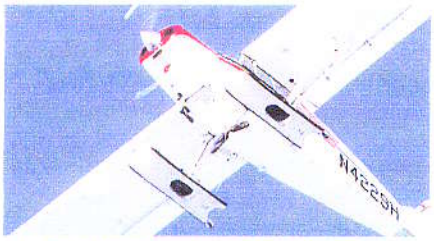
aileron). As soon as the right wing begins lifting, the airplane is ready to fly, so neutralize the ailerons and the airplane will lift off. This technique results in safe, short takeoffs with an airplane lifting off banked slightly toward the wind. Because the airplane is banked, the low side of the airplane will have its ski in the snow slightly longer than the high side ski. The crust drag on that low ski caused a yaw that I will not soon forget. Because the airplane was already flying, I was able to climb away from the LZ and ponder the issue of wheel penetration skis and breakable crust.

Fast forward to winter of 2002. Gary Landes handed me the key to his hangar, stating that his 150 horsepower PA-12, on the latest generation of LW2500 wheel penetration skis, is just like any other Cub. Five minutes from Merrill Field in downtown Anchorage, I landed on a small lake. Snow conditions consisted of four inches of soft snow on top of a crusty layer, presenting the

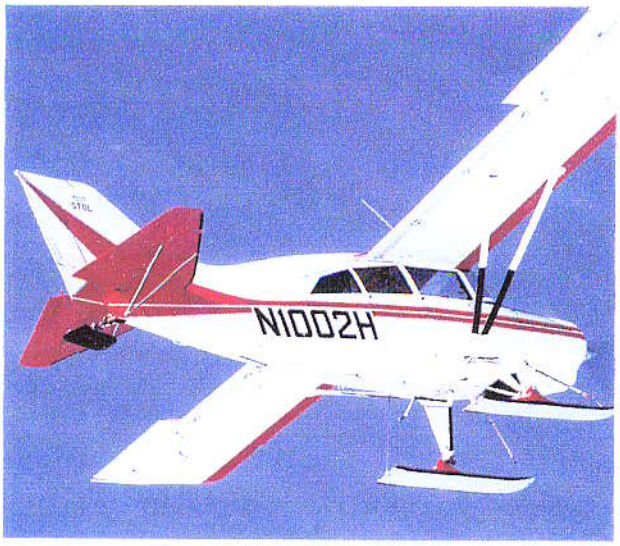


The first generation LW2500 (above) still used a rear cutout like the older LW3600. The cutout is eliminated from the new design.

same drag issues that I had encountered with the PA-14 high on the glacier. Without the advantage of a sloped takeoff area, the drag of the wheels on the snow was apparent. But, following power application, I felt a drag decrease as the tailwheel lifted free of the snow surface and the skis climbed on top of the soft layer, lifting the main wheels from the crust. A tail ski will go a long way to reducing the total drag.

In soft, wet, or packed snow, the LW 2500 works great, but a straight ski is at a decisive advantage on breakable crust. A measured drag race to liftoff is likely to be won by a straight ski over a wheel ski in any conditions but dry ground. When using a sloped and short landing zone for springtime glacier operations, the performance, simplicity, and low cost of the Landes Airglas wheel penetration ski make the LW2500 the perfect tool for the job.

For more information contact Airglas Engineering Inc at 907-344-1450 or visit www.airglas.com.



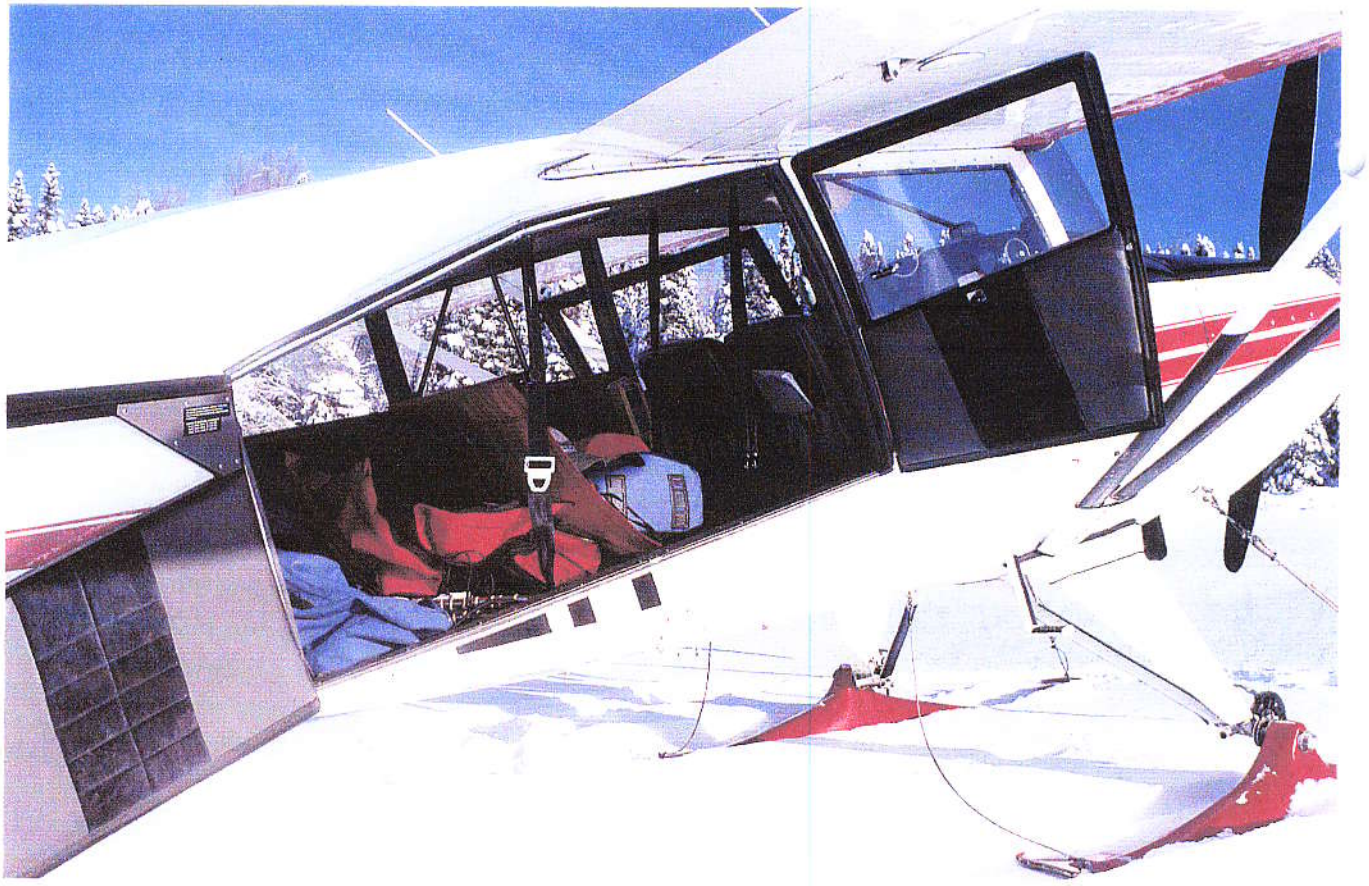
Maule M7-235

Photography by Peter M. Diemer

ew things compare to a crisp winter day in the North Country. The cold is *exhilarating* — zero degrees plus a 12-knot wind chill from the north. The Maule MX-7-235 ski plane, filled with winter gear and two pilots, charges into the cold dense air — air thick with performance and promise.

Flaps on, full power, tail low, rotate *hard*. Pull to 20 degrees nose up pitch and levitate at 1,500 FPM. Circle the lake. Land softly. Repeat.

It is time to rest. Shutdown. The plane glides silently across the brilliantly lit snow, the skis emit a satisfying *scrunch*. Backcountry bliss.



Bill Ro.

Wheel Penetration Ski

Introduction by Peter M. Diemer, Field Test by Dave Calkins
Photography by Tom Evans

Every year the best ski flying locations seem to be just out of reach. As winter gives way to spring at lower elevations, the alpine snowfields reach their yearly ski flying and winter recreation prime. Depending on where you live, this magic window can be time- and weather-limited to a few brief weeks. Unfortunately, the low-level ski plane bases are no longer suitable for operations by the time the higher elevations reach optimum condition. The solution: combination wheel skis.

Few aviation modifications or accessories are as inexpensive or simple as bolt-ons. But that's exactly what Wes and Gary Landes of Airglas Engineering in Anchorage, Alaska, are trying to do with their new line of LW2500 wheel penetration skis, making them affordable and simple to install. Famous for their line of straight skis and helicopter ski accessories (see Feb/Mar 2000), Airglas launched their new lightweight LW2500 skis intended for the Cub, Husky, Maule and Citabria market just four years ago.

Based on the much larger LW3600, which is certified for the Cessna 180 and 185, the LW2500 is an updated and improved version of the technology. Originally engineered and certified with the 3600 by Wes Landes in the late 1960s, the LW2500 program received a boost of enthusiasm by son Gary in the mid-'90s. "All that was left was flight testing," said Gary. "The ski was already TSO'd and I knew that it would perform well on the lighter weight planes like the Cub series." Airglas obtained STC approval for installation on the PA-18, 12, and 14 in 1998. Several field approvals have also been granted for installation on the PA-20.

With over 70 sets now in service, the LW2500 has proven to be an excellent compromise between lightweight and super-slick straight skis and more complex fully retractable wheel ski systems. The advantages of combination skis (either retractable or penetration) are numerous: increased fueling options, increased landing areas, operations from dry, paved airports and, most importantly, the extension of the ski flying season.

The Airglas wheel penetration ski combines proven fiberglass construction with practical design engineering. The design intent is minimizing drag of the protruding tire, maximizing ski flotation, and simplifying the installation procedure. While the ski design is simple enough, the Cub install procedure still has some challenges to meet the bolt-on classification.

"While developing the STC, I discovered that there is virtually no consistency with regard to Cub gear," lamented Gary. "Every set of gear is different." This presented a problem to Airglas, whose skis are virtually identical. "It's no big deal on straight skis, because there is no interaction between the ski and wheel," Gary said. "The LW2500s require that the ski, wheel and brake all interact."

There's the rub. As Cub gear gets bent, twisted and rebuilt, critical distances can become nonstandard. Even among the different new gear fabricators, the distance from the axle end to the brake torque plate can vary. This is important because the installation of the LW2500 requires a stub axle and a welded-on fitting, both based on the location of the torque plate.

"A couple of customers have completed the welding," said Gary. "But 99 percent of the time we perform the work because we have accurate jigs and we are much faster."

Now Airglas includes the required gear modifications in the price of a new set of LW2500s. That's right, no

Second generation LW2500 skis. Note the position of the rear wheel.

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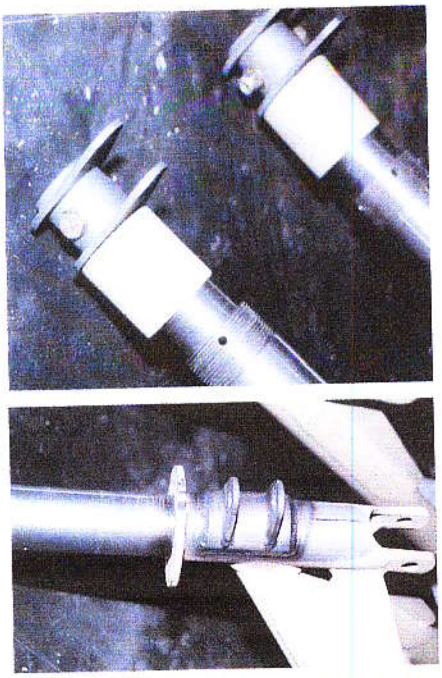


The LW2500 installation requires some gear modifications. The positions of the inboard bracket (above) and the stub axel and outboard bracket (top) are dependent on the location of the brake torque plate. Airglas uses precise jigs to locate the brackets based on the torque plate.

more fooling with homemade jigs and fighting with your bent gear. Now you can just pull your gear and ship it to Airglas for modification by their expert welding staff. However, your Cub is gearless during the process. Fortunately, Airglas can turn the gear quickly; however, time is lost during shipping and it does take one and one half days for the modifications to be made once the gear arrives at the shop.

"It would be great if everyone bought a new set of three-inch extended gear with the skis," said Gary. "And I'm not even in the landing gear business!"

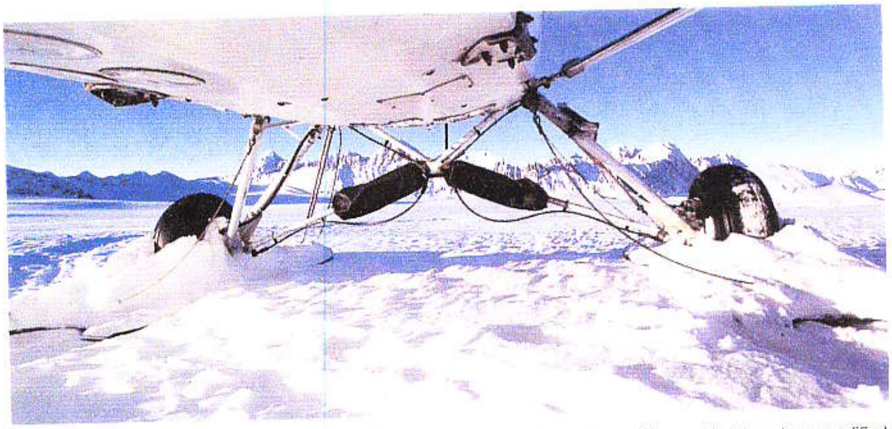
According to Gary, new straight gear is considerably easier to modify and at the same time, facilitates a better ski installation. But at $450 per side from the few suppliers, most folks opt for modifying their existing gear.

Important improvements have been made to the Landes wheel penetration design and incorporated into the LW2500. The older design incorporated a U-shaped cutout at the rear of the ski in which the ski's tailwheel is centered and mounted on a fiberglass leaf spring.

"We discovered that the leaf spring tension is critical to takeoff performance," said Gary. "A misadjustment can increase the friction of the tailwheel significantly and degrade takeoff performance."

This tendency has led the LW3600 skis to a rather conflicted reputation with backcountry operators. The LW3600s come highly recommended by some pilots, while others complain about poor performance. Initially the LW2500 used the same system as the 3600, however Airglas quickly addressed the concern with the LW2500 by eliminating the cutout entirely and replacing the fiberglass spring-mounted wheel with a much smaller hard-mounted wheel. The new design minimizes rolling friction during operations from non-snow surfaces and significantly reduces the drag experienced during snow operations. As a result, the new LW2500s are receiving high marks from the 70 or so pilots who currently operate them.

At $3,970 per set including the rigging, the LW2500, is competitively priced. In fact, even if you invest in new extended gear, which will allow a simple seasonal gear change (the skis can remain attached to the gear), your total investment is only $4,870. Sets are available to fit both 1 1/4-inch and 1-1/2 inch axles.



First generation LW2500s used a rear wheel arrangement like the larger LW3600. These skis (above) are modified. The center-mounted rear wheel is replaced with a hard-mounted smaller wheel on the outside edge of the ski. The second generation (as shown on page 27) eliminates the cutout and uses a single hard-mounted center wheel.

FIELD TEST

When you need skis, you need skis. When you need wheels, you need wheels. There are, notably, times when one needs the advantages of a wheel ski not available to the straight-ski equipped operator. So what will you do when your operations require skis and wheels? Mount up a set of Airglas LW2500 wheel penetration skis and put them to work. If you must depart dry surfaces and alight upon snow, this is a fine way to do it. You want to know how they fly? They fly great!

The main wheels extend only 1.5 inches below the ski bottom.

The Airglas wheel penetration ski combines proven fiberglass construction with practical design engineering. The design intent is minimizing drag of the protruding tire, maximizing ski flotation, and simplifying the installation procedure.

My earliest experience with these skis was the spring of 2001. I installed a set on my father's 1948 PA-14 Family Cruiser (the only four-place in the Piper long-wing Cub group) to handle some late spring ski-flying operations before float season came around.

In a more recent experience with the LW2500 wheel penetration ski, I pushed Gary Landes's PA-12 back into its hangar following an hour of low-and-slow with a few landings on low altitude lakes in the local area.

First impressions are lasting; my first impressions of the LW2500 from back in Spring 2001 were good. Normally my late spring takeoffs would have been on straight-floats or 26-inch tundra tires on three-inch extended Cub gear. But combining the LW2500s and 8.00 by 6 wheels, with the pull from the 150-horse Lycoming through a Borer prop resulted in a pretty short takeoff run — only marginally longer than on tundra tires departing dry pavement at sea level.

Following that first takeoff on LW2500s, the PA-14 was run onto a Landing Zone (LZ) of wet springtime freeze-thaw snow at 5,800 feet MSL. The airplane was lightly loaded with fuel, my wife, our dog and our survival gear. The surface snow was sloppy wet to a depth of about two inches under which the snow pack gradually increased in firmness. I had been warned by long-time wheel penetration ski users to beware of wet snow packing up around the tire opening in the ski and causing very high drag. It was a pleasant surprise to make an uphill landing and have enough power at 5,800 feet MSL to taxi uphill to my intended parking bench. Warnings to clear the area in front of the tires when parked to avoid compacted snow from chocking them went unheeded, as I needed some chocks to keep the plane from sliding down the slope.

My little family ended the outing in the Chugach Mountains of Southcentral Alaska with an impressively short departure run from the slight slope where I had parked. Yes, I was favorably impressed. What about the high drag of that wheel furrowing through the snow? What about the wheel opening scooping

The advantages of combination skis (either retractable or penetration) are numerous: fuel flexibility, increased landing area, operations from dry, paved airports and, most importantly, the extension of the ski flying season.

snow? What about the plane being chocked in place by the compacted snow around the wheel? None of these questions became issues.

The next flight occurred a week later to the same area. Upon arrival we discovered that a storm earlier in the week had deposited fresh snow on the LZ. Since the sunlight provided adequate depth perception, I landed long (further up the sloping LZ) and utilized the steep upper end. (The rationale was that turning around at the top of the LZ would allow use of a steeper takeoff area when we departed.) The new snow might require the use of this steep slope advantage. I flew several evaluation passes over the landing zone, then executed a shallow final approach with moderate power and a smooth roundout, followed by further power application at touch down and near full power when approaching the top of the LZ. When we disembarked we found 10 inches of Chugach fluff — powder snow that any downhill skier would covet. The LW 2500s handled it with ease.

Wanting to utilize the good light and fresh snow, I left my wife and dog on the snow and departed the LZ to check out some other landing options in the immediate area. Sampling the area would provide good performance comparisons of various snow depths. My light plane weight and steep takeoff run when leaving the first LZ provided an exhilarating transfer from snowbound to airborne. The visual picture is deceptive during these conditions and the temptation to fly away from the terrain is strong. These steep downhill takeoffs require the pilot to follow along the descending terrain upon takeoff in order to gain airspeed. I chose several other LZs of both shallow and steep angle, and left my mark on the terrain before rejoining my wife.

So far the LW2500 was not hampered by heavy, wet snow or moderately deep powder snow. I had flown the plane relatively light and used the advantage of the sloping terrain for takeoff. By this time my thinking was that these skis were a good replacement for the Airglas L2000 straight skis that had been removed from the airplane when the low elevation snow had melted. I attributed the performance equality to the slight surface area increase of the LW2500 over the L2000. I felt confident in the wheel ski performance.

My next operation on the LW2500 skis several weeks later involved shuttling a group of paraglider pilots to a glacier nearly 6,000 feet MSL. My first landing of the day was performed on a slightly sloping LZ just to the side of the tracks made by a Cessna 185 on hydraulic wheel skis, also shuttling glider pilots. Twenty-four paragliders would be mass launching from the glacier and landing nearly six miles away on the valley floor near sea level. As I rounded out and touched down with my heavy load of two passengers and their glider bags, the aircraft pitched nose-down, abruptly enough to require a significant application of elevator and considerable amount of power to hold the nose stable. The plane came back off the snow, followed by another touchdown exhibiting the same abrupt nose-down pitching. Slightly less power application and elevator control on this second alighting allowed me to handle the pitching without flying off the snow again. I taxied to the drop-off area with the use of full power and quietly hoped that my extra landing had been unnoticed by the paraglider pilots I had deposited. When in the wilderness, customers are keen to observe all aircraft operations. Several of the glider pilots present at the time are jetliner captains who fly bush planes as well. They agreed that I should log the extra takeoff and landing they had observed.

When I climbed out of the PA-14 and stepped off the ski into the snow, I discovered the snow condition most-likely to hamper wheel penetration ski operations on the LW 2500: breakable crust covering a soft, deep layer. Wheel penetration skis are hampered by the protrusion of the main wheel tire through the otherwise smooth ski bottom, causing very high drag as it breaks up the crust. The drag increase results in the nose pitching down upon touchdown. This experience taught me what the old-timers' suggestions hadn't. My subsequent departure from the area — loaded with one paraglider pilot who wasn't comfortable with the mass launch — confirmed the crust drag problem.

I performed a crosswind takeoff using the upwind aileron technique: Start the slide down the slope, keep the tail-ski just off the snow, hold ailerons into the wind (left crosswind, left