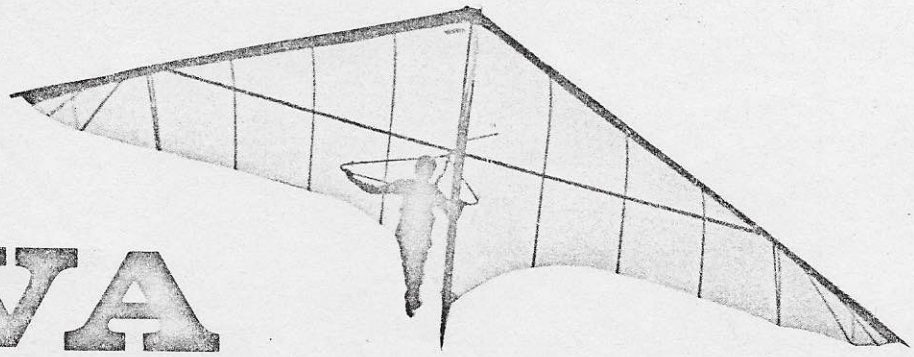
NOVA



OWNERS MANUAL

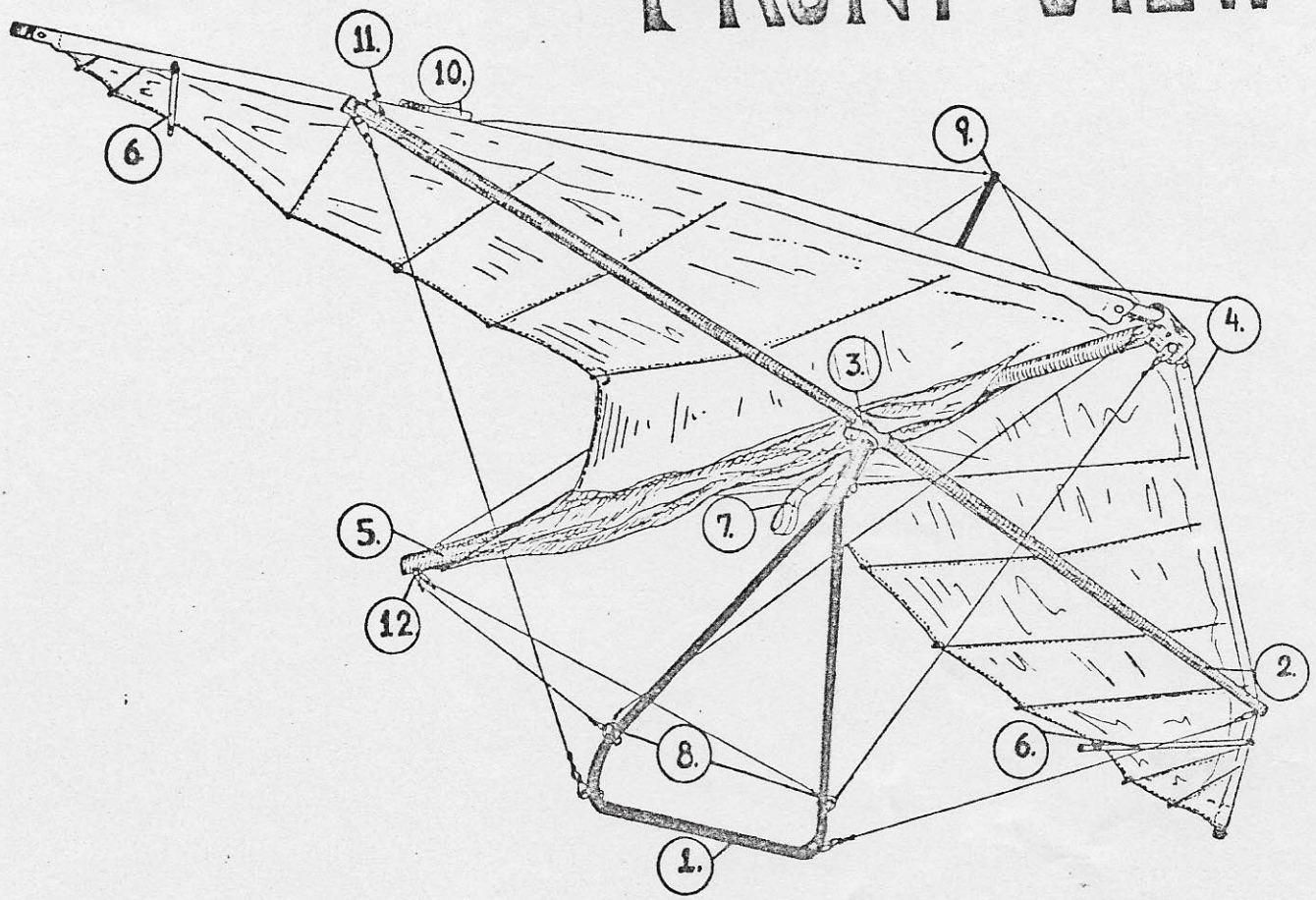
&

FLIGHT GUIDE

SUNBIRD ULTRALIGHT GLIDERS

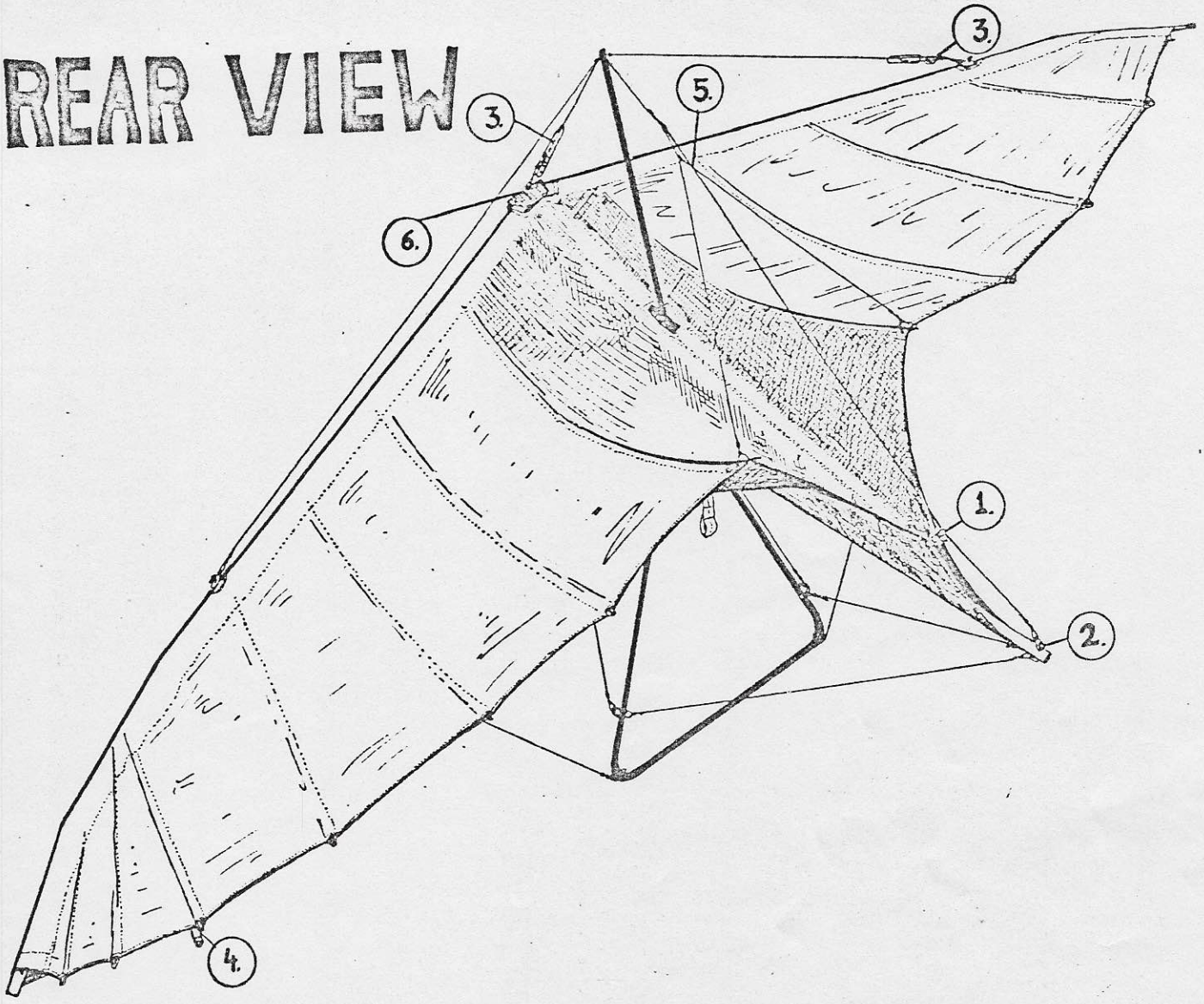
12501 GLADSTONE AVE. #A4
SYLMAR, CALIFORNIA 91342
(213) 361-8651

FRONT VIEW



1. CONTROL BAR
2. CROSSBAR
3. CROSSBAR CENTER SECTION
4. LEADING EDGE
5. KEEL
6. TIP TUBE
7. PILOT SUSPENSION LINE
8. FLYING WIRE SHACKLE
9. KINGPOST
10. QUICK-TENSIONER
11. WINGBOLT
12. KEELBOLT

REAR VIEW



1. KEEL POCKET STAND UP
2. KEEL BOLT
3. QUICK-TENSIONERS
4. TIP TUBE VELCRO ATTACHMENT
5. BRIDLE
6. NOSEPLATE

NOVA
OPERATING LIMITATIONS

FLIGHT OPERATIONS SHOULD BE LIMITED TO NON-ACROBATIC MANEUVERS, I.E. THOSE IN WHICH THE PITCH ANGLE WILL NOT EXCEED EITHER 30° NOSE UP OR NOSE DOWN OF THE HORIZON AND IN WHICH THE BANK ANGLE WILL NOT EXCEED 60°.

Stall Speed:	18 m.p.h.
Maximum Speed:	40 m.p.h.
Positive Limit Load Factor:	+5.7
Negative Limit Load Factor:	-3.0
Recommended Skill Level:	Level III - Level IV

UNLESS PROPER AUXILLARY EQUIPMENT IS INSTALLED (TOWBAR, FLOATS, ETC.) THE NOVA SHOULD NOT BE TOWED.

NO TESTS HAVE BEEN PERFORMED TO DETERMINE THE SUITABILITY OF USING AUXILLARY POWER ON THE NOVA.

MODEL	RECOMMENDED WEIGHT RANGE
150	100 - 140 lbs.
170	120 - 160 lbs.
190	140 - 190 lbs.
210	160 - 200 lbs.
230	175 - 220 lbs.

THE NOVA IS CHARACTERISTICALLY INCAPABLE OF SPINNING.

MAINTAINANCE

Properly cared for and used, the Sunbird NOVA is remarkably maintainance free. In in the interest of maximum safety, we make the following recommendations:

GENERAL RECOMMENDATIONS

* Avoid kinking cables when stowing glider.
* When transporting, use cover when possible.
* Wipe off glider with damp cloth following use at the beach.
* Do not overtighten quick release tensioners.
* Properly support glider when transporting.

In addition to normal pre-flight checks, we suggest the following schedule of inspection and maintainance:

EACH FLIGHT DAY

* Normal Pre-flights.

EVERY 25 FLIGHT-HOURS OR 3 MONTHS Carefully and closely inspect:

* Cables for abraded strands, severe kinks and other damage.
* Tubing for kinks, dents, deep scratches and other damage.
* Sail for ripped grommets, loosened sail mounting screws and other damage.
* Bolts and wingnuts for excessive wear.
* Pilot suspension web and harness for inadvertant cuts, abrasions or other damage.

REPLACE OR REPAIR DAMAGED OR WORN COMPONENTS.

EVERY 100 FLIGHT-HOURS OR 12 MONTHS

* Take your NOVA to an authorized Sunbird Dealer for an annual inspection.

BASIC FLIGHT GUIDELINES

Hangliding is a potentially dangerous activity requiring the active pursuit of specialized skills and attitudes if the inherent dangers are to be minimized. These GUIDELINES are intended to be only a basis from which to form the attitudes necessary for safe flight.

* IF YOU DO NOT HAVE AT LEAST A HANG 3 RATING, OBTAIN FLIGHT INSTRUCTION FROM A U.S.H.G.A. CERTIFIED FLIGHT SCHOOL BEFORE ATTEMPTING TO FLY THE NOVA.

* Before flying the NOVA carefully read the OWNER'S MANUAL and adhere to its suggestions.

* Always wear a helmet (designed specifically for hangliding) when flying.

* Aerobatics of any kind should not be attempted with the NOVA.

* Do not fly under the influence of any substance that will impair judgement, including liquor, drugs and antihistamines.

* Never fly without a preflight check of your glider, your harness, and <u>yourself</u>. (Too tired? Wind too fast or gusty for your experience?)

* Never replace lost bolts, nuts, etc., with "hardware" store components. See us or another reputable company for the appropriate replacements. (It's a good idea to have extra parts in your flight kit.)

* Never improvise a component, i.e., baling wire for cable. (It happened--and it was fatal.)

* Never be pressured (by friends?) into a flight <u>you</u> feel should not be made.

* Avoid overconfidence--know well your limitations.

* Leave cliff launches to experienced flyers.

* Always carefully inspect your landing area (on foot) <u>before</u> flying.

* Always have alternative landing areas picked out along (and in the vicinity of) your intended flight path in case you must land prematurely.

* ALWAYS WEAR A PARACHUTE AND KNOW HOW TO USE IT.

PREFLIGHT CHECKLIST

The following are the elements of a good preflight check. Every pilot should include at least these items in a routine check prior, during, and after assembly of the glider for flight.

--Floating tips are out and velcroed to sail.

--Wingnuts on wingbolt are snug and secured with an aircraft safety pin.

--Quick-tensioners are tightened so that the flying wires are just snug.

--Shackle bolts are tight enough to keep the shackle from rotating.

--Cable ends at shackles are "up" on the shackle.

--Wingnuts and bolts are not excessively worn or bent.

--Noseplate bolts are secure.

--Heartbolt is secured with cotter pin.

--Cables are not kinked, frayed or otherwise damaged.

--Leading edges, crossbar, keel, kingpost, and control bar are not dented, kinked, bent, or otherwise damaged.

--Sail, particularly at grommets, is not ripped, or otherwise damaged. Sail mounting screws are tight.

--Leech-line is not frayed, cut, or damaged.

--All battens are "notched" into leech-line.

--Sail is not pinched between spar saddles.

--Pilot suspension system is not cut, frayed, or otherwise damaged.

GROUND HANDLING PROCEDURES

The following are recommended procedures for assembly and disassembly of the NOVA. You may find that a variation or combination of the following sequences is easier for you, but keep in mind that any method should minimize the abuse the glider receives because of wind and/or rough handling.

POST SHIPMENT ASSEMBLY

--Remove glider and control bar components from shipping carton(s).
--Inspect for damage.
--Assemble control bar
  (a) slide arms (with connector sleeves attached) one at a time into base tube. Note that the heads of the bolts should face in one direction (forward or back).
  (b) insert spacer between the arms and insert the lower control bar neck bolt and using lock nut supplied, secure the two arms with the spacer in between.
--Refer to the 'trim tag' attached to the control bar bracket and following the instructions provided attach the control bar to the control bar bracket. Note that a metal spacer separates the top of the control bar arms.
--Connect the flying wire shackles, with flying wires attached, to the control bar. Make sure the shackle is properly orientated so that the cables are not tangled, twisted or out of order. Refer to the section on "Tuning" before tightening down the shackles.

FLIGHT ASSEMBLY

--Pick a relatively level spot free of obstructions.
--Remove carrying cover.
--Rotate control bar up, attach keel bolt & safety pin.
--Turn glider over and stand upright with the tail down and into the wind.
--Put the kingpost up, connect the quick-tensioner to the nose-plate link and secure with the plastic safety sleeve.
--Unwrap the side flying wires and place to the side of the control bar.
--Rotate the center section of the crossbar so that the ends are swept to the rear.
--Slide the crossbar halves onto the center section. Be sure to carefully align each half when sliding it on. Avoid excessive twisting motions.
--Spread the leading edges and join the leading edge, crossbar, top and bottom side wires. The standoff belongs on top of the leading edge. Be sure the sail is not pinched by the saddles and the wingnut is secured with an aircraft safety pin. Connect the quick-tensioner to the side link and secure with the plastic safety sleeve.
--Starting at the root (center), slide the battens into the

batten pockets. Do not attach (notch) the battens to the leech line until the tip batten is reached, then starting with this batten, notch each batten in succession, working back towards the root. Pull the leech line just snug before continuing to the next batten -- this helps to insure that the leech line tension is uniform from batten to batten.

--Carefully rotate out floating tips and secure at trailing edge with velcro tabs. Be sure the front of the floating tip tube rests on the bottom of the leading edge. Do not attach the velcro tab tightly around the tip tube -- the sail must be free to move back and forth.

--Pre-flight the glider!

DISASSEMBLY

--Move the glider out of the way of landing gliders.
--Place the tail down and into the wind.
--Remove the battens from each side of the sail tie in separate bundles and place between rear flying wires (its harder to step on them there.)
--Disassemble wingbolt assembly, leave the bolt standoff, etc. on the side flying wire.
--Fold leading edges in, being careful to keep the keel and the leading edges in the same plane.
--Roll up each half sail around a batten bundle and tuck this roll into itself, around the leading edge.
--Place ties around the middle rear and towards the rear of the folded assembly.
--Remove the crossbar halves and tie them to either the top or bottom of the folded assembly behind the kingpost bracket and in such a manner that the possibility of damage is minimized.
--Rotate the crossbar center section in.
--Wrap the side flying wires around the bundled sail, leading edges, and keel, just in front of the kingpost bracket.
--Disconnect the noseplate, quick-tensioner and rotate the kingpost down and secure with a tie.
--Tuck the kingpost wires in along the length of the rolled sail.
--Place additional ties as required.
--Put on carrying cover, but do not fasten.
--Lay the glider on the ground, disconnect the keelbolt and rotate the control bar down.
--Organize and secure cables, close carrying cover fasteners, secure control bar base with a tie.

SPECIAL PRECAUTIONS FOR HIGHER WINDS

--You will notice the battens are a little more stubborn to notch. This is normal and results from the sail being pre-loaded.
--The glider, following assembly and prior to take-off will be tail to the wind and must be turned around. We suggest the following procedure: Grasp the front flying wires near the

nose. Pull the glider's nose slightly forward just enough to lift tail, but not enough to inflate the sail from the rear. Tip the glider onto one corner of the control bar, and quickly rotate the nose around into the wind, gradually raising the nose to just above the neutral position as you bring it around. Be careful not to damage the flying wire cables if your control bar is of the breakdown type. It is a good idea to try this 'turn around' a few times in low winds before trying it in higher winds.

--When moving the glider around or preparing for take-off, hold the attitude somewhat higher than neutral -- do not try to force the glider into the neutral position, the aerodynamic pitching forces are too great and are considerably lessened by raising the nose a bit. In higher winds it's a good idea to have cable assistance.

SPECIAL NOTES

--It is a good idea to use a standard assembly procedure and not to interrupt it until the glider is completely assembled and preflighted.

DON'T

--Step on your battens.
--Leave the glider nose into the wind (either up or down) in winds greater than 10 m.p.h.
--Leave the glider unattended in gusty or variable winds.
--Move glider unassisted in winds greater than 15 m.p.h.
--Fly if it is so windy or gusty that it is difficult to assemble your glider without assistance.

TUNING THE NOVA

Unlike gliders with deflexers, the tune of the NOVA does not vary appreciably in production. Once tuned the glider tends to stay tuned.

Adjustments in pitch may be made by changing the position of the control bar on the control bar bracket. Further adjustments may be made by rotating the control bar bracket forward or aft. Normally the suspension rope is hung from the top of the control bar. Note that it hangs behind the control bar, not in front of it.

If necessary, lateral adjustments are made by differential adjustments of the control bar flying wire shackles. Loosen the shacklebolts so the shackles are free to rotate and move the sail keel pocket from side to side -- note how the shackles move. Tighten the shackles so that the keel pocket is shifted in the direction the glider tends to turn. Before using this method be sure the leech lines are equally adjusted.

FLIGHT CHARACTERISTICS
TAKE-OFFS AND LANDINGS

TAKE-OFFS

Because of the NOVA's unusually high stability in the lower angle of attack range you will find it is difficult to hold the glider neutral to the wind when preparing to take-off. The force you feel when you attempt to hold it neutral in moderate winds is indicative of what the gilder will be trying to do should you get in a situation where the sail is 'blown down' - this force means an increased margin of safety. To reduce the strong tendency of the glider to rotate nose-up, LET THE NOSE COME UP UNTIL THE SAIL BEGINS TO INFLATE. This is the correct take-off attitude for the NOVA and it normally will not result in the glider pitching nose-high during take-off. DO NOT ATTEMPT TO HOLD THE WING NEUTRAL TO THE WIND - let the nose come up a bit and you will find ground handling and take-offs much easier.

LANDINGS

Landings are straight forward on the NOVA. As in other high performance gliders it is best to land the NOVA using the upright, full drag, hands on the downtube pilot position. Because of the larger sail area and lighter wing loading the new NOVA pilot may find he/she flares a little too early. This tendency will disappear after a few landings.

FLIGHT CHARACTERISTICS
LONGITUDINAL (PITCH)

The pitch characteristics of the NOVA represent a breakthrough in ultralight glider aerodynamics. Before the development of the NOVA there always has been a tradeoff between safety (pitch stability) and performance (pitch control force/response). A glider that was conservatively stable necessarily had relatively large pitch control forces in turns and when flying fast. Long flights requiring aggressive pitch control and/or many turns were exhausting. This additional effort was simply the tradeoff required for additional safety. The NOVA avoids this tradeoff by employing an aerodynamic system that provides variable stability.

Estimates indicate 90 - 95% of the time a hanglider will be flown in the relatively narrow range of angle of attack of approximately 15^{o} - 25^{o}. This 10^{o} normal flight range is somewhat less than 3% of the possible total range of 360^{o}. The ideal configuration would be a glider with moderately low stability in the normal flight range -- resulting in low control forces and quick response, but with a moderately high stability "barrier" on either side to help keep the glider within the normal band of angle of attack.

This is essentially what has been achieved with the NOVA. The NOVA's unique blend of aspect ratio, nose angle, and use of an engineered floating tip/bridle system results in a glider that has just enough stability in the normal flight range to give proper control force feedback to the pilot; however, outside of this range the stability increases dramatically, to levels previously not achieved in flexwing design. In this way the NOVA pilot can have the best of both high stability and sensitive pitch control.

As a result of the light control forces the new NOVA pilot may find he/she is flying too fast because of inadvertantly pulling in on the control bar. The new pilot should also note it takes considerably less control force to achieve and maintain a given speed. The unusual effectiveness of the NOVA's weight shift pitch control means that if you stuff the bar to your knees, be prepared (like in a sailplane) for the nose to point DOWN and the wing to accelerate FAST.

Many pilots have been surprised by the NOVA's ability to penetrate. How can a glider with such an excellent sink rate (i.e. a "floater") have resonable penetration? "Penetration" is really just another way of describing L/D at higher speeds. Performance at speed depends primarily on parasitic drag and the induced drag that results from a poor load distribution. Because of it's unique design, the outboard sections of the NOVA's wing do not 'blow down' - with the associated increase in induced drag and penalty in performance and penetration.

FLIGHT CHARACTERISTICS
LONGITUDINAL (PITCH) (cont.)

Stalling of the NOVA takes two different forms. If the glider is slowed gradually it will have a very mushy stall. Approaching the stall in this manner the control bar can be pushed nearly all the way out and the glider will have a very mushy 'break' with a lot of warning. If the speed is reduced quickly, the stall is more abrupt, there is less warning and the 'break' is more defined. In neither case is there an uncontrollable tendency for the glider to fall off on a wing, since the NOVA retains a moderate amount of control near the stalling angle of attack.

The new NOVA pilot will notice that there is less pitch-up upon entering thermal lift. This is due in part to the NOVA's very large effective nose angle. Incidentally, at the time of this writing the NOVA has the largest effective nose angle of any production flexwing in the U.S. (It has an average quarter chord sweep of just over 18°.) The reduced tendency to pitch-up in thermals is just one of many unique characteristics that results in the NOVA being significantly more pleasant to fly in tough conditions.

SUMMARY: The NOVA's state of the art design results in light pitch control forces and quick response without sacrificing overall stability. Because of the light control forces the new NOVA pilot may need to pay special attention to air speed. The NOVA's stall is straight forward and easy to control with no tendency to spin or fall off on a wing.

FLIGHT CHARACTERISTICS
LATERAL (ROLL-YAW)

The NOVA has been characterized by several top pilots as having the best "turn efficiency" of any glider they have flown. The unique combination of nose angle, aspect ratio and other aerodynamic factors results in a glider that practically auto-coordinates thermaling turns, has no adverse yaw and virtually no side slip. Pilots sense an unusual 'smoothness' in turns. Control forces are very light, and control response is fast and direct enough that there is little tendency to overbank turns, even at steeper bank angles. Turn techniques may be varied from the conventional coordinated turn to very shallow-banked 'flat turns'.

The glider has not exhibited any negative lateral characteristics. Our tests indicate it will not spin. Properly trimmed it will not fall off on a wing. Although control forces are light, if the control bar is released in a turn the glider will roll out. If the glider has been trimmed for thermaling and the control bar is released the glider will continue turning with the same bank angle and slowly roll out. The NOVA maintains adequate control feel at high angles of attack, so the experienced soaring pilot may fly relatively close to stall without fear of spinning, falling off on a wing, or severe loss of control. Considering its large, efficient span and sail area the NOVA is surprisingly nimble in roll, completing a 60^{o} to 60^{o} roll test (turn to turn) in 2.4 seconds.

SUMMARY: The NOVA is quick but predictable in roll. Control in turns is direct with little lag or necessity for complex control motions. The glider's lateral control characteristics are such that the average LEVEL III or IV pilot will feel comfortable and confident even on initial flights.

EXTREME FLIGHT CONDITIONS

AEROBATICS

NO AEROBATIC MANEUVERS HAVE BEEN SPECIFICALLY APPROVED. FLIGHT OPERATION SHOULD BE LIMITED TO NON-ACROBATIC MANEUVERS, I.E. THOSE IN WHICH THE PITCH ANGLE WILL NOT EXCEED EITHER 30° NOSE UP OR NOSE DOWN FROM THE HORIZON AND IN WHICH THE BANK ANGLE WILL NOT EXCEED 60°.

PITCHOVERS/SEVERE TURBULENCE

Sunbird has invested a great deal of time into the research of the pitchover phenomenon. A summary of this research can be found in the Selected Reprints section of this manual. This information has been taken into account in the design of the NOVA. While every reasonable effort has been made to make the NOVA pitchover resistant, the forces of nature and the variation of piloting techniques and skills are such that the NOVA could concievably experience a pitchover. PILOTS SHOULD ALWAYS WEAR A PROPERLY MAINTAINED EMERGENCY PARACHUTE AND KNOW HOW TO USE IT.

Windy weather and topological conditions that can result in severe turbulence should be specifically avoided, but if you should inadvertently find yourself in severe turbulence in the NOVA; current flight experience, research and information suggest you fly FAST ... between 30 and 35 m.p.h. Flying fast increases the stability and damping of the glider and reduces the magnitude of gust induced changes in angle of attack. Flying in this range will increase the forces on the air frame, but the loading should still be well within the strength envelope of the glider.

WHIPSTALLS

WHIPSTALLS ARE CLASSIFIED AS AN UNAPPROVED ACROBATIC MANEUVER AND ARE SPECIFICALLY PROHIBITED.

WINGOVERS

A properly executed wingover does not result in an unusual angle of attack or put unusual loads on the airframe, however, improperly executed wingovers can be very dangerous. Because of the potential danger a wingover is classified as an unapproved aerobatic maneuver.

FLIGHT CLOSE TO THE GROUND

The ground is what can hurt you, and anytime you are near it you should fly extra carefully. Generally, as you approach the ground you should increase your airspeed to the speed for maximum L/D -- faster if the situation warrents (strong gradient, etc.). Steep turns should also be avoided because of the increase in the likelihood of stalling or excessive slipping.