Operators Speak Out on the LTS101

The LTS101, Powering the HH-65 Dolphin, Eurocopter BK 117, AS 350 AStar, and the Bell 222
Honeywell’s LTS101 Turboshaft Engine

The LTS101 family of turboshaft engines has logged more than 8 million flight hours for an increasingly satisfied group of customers.

Customer Profiles

From Greenland to New Zealand, Canada to Mexico, operators depend on the LTS101 to perform missions under the most extreme, and demanding, conditions.

About The LTS101

Honeywell engine upgrades on the LTS101 continue to deliver greater reliability, reduced cost-of-ownership, and performance growth.
LATE IN 1994,

Honeywell acquired the Textron Lycoming Turbine Engine business, which brought an installed base of LTS101 helicopter engines into the fold.

LTS101 offered high power from low weight—ideal for a helicopter—but not all of the teething problems had been resolved. The in-flight shutdown rate and unscheduled engine removal rates were too high, along with the cost of ownership. Textron Lycoming had been working on the problems for several years, and Honeywell—long a proponent of Six Sigma process improvement and Total Quality programs—brought its own engineering focus to continuing the efforts.

Not just on “solving problems,” but on a program of continuous improvement. Time between scheduled hot section inspections (HSI) more than triples, when recommended upgrades have been installed.

The Dolphin—which accounts for about half of all Coast Guard flight hours—climbed to the top of availability charts. In some models of the engine, power has increased more than 27%.

TODAY,

The LTS101 family has logged more than 8 million flight hours for an increasingly satisfied group of customers.

Honeywell recently received FAA certification of its latest LTS101 model turboshaft engine, designated the LTS101-850 (for twin engine applications) and the LTS101-700 (for single engine applications). This engine upgrade can be installed in the above platforms without altering the engine installation envelope.

The -850 recently completed a series of company-sponsored flight evaluations that yielded some astounding results. During the tests, the -850 demonstrated more than double the rates-of-climb for both twin and single-engine operations when compared with the -750. The -850 is designed to provide more than a 14% take-off power improvement at sea level and 25% at hot day conditions by the introduction of a cooled gas producer (GP) turbine assembly. The cooled GP turbine not only increases available power, it increases GP disk and turbine blade life, resulting in reduced operating costs.

This engine family has demonstrated a four-fold improvement in reliability since 1996, as well as improved aerodynamics and increased GP disk life, from 6,300 cycles to 15,000 cycles. In 2005, Honeywell will complete further technology improvements resulting in additional performance increases with a new axial-centrifugal compressor design and a dual-channel full authority digital electronic control system.
The customers interviewed for this issue all noted past problems with LTS101—and at the same time complimented Honeywell for a diligent pursuit and implementation of solutions. RotorReview asked Dan Pelletier, Honeywell project engineer, to explain some of the problems—and how they were corrected.

“Most engines didn’t make it to scheduled HSI because of low power, not direct failure. They hit the measured gas temperature limit before reaching the HSI interval.” This largely came from hot section distress—which causes parts to become distorted or incur loss of material before they should—and carbon erosion of the first stage turbine blades. “Carbon particles moving at transonic speed—that’s like having high-velocity diamond particles in the gas flow path, they cut through everything.” The blade airfoil shape is flattened; efficiency is reduced. This affected operator cost, and required special pricing for these expensive blades, to help constrain that cost.

The hot spots were largely caused by irregular or insufficient airflow, and the carbon particles came from incomplete combustion. The baseline solution? Improve incoming air velocity to increase fuel air mixing in the new effusion combustor liner.

What about the problems with LTS101?

“The first step,” he said, “before we change anything, our standard engineering policy is to do a root cause analysis—understand the problem, identify the factors that might be contributing, and break the chain.” Solutions are sometimes intuitive; sometimes grow out of the wealth of experience gained over the years. Within the Honeywell engineering team, there quite likely is someone who has seen—and solved—a similar problem in the past. “There are very few really ‘new’ problems,” Pelletier noted, “although new technology and new materials may contribute to new solutions.”

Other improvements

“We redesigned the impeller shroud—it used to be a two-piece design with a bolted flange; now it’s one piece, resulting in more uniform expansion and contraction geometry. There used to be an abradable coating on the shroud; as it wore away, compressor efficiency was degraded and performance dropped. The coating now is eliminated with the new design. We introduced new materials to the combustor liner. We designed an improved air cooling flow gas producer nozzle, introduced a double-wall air-cooled combustor curl. We added a thermal barrier ceramic coating, for improved performance and durability.”

Results

An increased HSI interval, and reduced erosion due to more uniform combustion. Gas temperature margins are increased at any power level. There was a problem with oil jet and vent strut clogging, with oil coking
on hot metal. Solution: install a buffered seal and cool the strut with higher airflow. Chip problems at the #2 bearing? Inadequate lubrication. Solution: change the scheme. Before, oil was sprayed on the outside of the bearing. Now, oil is injected to the inner diameter of the bearing, from whence it flows outward.

Improved materials also play a role, where appropriate, but selection is often a balancing act. The more erosion-resistant tend to be too sensitive to high temperatures; those that better endure high temperatures are softer and wear away more quickly.

What does the future hold?

In an industry where airframes demonstrate a 40+ year longevity, systems and components are continually updated to keep those airframes in service. Many of those units are total replacements: throw out the old, bolt in the new. Power plants, thanks to continuing advances in materials and technology, can be upgraded to deliver ever-increasing power, at

lower cost, usually in the same frame size and without costly airframe modifications. LTS101 is a prime example.

“The LTS101 was designed more than 25 years ago,” Pelletier explained, “and admittedly, numerous problems had to be resolved.” He paused, then said, “As one of the customers in your profiles noted, there are still some issues with peripherals. But now, the engine itself is not only up to—I think, ahead of—contemporary standards, but continues on a program of planned growth and improvement that will benefit operators well into the next couple of decades.”

Time between scheduled hot section inspections (HSI) more than triples, when recommended upgrades have been installed.
Nick Kamariotis has worked with the LTS101 since 1983, when he was a BK 117 mechanic with MBB (before it became part of Eurocopter). “Yes, we saw problems with the engines,” he said, “but my job was pretty straightforward: if something was broken, I pulled it out and got it fixed.” Life was not so simple for the MBB marketing people, he noted. “They could have sold a lot more BK 117s, except for the engine problems.”

When interviewed, Kamariotis was at a Wackenhut Services location in Aiken, SC, because, as he told us, “I wanted to try working on the customer side for a change.” Wackenhut—overall, with more than 40,000 employees—provides security, training, and support services to government agencies and industrial customers nation-wide.

At Aiken, Wackenhut operates two BK 117s, six engines, patrolling a 310-square-mile secure Department of Energy site in South Carolina—an area about the size of Washington, D.C., Maryland, and Virginia inside the beltway. “I’ve had no unsched [sic] removals since I’ve been here,” he said. Kamariotis hadn’t seen any engines reach the 1,800 hour HSI point because the upgrades had not been in place long enough.

Otherwise, what advantages have the upgrades brought? “For power, the effusion combustor liner and the impeller shroud—the difference of night and day.

The #2 bearing; no more chips. No strut clogging. The seal package—no more acidic oil in the engines.”

Is everything perfect? “No . . . is anything ever ‘perfect?’” he replied. “There are some accessory issues—governor, fuel pump, air flow modulator, that sort of thing—but Honeywell engineering has been painfully upfront—brutally honest—about problems, about what they’ve been doing to solve them.

“There’s no question, Honeywell is really doing a good job. For example, at the last Helicopter Association International conference, Jim Ebken and Dan Pelletier made it a point to talk with you, one-on-one, listening, finding out about your issues—then working on them.”

Denis Robitaille is director of maintenance of the Canadian operator, Abitibi Helicopters. They operate a fleet of 19 rotary aircraft from two fixed bases—one, at that point in northern Quebec where the roads and the population thin out, and the other, in the far west, at Calgary, British Columbia. Abitibi specializes in industrial lift to remote locations—slings and passengers—including support of seismic explorations for natural gas deposits. On any given day, Robitaille might have aircraft at work in the Arctic and the swamps of Louisiana. “We must be prepared to operate in a temperature range -40 to +40 degrees C,” he said.
Robitaille brings 25 years experience to his job, 18 of them with Abitibi.

Some years back, they did a bold thing: they ordered ten AStars with the LTS101 engine, rather than with a competing brand. They knew that there were durability problems—but also knew that their crew could take care of those engines themselves, off in the far reaches where they worked and where access to support was limited. “We could open an engine in a day, replace whatever needed replacing, close it up in another day and be back flying.” Spares were reasonably priced, and available, and they could afford to keep a supply on hand.

Today, Robitaille operates a mixed fleet—other airframes, other engines. He continues to operate with the LTS101 and is impressed with Honeywell service, and what has been done to upgrade his -600A-3 to the higher performance -600A-3A standard.

“The A-3A upgrade really improved the temperature margins. Now, we never temp out; we’ll torque out first.

“It’s been a long time,” he added, “since I had to open an LTS101 engine except maybe to repair FOD [foreign object damage]. Now, when they reach their HSI, we send them to Greer [Honeywell’s facility in Greer, SC].”

Jose Erosa, operations director for Transportes Pegaso, has three BK 117s in offshore operations supporting oil platforms in the Gulf of Mexico. Performance is important; reliability is paramount: emergency landing spots are few and far between. In fact, Erosa noted, a few years back his clients refused to consider any helicopter with the LTS101. As the engine has changed, so have the attitudes. His pilots operate with confidence, and Erosa is very happy with the engine today—especially with the improved performance in hot weather conditions, and the proven extension to the HSI interval.

Branson, Missouri, bills itself as “the Live Entertainment Capital of the World,” with restaurants, discount shopping malls, and some 30 venues owned by, or frequently featuring, performing artists ranging from Andy Williams and Glen Campbell, through Charley Pride, to Russian comedian Yakov Smirnoff. It definitely is a destination: with a permanent population fewer than 4,000, Branson hosts more than 7 million visitors a year.

Table Rock Helicopters adds flying tours to the recreational choices, operating two D-model AStars, with the LTS101-600A-3. As Donald Halbert, director of maintenance, told RotorReview, “We offer a variety of sightseeing tours, running from five to 30 miles, flying over such sites as the dam, the lake, a fish hatchery, downtown Branson.” Not as dramatic a vista as offered by helicopter tours in other parts of the country, perhaps, but Table Rock provides the first opportunity many people have ever had to fly in a helicopter for a reasonable fee. The shorter, seven-minute ride in fact is advertised as “an up-and-down experience” for less than $25.

Tours are suspended during the winter months—December to March—and one helicopter is kept on standby in the event of a charter, or to provide emergency assistance to local medical or law enforcement agencies. Halbert explained, “The other bird becomes our project for the winter.” for cosmetic or equipment refurbishment.
Halbert got his AP license from Spartan fifteen years ago, then went to work with a company on the Gulf of Mexico. They operated AStars on runs to drilling platforms “when they were not a good thing to be around,” he admitted. “Once, in an interview with a trade magazine reporter, when I told him I had an AStar, he said, ‘Have you complied with your weekly engine change?’” He next spent a few years with an EMS (emergency medical service) operation in Texas, then, five years ago, joined Table Rock. He agrees that he has seen the LTS101 go from ugly, to bad, to good—better than good. “The engine has come a long way, 1,000 times better.”

Recent upgrades include the new effusion liner and GP nozzles, which have greatly improved performance. “Before,” he said, “our power margins were +30 degrees C. Today, +60 C.”

Removals? “We just pulled one out the other day, hot section inspection, to send to Greer. The only other time it’s come off the aircraft was to have GP nozzle seal rings replaced. Perhaps not necessary, but we think that’s good preventive action.”

Any complaints? “To be honest, sometimes we wish that the upgrades were a little bit cheaper . . . I guess I understand the business, but that doesn’t mean I can’t wish. Like, I can go to the car lot and wish that new PT Cruiser was $12,000 instead of $20,000.”

Another issue: about four years ago, Table Rock did have a problem getting some parts. With no rental engines available, one helicopter was out of service for about a month. “After that,” Halbert said, “we bought a spare engine.”

Airwork

Airwork, based in Auckland, New Zealand, began operations in 1936 as a maintenance facility. Since then, the company has grown substantially, now encompassing all facets of general aviation: including aircraft and part sales, design, manufacture and installation of specialist modifications, fixed wing and helicopter engineering, aircraft lease and operation, avionic, electrical and instrument overhaul, helicopter component overhaul, and turbine engine overhaul.

Airwork is a Honeywell-approved maintenance center for the LTS101 engine. Program Manager Grant Barrow supports some 145 engines throughout the Asia/Pacific region. “I’ve been with Airwork for about three-and-a-half years,” he said. “I started in the industry with the Air Force, working with UH-1 Iroquois (our version of the Huey).” He finds his job varied, with never a dull moment. “Supporting the engines in this region, spread throughout several different countries can be logistically difficult, but it’s my job to make that happen.” Barrow notes that operators are becoming a lot more aware of the advantages of engine upgrades. “It wasn’t too long ago that these engines...
were not looked upon favorably. Some operators were lucky to achieve 600 hours between hot section inspection, let alone 1,200 hours.” The changes are beginning to have an impact. “Lately,” he said, “we have seen around 35 engines in the region upgraded to the 1,800 hour scheduled HSI program.”

“...good to be working with a company that’s looking forward; it’s refreshing to see the continual development that is going into the engine, which has long-term benefits for the operator.”

Honeywell customer service? “If we have an issue, we can easily discuss it.” But, most important, “It’s good to be working with a company that’s looking forward; it’s refreshing to see the continual development that is going into the engine, which has long-term benefits for the operator.”

Any suggestion for improvement? “Component pricing is a hot topic at the moment, and is an area where Honeywell could make improvements.” He added, “I’d like to see a further extended HSI. I believe that the U.S. Coast Guard is on a 2,400 hour program, but this is not yet commercially available. But maybe, someday?” Maybe, indeed.

Greenland. The world’s largest island, much of it locked in permanent deep-freeze—three times the size of Texas, 85% covered by ice. Greenland (with precious little that is green) would seem totally inhospitable, yet some 56,000 people live there. They fish. They explore for natural resources. In good weather, they host a steady stream of adventure- and scenery-seeking tourists. In bad weather, they endure.

Railroads? None. Highways? 93 miles, two-thirds unpaved. In the summer, because most of the people live near one coast or another, some people can get around by boat. In the winter—well, need to visit the dentist? You might have to ride in a helicopter. Want to get your mail—or even some fresh milk? Same story. Enter: Air Alpha, operating six Bell 222Us (with twelve LTS101-750C engines), one Bell 206, and two Cessna Grand Caravans.

The company—headquartered in Denmark—has flight operations in Greenland, a small maintenance facility on the island and a main base back at the home office, along with an aircraft sales department. Torben Steffensen holds several executive positions with Air Alpha, including, for our purposes, director of maintenance.

“...good to be working with a company that’s looking forward; it’s refreshing to see the continual development that is going into the engine, which has long-term benefits for the operator.”

Air Alpha is not the only aircraft operator in Greenland, nor the largest. That honor goes to Air Greenland, which flies helicopters and a Boeing 757.
But Air Alpha is number two, and, as rotary-wing operators go, is one of the larger companies in Northern Europe “other than those,” Steffensen explained, “in the North Sea oil business.” There are some local staffers, but most of the 40-man Air Alpha crew is on 30-day rotation—hangar crew, pilots, mechanics—30 days on duty, 30 days back home in Sweden, Iceland, Denmark. Which may give you some idea of the working conditions.

Air Alpha has been in Greenland for about ten years. They started with AStars, but after five years, did a comprehensive evaluation, matching different models to their needs, mission, and operating environment. “We came up with nothing else but the Bell 222 with the LTS engine.” Steffensen applauds the decision. “We have had big success both with the Bell product—extremely good support from Bell—and the same on the engine.”

Air Alpha bought the 222s as pre-owned aircraft—two in Germany, one in Turkey, one in Brazil, two in the United States—and has just installed the last of twelve 1,800-hour upgraded engines. Steffensen admits that they haven’t bought all available modifications—it’s a cost/benefit issue. “Safety-wise, we do everything. Some of the others, we think about.”

No problems? “Oh, we have had our problems, our bad luck, happens all over, but we get the best support you can think of. Mike Matthews at Greer—our contact person—the guy we call, he is helping us a lot in person and with his team, and several times he has had people up there.”

Air Alpha doesn’t have the luxury of simply sending an engine off to Greer unless absolutely necessary. That requires flying the engine to a commercial airport, then to Copenhagen, then back over the Atlantic to the U.S. and on to Greer. “It’s much better for some more basic stuff when Greer can come to us,” he said. “Two guys in polar suits.”

The service has been so good, that Steffensen recently elected not to switch to an “approved Honeywell contractor” for overhauls and repairs, even though he might be able to save some money. “You can call us,” he said, “a very satisfied customer.”

“Yet you can call us a very satisfied customer.”

— Torben Steffensen
The Honeywell LTS101-850B-2 turboshaft continues to build on the reputation of the LT101 series of turboshaft engines.

With the recent introduction of the High-Cycle Cooled Gas Producer Turbine hot day power has been increased up to 18% and cycle life has more than doubled. Honeywell engine upgrades continue to deliver greater reliability, reduced cost-of-ownership, and performance growth.

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<th>Comparison of LTS101 Rated Shaft Horsepower (SHP) ISA, Sea Level</th>
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<td>Max. Continuous</td>
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Thermodynamic power quoted.
SHP increase of -850B-2 ‘HOT/HIGH’ is up to 18% over current -750B-2 engine!

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Selected LTS101 Applications
- Eurocopter/Kawasaki BK117 2xLTS101-750B-1
- US Coast Guard HH-65A 2xLTS101-750B-2
- Bell Textron 222B & 222UT 2xLTS101-750C-1
- Eurocopter AS350 1xLTS101-600A-3A