

Atos Service Manual

Translated August 1999 by Heiner Biesel

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1 Car transport

Since the spar is made of carbon fiber it is quite susceptible to damage from point loading. It is best to support the glider with several padded supports. If there are only two supporting points, such as a roof rack, they should each be at least 4 inches wide to distribute the load. Adjust the straps only as tight as necessary and spread them apart.

The Atos should be transported with the control bar bracket facing upwards. This usually means that the zipper is on top. Use a waterproof bag to keep the Atos dry and to protect it against salt. The composites used in the construction of the spar, the spoiler, and the flaps can absorb moisture. If the Atos gets wet it should be dried immediately to prevent mould and corrosion.

2 Setup and Breakdown

Setup

1. Attach the base tube to the down tubes.
2. Flip the Atos upright and rest it on the control bar. Do not hold the glider at the nose fitting as this can damage the keel.
3. Flip out the nose turnbuckle. If the wings are spread out with the turnbuckle inside, the nose tube or the spar may be damaged.
4. Spread the wings until the keel tube touches the ground. Do not insert the tail extension tube at this point.
5. Insert the tip tubes and wands, and push them in as far as they will go. Attach the tip cam to the tube. Place the upper and the lower cords in the corresponding grooves on the cam. Tighten the cam until it rests on the inside of the sail. Do not let it slip and hit the tip. Fold out the outermost two ribs at this point.
6. Attach the rings at the trailing edge of the sail to the keel fittings. Push keel as far forward as necessary to accomplish this. Be careful not to damage the flaps.
7. Close the top zipper.
8. Connect the nose turnbuckle to the D-tube fitting and tighten it while pushing on the nose to spread the wings. Verify that you have tightened the turnbuckle the correct amount by noting that the string forms two hanging loops and is not twisted. The turnbuckle has to be exactly at the stopper nuts and the bolts must be secured with the safety rings.
9. Insert stinger.
10. Fold out and attach the ribs to the sail.
11. Attach the flap control cables to the flaps using the pip pins.
12. Attach spoilerons to actuating levers.
13. Now attach the front nose wire, the nose tube, and nose cone, and close the bottom zipper. Especially after an inspection where the Velcro had to be opened completely, it may happen

that the sail is uneven. If this is the case, loosen the Velcro, adjust the trailing edge of the sail, and close the Velcro again.

14. Thread the flap cord through the clamp on the base tube and check the flap position. Put a knot into the cord at the jam cleat to mark the position in which the flaps are fully retracted. This is a slightly negative flap setting.
15. Attach the control cables of the spoilers to the base bar and secure them to the quick pins. Slide the protective covers over the fittings

Check before every launch:

- Check all links on the glider after set-up, such as safety rings and split-pins, etc.
- Make sure the flaps are fully functional. Check all positions, and make sure that they move freely at all six ribs on which they pivot.
- Verify the spoiler deflection by moving the control bar. You should have about 80 degrees deflection.

Breakdown

Breakdown of the Atos is simply the reverse of the set up procedure. Make sure you observe the following points:

- Rest the glider only on the spar and the tip rods, not on the extended ribs.
- Remove the flap before releasing the nose fitting.
- The sail should only be zipped and unzipped while the nose turnbuckle is not tensioned.
- Detach the spoiler cables before you fold the wings in.
- Make sure you fold the sail in the keel area so the zipper will not be damaged when folding in the spars. Fold the top zipper back once toward the wingtip before folding the sail. Stand in front of the glider and pull the sail up across the D-tube toward yourself. Fold the sail around the D-tube. Place the zipper pull at the trailing edge of the sail.
- Be careful when folding the wings and do not force them. Make sure you have detached the spoiler control cables, and that the turnbuckle cannot get caught.
- When dismantling the spoiler, be careful the spoiler lever does not snap back against the rib.
- Make sure you pack all parts in the bag so that they will not be damaged during transport.
- Fold flaps and spoilers so as to lay as flat as possible on the wings.

3 Flying Characteristics of the Atos

3.1 Launching

The Atos is slightly tail heavy during ground handling. However, the wing will establish the proper nose angle during the first couple of steps at takeoff. Experiment with a short run on flat ground to become familiar with this characteristic. The spoilers are highly effective for balancing the wing even during gusty conditions, but you should take some time to test out their response before your first flight.

For takeoff pull just enough flap so that the knot is even with the edge of the rubber covering of the control bar. Launch is much the same as for any other hang-glider.

3.2 Flying the Atos

The Atos is controlled by weight shift like any conventional glider. It will take a little while to get used to the slack in the spoiler control cables and the response time of the glider. The Atos does not require any high-siding in turns and is quite easily controlled in roll and pitch. Control effort is significantly less than required for conventional gliders. Initiate a turn by simply pushing and holding the control bar to the side, then center the control bar when the proper turn has been established. Quick control impulses are not effective.

The spoilers produce a strong yawing moment when fully deflected. This can be an advantage when quickly changing direction e.g. when thermaling. It is possible to over-control the glider in yaw at high speeds. Control movements should therefore be reduced at such speeds.

Reduce spoiler deflections under these conditions:

Speeds greater than 65 km/h (40 mph) with flaps set at 70 degrees.

Speeds greater than 80 km/h (50 mph) with flap settings between 0 and 15 degrees.

An airspeed indicator should be used initially to establish the correct speeds. NOTE: Do not spin the Atos! It is possible to exceed the structural limits of the glider during spins and their recovery. Spin recovery is initiated by returning the control bar to the neutral position and pulling gently out of any dive.

3.3 Thermaling

The Atos thermals best at a flap setting of about 15 degrees. However, in strong turbulence it is best to reduce this.

At speeds above 65 km/h (40 mph) best sink rate is obtained at zero degrees flap. Best glide is between 31 and 35 mph at approximately 5 degrees flap.

3.4 Landing the Atos

For landing, the flaps should always be fully deflected. This is the best way to obtain the lowest stall speed. The easiest way to regulate the glide path is to deflect the flap completely and to vary airspeed.

It is recommended during the first landings to position the flap for landing while at an altitude of 150 feet or more, and to fly a long final. To avoid having the tip tubes touch the ground, be prepared for an aggressive flare.

3.5 Winch towing

The best way to tow the Atos is with a flap position of 15 degrees. Speed control is optimal at this flap setting. Lower winch tow speeds often mean a higher release altitude.

3.6 Aerial towing

In conditions of very low winds the Atos should be launched at a flap position of 15 degrees. With a headwind a lower flap setting is better. The trim speed can be adjusted to the speed of the towing aircraft. It may be necessary to push out more on tow than you would with a conventional glider.

4 Maintenance

The Atos is mostly made out of fiber reinforced material. Compared to metals, composites do not show obvious signs of damage. Metals deform before they will break, while composites may only show hairline cracks if damaged.

Damage to composite materials can be detected by looking for signs of delamination and by checking the stiffness of the material. However, it is not always easy to detect such damage, and we recommend that you have your dealer inspect your glider if you suspect any damage.

Dealer inspections should take place ever 200 hours or 2 years, whichever comes first. Between dealer inspections you should perform the following checks yourself.

4.1 Adjustment of the control cables

The control cables are adjusted at the factory and should have about a half an inch of slack on each side. Always check this before every launch. Lift the nose slightly and move the control bar from side to side to check slack.

After the first few flights the knots get tighter, and cables and cords stretch. This will increase slack. Adjust the slack of the spoiler control cables to not exceed one inch on either side.

Follow this procedure for adjusting the spoiler control cable:

With the glider set up, open the Velcro at ribs 5, 6 and 7. Fold in the rib at the spoiler position and adjust the spoiler cord at the spar fitting. Check the amount of slack and the proper operation of the spoilers. Make sure the knot on the spoiler cord is good and tight, and that the Velcro is properly closed. This is done most easily when the spoiler rib is folded in and the wing is set close to the ground. Remember, the spoilers are your **only** flight controls for roll, and if the spoiler cords come undone you will have no directional control. Verify that the spoiler is adjusted properly by attaching only the spoiler rib to the rear of the sail and moving the wing up and down. Make sure that the spoiler cords are well tied with two half hitches and a closing knot. After adjusting the spoiler cord you must also adjust the spoiler stop cord as described next.

4.2 Function of the stopper cord

The spoiler cord has a stop cord to reduce the effects of a bad landing on the spoiler rib and lever during which the trapeze can be shifted crosswise. This stopper cord attaches the spoiler cable to the spar to limit its travel.

4.3 Adjustment of the stopper cord

The maximum deflection of the spoilers should be about 80 degrees. In this position the spoiler cord has to be tight. Check it by moving the spoiler lever manually. The spoiler cord should be slack when the spoilers are not deflected. If it is not, the spoiler cord must be shortened; otherwise spoiler deflection will be limited which will have a negative effect on the roll rate. Make sure that the stopper cord and the control cord are not twisted around each other. If it is, the steel cable on the pulley has to be adjusted correspondingly.

Check this after every 50 hours or every 20 flights during setup.

4.4 Exchange of the spoiler cords

Replace spoiler cords after approx. 200 hours, after 2 years, or immediately upon showing signs of wear.

4.5 Checking the cord pulley

Check the pulleys regularly for wear. They must turn freely and must not permit the cord to leave the groove of the pulley. Check every 50 hours.

4.6 Check of the ribs and rib connections

Ribs can be checked visually and mechanically. A defect or weak spot on the laminate may be detected by pressing the tube with your thumb and forefinger. There should be no deflection or cracking sound. Check the connections between the ribs and the D-tube. Weak points on the rib connections can be found by pushing on the rib ends with about 10 pounds of force. Rib 5, which holds the spoiler lever, should be checked with extra care. Also check the link for the spoiler lever. The ribs should be checked about every 50 hours, or after any hard landing.

4.7 *Outermost rib and tip tube*

Check the tip rod and the outermost rib every time the wing contacts the ground during landing.

4.8 *Wing pin and spar fittings*

The wing pin and the spar fittings are made out of a high-strength aviation alloy. To avoid corrosion those parts are nickel-plated. As the coating may wear, these parts should be wiped down with a lightly oiled cloth, especially after the glider gets wet. The fittings may require additional lubrication if they have gotten wet.

The turnbuckle should be greased about every 50 flights, or whenever the fitting becomes difficult to turn. Failure to do so may wear out the turnbuckle. Untie the knots of the cords on the turnbuckle so that the thread of the turnbuckle can be unscrewed half way and lubricated. If the turnbuckle still does not turn smoothly and easily it will have to be replaced.

Make sure the turnbuckle is properly reassembled. The body of the turnbuckle should be flush with the limit nuts. When the glider is set up the nuts have to be at their limits and the rods should not be twisted.

Take care that the trim is not altered when the sail is readjusted.

4.9 *D-Tube*

The leading edge of the D-tube can be checked for damage as described earlier, and the owner may repair damage to it. However, any damage to the spar caps will require inspection, repair, or replacement by your dealer. The spar caps are located above and below the spar at the rear of the D-tube. Damaged spar caps can cause the spar to fail in flight. If you detect **any** damage in this area, take your glider to your dealer. He will be able to tell whether the spar can be repaired or whether it has to be exchanged. The same applies for extreme impact loads on the spar during improper transport or after a crash.

4.10 *Cord connection at the ribs and the tip tube*

Ribs and tip tubes are tied with 2 mm cord. If the tension of these cords is not correct the sail will usually have wrinkles, and you should adjust the tension of the cords. Cords usually stretch during the first few flights, so check them frequently. A damaged cord must be replaced immediately. Pay special attention to the connection at rib 5, and at the tip tubes.

4.11 *Cord connection at the flap*

The cord is exposed to high mechanical loads at the link to the quick pin. Check this area every 10 hours for wear and delamination.

4.12 Restoring rubber of the flap

Replace the rubber cord if the flap does not completely retract when the flap cord is fully released. It is also possible that the mushroom strap holding the flap pocket to the sail has been tightened improperly. Try adjusting the mushroom strap. If this does not correct the problem you can shorten the restoring rubber cord by approximately an inch.

Periodically, and after heavy use, you should check all seams, loops and ribbons on the glider sail. The zippers should run smoothly. To extend the life of your sail, we recommend you store the glider dry and avoid exposing it to ultraviolet rays any more than necessary.

The zippers on the sail are attached with Velcro straps to the sail so that the turnbuckle at the nose fitting has to be tensioned with 1.5 turns to fully tension the sail. If any more turns are necessary, adjust the sail attachment to the keel by adjusting the straps that attach these fittings to the inside of the sail.

5 Flight limits

V_{ne} (flaps 0 to 15 degrees)	80 km/h	50 mph
V_{ne} (flaps 70 degrees)	70 km/h	50 mph
Maximum wing loading	+4g	
Takeoff weight range	80 -152 kg	176 – 334 lbs

6 Technical data Atos 146

Span	12.82m	40 feet
Aspect ratio	12.1	
Flap deflection relative to the keel tube	0 – 70 degrees	
Wing area	13.6 m ²	146 ft ²
Weight	34kg	75 lbs.