Essential Characteristics of RC DLG /f3K Gliders – by Perplexity

For a modern **F3K/DLG competition glider**, the central design objective is not simply minimum weight. It is the best compromise between **low mass, high launch stiffness, low aerodynamic drag, predictable handling and rapid task transitions**. F3K rules limit the model to a **1.5 m maximum span and 600 g maximum flying mass**, while competitive models commonly fly at roughly **210–270 g**, depending on lay-up, ballast and conditions.fai+2

Look up unfamiliar terminology in Google.

The figures below are practical targets for a top-level 1.5 m model, not universal rules. Exact values vary with airfoil, planform, pilot technique, climate and the manufacturer's structural philosophy.

Essential characteristics

Characteristic	Typical optimum or target for a competition F3K model	Why it is refined so carefully
Low all-up mass	**210–260 g ready to fly** in calm or light conditions; approximately **255 g** is a	Low mass reduces minimum sink speed, improves climb in weak

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	useful benchmark	thermals and permits slower, more accurate landings. However, an excessively light model becomes fragile, penetrates poorly and can be difficult to control in turbulence. The best models therefore optimize mass rather than simply minimize it. A published NRJ competition model, for example, is listed at **213 g**, while BARCS gives approximately **255 g** as a representative modern F3K weight. hyperflight+1
Wing loading	Approximately **10.5–14 g/dm²** unballasted; about **11–12 g/dm²** is a strong general-purpose target	Wing loading determines the compromise between minimum sink and cruise speed. Low loading is valuable for weak lift; additional

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		ballast raises the best-glide speed and improves penetration into wind. A commercial 1.5 m NRJ is quoted at **11.2 g/dm²**. hyperflight
Maximum legal span	**1,500 mm or less**	The full allowable span increases aspect ratio and reduces induced drag without exceeding the F3K limit. It also gives more wing area for a low wing loading and improves thermal efficiency. fai
High aspect ratio	Typically around **AR 13–16** for a modern 1.5 m F3K design	High aspect ratio reduces induced drag, particularly when circling slowly. The penalty is increased bending load and reduced structural margin, so carbon spar caps, skins and joiners

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		must be engineered precisely. Modern designs increasingly push aspect ratio because the aerodynamic benefit is substantial. kralovensky
Light, stiff wing	Typical moulded competition wing: roughly **85–115 g**, depending on lay-up and intended conditions	The wing must be light enough to achieve low sink but stiff enough to retain its designed twist, camber and incidence during a discus launch. A published NRJ wing range is **84–90 g for a light lay-up, 94–100 g standard and 109–115 g strong**. hyperflight
Wing bending stiffness	No universal accepted value; practically, the wing should show **negligible visible deflection or permanent set during a full-power**	Bending flex changes the angle of attack and unloads the wing during launch. Excessive flex wastes launch energy, changes trim dynamically and

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	launch. A useful engineering target is a first bending mode comfortably above launch excitation, commonly **roughly 15–25 Hz** for the complete wing	can cause flutter or structural failure. Top models use carbon spar caps and skins specifically to obtain high stiffness for very little mass.
Wing torsional stiffness	No simple industry standard; target **minimal twist under launch and control loads**, often with torsional compliance low enough that control-surface movement remains repeatable	Torsional deformation changes washout, aileron effectiveness and flap camber. It is particularly damaging in a DLG because the wing experiences large rolling and pitching loads during the launch rotation. The wing skin is therefore a primary structural component, not merely an aerodynamic covering.
Launch strength	Designed for repeated discus launches	Launch height directly increases the

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	of roughly **35–60 m**, with elite launches often exceeding **60 m** in favourable conditions	time available to find lift and gives the pilot more options during an F3K task. The launch peg, wingtip, spar and centre section must tolerate high transient loads without adding excessive reinforcement weight. BARCS reports typical launches above 140 ft and elite launches above 200 ft. barcs
Launch peg and hardpoint	Peg positioned at the manufacturer's calculated spanwise and chordwise location; hardpoint must transfer load directly into spar and skin, not just adhesive	The peg converts the pilot's rotational force into aircraft acceleration. Its position affects launch rotation, roll coupling and structural load. A poorly supported peg can tear out the wing even when the surrounding skin appears strong. Guidance on high-

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		load installations emphasizes direct load transfer into a carbon reinforcement or hardpoint. youtube
Low-drag wing section	Typically a purpose-designed low-Reynolds-number section around **5.5–7% thickness**, with the thickest point and camber selected for the intended speed range	F3K wings operate at low Reynolds numbers, commonly of the order of **50,000–150,000** over much of the span. Conventional full-size glider sections are unsuitable because separation bubbles and profile drag become significant. Purpose-designed sections, including Drela-derived families, optimize lift-to-drag ratio and gentle stall behaviour at model scale. barcs+1
Low surface	Surface deviations ideally kept to	At low Reynolds number, small

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waviness and accurate airfoil shape	approximately **0.1–0.3 mm** over the critical forward portion of the airfoil; sharp steps and misaligned joins should be avoided	surface defects represent a significant fraction of the boundary-layer thickness. Moulded carbon wings are refined because an inaccurate leading edge, hinge step or join can increase drag enough to offset gains from a lighter structure.
Efficient flap/camber system	Full-span or near-full-span ailerons; approximately **±1–3°** camber adjustment in normal flight, with larger landing deflection available	One fixed airfoil cannot be optimal for launching, searching, thermalling, cruising and landing. Slight positive camber improves slow thermalling; reflex reduces drag at speed and during the launch; large upward deflection acts as an airbrake. F3K models commonly use ailerons as camber-changing flaps and landing

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Control-surface stiffness and precision	Minimal free play; typically aim for less than about **0.2–0.3 mm at the trailing edge** and no visible surface distortion under normal servo load	F3K requires small, repeatable trim changes. Slop in aileron or elevator linkages produces inconsistent launch presets, wandering trim and energy loss through unnecessary corrections. Top models use short, stiff linkages, close-fitting horns and carefully supported hinges.
Tail-boom mass	Approximately **20–35 g** for a high-quality 1.5 m carbon boom, depending on length and construction	Tail-boom mass is especially expensive because it lies far behind the centre of gravity. Every gram at the tail may require additional nose ballast, multiplying the final penalty. The boom must nevertheless resist

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		bending and torsion so that elevator and rudder inputs remain accurate.
Tail-boom bending and torsional stiffness	No universal published optimum; target **no perceptible control-induced tail movement** and no significant permanent deformation after launch loads. Stiffness should be measured for the actual boom rather than specified by wall thickness alone	The boom is normally sized by stiffness rather than ultimate strength. Flex changes tail incidence, delays control response and can produce trim changes during launch. A lighter boom is worthwhile only while it remains sufficiently stiff; a very flexible boom can cost more performance than its mass saving provides. rcgroups
Tailplane mass	Horizontal tailplane approximately **4–7 g**; fin approximately **4–7 g**, including mounting hardware where possible	Tail surfaces are at the end of a long moment arm, so their mass has a large effect on required nose ballast

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		and overall inertia. The published NRJ figures are **4.7 g for the tailplane and 5.4 g for the fin**. hyperflight
Tail volume and moment arm	Long, light boom with a horizontal-tail volume coefficient broadly around **0.35–0.50** and adequate fin volume for positive yaw control	A long tail moment arm allows small, light tail surfaces to provide sufficient pitch and yaw stability. This reduces tail mass and drag, but excessive tail moment or surface area adds wetted area and structural weight.
Low-drag fuselage pod	Typical competition fuselage/pod assembly approximately **30–45 g**; minimum practical frontal area consistent with battery, receiver and servos	The fuselage is a significant portion of parasite drag. A narrow pod reduces drag during search and penetration, while a carefully shaped nose provides smooth flow and sufficient room for electronics. The NRJ

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		fuselage is listed at approximately **38 g**. hyperflight
Rearward equipment and servo layout	Keep mass concentrated near the centre of gravity; avoid unnecessary tail-mounted mass	Low polar moment of inertia makes the model more responsive in roll and pitch and reduces the nose ballast needed to balance tail components. Modern F3K layouts commonly place servos and battery in the pod, using pull-string or lightweight linkages for the tail.
Centre of gravity	Often approximately **60–70 mm behind the wing leading edge**, measured at the manufacturer's reference point; an NRJ example gives **64.5–66.5 mm**	CG is not a single universal optimum. A rearward CG reduces static stability and may lower trim drag, but makes the model more sensitive and can degrade launch recovery. A forward

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		CG is safer and more stable but usually increases tail load and drag. Competition pilots tune CG together with elevator trim, decalage and ballast. hyperflight
Longitudinal trim stability	Neutral-point margin commonly kept small but positive, often approximately **3–8% of mean aerodynamic chord** for an advanced setup	Top models are deliberately close to neutral stability to reduce trim drag and improve efficiency, but they must remain controllable during launch, turbulence and landing. The acceptable margin depends strongly on tail configuration and pilot preference.
Dihedral and polyhedral	Total effective dihedral commonly around **6–10°**, though the exact	Dihedral provides roll stability and allows rudder to coordinate turns

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	distribution can be multi-panel and highly design-specific	efficiently. Too little makes the model demanding and increases aileron workload; too much reduces roll authority and can waste energy in yaw-roll coupling. A commercial DLG example lists approximately **7°** dihedral. hyperflight+1
Wing incidence and decalage accuracy	Build accuracy preferably within roughly **0.1–0.2°** between intended incidence references	Small incidence errors can cause persistent trim drag or unequal behaviour between flight modes. Competition models are moulded and jigged accurately because a fraction of a degree is significant at low drag and low airspeed.
Ballast capability	Useful ballast range approximately	Ballast allows one airframe to cover

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	30–180 g, depending on model and structure; ballast should be close to the CG	calm thermal conditions, moderate wind and fast returns. It raises wing loading without substantially changing trim or rotational inertia when located near the CG. A published F3K design advertises a ballast range of approximately 30–180 g. f3j
Battery and electronics mass	Often approximately **15–30 g battery**, **4–8 g receiver** and lightweight servos; exact values depend on voltage and servo count	Electronics are necessary mass, so competition models use compact high-torque servos and small batteries while retaining adequate current margin. Saving weight is beneficial, but reliability is more important than removing the final few grams. An NRJ specification lists a

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		15 g battery, 5 g receiver and 34 g total servos. hyperflight
Servo torque and resolution	Typically miniature digital servos around **8–15 g**, with adequate torque margin rather than minimum rated torque; aim for at least **2:1 static torque margin** over calculated hinge load	Launch vibration and aerodynamic loads can exceed those encountered in ordinary thermal flight. High-resolution, low-slop servos preserve precise camber and launch presets. Overly small servos may save a few grams but introduce centring errors, stripped gears or insufficient control authority.
Aerodynamic alignment	Wing join, tailplane, fin and boom alignment within approximately **0.2–0.5°**, with no measurable fin twist	Misalignment creates constant sideslip, unequal roll response and additional rudder or aileron trim. The penalty is especially noticeable in a

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		high-aspect-ratio, low-drag model where the pilot expects the airframe to fly straight with minimal correction.
Landing and catching robustness	Reinforced nose, wing roots, peg area and leading edge; structure should survive normal hand catches without adding large distributed mass	F3K scoring rewards not only flight time but also fast, accurate landings. A fragile model may be lighter but lose contests through damage or missed catches. The best designs reinforce local high-load regions while leaving low-load areas extremely light.
Mode-to-mode repeatability	Launch, cruise, thermal, speed and landing presets should return to the same surface positions to within	F3K tasks demand immediate changes between launch, searching, thermalling, high-speed return and

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	roughly **0.1–0.2 mm at the servo output or a few tenths of a degree at the surface**	landing. Computer radio mixing is therefore part of the aircraft system, not merely a convenience. BARCS specifically notes the use of sophisticated computer radios and flight modes to optimize F3K models. barcs

What "optimal" really means

The most important point is that these values are **coupled**:

- Saving **1 g from the tail** may save more than 1 g overall because less nose ballast is needed.
- Increasing wing stiffness usually improves launch height, but excessive reinforcement increases wing loading and minimum sink.
- Moving the CG rearward may reduce trim drag, but it also reduces stability and makes launch handling more demanding.

- A very light model is excellent in weak lift, while a slightly heavier or ballasted model may be decisively better in wind.
- A thin, high-aspect-ratio wing can be aerodynamically superior, but only if its torsional stiffness preserves the intended airfoil under launch and manoeuvre loads.

Practical target specification

For a strong all-round competition model, I would use the following starting specification:

Item	Sensible target
Span	1,500 mm
Ready-to-fly mass	230–255 g
Wing area	Approximately 19–21 dm^2
Unballasted wing loading	Approximately 11–13 g/dm^2
Wing mass	Approximately 90–105 g
Fuselage/pod	Approximately 32–42 g

Item	Sensible target
Tailplane	Approximately 4–6 g
Fin	Approximately 4–6 g
Tail boom	Approximately 25–35 g
Airfoil thickness	Approximately 5.5–7%
Aspect ratio	Approximately 13–16
Dihedral	Approximately 6–10° effective total
CG starting range	Approximately 60–70 mm behind the leading edge, then flight-tested
Ballast	Approximately 50–150 g near the CG
Launch preset	Commonly slight aileron reflex and elevator compensation, but determined by flight testing
Surface free play	As close to zero as practical; ideally less than 0.2–0.3 mm at the trailing edge

These are engineering starting points rather than substitutes for the manufacturer’s CG, incidence and control-throw data. The defining characteristic of the best F3K models is that **every gram and every fraction of a degree is assigned a purpose**: mass is removed from low-load regions, stiffness is concentrated along load paths, and the aerodynamic geometry is kept accurate enough that the radio presets produce the same aircraft behaviour on every flight.