

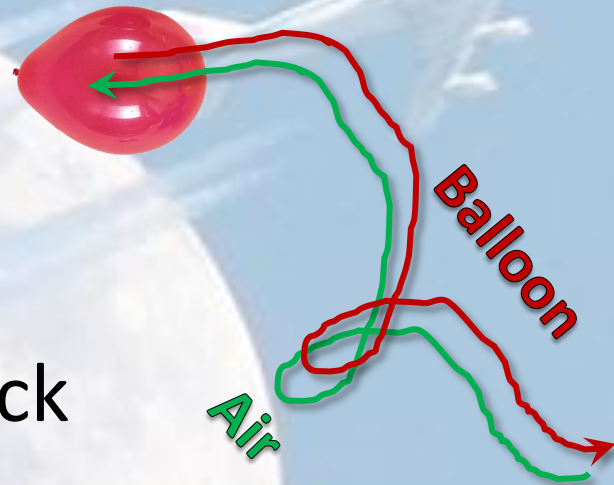


# ***JET PROPULSION***

Newton's Third Law in Action

# *PLAYING WITH BALLOONS*

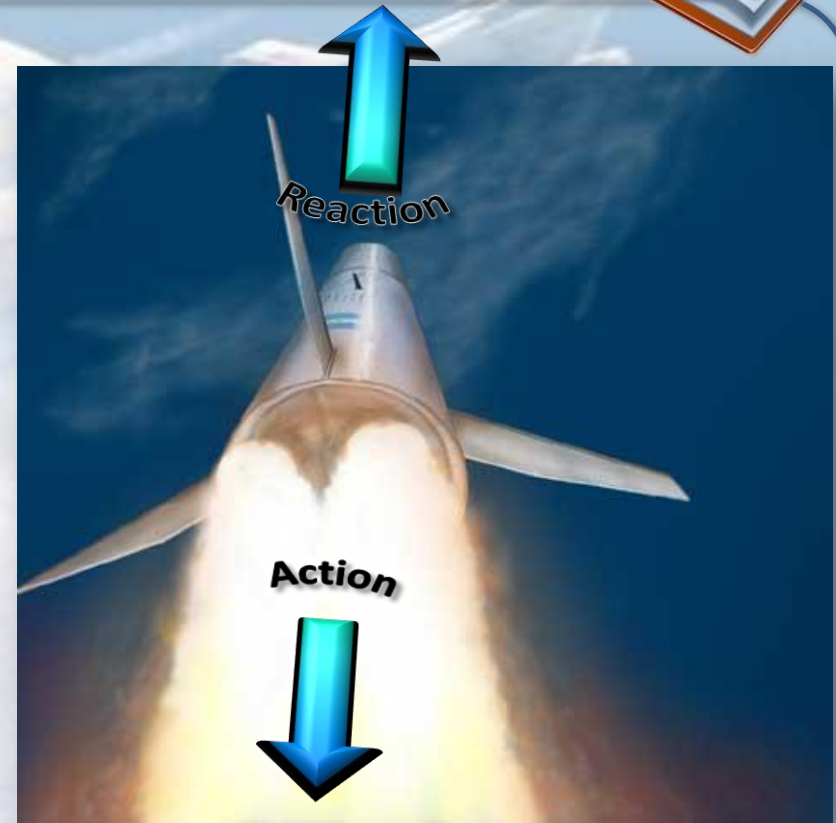
- You blow up a balloon.
- You let go, and the balloon takes off.
- Air is pushed out of the back of the balloon as it shrinks.
- The air pushes the balloon forward.
- This is a typical action/reaction force pair – Newton's Third Law in action.



# ROCKETS AND JETS



- Action/Reaction forces explain how rocket ships and jets fly.
  - The rocket pushes burning gases out behind it. (Action)
  - The rocket is propelled forward. (Reaction)
- This is called **jet propulsion**.



# ***MORE ON ROCKETS AND JETS***

**A jet engine and a rocket ship move the same way.**

- When the fuel burns, hot gases are released that expand and press against the walls of the chamber.
- The chamber pushes back against the fuel.
- If there is an opening at one end of the chamber, there is a net force moving the molecules out of the chamber.
- The net reaction force at the other end of the chamber causes the object to move in the direction opposite the moving molecules.

# WHAT'S THE BIG DEAL?

- The Chinese stuffed gunpowder into sections of bamboo tubing to make rockets for military weapons 3,000 years ago.
- But no one believed they could fly in space.
  - A runner on Earth pushes against the ground.
  - In space, there is nothing to push against.

- An understanding of Newton's Third Law helped people realize that space travel was possible.

