FLIGHT MANUAL
for
DUO DISCUS N57CG, SERIAL #217

This manual is not approved for flight, but is a guide only for the operation of this glider, which must be operated in compliance with information and limitations contained in the approved flight manual.

Table of Contents

Section 1

1.1 Introduction

This flight manual supplement is prepared for use by Chicago Glider Club personnel to provide pilots, check pilots, and instructors with information for the safe and efficient operation of the Duo-Discus.

This manual is not approved for accurate or complete data.

1.2 Certification Basis

This Duo-Discus has been approved by the LBA in compliance with JAR Part 22 and amendments thereto. The LBA type certificate #396 was issued March 21, 1994.

The aircraft is certificated in the Utility category of airworthiness.

1.3 Warnings, Cautions, and Notes

The following definitions apply:

WARNING: non-observation of the corresponding procedure leads to an immediate or important degradation of flight safety.

CAUTION: non-observation of the corresponding procedure leads to a minor or to a more or less long term degradation of flight safety.

NOTE: draws attention to any special item not directly related to safety, but which is important or unusual.

1.4 Descriptive data (see approved manual for detail)

This aircraft is a tandem two-seat sailplane with a 20 meter wingspan (65.62 ft), 28.28 fuselage length, and approximate empty weight of 926 lb (see Weight and Balance data for actual weight.)

for advanced training and cross country flying of glass and carbon fiber reinforced plastic (GFRP/CFRP) with a T-tail and fixed stabilizer and elevator.

Further detail, including Technical Data of the wings, fuselage, tailplane and controls are contained in the approved manual.

SECTION 2

2.1 Introduction

Section 2 includes operating limitations, instrument markings, and basic placards necessary for safe operation of the sailplane, its standard systems and equipment.

The limitations included here and in section 9 have been approved by LBA.

2.2 Airspeed limitations

V_{NE}=	Never exceed speed in calm air	135 kt	limit controls to 1/3 deflection
$V_{=RA}$=	Rough air speed	97 kt	
$V_{=A}$=	Maneuvering speed	97 kt	no full or abrupt control inputs
$V_{=T}$=	Maximum aerotow speed	81 kt	
$V_{=W}$=	Maximum winch launch speed	81 kt	
$V_{=LO}$=	Maximum landing gear operating speed	97 kt	

2.3 Airspeed indicator markings

Green arc	49-97 kt	Normal operating range
Yellow arc	97-135 kt	Caution all maneuvers and rough air not permitted
Red line	135 kt	Maximum speed for all operations
Yellow triangle	54 kt	Fence speed with maximum weight, no water ballast

2.6 Weights

Maximum takeoff weight	1543 lb (700 kg)
Maximum landing weight	1543 lb (700 kg)
Maximum takeoff and landing weight without water ballast	1455 lb (660 kg)
Maximum weight all non-lifting parts	970 lb (440 kg)

2.7 Center of Gravity information

Datum	Wing leading edge at root rib
Maximum forward c.g.	1.77" aft of datum
Maximum rearward c.g.	9.84" aft of datum

Do not exceed maximum rearward c.g. This requirement is met when the minimum front seat weigh observed. A lower front seat weight must be compensated by adding lead weight ballast (see sect 6.2).

2.8 Approved maneuvers

The Duo discus is certified in the Utility category for normal sailplanes.

WARNING: Aerobatic maneuvers such as;

- Spins
- Lazy Eights, Chandelles, Stall Turns, Steep Turns
- Positive Loops and
- Cloud Flying

are not permitted.

2.9 Maneuvering Load Factors

Do not exceed these load factors when the sailplane is pulled up:

a) with spoilers locked and at $V_{=A}$= 97 kt.	+5.3, -2.65 g
with spoilers locked and at $V_{=NE}$=135 kt	+4.0, -1.5 g.
b) with spoilers extended	+3.5 g at $V_{=NE}$

2.10 Flight Crew

When flown solo, control is from the front seat. Minimum front seat weight must be observed or ballast must be added to reach the permissible figure.

2.11 Kinds of operation

When minimum equipment is installed the duo discus is approved for Day VFR only.

2.12 Minimum Equipment

Instruments and other basic equipment must be of an approved type and should be selected from the in the Maintenance Manual.

Normal operations

2 airspeed indicator (range up to 162 kt) with color markings according to 2.3
2 Altimeter
1 Outside air temperature gauge
2 Four piece safety harnesses
2 Automatic or manual parachutes, or;
2 Back cushions approximately 3.9" when compressed.

CAUTION: The sensor for the OAT must be installed in the ventilation air intake.

For structural reasons, the maximum weight of each instrument panel must not exceed 22 l

2.13 Aerotow and Winch Launch

Aerotow maximum speed	81kt.
Weak Link	1543-2006 lb*
Minimum length of tow rope	98 ft.
Tow rope material	Hemp or nylon
Winch Launch maximum launching speed	81 kt. (not approved without c.g. hitch)
Weak link in cable	1543-2006 lb

* Different from FAR requirements.

2.15 Limitations placards

The following placards must be displayed in glider:

Maximum permitted all-up weight: 1543 lb.
Maximum permitted speed (IAS)

Never exceed speed	135 kt.
Rough Air speed	97 kt.
Maneuvering speed	97 kt.
Aerotowing speed	81 kt.
Winch launching speed	81 kt.
Landing gear operating speed	97 kt.

With Fin Tank Installed: Seat loads

Seat Load	Two persons		One Person	
	min	max	min	max
front seat load	220-(154lb)	243 lb	(154)-220 lb	243 lb
rear seat load	at choice	243 lb.		

Loads less that above minimums must be raised by using trim ballast (see 6.2).The value shown in parenthesis may be used after verifyin ballast quantity in the fin tank and appropriate loading chart.

WEAK LINK FOR TOWING: For Aerotowing and Winch launching: 2006 lb. Maximum

Tire Pressure:	Nose wheel	43 psi
	Main wheel	57 psi
	Tail wheel	43 psi

Further placards may be found in the maintenance manual.

SECTION 3

3.1 Introduction

Section 3 provides check lists and amplifies procedures for coping with emergencies that may occur. Emergency situations can be minimized by proper pre-flight inspections and maintenance.

3.2 Jettisoning the canopy

Swing back one of the red locking levers provided on the port side of the canopy frame and swing the canopy sideways to fully open.

The canopy will then be torn out from its hinges by the airstream and gets carried away.

3.3 Bailing out

The canopy frame on the fuselage is made from laminated rovings so that it is strong and without sharp edges.

The front seat person can grab it and use it as a support for bailing out. The rear seat person can raise himself by grabbing the cut-outs on either side of the instrument panel.

3.4 Stall Recovery

Whether flying straight ahead or in a banked turn, recovery from a stall is made by firmly easing the stick forward and, if necessary, applying opposite rudder and aileron.

EDITOR'S NOTE: Use of aileron prior to regaining flying speed may complicate the stall and lead to a spin or spiral. Experimenting with forward stick movement will determine the necessary amount to lessen the angle of attack and commence recovery, at which time aileron and rudder may assist in recovery from the stall.

3.5 Spin Recovery -Intentional spins are not approved, following procedure is for unintentional spins only.

With the center of gravity rearward, a steady spin is possible. After recovery controls are applied, rotation will stop after about ¼ to ½ turn. A safe recovery from a spin may be attained as follows:

a) Ailerons neutral
b) Opposite rudder against rotation

c) stick forward until rotation stops
d) neutralize rudder and pull gently to recover from the dive.

Loss of height will be approximately 328 feet and a recovery speed of about 70-92 knots.

With the center of gravity in the most forward position, a steady spin is not possible. The sailplane will stop rotating after a half or full turn and enter a spiral dive, from which recovery is made normally.

3.6 Spiral Dive Recovery

A forward center of gravity position may result in a spiral dive, indicated by a rapid increase in airspeed and acceleration.

Recovery is achieved by easing the control stick forward and applying opposite rudder and aileron.

EDITOR'S NOTE: The accepted U.S. recovery technique is to level the wings with coordinated aileron and rudder, then reduce the dive without exceeding airspeed limits and/or g limits. In discussions with knowledgeable long-wing pilots, using aileron without rudder may increase the rate of rotation as adverse yaw increases.

WARNING: The permissible control deflection on pull-out at $V_{=A=}$ - $V_{=NE=}$ musty be observed!

3.9 Other Emergencies

a) Flying with uneven water ballast

If the wing tanks are dumping unevenly, at lower speeds, it will be necessary to apply aileron to keep the wings level. Care must be exercised to avoid stalling.

When landing with uneven water ballast, touchdown speed must be increased by 5 kt and the pilot must be prepared to veer off course as the heavier wing tends to drop. To counteract this drop, opposite aileron must be applied.

b) Emergency landing with gear retracted

Landing with gear retracted is not recommended because of the possible energy absorption the extended gear will provide.

If the extended gear is unavailable, land with a flat angle and without pancaking.

c) Ground Loop

Should the sailplane appear to overrunning the landing area, a controlled ground loop should be made at least 131 feet from the end of the field.

If possible, turn into the wind and as the wing tip is forced down, push the stick forward.

d) Emergency Water Landing

The duo discus cockpit will probably completely submerge on landing with the gear retracted.

Therefore, landing on water should be a last resort, and the wheel should always be extended.

SECTION 4

4.1 Introduction

This section provides check lists and amplifies procedures for conducting the daily and pre-flight inspection and includes normal operating procedures and recommended speeds.

Normal procedures associated with optional equipment are found in Section 9.

4.2 Rigging and Derigging

The duo discus can be rigged by two people if a wing stand or trestle is under one wing tip.

Prior to rigging, all pins and their corresponding bearings on fuselage, wing panels, and tailplane should be cleaned and greased.

a) Inboard Wing Panels

Unlock spoiler lever and set water ballast control knob to "closed."

Insert left wing panel first. It is important for the helper on the wing tip to lift the trailing edge more than the leading edge so that the rear wing attachment pin does not force the inner race of the swivel bearing on the fuselage down and out of alignment.

Check that the spar stub tip is located correctly in the cut-out on the far side of the fuselage.

Check that the angular levers on the wing root rib are properly inserted into their corresponding funnels on the fuselage.

Push the main wing pin in approximately 1" so that the wing panel is prevented from sliding out by the CFRP cover of the front wing suspension tube. The panel tip can now be placed on a wing stand.

Next, insert the right panel. And follow the same procedure. When the starboard spar stub has engage in its corresponding bearing on the opposite wing panel(recognized by a

sudden extension of the unlocked spoilers), the starboard panel can be pushed fully home - under some pressure.

If it is difficult to push the panel fully home, remove the wing pin and draw the panels together with the aid of the rigging level (flat side only.)

Finally, push the main wing pin fully home and secure the handle.

b) Wing Tip Extensions

Insert spar of wing tip extension into the spar tunnel of the inboard wing panel with locking pin pushed down and aileron deflected upwards.

When fully home, the spring-loaded pin must have engage (snapped up) in the corresponding opening on the inboard wing panel. Make sure the coupling lap on the lower side of the inner aileron has correctly slid under the adjacent outer aileron.

If the locking pin is not flush with the upper wing surface, it has to be pushed up from the lower side with the aid of the tailplane rigging pin.

WARNING: Do not tape aileron gap between the main wing and the tip.

c) Horizontal Tailplane

Screw the Round-headed rigging tool into the front tailplane locating pin on the leading edge of the fin. *(EDITOR'S NOTE: Some S-H people leave this in place all the time.)*

Slide the tailplane aft onto the two elevator actuating pins, pull rigging pin and its pin forward, seat stabilizer nose and push locating pin home into from tailplane attachment fitting.

Remove rigging tool (*or leave in place - see above note).* The locating pin must not protrude in front of the leading edge of the fin.

Check whether the elevator actuating pins are really located by moving the elevator.

d) After rigging

Do a positive control check with the aid of a helper.

Use tape to seal wing/fuselage joint, wing panel joints, and tip extensions.

> CAUTION: Do not seal the gap between the aileron on the tip extension and the aileron on the main wing panel.

If no rubber seal is present between the tailplane and the vertical fin, seal gap with tape.

e) Derigging

Remove all sealing tape from fuselage/wing fillets, wing tip extensions, and fin junction.

f) Horizontal tailplane

Using the rigging pin, pull out the front tailplane attachment pin, lift stabilizer leading edge slightly and pull tailplane forward and off.

g) Wing tip extensions

Push locking in down and carefully pull out the tip extension.

h) Main Wing Panels

Unlock spoilers, set water dump valve to "closed" and unlock handle of main wing pin.

With a helper, on the tip of the wing panel, pull out main wing pin, except for the last 1 inch. Withdraw the starboard panel, rocking forward and backward if necessary.

Then, remove wing pin and withdraw the remaining panel.

4.3 Daily inspection - (see diagram in approved manual and follow appropriate numbering.)

1. Open canopy

   Check main wing pin properly secured
   Visually check all accessible control circuits in the cockpit
   Check for full and free movement of the controls
   Check for foreign objects
   Check tire pressure - nose = 43 psi. main = 57 psi.
   Check tow release for proper function

2. Check upper and lower wing surface for damage
   Check and grease water ballast dump valves
   Check wing tip extensions for proper connection (locking pin flush with upper wing surface)
   Check ailerons in good condition and operate freely, unusual play, and hinges for damage

3. Check spoilers for fit and locking

4. Check fuselage for damage
   Check static ports at 3.35 ft forward of base of fin and below the wing fillet

5. Check tail skid or wheel (tire pressure = 43 psi.)
   Ensure Braunschweig tube is installed and pitot pressure head is clear
   Check fin water ballast tank spill holes are clear, water level in tank, and dump holes are clear,

6. Check horizontal tailplane for proper attachment and locking, elevator and rudder for damage and free movement.

7. Repeat inspection on other side of glider.

After hard landings or excessive loads, the resonant wing vibration frequency should be checked, entire surface checked for cracks or other damage.

4.4 Preflight Inspection

Use an approved checklist prior to take-off. In addition to A-B-C-C-D-D-E, CB-SIFT-CB, or other list;

- Water ballast in fin tank?
- Loading charts checked?
- Parachute fastened?
- Seat belts secured?
- Seat, head rest, and pedals adjusted for comfort?
- All controls and instruments accessible?
- Spoilers closed?
- Positive control check?
- Elevator trim set?
- Canopy closed and locked?

4.5 Normal Operating Procedures and Recommended Speeds

4.5.1 Launching methods

Aerotow is only permitted with a nose tow release. The maximum indicated airspeed is 81 kts.

Adjust trim to middle setting for most c.g. position, but for rearward c.g., adjust to first third of travel of the lever. After lift-off, adjust trim to minimize stick loads.

The elevator should be near neutral for most c.g. positions, but forward stick be used until tail lifts if c.g. is aft.

The approved manual recommends holding *downwind* aileron for a cross wind take off; i.e., for a left crosswind, hold the stick to the right/ This is to counteract increased lift on the right wing generated by the tug's prop wash. *Editor's note: Conversations with pilots flying from high altitude airports and with tow ropes shorter than 200 feet indicated that this is effective. However, local testing should be done to determine if the use of 200 feet tow ropes and reasonable density altitudes require this action, which is contrary to most literature and training presently used.*

The normal tow speed when flying solo is 54-65 kts and 65-76 kts when flown with two occupants and water ballast.

The gear may be retracted during the tow, but is not recommended because it would require changing hands may cause the glider to get out of position. *Editor's note: To create a more standard atmosphere in the Chicago Glider Club, leaving the gear extended until after release is recommended.*

Winch Launching is only permissible with a c.g. tow release in place. Maximum speed is 81 kts.

Editor's note: We have no c.g. hook, so winch launches are not approved

4.5.3 The duo discus has pleasant flight characteristics and can be flown effortlessly at all speeds, loading conditions, configurations, and c.g. locations.

Elevator trim is adjustable from about 38 kts to about 108 kts.

High Speed Flying

Full deflection of the controls may be applied only up to 97 kts (Rough air speed and Maneuvering speed), especially when in turbulence, rotors, thunderstorms. Dust devils, or when crossing mountain ridges.

At $V_{=NE}$ (135 kts), only one third of full deflection is permissible. Be especially careful of sudden elevator movements.

With an aft c.g. the control stick movement from point of stall to maximum permissible speed is relatively small, though the change in speed can be noticed by a perceptible change in stick loads .

Though the spoilers may be extended up to $V_{=NE}$ (135 kts), they should only be used at speeds above Maneuvering (97 kts) in an emergency of if maximum permitted speeds are exceeded inadvertently.
A dive with the spoilers fully extended is limited to $30^{=o}$ nose down at maximum all up weight and 135 kts. Maximum speed.

In a dive with the spoilers extended, pull out less abruptly than with the spoilers retracted.

Low Speed Flying

Stall characteristics and low speed handling should be done while flying straight ahead and in turns up to $45^{=o}$.

In level flight, a stall warning usually occurs 3-4 kt above stall with vibrations in the controls. As back pressure is added, the vibration becomes more pronounced, ailerons become mushy, and a slight pitching motion may occur.

At the stall is reached, a distinct drop in airspeed occurs and may oscillate due to tail mounted pitot tube. With the c.g. aft, a wing may slowly drop. With c.g. forward, with stick full back, the sailplane will mush without nose or wing drop.

To recover, move the stick smoothly forward, use aileron and rudder to level wings.

A loss of height of up to approximately 98 feet can be expected.

When stalled during a $45^{=O}$ turn with the stick full back, the sailplane continues to fly in a stalled condition with no uncontrollable tendency to enter a spin. Appropriate use of controls returns the sailplane to normal flight.

Influence of water ballast

Except for a higher stall speed due to the increased weight, water ballast in the wing tanks has no aggravating influence on the stall characteristics. With water ballast in the tail, stall characteristics are like those found for aft c.g. position.

4.5.4 Approach

Normal approach speed when flown solo, with spoilers fully extended and gear down is 49 kts dry, or 57 kts at max gross weight.

The yellow triangle on the ASI at the 54 kt mark is the recommended approach speed when crossing the fence for max gross weight dry.

The spoilers open smoothly and are an effective landing aid.

The L/D in these conditions is about 6.7:1!

Side slipping is possible. While holding a straight track, the rudder may be deflected about 85% (resulting in a yaw angle of about 40^{o} and a bank angle of about $25\text{-}30^{o}$.

CAUTION: With full rudder deflection, side slips in a straight line are not possible; the sailplane will turn in the direction of the rudder.

WARNING: The performance and aerodynamic flight characteristics are adversely affected by heavy rain or ice on the wings. Increase approach speed at least 5 kts.

4.5.5 Landing

Off-airport landings should always be made with the gear down to avoid vertical impacts.

The main wheel and tail wheel should touch simultaneously.

To avoid long ground runs, use minimum touch down speed of 38 kts. An increase of only 10 kts increases the kinetic energy by a factor of 1.65. The elevator should be held full back.

The hydraulic wheel brake is actuated by two methods; 1) the fully deflected spoiler handle, and 2) the squeeze handle on the stick.

4.5.6 Flight with water ballast

Editor's note: See approved flight manual for weight and balance data and allowable water ballast.

WARNING: On flights at air temperatures near or below freezing (32°F), water ballast must be dumped at no lower than 36°F.

Do not park the sailplane with full ballast tanks if there is a chance the water will freeze.

The water tanks are integral to the nose section of the wing and should be filled with clear water only through the openings in the upper wing surface. The openings are closed with plugs, which have a threaded hole for the tail rigging pin.

WARNING: The threaded hole is also the vent for the tank, so must be kept open!

Each tank hold 26.15 U.S. gallons, which will dump in about 5 minutes.

Fill each tank equally. If partially filled tanks, hold the wings level to ensure the water is equally distributed. Internal baffles maintain the balance while flying.

CAUTION: There is little point in loading much water ballast if the average rate of climb is not expected to exceed 200 fpm, or if the thermals are narrow.

WARNING: Never pressurize the tanks.

Water ballast is dumped through an opening on the lower side of the main wing panels, about 6.33 feet from the root. The dump valves are hooked up automatically on rigging.

All water ballast should be dumped prior to landing off airport.

When flying at max gross weight, the low speed and stall characteristics vary from dry flight; the stall speed is higher and greater flight control deflection must be used.

WARNING: Should the tanks dump unevenly, or only one tank dumps, aileron deflection of 50% and a greater approach speed is required. The heavier wing should be kept slightly higher on landing until slowed as much as possible before allowing it to touch the ground.

Water ballast fin tank

A tail ballast tank which holds up to 24 lbs of water is installed. Any quantity less than that can be added by covering the appropriate spill holes on the fin - one less than the desired amount of water.

Tail ballast may be used to "adjust" the c.g. for different pilot weights, whether solo or dual. Regardless of pilot weights, the maximum allowable weight may not be exceeded. To fill the tank, insert one end of a flexible plastic hose into the tube protruding from the

rudder gap at the top of the fin on the left hand side and the other end to a suitable container and pour the water into the fin tank. When it runs from the appropriate spill hole, the tank is full to the desired level.

To dump the tail ballast, open the wing ballast dump valves, opening the tail valve through an interconnection with the wing valves. Water is then dumped from an opening on the lower side of the fuselage tail boom, adjacent to the rudder. A full tail tank will dump in approximately 2 minutes, ensuring the tail tank is empty before the wing tanks.

Editor's note: See approved flight manual for further details of the mechanics involved and the pertinent weight and balance data.

4.5.7 High altitude flight

True airspeed increases at higher flight altitudes, so to avoid flutter, consult the approved flight manual for appropriate speeds versus altitudes. As an example, at 9843 feet MSL, the true airspeed limit is 130 kts, compared to 135 at sea level. At 25,000 feet, it is approximately 100 kts!

4.5.8Flight in rain

Though flying in rain shows no significant difference in stall speeds, the performance deteriorates by some undetermined factor.

SECTION 5

5.2.2 Stall speeds

The listed stall speeds were determined in straight and level flight at the weights listed.

With spoilers closed and 1100 lbs,	19-24 kts
With spoilers open	22-24 kts
At 1543 lbs, and spoilers closed	31-32 kts
With spoilers fully open,	33-36 kts

The loss of height from beginning of stall until regaining normal flight attitude is up to 98 feet.

5.3.1 Demonstrated crosswind performance

Maximum demonstrated crosswind capability is 11 kts.

5.3.2 Flight polar data

Maximum gross weight	1543 lbs.

Wing loading	7.6 lbs/ft ^{2}
Minimum sink rate	114 fpm
Best L/D	45 @ 54-56 kts.

SECTION 6

6.2 Weight and balance data

Editor's note: A careful study of the different possible combinations of pilot weights, ballast weights, and tail ballast is critical to the safe operation of this glider. Consult the approved flight manual for further information.

Maximum gross weight - no ballast	1455 lbs
Maximum gross weight - with ballast	1543 lbs
Empty weight - 7/30/99	905 lbs
Empty weight c.g.	20.3" aft datum
C.G. range	1.77"-9.84" aft datum
Front seat arm	55.1"
Front seat minimum weight	154 lbs
(may be adjusted with fixed weights or tail ballast)	
Front seat maximum weight	243 lbs
Rear seat arm	-11.4"
Rear seat maximum weight	243 lbs
Wing water ballast arm	2.56"
Tail water ballast arm	209.4"

SECTION 7

7.1 Description and operation of systems

This chapter describes the location and operation of the various handles and switches. Consult the approved flight manual for details.

7.13 Removable ballast

There are two mounting provisions for removable ballast, both located in the cockpit, just forward of the instrument panel.

There are a series of weights, each weighing 8 lbs, which can be mounted on the bolts. The front seat pilot weight minimum of 154 lbs can be reduced by adding enough of these

weights to match the pilot's weight. Consult section 6.2.2 in the approved flight manual for adjustments to the minimum front seat weight.

SECTION 8

8.4 Ground handling and transporting

When moving the glider on the ground, always use a tail dolly. When pushing by hand, do not push or pull from the wing tips, but as close to the fuselage as possible.

When storing, it is best to store in a hangar, if available. However, if kept in a trailer, ensure all water ballast tanks are completely empty and that the trailer is adequately ventilated.