Aircraft Design Proposal

Laws of Motion – National Aeromodelling Competition 2025–26

1. Our Aircraft Design

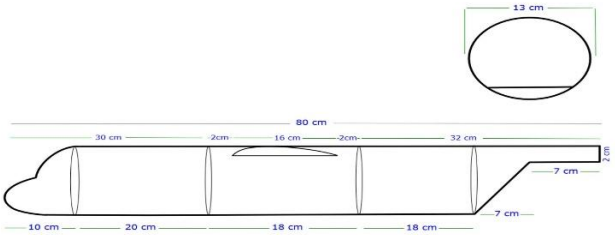
Our aircraft is a payload-optimized fixed-wing radio-controlled aircraft designed specifically for the **Laws of Motion – National Aeromodelling Competition 2025–26**. It follows a **transport-aircraft-inspired configuration**, similar to an Airbus-style airliner, adapted for propeller-driven RC operation.

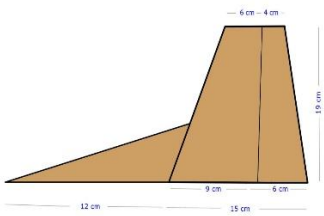
The aircraft features a **high-mounted dihedral wing** with **wing-mounted tractor propellers**, providing efficient thrust distribution, enhanced lateral stability, and predictable low-speed handling under payload load. A high-wing layout further improves stability during climb and cruise.

The design prioritizes a high payload-to-empty-weight ratio, with a centrally located payload bay near the center of gravity and a **simple single-channel servo-operated payload release system**, ensuring reliable, repeatable performance while remaining fully compliant with competition constraints. .

Aircraft Design Highlights

- Transport-aircraft-inspired layout, visually similar to an Airbus-style airliner
- Fixed-wing, propeller-driven RC aircraft optimized for low-speed, high-lift flight
- High-mounted wings with positive dihedral for improved lateral stability
- Wing-mounted tractor propellers for efficient thrust distribution and enhanced airflow over the wings
- High-wing configuration providing inherent roll and pitch stability under payload load
- Streamlined cylindrical fuselage enabling efficient internal payload accommodation
- Centrally located payload bay positioned near the aircraft center of gravity
- Simple, single-channel servo-operated payload release mechanism
- Lightweight airframe with structurally reinforced load-bearing regions





2. Why This Design Was Chosen

The design was finalized after detailed evaluation of the competition scoring formula, aircraft limitations, and payload characteristics—specifically golf balls weighing 45 g with a diameter of 43 mm.

The key reasons for selecting this configuration include:

- High-wing aircraft inherently provide better roll and pitch stability, especially under payload load
- Low-speed flight capability is essential for safely lifting heavier payloads
- Locating the payload bay near the center of gravity minimizes trim changes during payload release
- Simple mechanical systems reduce failure risk and improve repeatability
- The design strictly avoids the use of gyroscopes, programming, or prohibited electronics, ensuring full rule compliance

3. Benefits of This Design

- Low stall speed, enabling safe operation with maximum payload
- Predictable and stable handling, reducing pilot workload
- Minimal center-of-gravity shift during payload release
- High structural efficiency while maintaining low overall weight
- Ease of repair and quick turnaround during competition
- Fully compliant with KTJ Laws of Motion regulations

4. Expected Lifting Capacity

Based on design calculations and preliminary performance estimation:

- Expected payload capacity: 5–6 golf balls
- Total payload weight: approximately 225 g to 270 g
- Minimum flight time with payload: greater than 30 seconds
- Empty aircraft weight: maintained below 1.2 kg

This payload capability is expected to yield a competitive payload-to-weight score in both the Qualifier and Main Rounds.

5. Materials Used

To achieve an optimal balance between strength and lightweight construction, the following materials are used:

- Kraft foam board for primary wing and fuselage structure
- Carbon fiber spars to reinforce the wing against bending loads
- Lightweight plywood or composite plates for motor mounting and payload bay support
- Hot glue and epoxy adhesives for structural bonding

These materials ensure sufficient durability while keeping the airframe lightweight and easy to fabricate.

6. Hardware Components Used

- Brushless DC motor
- 3S Li-Po battery
- 2.4 GHz RC receiver
- Standard RC servos for control surfaces and payload door
- Propeller with diameter not exceeding 13 inches

The propulsion system is selected such that the thrust-to-weight ratio remains below 1.2 without payload, fully complying with competition constraints.

7. Payload Dropping System Explanation

The payload dropping system consists of a servo-actuated mechanical door controlled using a single transmitter channel.

- Golf balls are stored internally within the payload bay
- A single servo actuates the door mechanism
- All payloads are released simultaneously
- Each payload falls as an independent object, not as a combined mass
- The system emphasizes simplicity, reliability, and repeatability, ensuring consistent payload release during every attempt.