FLIGHT SAFETY FOUNDATION

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Overhaulers' Tips for Taking the Mystery out of Aircraft Engine Break-in

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Dedicated to the aviation mechanic whose knowledge, craftsmanship and integrity form the core of air safety.

Robert A. Feeler, editorial coordinator

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Overhaulers' Tips for Taking the Mystery out of Aircraft Engine Break-in

—

John Brant
Phillips 66 Co.

Aircraft owners, pilots and overhaulers take a collective deep breath as they approach one of the most critical points of an engine's life — break-in. A new engine or freshly overhauled engine is an expensive investment, with the first few hours of engine operation determining how well it will operate until TBO (time before overhaul). Improper break-in can lead to cylinder problems or even a costly engine failure which could contribute to an incident or accident.

Some overhaulers are involved each year in hundreds of engine break-ins. Whether you operate a reciprocating opposed-piston engine or a radial engine, it is important to understand and follow the overhauler's recommended break-in procedures, which are based on partial experience and manufacturers' recommendations.

There are two distinct stages of an engine break-in and they should not be confused: the run-in period (usually performed by the overhaul shop in a test cell on which the engine is mounted on a ground apparatus) and the break-in period (first 50 hours of flying). For the most part, opposed-piston engines and radial engines undergo similar test-cell and flying procedures.

The run-in checks engine power (horsepower), ensures that no leaks (fuel, oil or induction) exist, properly sets the fuel injection system and initiates the break-in process. Overhaulers usually perform the run-in as part of the overhaul.

Most engine run-in tests take place in the test cell before installation into the aircraft. (It is possible under carefully monitored conditions to perform run-in with the engine installed on the aircraft. Nevertheless, aside from the risk of test flying a freshly overhauled engine, there is the possibility of overheating the engine on the ground.)

In a test cell, the engine is monitored in a controlled environment where instruments are used to calibrate oil temperature, cylinder-head temperatures, rpm and manifold pressure. The engine is operated at varying speeds for different time increments; to prevent overheating, the engine is not operated continuously. This process can take two hours in the test cell for an opposed-piston engine and as long as two and one-half hours for a radial engine.

Typically, the engine is allowed to cool and then the oil screen is checked for metal particles. If everything is satisfactory, the oil tank is topped to the exact measure. Then the engine is operated for one full hour at the recommended rpm, as indicated in the specific overhaul manual. Then oil consumption is measured.

Exact procedures may vary among engine shops, but generally parameters set by the engine manufacturer's overhaul manual are followed. Test procedures and results are logged and verified by an inspector. In most cases, run-in procedures are the same regardless of cylinder type — steel, chrome or Cermicrome.

Cooling and Lubrication Are Critical in Run-in, Break-in

Cooling and lubrication are the most critical parts of engine run-in and break-in. During the run-in period, if either cooling or lubrication is unsatisfactory, there is a risk of cylinder glazing, which occurs when cylinder walls become overheated because of insufficient oil wetability, piston scuffing or bearing/crankshaft wear. (Wetability is the ability to maintain oil-film strength, or viscosity, on the cylinder walls.)

During break-in, the engine operates hotter because there is more friction. This friction results from the metal-to-metal contact that is required for the piston rings to seat within the cylinder bores. The rings must move up and down the cylinder barrels long enough to make the two compatible. Engine temperatures, which vary depending on the individual engine, decrease after the rings are seated properly.

To keep an engine from overheating in the test cell, engine shops use club propellers that are shorter than flight propellers. These club propellers force air close to the engine. Because the engine is not in a moving airplane, air flow to the engine is not sufficient, so increased air flow must be generated by choosing the correct kind of baffling and club propeller for a specific engine.

Proper lubrication is important to seat the piston rings. Some technicians prefer to use mineral oil to seat the rings and then at 50 hours of engine operation change the oil to an AD (ashless dispersant) type. Others prefer to use an AD mineral multigrade oil during run-in, break-in and throughout an engine's routine operation. To ensure compliance with warranties, operators should follow the manufacturers' or overhaulers' recommendations.

Lubrication Means Choosing Among Oils

Confusion about which oil to use in an engine usually occurs when individuals theorize and repeat anecdotal information that is not based on facts.

Piston compression rings in an aircraft application are designed with a

Technician completes final inspection of cylinders, pistons and rings before reassembly of an engine. During break-in, the piston rings seat within the cylinders of new or freshly overhauled engines.

tapered edge. To seat the rings properly, this edge must wear quickly across approximately 10 percent of the ring surface area. During the break-in process, rings exert a tremendous amount of pressure against the cylinder walls. This pressure forces oil away from the ring/cylinder area, allowing the metal-to-metal contact necessary for ring seating. This contact causes temperatures to rise within the cylinder. During break-in, the hottest temperatures within the engine are at the contact point, where it can reach 600 degrees to 650 degrees F (318 degrees to 346 degrees C). At that heat level, the oil film is forced away from the cylinder walls to allow the direct ring/cylinder contact necessary for break-in; following initial break-in, the oil film remains intact when cylinder temperatures and pressures are reduced significantly. The high break-in temperatures should not recur unless there are problems or new rings are installed.

Synthetic oils have a film-temperature gradient about 100 degrees F (37.78 degrees C) higher than the 600-degrees to 650-degrees F range, so they inhibit the initial contact necessary for ring seating.

When the ring edge has worn away and seated, the pressure against the cylinder wall is reduced, allowing for improved lubrication and the return to normal operating temperatures.

After the rings have seated, an oil performs its normal and critical functions in the engine. In the area between the ring and cylinder wall, a lubricant provides the necessary seal, which aids in controlling oil consumption, lubrication, cooling and containment of the combustion by-products.

Proper lubrication is critical for the cylinder/ring mating to take place effectively. There are three options for oil selection during break-in:

Single-viscosity all-mineral oil is typically found in aviation grades 80, 100 or 120. This is the traditional choice. The oil has been used successfully for many years and is still recommended by many technicians.

Single-viscosity — straight-grade — oils, however, contain a high percentage of "bright stock," a heavy molecular base oil which inhibits the break-in process. These larger, heavier molecules contribute to lacquer and varnish deposits and can aggravate cylinder glazing.

Ashless dispersant (AD) oil chemistry in mineral aviation oil is designed to prevent engine deposits from forming. Residues are dispersed throughout the oil system and held in suspension until they can be drained, thus preventing buildups. This is especially important during break-in, when large amounts of contaminants are created. The additive compounds are nonmetallic — or ashless — so they do not form combustion-chamber deposits. AD oils do not inhibit the break-in process.

Although there is debate about whether straight-grade mineral oils are better than those with dispersants, there is little if any difference in actual break-in time.

Multiviscosity oils are designed to exhibit varying rates of flow at radically different temperatures, providing proper film strength at all temperatures. Multiviscosity oils are available in both the all-mineral oils and AD oils.

The smaller molecular properties of multivicosity oils offer less resistance to the break-in process, resulting in faster break-in. Also, the problem of varnish or lacquer caused by the larger, heavier molecules of single-viscosity oils is reduced dramatically. The benefits of using a multiviscosity oil during break-in are diminished if synthetic components or anti-wear additives are present in the oil because these inhibit the break-in process.

Some technicians believe that the ashless dispersant properties in the oil are especially useful after break-in when an increased amount of wear metals are in the engine. The oil suspends these contaminants instead of allowing them to collect in the bottom of the crankcase where they can form a harmful sludge. They also claim that this allows the use of one type of oil from break-in to TBO, eliminating the need to stock two kinds of oil. After a top overhaul of an engine using a synthetic multiviscocity oil, for instance, the oil would have to be drained and replaced with mineral oil during the break-in, and then replaced with the synthetic multiviscocity oil.

The proper oil also helps prevent cylinder glazing during run-in. Some technicians believe that glazing can be magnified with the use of single-viscosity mineral oils, which contain large and heavy molecules. These oils contain greater amounts of varnish and lacquer, provide less penetration for initial ring seating and can inhibit the break-in process. If a cylinder is going to glaze, it will usually occur during the first hour of operation. The longer an engine is operated at lower power, the greater the chance of glazing the cylinders and causing wear to other parts of the engine.

After a cylinder is glazed, it must be removed and honed. Then it must be reinstalled on the engine and the run-in process must be repeated. If an aircraft is flown incorrectly, glazing can still take place.

Overhaulers caution against “babying” the engine. If the aircraft is not flown with enough power — usually at least 75 percent — forces inside the cylinder will not be sufficient to help create the necessary wearing of parts. Pressure in the cylinders forces the rings against the cylinder walls and causes the rings to seat properly. A glazing problem or pistons/rings problem can be created by operating at manifold pressures that are too low, which allow the rings to vibrate too much.

A decrease in oil temperature and cylinder-head temperatures, and a decrease in oil consumption, usually signify that break-in is normal. Overhaulers stress that it is impossible to label definitively what are “right and wrong” temperatures and oil consumption rates, because engines vary.

Nevertheless, an increase in temperature or oil consumption might signal a problem, so the operator should ask the overhauler for advice.

In the first hour or so, a certain amount of wear occurs and a noticeable reduction in temperatures should occur too. For example, the cylinder head temperatures may decrease 50 degrees F during cruise. Of course, outside air temperature has an effect; in 100-degree F (37-degree C) air, the engine does not cool as much as in 30-degree F (-1-degree C) air.

Pilot's Role Also Key in Engine Break-ins

After an overhauled, run-in engine has been installed in the aircraft, the engine break-in is in the pilot's hands. Seventy-five percent of normal ring/cylinder wear occurs during the break-in period when the ring-to-cylinder-bore seating is completed. This seating can happen in the first several hours or first 50 hours of operation, so it is critical to follow proper break-in procedures. Many engine shops provide written instructions about how to operate a new or freshly overhauled engine after it has been installed on the aircraft. Some examples follow:

- In hot weather, select the coolest time of the day for both ground run-in and in-flight break-in. This is to avoid overheating the engine;

- Select a dust-free area for ground run-in. Dust can contaminate the oil and cause wear to metal parts;

- With the cowl flaps fully open, run the engine no more than three minutes to four minutes at moderate power;

- Allow the engine to cool considerably and repeat short runs of three minutes each. Do this as many times as necessary to correct discrepancies;

- If all discrepancies are corrected, complete a brief power run (15 seconds to 20 seconds); and,

- Test fly the aircraft one hour. Use standard power for climb and at least 75 percent power for cruise.

Oil consumption can vary during break-in. Some customers do not add a quart for 25 hours; others might burn a quart in three hours. A good example is a twin-engine aircraft in which the engines are operated similarly, but one has a lower oil-consumption rate than the other. Beware of excessive oil consumption, however, which could indicate a cylinder has glazed. If you have questions, talk to your overhauler.

The importance of an oil change is magnified after break-in when the amount of worn metal particles in the engine oil is much greater than during normal operation. Change the oil after the first 10 hours to 12 hours of initial operation to remove the break-in particulates from the system. Filters and screens should be checked for excessive metal particles.

Plan another oil change within 50 hours along with a "fine tuning" that should include resetting valve clearances, checking magneto timing and examining cylinder-head stud nuts and their torque values. It is better to find a problem within the first 50 hours than to let it escalate into a more serious problem later.

Operating environment and the type of oil filter used should also be considered. Some overhaulers recommend 50-hour oil changes with the use of a full-flow filter and 25-hour oil changes without one. Others recommend completing a compression check every 25 hours along with an oil change and oil screen inspection.

Long-term operation of an aircraft begins with a successful engine run-in and break-in.

Communicating with an overhauler to determine the best lubrication and break-in procedures for the aicraft engine will help determine how the engine will operate until TBO.♦

About the Author

In his 20-year career with the Phillips 66 Co., Bartlesville, Oklahoma, U.S., John Brant has concentrated on lubricants for nine years. He has specialized in aviation piston-engine oils and providing technical support services for engine-oil users.

PRI Instrumentation Wins Technology-Transfer Award for Magneto-optic/Eddy Current Imager (MOI)

The Technology Utilization Foundation has presented the Technology 2004 Award for Excellence in Technology Transfer to PRI Instrumentation, a small high-tech company that has developed commercial applications for the magneto-optic/eddy current imager (MOI). The MOI (*Aviation Mechanics Bulletin,* Nov.–Dec.1992) is an instrument of nondestructive testing (NDT) that uses an advanced type of eddy-current technology.

W.C.L. Shih, founder of PRI Instrumentation, accepted the award at an awards dinner in Washington, D.C., U.S., sponsored by the U.S. National Aeronautics and Space Administration (NASA), NASA Tech Briefs and the Technology Utilization Foundation in cooperation with the U.S. Federal Laboratory Consortium for Technology Transfer.

According to PRI Instrumentation, "The world's aging aircraft fleet requires [NDT] instruments that are reliable and easy to use. The MOI is the only direct imaging system capable of detecting small defects where the aircraft does not have to be disassembled for inspection."

GAMA Releases New Electronic Publications Standard

The U.S. General Aviation Manufacturers Association (GAMA) has released a new specification for preparing general aviation maintenance information in electronic media, and for converting the vast backlog of manuals, parts catalogs, service letters and bulletins into formats capable of online retrieval.

Specification No. 9, the Electronics Publications Standard (EPS), also describes the minimum and recommended functional requirements that must be met by computerized retrieval systems for accessing aviation maintenance information.

The specification does not affect technical content, but facilitates electronic data exchange between manufacturers and an airline's in-house publishing system.

The EPS uses standard generalized markup language (SGML) and document type definitions (DTDs) specifically designed to accommodate general aviation data.

According to GAMA, the new standard will allow almost all existing general aviation publications to be converted cost-effectively from paper to electronic media, using one of three electronic publication options described in the specification:

- **Page-based publications.** These are created by scanning existing paper pages, and are viewed in on-screen segments analogous to pages;

- **Pageless publications.** These present data as discrete blocks or sections rather than individual pages; and,

- **Bookless publications.** These maintain all information in a data base, and the information is obtained and formatted according to the user's choice in interaction with the system.

GAMA Specification No. 9 is available for $25 from GAMA, 1400 K Street NW, Suite 801, Washington, DC 20005 U.S.

NTSB Advises Caution in Using Tundra Tires

The U.S. National Transportation Safety Board (NTSB) has issued a safety recommendation that calls attention to possible adverse flying characteristics of light aircraft resulting from the installation of oversized tires, commonly called "tundra" tires.

During the past two years, a number of fatal accidents have occurred in which an aircraft has stalled while maneuvering close to the ground during landing approach or while spotting game. In five such accidents, no mechanical defects were found, but the aircraft was equipped with tundra tires. The NTSB is concerned that these oversize tires may be adversely affecting the stall speed, the flying characteristics or both of aircraft so equipped.

Tundra tires have been approved by U.S. and Canadian authorities as modifications on the Piper PA-18 SuperCub, Interstate S-1B2 Arctic Tern, Bellanca Citabria 7-series Champions, Helio Courier and Cessna 206.

Although these installations were approved under Supplemental Type Certificates (STCs), it appears that adequate tests were not performed to determine whether these unusually large tires increased the stall speed or adversely affected the airplane's flight characteristics.

Because the PA-18 is the type most commonly equipped with tundra tires, the NTSB has called for the U.S. Federal Aviation Administration (FAA) to conduct flight tests to determine the effects of tundra tires on this aircraft.♦

This information is intended to provide an awareness of safety problems so that they may be prevented in the future. Maintenance alerts are based upon preliminary information from government agencies, aviation organizations, press information and other sources. The information may not be entirely accurate.

Improperly Manufactured PMA Parts Affect Flight Characteristics of Single-engine Cessnas

In September 1992, a Cessna 152 was destroyed when it crashed shortly after taking off at a midwestern airport. According to witnesses at the airport, the airplane took off and executed a 180-degree turn as if to return to the airport. As it appeared to line up with the opposite runway, it rolled to the right and descended. One witness stated that the airplane was skidding sideways in a level flight attitude at approximately 100 feet to 150 feet (30 meters to 45 meters) altitude, just before it dove into the ground.

The investigation disclosed that one magneto was faulty and could have resulted in the engine running rough. This was apparently the reason why the pilot decided to return after takeoff, but it did not account for the nonstandard flight characteristics and the apparent stall leading to the crash.

Investigators found that the airplane was equipped with a Bush Conversions short-takeoff and landing (STOL) kit. The STOL kit had been approved for virtually all previously manufactured Cessna single-engine airplanes by the issuance of Supplemental Type Certificate (STC) SA1371SW on Sept. 20, 1971. The STOL kit includes a wing leading-edge cuff and a stall fence on each wing, affixed to the top wing surface, chordwise, in line with the aileron/flap juncture.

According to the STC, an airplane with the STOL kit installed must not be placed in a spin and must contain a placard prohibiting spins. Cessna had conducted stall-spin tests of an aircraft modified with a similar leading-edge cuff in 1970, and had confirmed that the modified airplane could not be recovered from a spin without a spin chute. As a result, Cessna had elected not to offer the STOL option for its single-engine airplanes.

During the original flight tests performed by the U.S. Federal Aviation Administration (FAA) in evaluating the Bush Conversions STOL kit, the Cessna 150 being used displayed lateral instability when the wing fences were higher than the brackets mounting them to the wing. The FAA test pilot reported that the lateral instability was most noticeable when the airplane was stalled with the flaps extended and/or the airplane was in a skidding turn. The STC drawings on file with the FAA show that the fence mounting brackets are to be 0.75 inch (1.92 centimeters) high. The STC test and certification file records indicated that the FAA test pilot required the STC applicant to limit the height of the stall fences to the height of the brackets, 0.75 inch, before the STC approval was granted.

Inspection of the accident airplane revealed that the fences installed measured 1.625 inches (4.16 centimeters) high at their trailing edge, maintaining this height for 70 percent of their length, then tapering down to match the contour of the wing leading edge. After the accident, the U.S. National Transportation Safety Board (NTSB) inspected three other Cessna 150 airplanes that had been modified with the STOL kit, and found that the fences installed were from 1.375 inches to 1.750 inches (3.52 centimeters to 4.48 centimeters) high.

Bush Conversions and its predecessors had been granted a Parts Manufacturer Approval (PMA) to produce STC SA1371SW STOL kits; however, this PMA was surrendered approximately six years before the accident in 1992. Nevertheless, Bush Conversions continues to market STOL kits using parts manufactured prior to the surrender of the PMA. FAA inspectors have no authority to inspect or inventory parts of a manufacturer who previously held, but no longer holds, a PMA.

The NTSB confirmed that the FAA Suspected Unapproved Parts (SUP) Program does authorize the FAA to inspect non-certificate holders if it suspects that parts have been produced for installation on type-certificated products; nevertheless, the NTSB found that FAA field inspectors were not well-informed of this fact. The FAA has subsequently issued a memorandum to better inform its Flight Standards personnel on the provisions of the SUP program.

The NTSB is concerned that Bush Conversions STOL kits manufactured for installation on single-engine Cessna aircraft may not have been manufactured to the requirements of the STC, and that those airplanes not in compliance because of the higher-than-authorized flow fences may have unsatisfactory lateral stability.

The NTSB is also concerned that the FAA does not appear to have a means to oversee the continuing distribution of parts or kits after the PMA certificate has been suspended or revoked. Therefore, the NTSB has issued the following Safety Recommendations to the FAA:

- “Issue an airworthiness directive to require all owners of Cessna single-engine airplanes with [STC] SA1317SW Bush Conversions [STOL] kits installed to determine the height of the STOL kit stall fences and, if they are not in compliance, to take action as necessary to bring the installation into compliance with the STC; and,
- “Implement recertification flight testing for the Bush Conversions STC SA1317SW [STOL] kits, to determine compliance with the FAA requirements for stability and stalls. If the STC modification is proven to produce unsatisfactory flight characteristics, require removal of the SA1317SW STOL kits from all affected airplanes.”

The recommendations also called for the FAA to establish procedures whereby STC holders should maintain records to facilitate prompt issuance of airworthiness directives (ADs), service bulletins and other information and not to depend on maintenance technicians to discover their applicability during repetitive or annual inspections. In addition, the NTSB called for the FAA to ensure that field inspectors have adequate instructions and knowledge of the enforcement processes of the SUP under FAA Order 8120.10.

B-727 Landing-gear Door Fitting Problems Result in Gear-up Landing

In April 1994, a Boeing 727-200 suffered extensive damage after landing with the left main landing gear partially extended. A broken door fitting was found lodged in the gear-door hinge area. The landing-gear doors of the B-727 must open prior to extending the landing gear, and then reclose after the gear is extended. The gear doors are therefore actuated twice during each flight cycle and are subject to significant wear and tear.

The landing-gear door fittings incorporate a serrated bracket and laminated shims to facilitate alignment and rigging. In the left main landing-gear door that caused this malfunction, the shims were found to be degraded and distorted, and the bolt holes in the fittings elongated. U.S. National Transportation Safety Board (NTSB) investigators found that loosening the single outboard bolt and not filling the shim pocket caused the fitting and serrated plate to pivot and thus increase the stress levels in the fitting assembly. In the accident airplane, the aluminum fitting that failed showed evidence of low cycle–high stress fatigue failure. Inspection of the opposite (right-hand) gear-door fittings on this aircraft disclosed that at least one of the three attachment bolts had loosened and was not properly torqued to preclude movement within the assembly.

In the history of the B-727 series, several landing gear/wheel well door-jam incidents have resulted in accidents. The landing-gear door actuator fitting assembly of the B-727 series had been the subject of, or associated with, four previous NTSB recommendations, a Boeing service letter, three Boeing service bulletins (SBs), a U.S. Federal Aviation Administration (FAA) maintenance bulletin and four airworthiness directives (ADs). The three Boeing SBs have been revised seven times since 1967.

Although the aircraft involved in this latest accident had been inspected in accordance with the latest AD (93-01-14), the terminating action had not been accomplished. The NTSB said that finding an inadequately torqued bolt in the right door actuator fitting assembly of the accident aircraft indicated that the interval between bolt torque inspections may be inadequate. The NTSB said that the aluminum fitting should continue to be inspected for fatigue-induced cracks, because other cracks have been found following incorporation of the AD terminating actions. In addition, the previous ADs and SBs did not address inspection for shim degradation or thickness of the laminated shim material, the NTSB said.

The NTSB has issued a recommendation calling for the FAA to revise AD 90-02-19 and 93-01-14, applicable to the B-727 main landing-gear door actuator fitting assemblies, to reduce the current inspection intervals.

The NTSB said that the revision should require inspection of the laminated shims within the assembly for degradation and reduction in thickness, and that the revision continue to require repetitive inspections until an alternative design is available.

Two Different Problems, Same Result: Technician Caught in Nose-gear Doors of A310

An international carrier reported two separate instances when a technician working in the nosewheel well of an Airbus A310 was trapped when doors closed unexpectedly.

In the first instance, the nose-gear doors were actuated to the closed position after maintenance, but the right-hand door did not move at all. The technician looked into the wheel well, and seeing nothing wrong, climbed on the wheel to find the cause of the problem. When he attempted to assist the mechanism inside the wheel well, the door closed immediately, trapping the man between the doors.

In the second instance, the technician had been working in the nosewheel well with the doors open, but the operating handle had been moved to the "closed" position with the hydraulic system not pressurized.

The man was pinched by the door when the hydraulic system was pressurized by someone else working on the aircraft.

To prevent these accidents from occurring, install a safety collar on gear door actuators when working on the system, and "tag out" the system controls and circuit breakers when working on a system.♦

NEW PRODUCTS

CRC Introduces Long-term Corrosion Inhibitor

CRC Industries has introduced Protector 100, a product intended to provide long-term protection against corrosion in aircraft structures. CRC says that Protector 100 penetrates excellently and flows evenly between metal parts to protect crevices and sandwiched areas from corrosion. According to the manufacturer, Protector 100 displaces water on application, and leaves a tack-free, thin protective coating that resists the effects of heat, cold, humidity and salt spray and meets Boeing Specification 3-23.

The product can be applied using aerosol cans, brushed on or sprayed on using conventional air or airless equipment. The film is said to be easily removed with mineral spirits during repair or inspection. The inhibitor comes packaged with a safety data label printed on each container.

For more information, contact: CRC Industries Inc., 885 Louis Drive, Warminster, PA 18974 U.S. Telephone: (215) 674-4300.

Stronger Nylon Ties Offered

Haines Products has introduced a new model of electrical cable tie that it claims provides greater ease of installation with improved locking. The manufacturer says that this tie provides up to one-third more strength than previous nylon wire ties.

The ties are offered in a range of sizes from four inches to 32 inches (10 centimeters to 82 centimeters) and in standard black, neutral or custom colors.

For more information or to obtain samples, contact: Haines Products, 155 E. Ames Court, Islandia, NY 11803 U.S. Telephone: (516) 349-7777.

Nontoxic Bird Aversion Agent Reduces Bird-strike Risk

For years, bird control around airports meant shooting, poisoning, netting or other unacceptable methods. Federal laws in the United States ban many of these practices today.

A recently introduced product called ReJeXiT claims to provide an environmentally friendly way to reduce bird hazards around airports.

The product has received U.S. Environmental Protection Agency (EPA) approval, and the active ingredient in ReJeXiT is rated as "generally recognized as safe," according to the manufacturer.

The manufacturer says that food sources treated with this product become unpalatable to all species of birds, and ReJeXiT is rapidly biodegradable in the environment. In application, the manufacturer recommends:

- For ponds — 20 pounds per acre, by hand or power spray;
- For landfills — 20 pounds per acre, by power spray;
- For turf — 11.6 pounds per acre, by power spray; and,
- For pools of standing water on airports — 1.2 pounds per 100 gallons.

The product is said to have an odor reminiscent of grapes and its ingredients meet or exceed the U.S. Food Chemical Codex and comply British Pharmacopeia requirements.

For more information, contact: S & C Advertising, One International Centre, 100 N.E. Loop 410, Suite 965, San Antonio, TX 78216-4706 U.S. Telephone: (210) 342-7000, fax: (210) 342-3530.

Compact Ultraviolet Lamp Reduces Inspector Fatigue

Inspectors who use an ultraviolet (UV) lamp to perform fluorescent examination are familiar with the bulky and heavy UV lamps normally used. Spectronics Corp. has introduced a compact UV light head which it claims is the smallest and lightest unit available. According to the manufacturer, C-100 and SCC-100 units weigh only 1.75 pounds (0.79 kilogram) and measure only 5.5 inches (14 centimeters) in diameter. Both units produce a steady-state 365-nanometer intensity of 4,000 μW per square centimeter at 15 inches (38.5 centimeters).

The C-100 is powered by a magnetic ballast. The SSC-100 has a solid-state power supply available in 115- or 230-

The SSC-100, manufactured by Spectronics Corp., is a solid-state, high-intensity UV lamp.

volt versions or can be operated from an optional battery pack containing a high-frequency inverter and "smart" charger that requires only 3.5 hours to recharge. A 12-volt, 17-amp/hour battery is available separately.

For more information, contact: Spectronics Corp., 956 Brush Hollow Road, Westbury, NY 11590 U.S. Telephone: (516) 333-4840, fax: (516) 333-4859.

Automated Battery Monitor Provides Record of Battery Service

The Christie Electric Corp. has introduced the DataFLEX system, which is said to automatically monitor and record the condition of either lead-acid batteries or nicad batteries during charging and maintenance. The manufacturer states that this unit provides a complete, hard-copy battery servicing report, fully automates the service documentation process and calculates battery discharge capacity. The system does not require a personal computer.

According to the manufacturer, the DataFLEX unit senses charge or discharge levels by a clip-on current sensor loop. By means of a multiplexer, the cell voltage information is relayed to a microcontroller, which examines the data and provides appropriate readouts or warnings. The unit can generate visual and audio warnings to alert personnel to cell-balance faults, cell-polarity reversal or a negative slope condition.

Through an optional serial printer, a complete hard-copy report on the battery's performance can be provided.

For more information, contact: Christie Electric Corp. 18120 S. Broadway, Gardena, CA 90248 U.S. Telephone: (310) 715-1402, fax: (310) 618-8368.♦

The DataFLEX system from Christie Electric Corp.