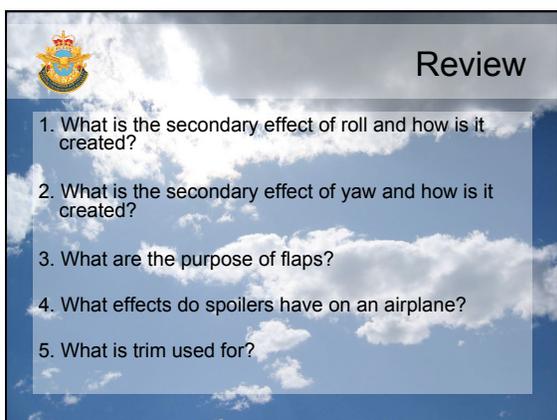


The slide features a blue sky background with a white cloud. In the top left corner is the Royal Air Force crest. The title "Theory of Flight" is in the top right. A silhouette of an airplane is in the center. At the bottom, a white box contains the text "6.04 Laws and Forces" and "References: FTGU pages 21-39".

Theory of Flight

6.04 Laws and Forces

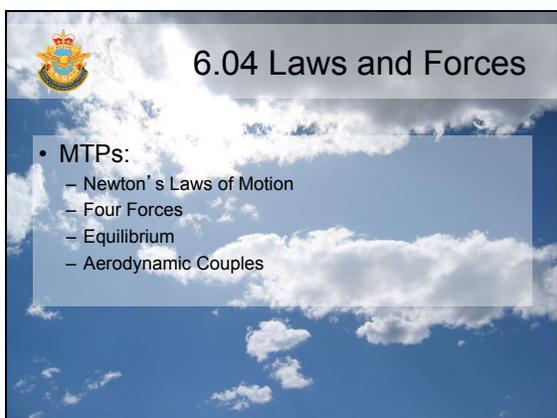
References:
FTGU pages 21-39



The slide features a blue sky background with white clouds. In the top left corner is the Royal Air Force crest. The title "Review" is in the top right. A white box contains five numbered questions.

Review

1. What is the secondary effect of roll and how is it created?
2. What is the secondary effect of yaw and how is it created?
3. What are the purpose of flaps?
4. What effects do spoilers have on an airplane?
5. What is trim used for?



The slide features a blue sky background with white clouds. In the top left corner is the Royal Air Force crest. The title "6.04 Laws and Forces" is in the top right. A white box contains a list of topics.

6.04 Laws and Forces

- MTPs:
 - Newton's Laws of Motion
 - Four Forces
 - Equilibrium
 - Aerodynamic Couples

Newton's First Law

- Newton's First Law
 - An object either is at rest or maintains uniform motion, unless acted upon by an unbalanced external force

Newton's Second Law

- Newton's Second Law
 - Force = mass x acceleration

Newton's Third Law

- Newton's Third Law
 - For every action, there is an equal and opposite reaction.

The force of the combusting rocket fuel forcing exhaust from the rocket produces an equal and opposite reaction force in the form of thrust

This basic premise holds true for all propulsion



Newton's First Law

- What does Newton's First Law have to do with aircraft?
- Uniform motion
 - Straight glide/cruise
- Unbalanced forces
 - Spoilers
 - Ailerons
 - Elevator
 - Rudder
 - Change in engine power
 - Flaps

Law #1
 -An object either is at rest or maintains uniform motion, unless acted upon by an unbalanced external force



Newton's Second Law

- What does Newton's Second Law have to do with aircraft?
- **Weight and balance**
 - What is one of the main differences you will notice when you go solo?

You will lift off sooner!

WHY?

Law #2: Force = Mass X Acceleration



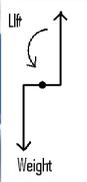
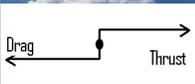
Newton's Third Law

- What does Newton's Third Law have to do with gliders?
- **Movement of control surfaces** push air and cause equal and opposite reactions to allow gliders to manoeuvre
- **Downwash** of air flowing over surface of wing causes equal and opposite reaction = LIFT
- Law #3
 - For every action, there is an equal and opposite reaction.



Aerodynamic Couples

- Aerodynamic Couples
 - **Parallel forces** that do not pass through the same point
 - Couples cause a **turning moment**
 - Imagine pulling on one of the arrows, what will happen?...It will cause it to turn



Moment

- What is a moment?
 - Force at a distance
 - Think of a teeter-totter...
 - Pretend you are riding a teeter-totter with a friend who is much heavier than you
 - Do you need to sit closer or further away to be in equilibrium?

The RECKLESS MOMENT





Moment

- Teeter-Totter Example



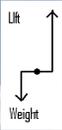

“Force at a distance”

 **Aerodynamic Couples**

Aerodynamic Couples

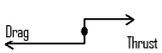
Lift and Weight

- When **lift** > **weight** the aircraft will climb
- When **lift** < **weight** the aircraft will descend



Thrust and Drag

- When **drag** > **thrust** the aircraft will slow down
- When **drag** < **thrust** the aircraft will speed up



 **Aerodynamic Couples**

- What happens when....
 - Lift is greater than thrust?
 - Weight is greater than drag?

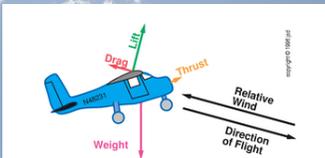
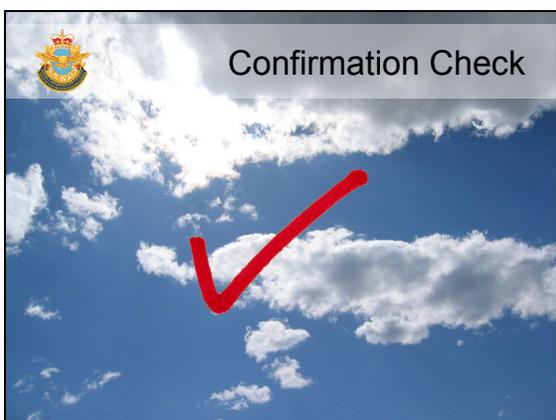


Figure 4.2: The Four Forces — Low Speed Descent

 **Confirmation Check**



 Confirmation

1. What are Newton's 3 laws?
2. What does it mean for an aircraft to be in a state of equilibrium?
3. What is the definition of a couple?

 Confirmation

- What is happen to an aircraft with the following couples?



 Sir Isaac Newton