# Pilot's Handbook

Sept 2013 Edition

Name_____

Brooklyn Aerodrome Flight School

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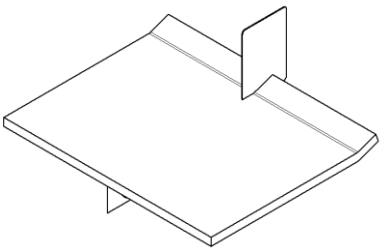
# Overview

Welcome to the wonderful world of *FLIGHT*. This book will be your guide through your first steps into designing, building, and testing your own gliders. This is a book to be read cover to cover, it is a reference book where you look up what you want to know.



This book has three sections. The first section covers what you have to do to get your BAFS Pilot's License endorsements. **Endorsements** are special stamps that show you know of to fly certain types of gliders.

The second section of the book covers procedures. A **procedure** is a set of steps in order to do something. The procedures in this book, will help you make sure things are done the same way, every time. This will help us be safe, and be good engineers.

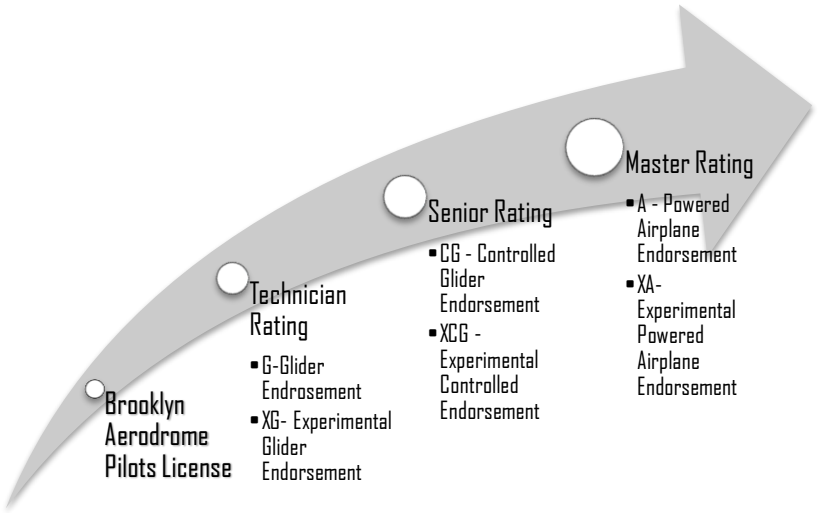
The final section of the book covers **Aeronautical Knowledge**. This section goes over the science of flight. In case you forget something, this is the place to look it up.

# Section 1
# Standards & Evaluation

# Pilot Licensing

As you proceed through the program, you will be able to add endorsements to your basic pilot's license. Endorsements allow you to fly different types of planes at the flight line.

You must show a basic understanding of planes and flight to earn your pilot's license, then you can add endorsements to your license as you learn more about flight and different types of planes



# Pilots License

## Knowledge Requirements:

- List and describe the four forces of flight
    - Lift
    - Thrust
    - Drag
    - Gravity

## Performance Requirements:

- Demonstrate the three axes of movement
    - Yaw
    - Pitch
    - Roll
- Locate the following parts of a plane:
    - Nose
    - Tail
    - Elevator
    - Vertical Stabilizer
    - Wing


## Glider Endorsement (G)

### Knowledge Requirements:

- Be able to explain rules of the flight line

### Performance Requirements:

- Safely conduct a two-hand overhead glider test flight
- Safely conduct a launcher power flight
- Build a plank glider to required dimensions


## Experimental Glider Endorsement (XG)

### Knowledge Requirements:

- Describe the importance of CG on airplane.

### Performance Requirement:

- Calculate the CG of a given plane, and balance with weight

# Airworthiness Standards

A plane must be tested before it is ready to fly on the flight line. These standards provide the framework for testing planes to ensure they can fly safely under power. Planes that meet the standards below, will receive a tail number and can be flown on flight line.

## Small Glider – Built to a BA Design

- Accuracy: All dimensions are ± 3mm to plan
- Center of Gravity: Found experimentally or mathematically, Marked on plane
- Balance: Plane balanced around CG
- Trimmed: Airplane will fly straight when released

## Experimental Small Glider – Built to Student Design

- Plans: Scale drawings of the airplane top and side view provided
- Dimensions: No dimension larger than 260 mm
- Surface Area: Total surface area no more than 540 $cm^2$
- Accuracy: All dimensions are ± 3mm to plan
- Surface Area: total surface area no more than 5400 $mm^2$
- Center of Gravity: Calculated mathematically and m
- arked on plane
- Balance: Plane balanced around CG
- Trimmed: Airplane will fly straight when released

# Section 2
# Procedures & Protocols

# Two-Hand Launch Procedure

1. Stand in the test area
2. Visually check around you
3. Hold the glider with two hands over their head
4. Say "Clear"
5. Let it go without throwing it
6. Observe the flight
7. If someone enters the area before they let it go, they can't launch the plane.

# Rubber Band Powered Launch

1. "Preflight" go down the checklist with your partner when you're on deck
2. "Prep" hook the plane onto the launcher, and pull it back to the mark.
3. "Clear" look around to make sure no one is in the way.
4. "Launch" let go of the plane
5. "Enter and Recover" enter the non-movement area and pick up your plane

# Testing Protocol

Before a plane is flown on the flight line, it must be tested. Test should be carried out with the two-hand drop to correct initial issues with trim, weight and balance

## Small Glider Testing (SG & XSG)

1. Use a two hand drop to test the plane
2. Adjust the CG so that the plane:
    a. Glides out a couple feet
    b. Doesn't pitch up or down dramatically during the flight
        i. To correct dramatic up pitch add more weight to the nose
        ii. To correct dramatic down pitch, reduce the weight on the nose.
        iii. To make minor corrections, bend or flatten the elevons
3. Adjust the trim so that the plane:
    a. Does not bank to the left or the right.
    b. To correct a bank to the left
        i. Raise the right elevon
    c. To correct a bank to the right
        i. Raise the left elevon
4. Attach the hook
    a. Unfold clip
b. Securely tape to bottom of plane

# Preflight

Each time a glider is flown, it is imperative that it is checked before it makes its next flight. Launch and Landing can unexpectedly change the aircraft.

Preflights use a call and response method. Have someone read the item, and you respond

## Small Glider (SG & XSG)

1. Airframe - Undamaged
2. Weight – Safely Attached
3. Hook – Safely Attached
4. Trim tabs – As Desired

# Finding Fore/Aft Balance Point Procedure

1. Have your partner hold out their index fingers
2. Lay the plane on their fingers so that it will balance without you holding it.
3. Mark the top of the plane where each finger touches the edge
4. Turn the plane a little a bit, get it to balance
5. Mark he top of the plane, and draw a second line
6. Where to the two lies cross is the Center of Gravity (CG)
7. Lay the protractor with the origin at the CG, and the 90° line pointing in the direction of flight
8. Trace along the base line, then use a ruler to extend the ends to the wing tips. This is call the Span

# Flight Line Procedures

The flight line is setup like a real airport. There are two sides:

- The **movement area** is where you are allowed to move around without asking permission, but you cannot fly planes in this area.
- The **non-movement area** is where you must ask permission to enter, this is also where planes may be flying.
- You can cross from the dotted side to the solid side without asking permission, But to cross it from the solid side, you must ask permission
- When a student enters the non-movement area they should pay attention, move quickly and recover their plane and return to the movement area.

<PICTURE OF FLIGHT LINE>

Flight Line Safety:

- The biggest reason for the flight line is safety. While it may seem overly complicated now, when we move into more advanced aircraft, this will help keep students safe.
- When given permission they may launch their airplane into or cross to collect the plane
- The teacher is acts the Ground Air Traffic Controller giving permission for one or all students.
- When a student enters the non-movement area they should pay attention, move quickly and recover their plane and return to the movement area.

# Small Glider Competition Event Rules

- Each challenge has its own specific rules
- A plane may be repaired between launches, but the basic shape and mass shouldn't be changed
- All measurements are taken from center of the CG mark.
- The judge has the final say on whether a launch was GOOD or a DUD not.

## Good Launch

- Plane travels at least one meter
- Hook stays attached to the plane
- May hit the floor ceiling or walls
- Vertical Stabilizer or weight may come off during flight or landing

## Dud

- Plane travels less than one meter
- Hook comes off or launcher malfunctions
- Glider hits an obstruction (e.g. pillar or desks)

## Distance Challenge

- Each competitor gets three GOOD launches
- Measurements are taken from front edge of the launcher to the furthest p
- oint of the plane
- After three launches the lowest score is discarded, and the remaining two scores are averaged
- The greatest average distance is the winner
- If there is a tie
    - All previous scores are discarded
    - Each tied contestant gets one GOOD launch
    - Furthest distance wins

## Accuracy Challenge

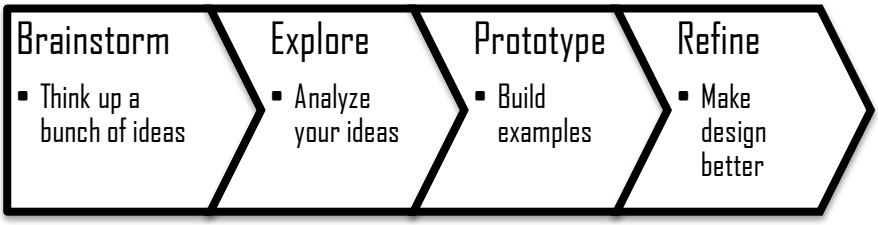
- Each competitor gets three GOOD launches
- Measurements are taken from the center of the target to the Closest point of the airplane
- After three launches the highest score is discarded and the remaining two scores are averaged.
- The lowest average distance from the target is the winner
- If there is a tie
    - All previous scores are discarded
    - Each tied contestant gets one GOOD launch
    - Furthest distance wins

## Cargo Capacity

- The first round starts with one washer; each round after that adds a washer
- Each competitor gets two GOOD launches to go at least 3 meters at that weight.
- Anyone failing to make three meters in their two chances cannot move to the next round.
- If all competitors fail to make a weight.
    - Everyone who was in that round may remove one weight
    - All contestants take one GOOD launch.
    - Measure the distance from front edge of the launcher to the CG point of the plane
    - Furthest distance wins

# Section 3
# Aeronautical Knowledge

# Engineering Process




### 1. BRAINSTORM

- Get as many ideas out as you can
- Don't worry about if they are good or bad ideas
- Have fun

### 2. EXPLORE

- Look at the criteria again
- Review your brainstorming designs
- Pick the **3** you think will work the best
- Add more details (like measurements) to designs you picked to refine them

### 3. PROTOTYPE

- Build examples of **2** your designs
- Test the examples

### 4. REFINE

- Pick the design that best meets the criteria
- Make modifications
- Build the final design