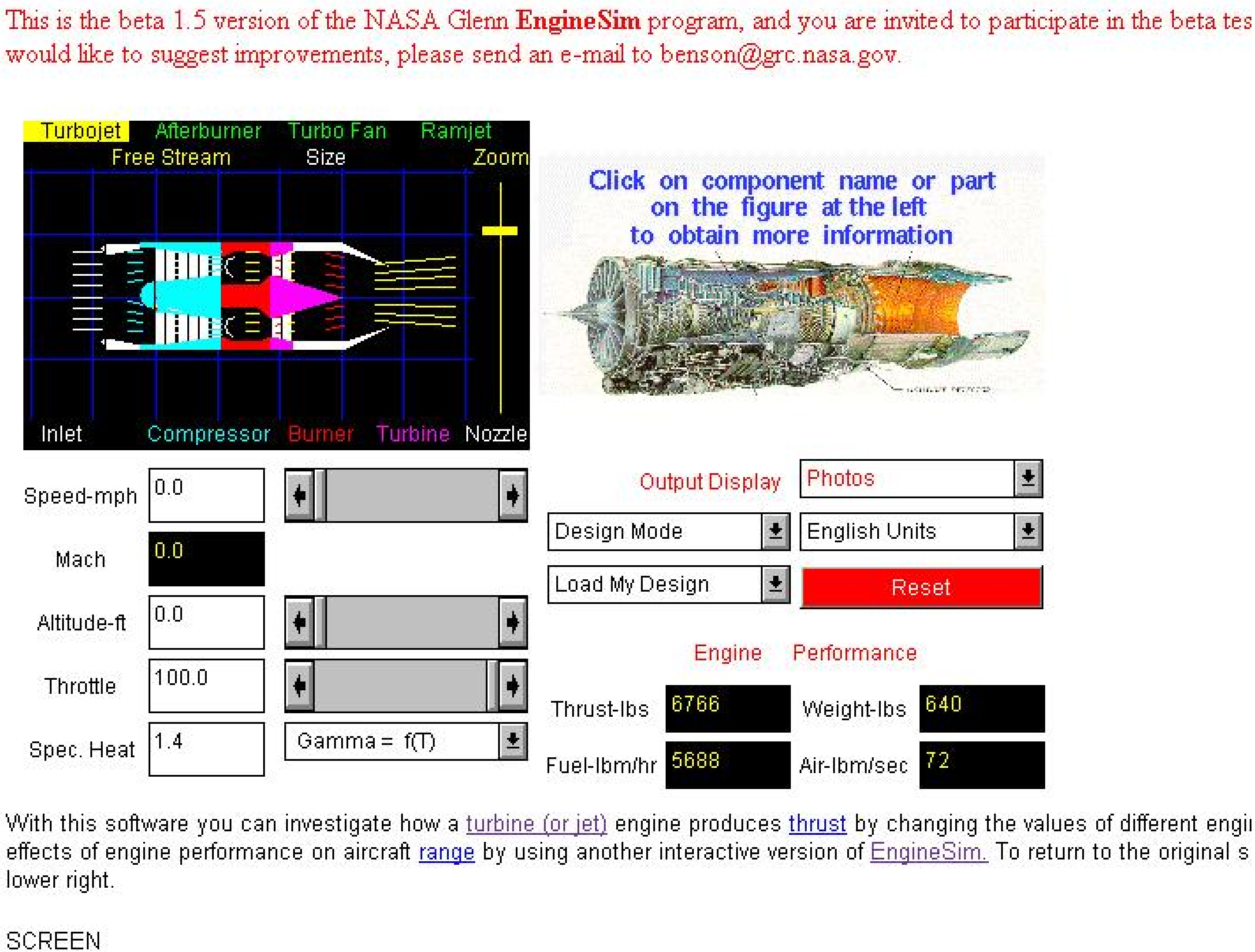
Example of Free Software FoilSim

This is a beta 1.5a version of the **FoilSim II** program, and you are invited to participate in the beta testing. If you find errors in the program or would like to suggest improvements, please send an e-mail to benson@grc.nasa.gov. Version 1.4n is still available if you prefer the older version.

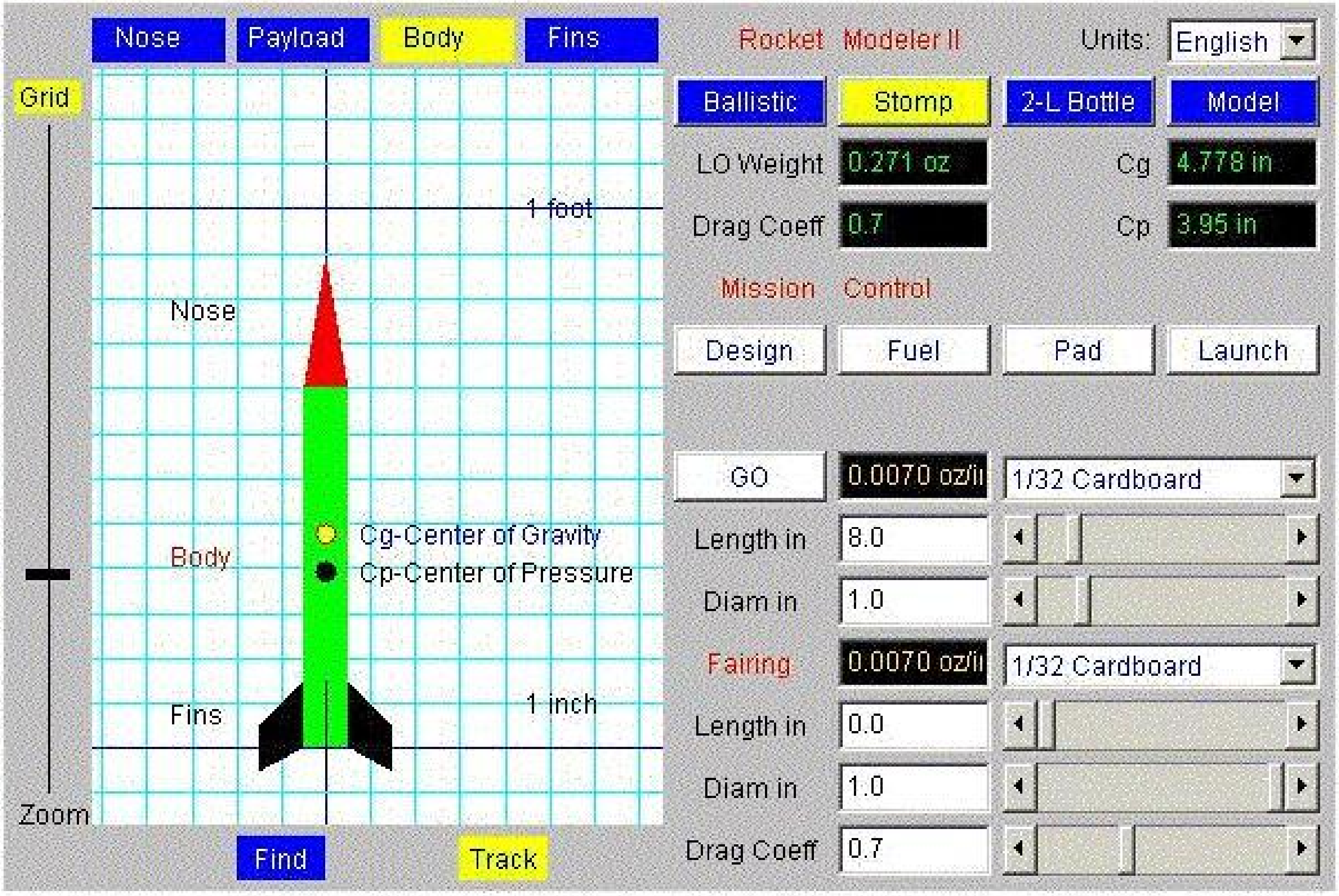


FoilSim II

Example of Free Software EngineSim



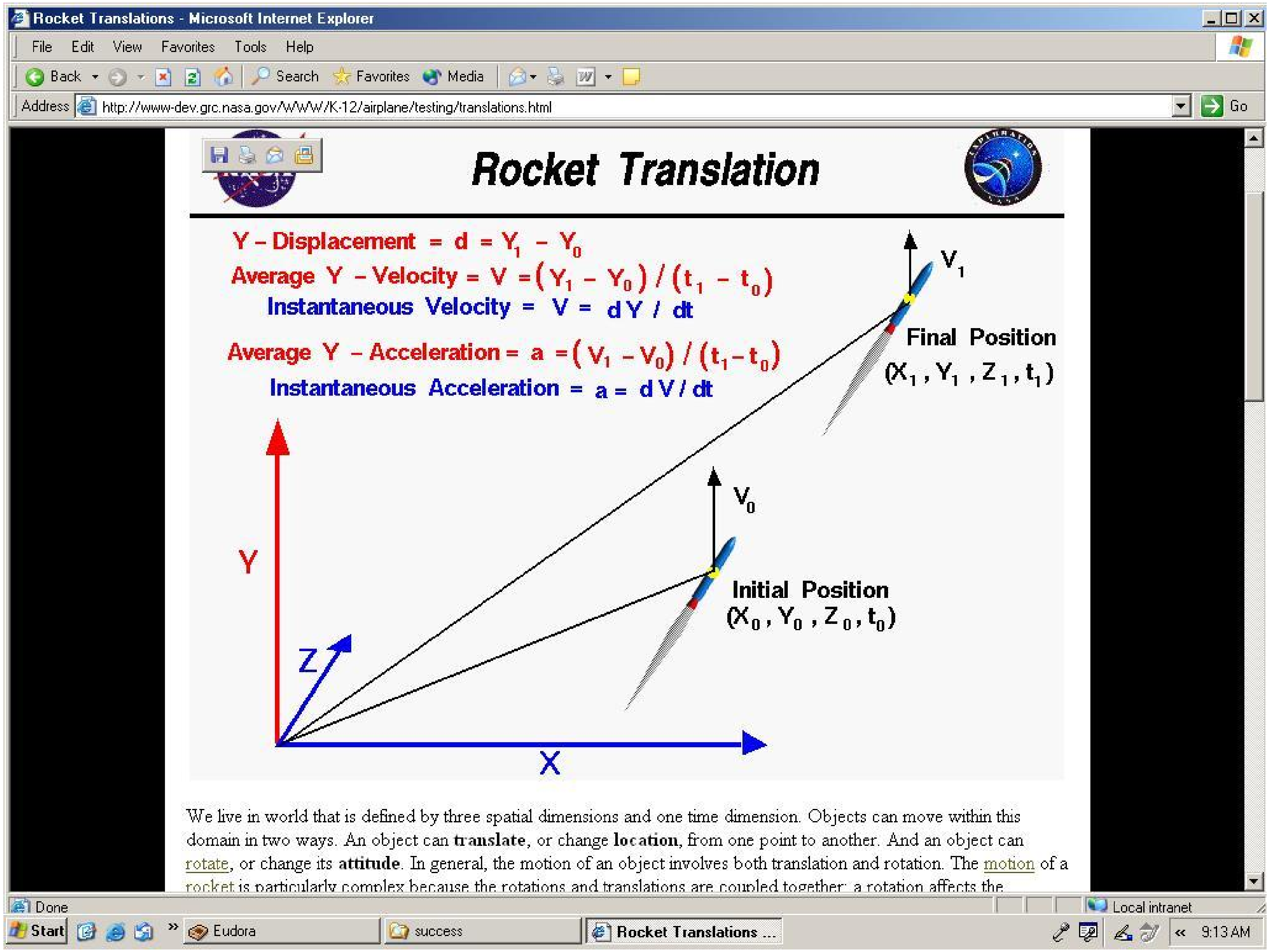
Example of Free Software RocketModeler II



Example of Free Software Calculators

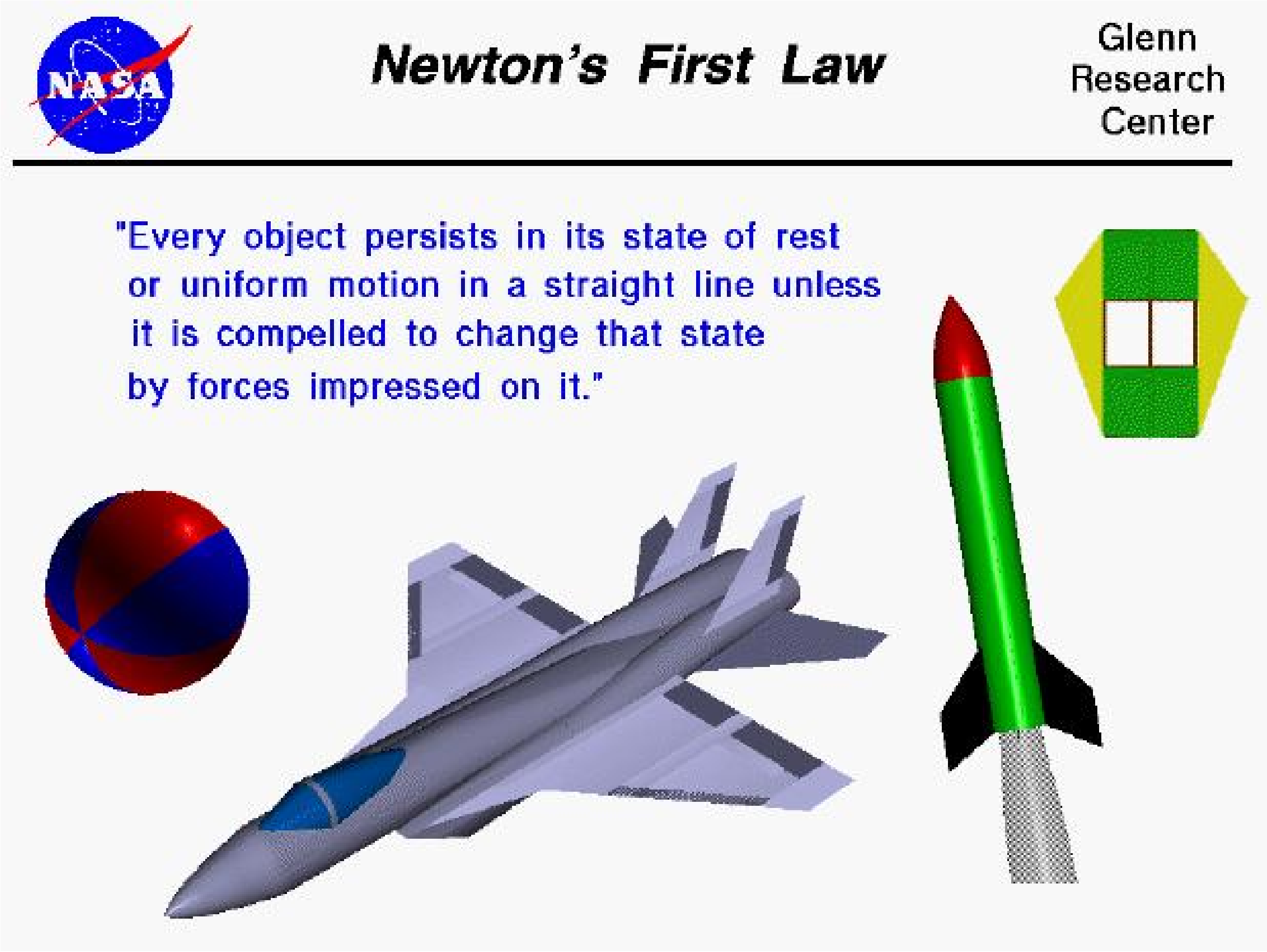
- Mach and Speed of Sound
- Standard Atmosphere
- Isentropic Flow
- Normal and Oblique Shocks
- Terminal Velocity

Page from Beginner's Guide

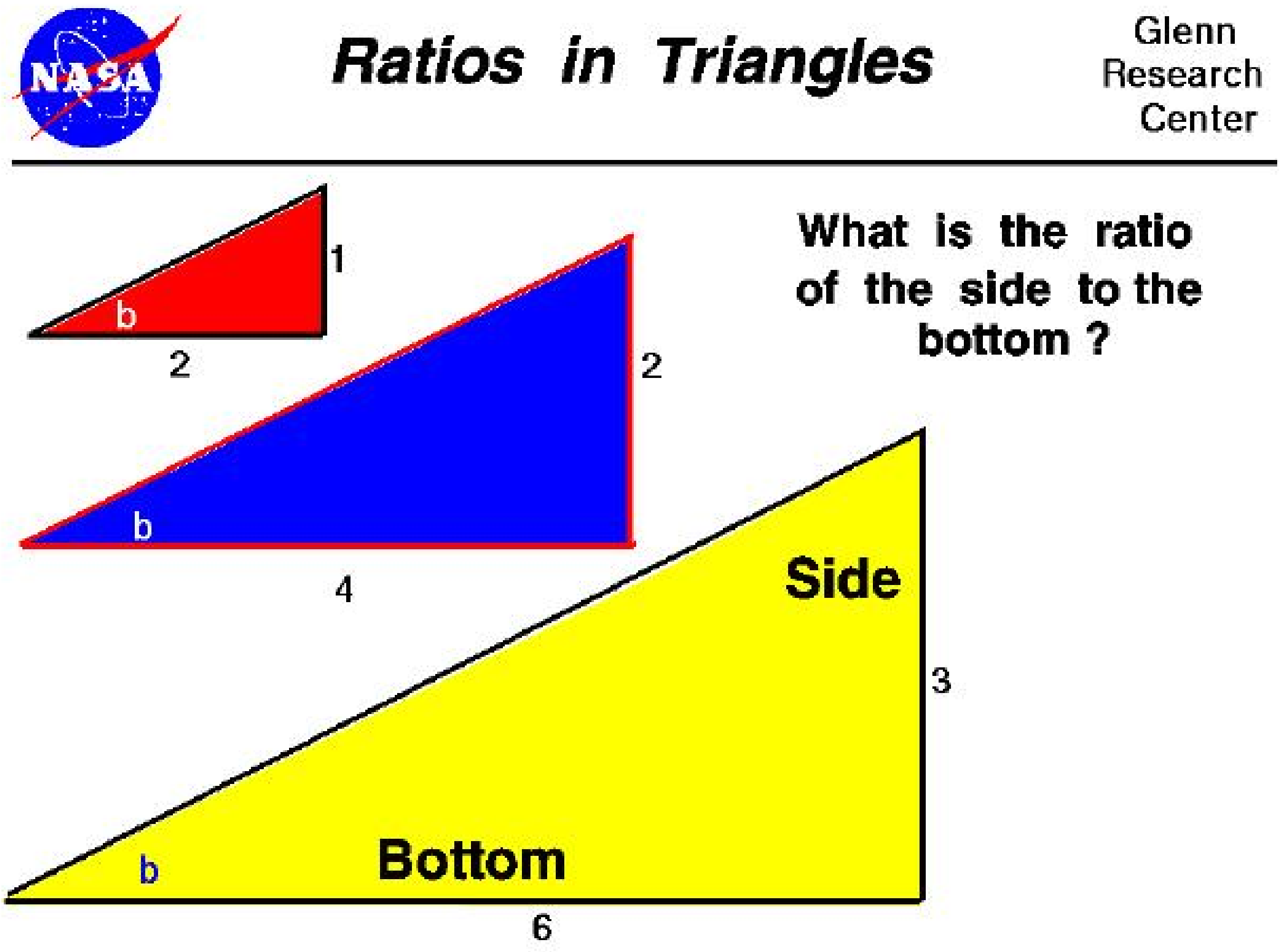


Samples of Content from the Beginner's Guides

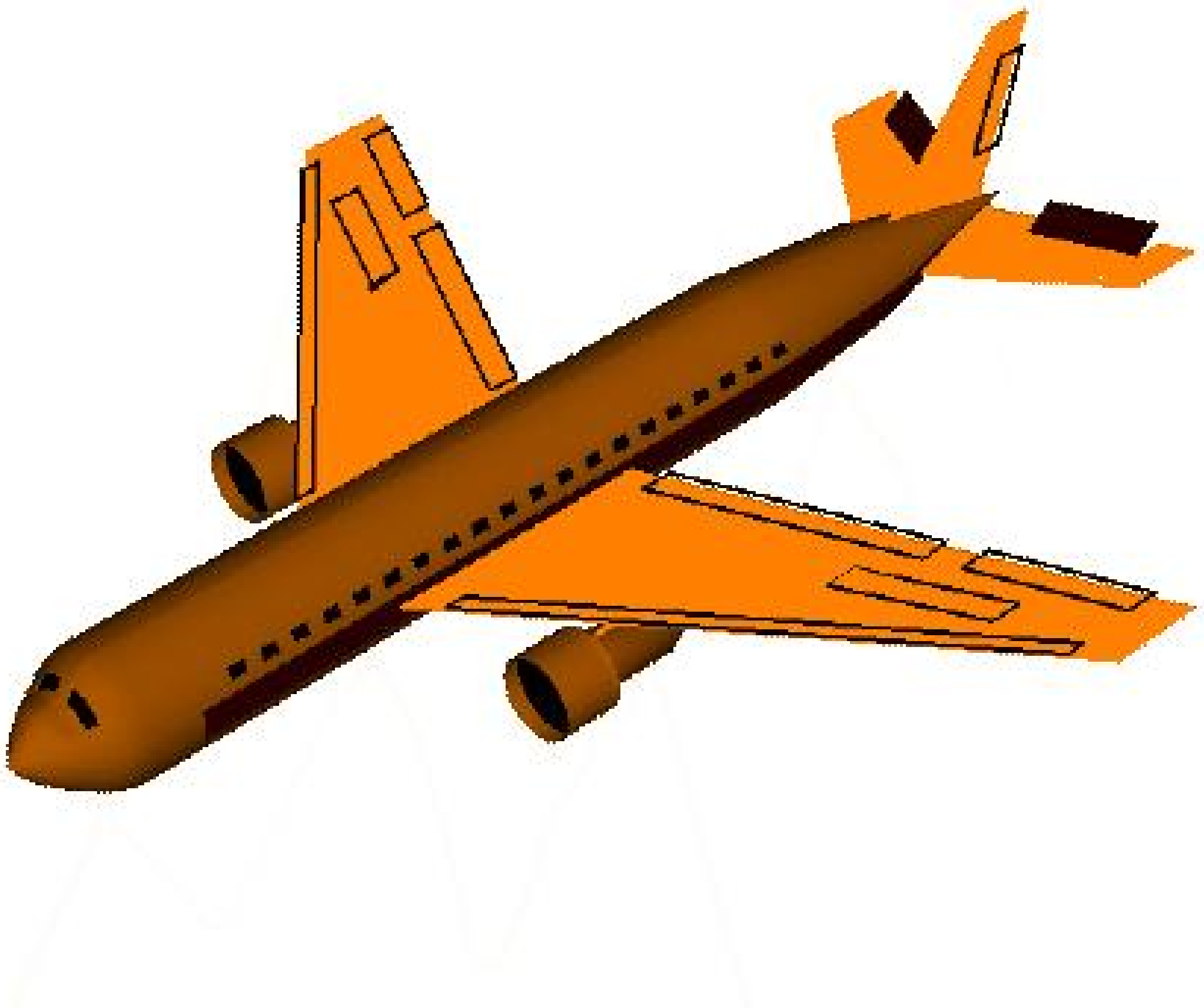
General Science Information



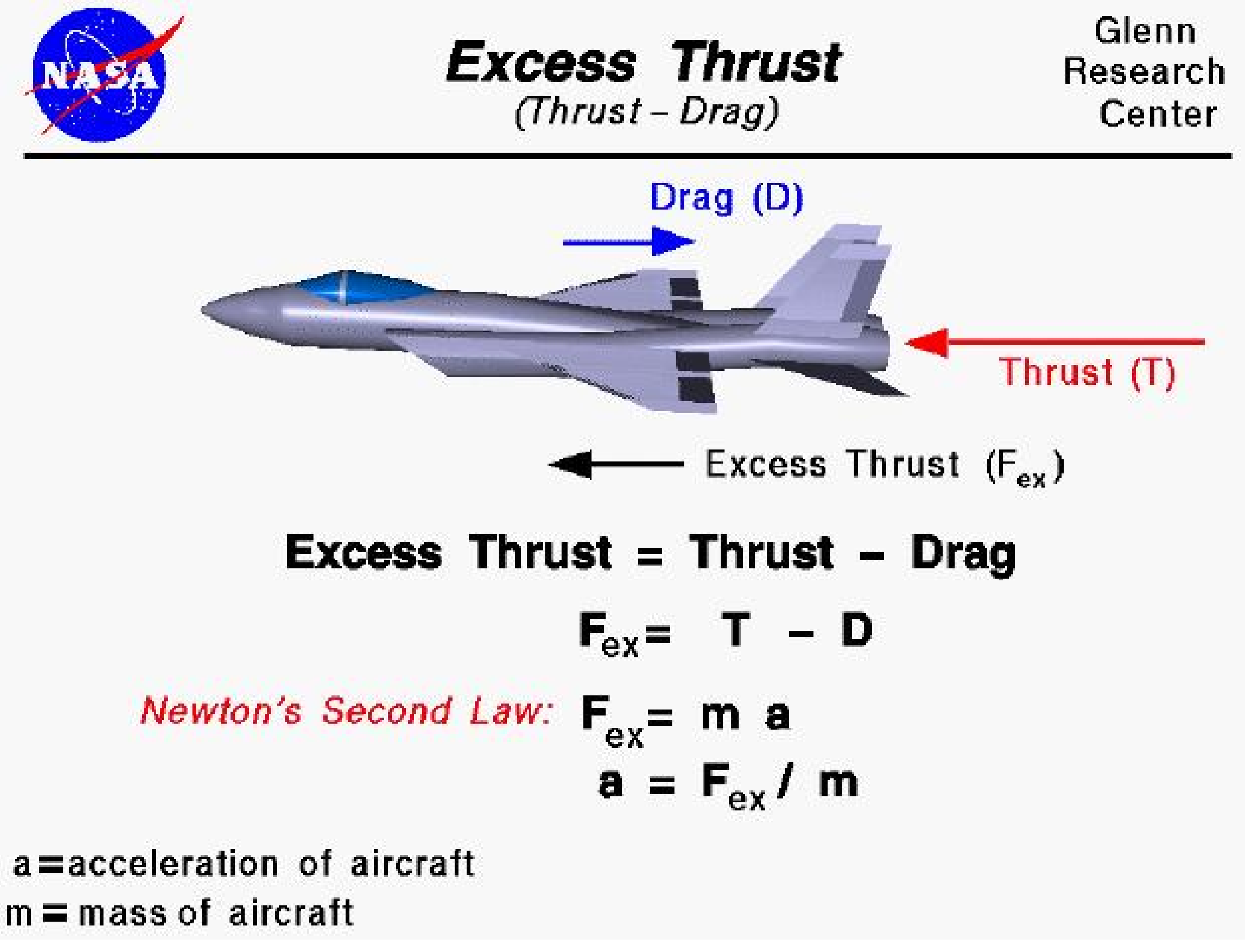
Fundamental Mathematics



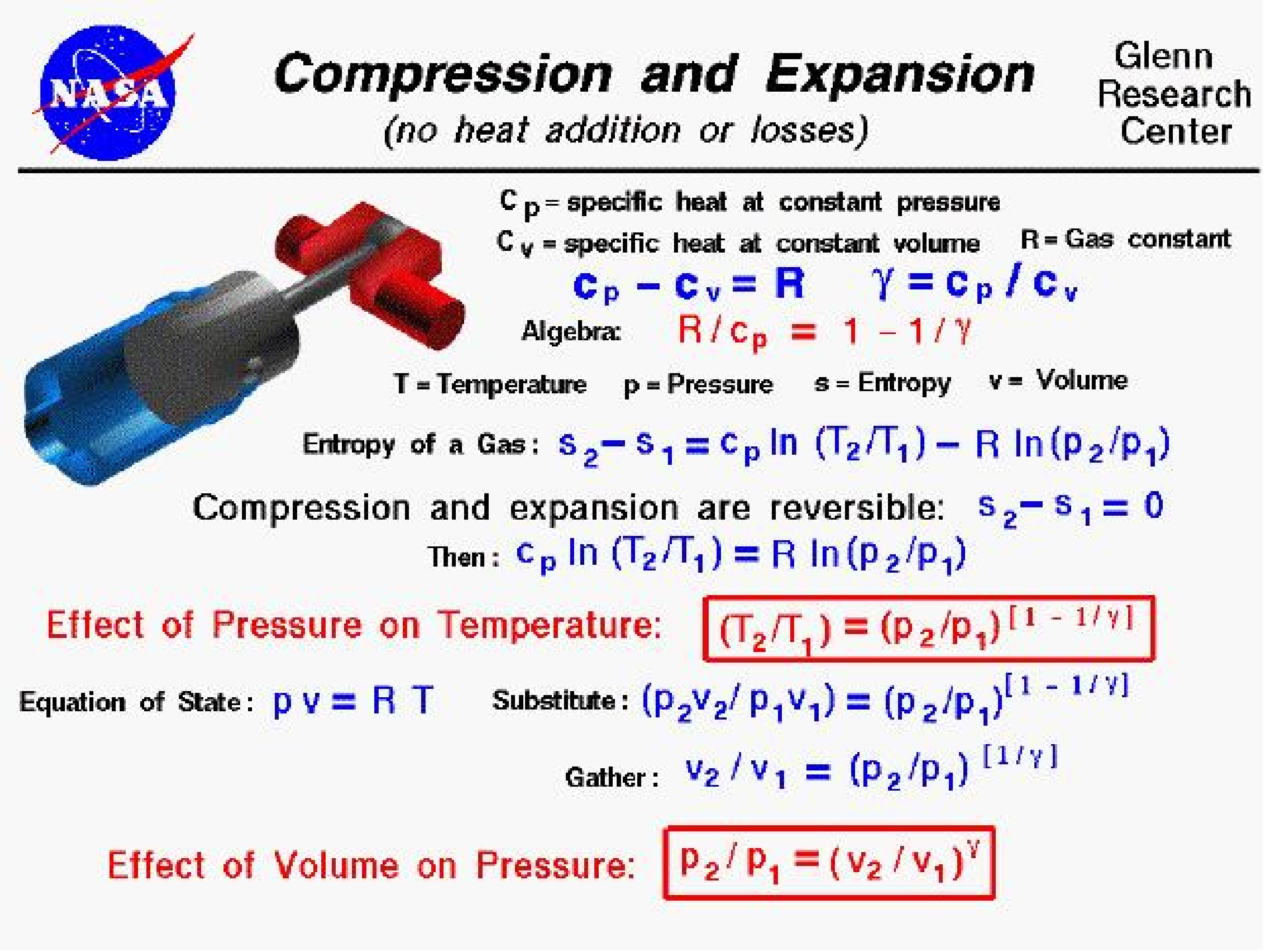
Animations



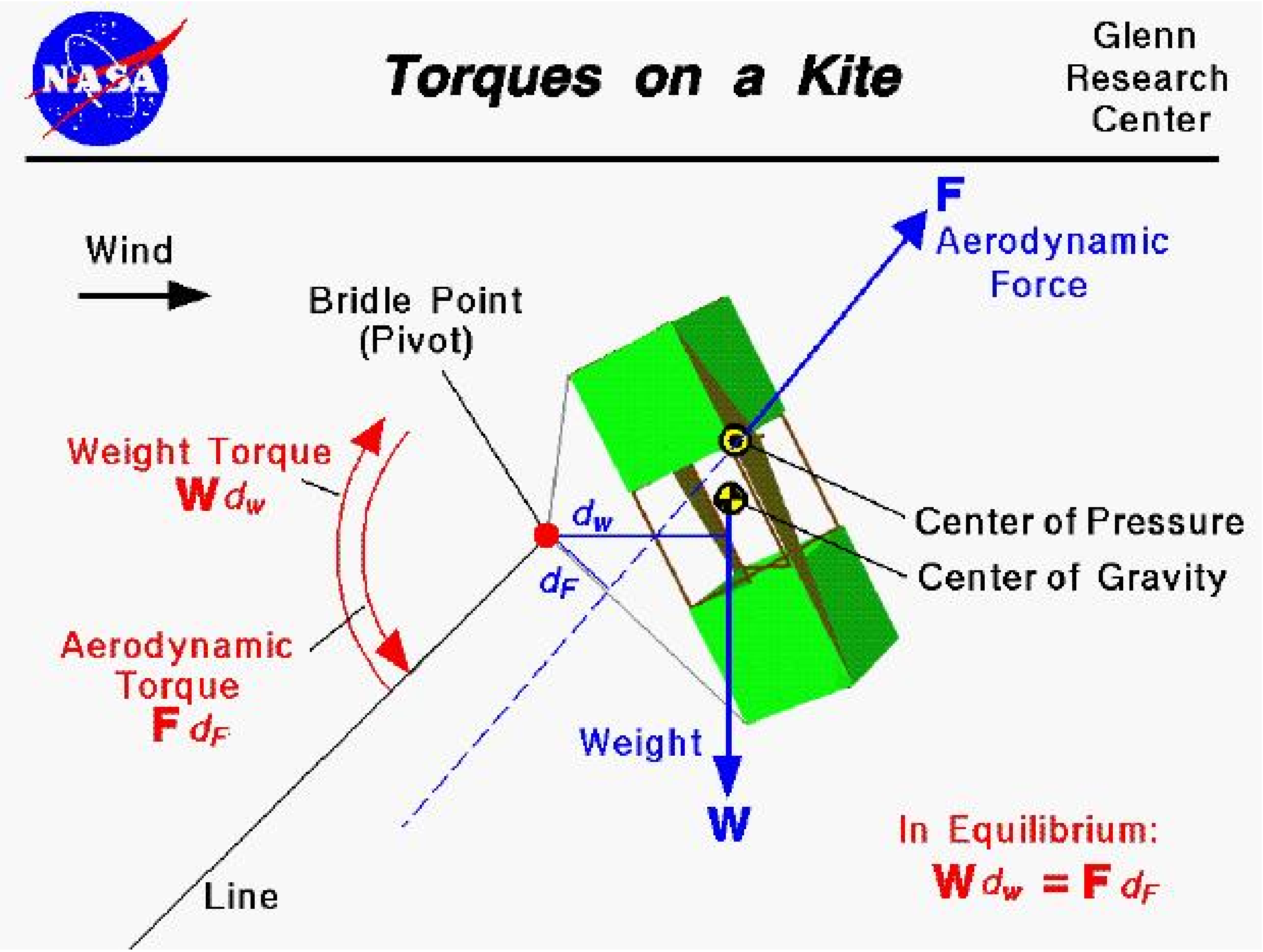
Equations


NASA
Excess Thrust
(Thrust – Drag)
Glenn
Research
Center
Drag (D)
Thrust (T)
Excess Thrust (F_{ex})
Excess Thrust = Thrust – Drag
F_{ex} = T – D
Newton's Second Law: F_{ex} = m a
a = F_{ex} / m
a = acceleration of aircraft
m = mass of aircraft

Derivations

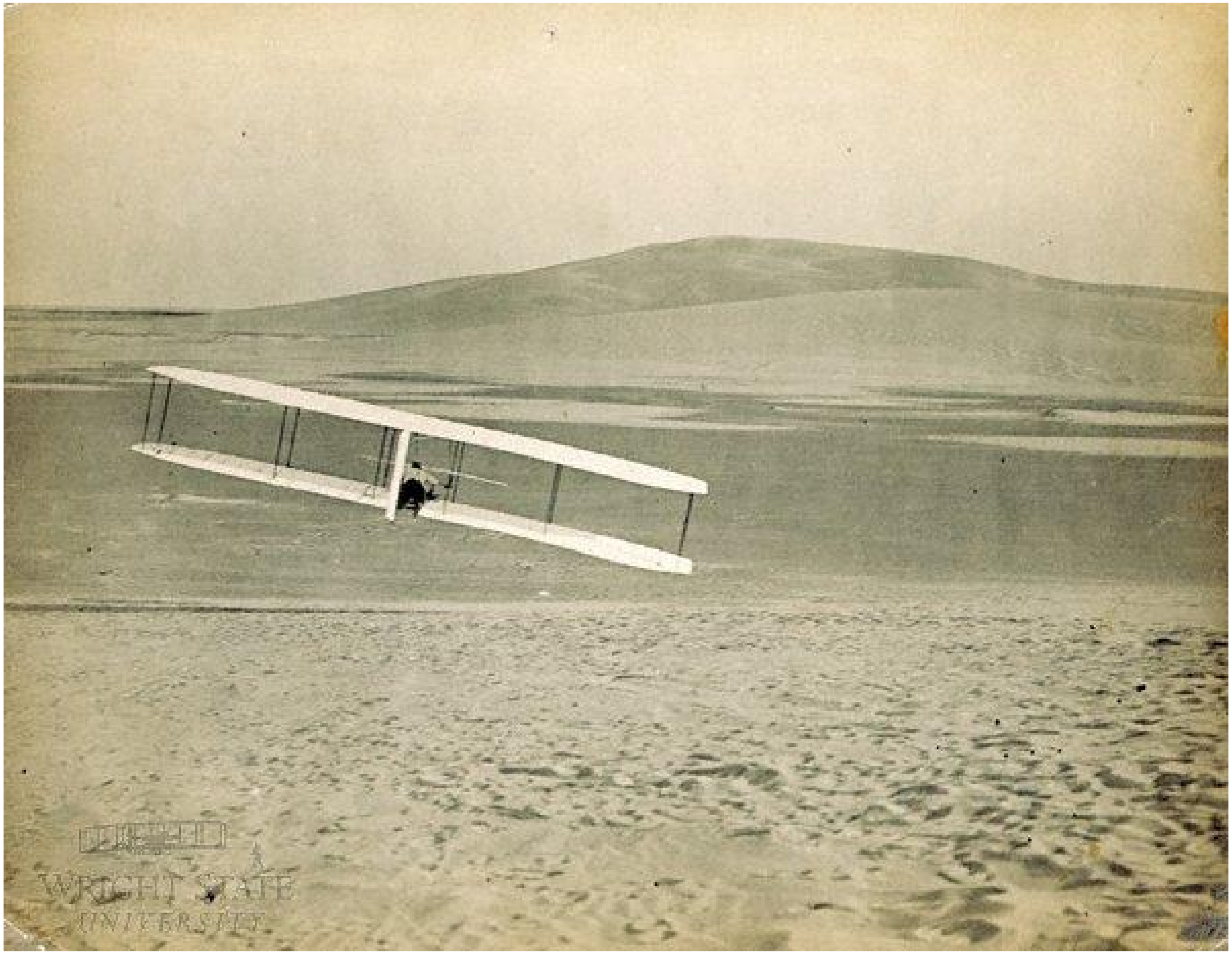


Diagrams

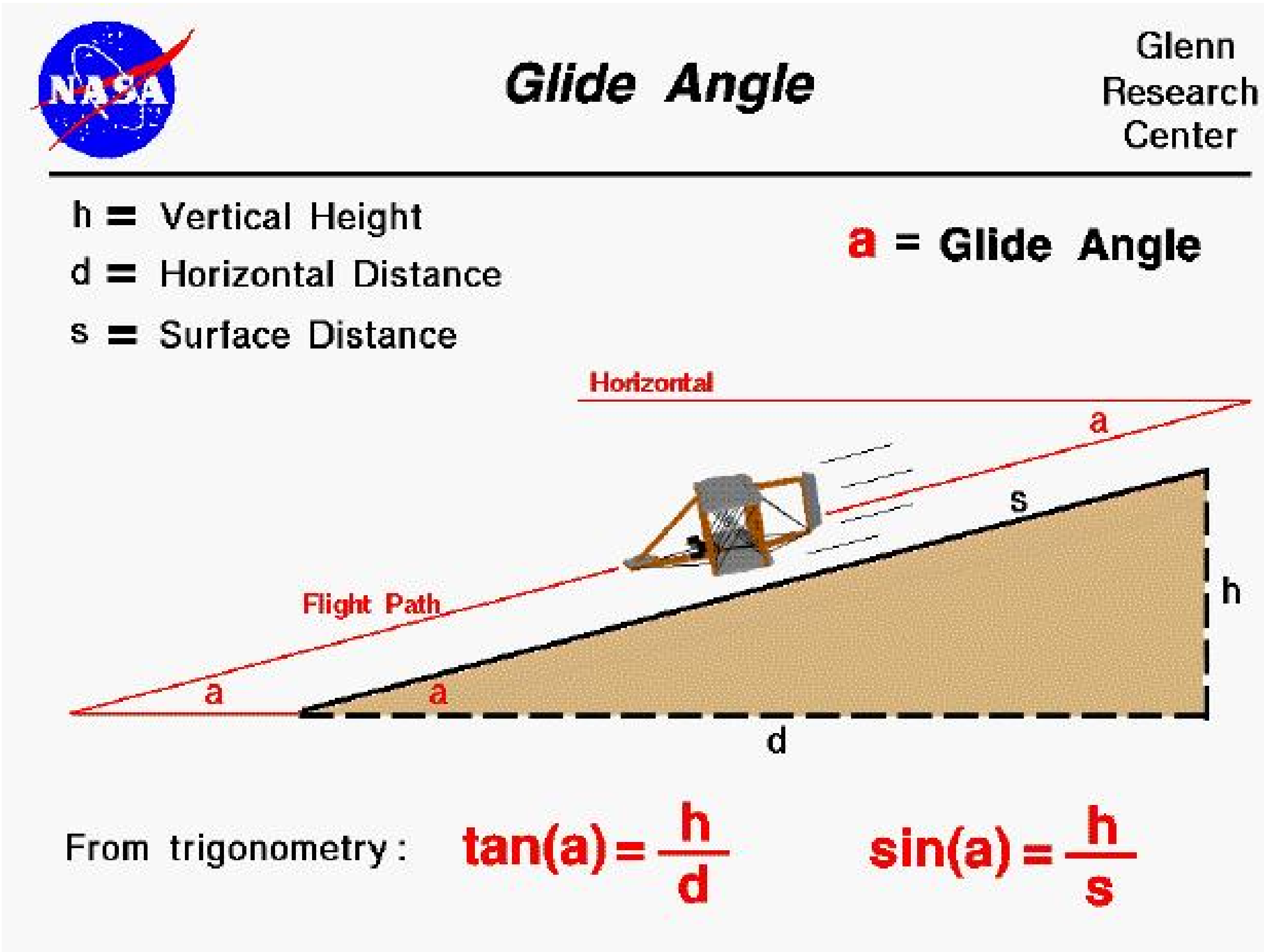


NASA
Torques on a Kite
Glenn Research Center
Wind
Bridle Point (Pivot)
F
Aerodynamic Force
Weight Torque
W d_w
d_w
d_F
Center of Pressure
Center of Gravity
Aerodynamic Torque
F d_F
Weight
W
In Equilibrium:
W d_w = F d_F
Line

Photographs



Applications of Math and Science



CURRENT EFFORTS

- Beginner's Guide to Hypersonics
    - Change of emphasis to undergraduates
    - Include real gas effects in supersonic programs
- New TBCC simulator based on JPC 97 program
- Available Sept 2006

FUTURE PLANS

- Extend current programs
  - Change FoilSim solver – include drag, moment and ground effects
  - Upgrade EngineSim to 3 spool, mixer nozzle, component design, and propellers
  - Java version of GasLab
  - More kite geometries
- New programs and websites
  - Power and Energy
  - Others ..

SUMMARY

- Concepts related to aerospace can be used to demonstrate math and science
- Beginner's Guides are available on the Internet for teachers and students
- Interactive Software programs are available for student exploration and learning
- Comments / Questions