Pulling a Rabbit Out of A Hat

…easy when you know the "tricks" of the "trade" …

Sharon Bowers, NIA Educator in Residence

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46th AIAA Aerospace Sciences Meeting

January 9, 2008

What do engineers do?

NATIONAL INSTITUTE OF AEROSPACE

Science is the study of what <u>Is</u>,
Engineering builds what <u>Will Be</u>.

The scientist merely explores
that which exists,

while the engineer creates …
what has never existed before.

Theodore VonKármán, c.a. 1957

Thinking like an engineer …

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Brainstorm uses for …

a tennis ball

What “NOT” to do …

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Voodoo Economics …

from *Ferris Beuhler’s Day Off* …

Force and Motion – In the Natural World

National Institute of Aerospace

Position and Motion of Objects –NSES K-4

- Pushing/Pulling

Motions and Forces –NSES 5-8

- Describing Motion
- Newton's Three Laws of Motion

Motions and Forces –NSES 9-12

- Newton's Three Laws of Motion
- Gravity

Force and Motion – In the Designed World

National Institute of Aerospace

Science and Technology –NSES K-4

- Abilities of technological design
- Understanding about science and technology
- Abilities to distinguish between natural objects and objects made by humans.

Science and Technology –NSES 5-8 and 9-12

- Abilities of technological design
- Understanding about science and technology

Force and Motion – In the Natural World

National Institute of Aerospace

Challenge: You and your team must digitally document at least three examples of force and motion. You have:

- **10 minutes**
- **one digital camera**
- **and two different balls**

Force and Motion –

The designed world learns from the natural world

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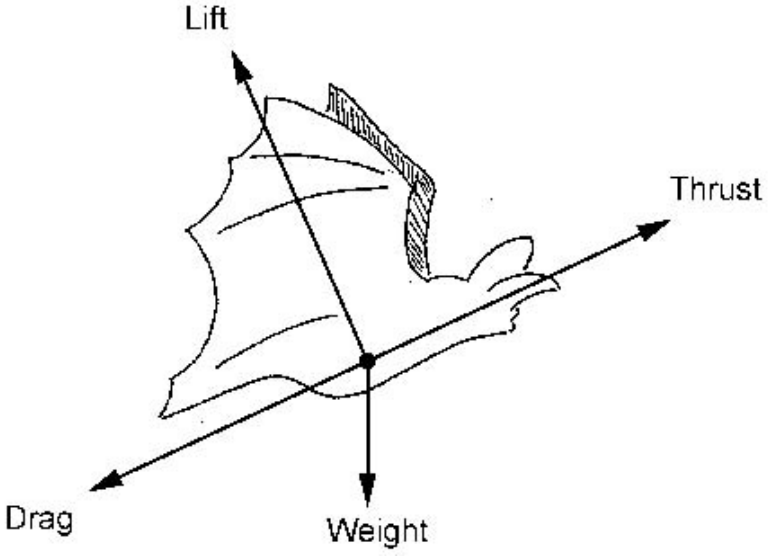
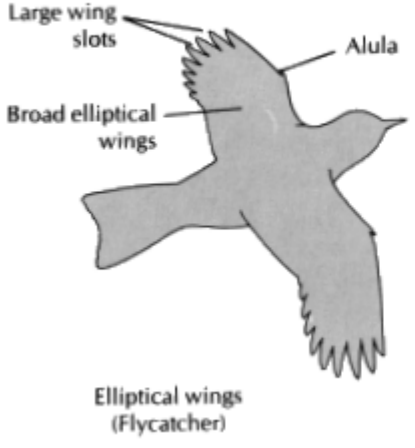
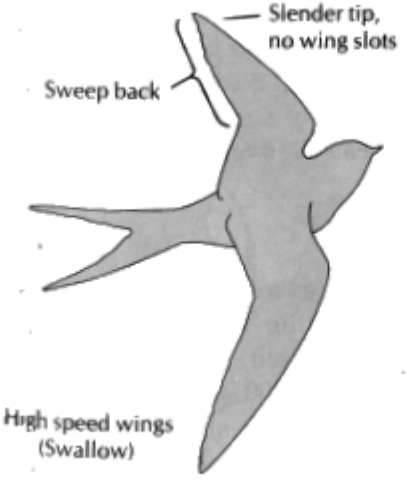
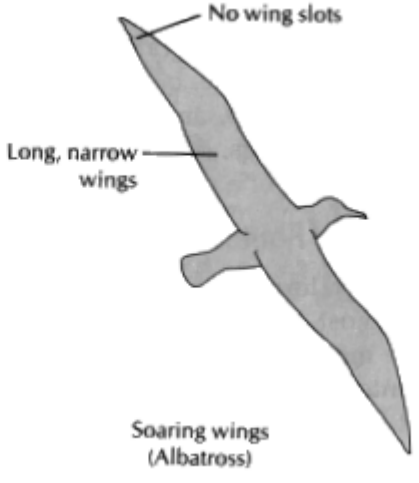
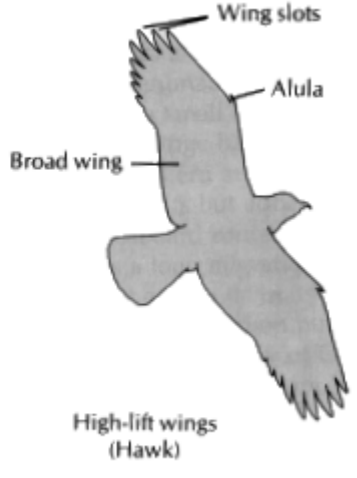






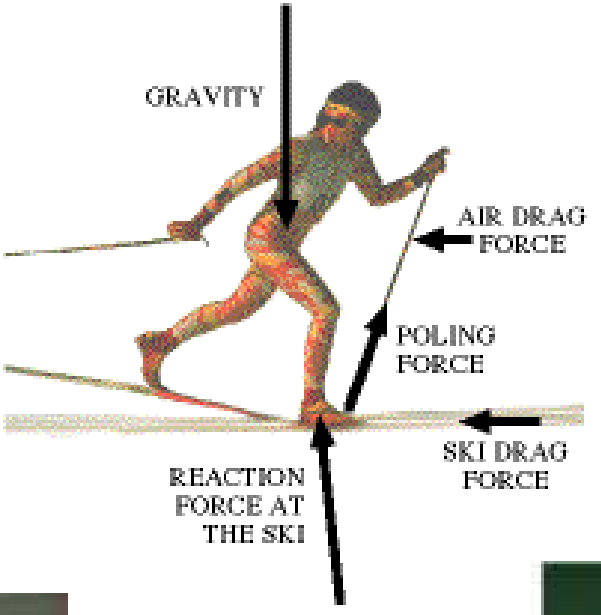




Force and Motion –

The designed world learns from the natural world

NATIONAL INSTITUTE OF AEROSPACE



EXPLORE: Mini-Challenges

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You and your team must be ready to compete in ***TWO*** mini-challenges in 30 minutes. You ***MUST*** begin with the basic designs, but may modify them in any way that you choose to meet the challenge.

1)First Challenge: Zippy Bugs O'Copter

2)Second Challenge: Marathon BWB Model

First Challenge: Zippy Bugs O'copter

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1) Begin by following the directions to create the Bugs O'copter.

2) Then … make any modifications you think necessary to create … the Bugs O'copter that will fall 2 meters in the fastest time.

Second Challenge: Marathon BWB Model

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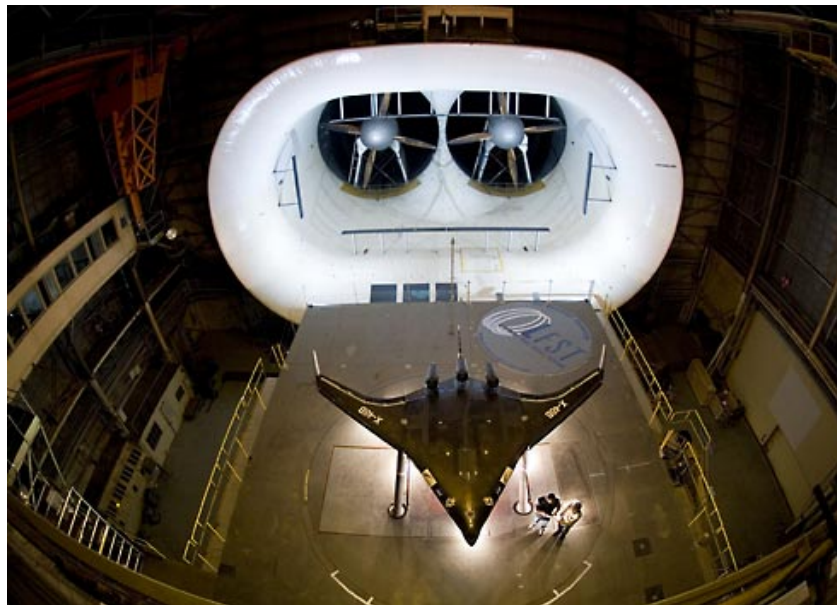
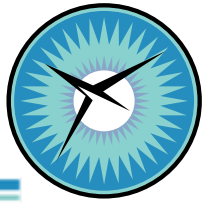
1) Begin by following the directions to create the BWB model.

2) Then … make any modifications you think necessary to create … a BWB model that can travel the greatest distance.





``What you need to invent, is an imagination and a pile of junk."

Thomas Edison,

quoted on National Public Radio, November, 2001.

TEAM CHALLENGE: Puff Mobiles

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How can you use the force of the wind to move a Puff Mobile? How far can your Puff Mobile travel in 10 seconds?

Using only …

--10 straws *
-- four wheels *
-- straight pins
-- one sheet of paper *
-- and … one of your team mates for the wind *

Build a Puff Mobile. You MUST use ALL of the * materials. You have 30 minutes until you'll compete.

DESIGN PROCESS: SCAMPER

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How have Oreo cookies changed over the years? Why have they changed?

S **Substitute**

C **Combine**

A **Adapt**

M **Magnify or minify**

P **Put to other use**

E **Eliminate**

R **Reverse or rearrange**

RE-DESIGN YOUR PUFF MOBILE

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You and your team have 20 minutes to re-design your Puff Mobile to meet the same original challenge.

Consider “SCAMPER”ing your original Puff Mobile to make improvements.

REVIEW

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Tonight, we've …

--**ENGAGED** our audience by looking at **FORCE** and **MOTION** in the natural and designed worlds.

--**EXPLORED FORCE** and **MOTION** by thinking and acting like scientists and engineers

--**EXPLAINED** the design process through **SCAMPER**

--**EXTENDED** our ideas by re-designing and improving a product

--**ENJOYED** learning

Everything I needed to know I learned from “Rocky and Bullwinkle” …

Now that you know some of the “tricks” of the trade, it’ll be easier to “pull a rabbit” out of a hat …