Cooperative Training for Aviation Technicians: An Opportunity for the Corporate and Commuter Communities

New concepts and innovative methods can provide meaningful and useful training for tomorrow's technicians.

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by

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The regulation governing airframe and powerplant mechanic training schools, U.S. Federal Aviation Regulation (FAR) Part 147, is currently under review and is likely to be substantially rewritten. It is not likely, however, that this revision will address a major weakness that exists in the training of future technicians, namely that much of the equipment and training aids in use by the certificated schools is not typical of that which the newly licensed technician is likely to encounter upon entering the job market.

Many Training Aids Are Obsolete

A survey of the 149 U.S. Federal Aviation Administration (FAA) certificated mechanic training schools, conducted by *Aviation Equipment Maintenance* magazine in 1987, indicated that the majority of airframe and powerplant (A&P) mechanics who graduated from these schools were trained on obsolete and outdated equipment. Fifty-eight of the schools responded to the survey and the results were considered to be a valid representation of the overall situation within the industry. The responses, summarized in the accompanying charts, illustrate the scope of the problem. For example, only 10 percent of the respondents had an airworthy turboprop airplane available and only seven percent had an operational turbojet aircraft on which the student could get hands-on experience (Chart 1).

Aircraft Available For Hands-on Training

Aircraft	Percent of Schools with Airworthy Aircraft	Percent of Schools with Aircraft not Operational
Single-Engine Piston	76	82
Multi-Engine Piston	49	62
Turboprop	10	9
Turbojet	7	38
Helicopter	36	72

Note: Airworthy is defined as a flyable aircraft. Not operational is defined as not flyable and with no intent to ever make the aircraft flyable.

Chart 1

In the area of avionics and electronics training, the lack of modern, state-of-the-art equipment on which the student can acquire hands-on experience is even more alarming. Not one of the responding schools had an operational inertial navigation or laser gyro system for the student to use in training. Only half of the responding schools had an operational autopilot, Loran, radar altimeter, gyro compass, or high frequency communication system (Chart 2). With just one of these systems costing up to $100,000, the lack of such modern training aids is understandable from an economics standpoint, but the technician graduating from these schools is poorly prepared to work on current aircraft.

The survey indicated a similar situation for powerplants used as training aids in the certificated schools. As Chart 3 illustrates, only 27 percent of the respondents had operational turboprop engines for use in airframe and powerplant training courses. Not surprisingly, a greater proportion (45-56 percent) of the respondents had operational turbine engines in the 2,500- to 5,000-pound thrust range, which were largely military surplus-type engines. Obviously, few schools can afford to have a test cell set up with a current multi-million-dollar wide-body jet engine just for training purposes.

Employers Are Dissatisfied

The magazine also conducted a corresponding survey of typical employers of these newly-licensed technicians and confirmed that the majority of employers were dissatisfied with the technical competence of the average graduate. Virtually every employer surveyed commented on the need to improve technician training. The lack of modern and current state-of-the-art

Avionics Equipment Gap

System	Percent of Schools Offering System Course	Percent of Schools with Operational Equipment
VHF communications	93	81
HF communications	57	31
ADF systems	100	87
Gyro compass system	63	50
Inertial navigation	19	0
Laser gyro systems	7	0
Weather radar	82	62
Radar altimetry	50	37
Loran systems	63	43
Autopilots	75	50

Note: The percentages shown in the right hand column reflect the totality of responding schools, not only those that offer the system course.

Chart 2

Engines Available For Hands-on Training

Powerplant	Percent of Schools with Operational Engines	Percent of Schools with Not Operational Engines
Under 150 hp (piston)	5	61
150 to 500 hp	92	81
Over 500 hp	27	33
Under 750 hp (turboprop)	27	36
Under 2,500 lbs (turbine)	45	47
2,500 to 5,000 lbs	56	47
Over 5,000 lbs	14	32

Note: Operational is defined as engines mounted or operational in a test cell or on an aircraft. Not operational is defined as an engine not capable or intended to be run in a test cell or on an aircraft.

Chart 3

training aids and actual equipment on which the student can receive hands-on experience was felt to be a major factor in this shortcoming.

The schools are in the middle of this dilemma. The training of A & P mechanics is a business and it is unlikely that any school can afford to buy a complete commuter or corporate jet aircraft, a current turbofan engine, or an electronic flight information system for use as a training aid. The lack of current state-of-the-art training aids at most certificated training schools is basically an economic issue and is not likely to be corrected by the institutions without substantial assistance from outside resources.

New Training Concepts Are Needed

A few of the major airlines have taken steps to assure themselves a supply of qualified technicians by instituting their own A & P mechanic training programs. By setting up an ab initio program, these employers can be assured that their technician candidate receives training that will prepare the student to be productive and qualified on their specific equipment upon graduation. Such programs are not new. In fact, many international operators have had complete technician training programs culminating in apprentice training programs.

However, the operation of a full-blown apprentice program requires a large fleet operation, which is well beyond the scope of any single corporate aviation or commuter air carrier operator. However, there is another option available to the aviation community. The corporate aviation community and the commuter industry are in a unique position to take the initiative and improve the quality and competence of the typical graduate of these schools. Among the factors creating this opportunity are:

- Most corporate and commuter aircraft are among the most current state-of-the-art and are replaced more frequently than large airline fleets.

- Corporate and commuter operators typically perform a wide range of their own maintenance, and there is very little “specialization” of technicians.

- Few corporate and commuter operators are constrained by union agreements or work rules.

Co-op Training Could Be An Answer

Several corporate operators, particularly in the Westchester/White Plains, N.Y., U.S., area, have programs through which they hire students as part-time helpers, although these are not full-fledged co-op programs where the student receives credit for training received on the job. However, this concept could be expanded to establish a true cooperative A & P training program with area technical training schools. This will not only provide the schools with a "real-world" environment in which the student can benefit from practical experience, but will also ensure that the participating corporate or commuter operator has a pool of trained candidates for future employment.

Balanced Instruction

Under the scenario envisioned, the school would continue to provide the classroom lecture and theoretical training portion of the required instruction. This could be done in six- or eight-week phases. In the alternate phases, the student would be assigned to a participating operator to acquire practical experience in subjects previously covered in the classroom phase. This may require that the operator and the school match the work normally performed by the operator with curriculum requirements and set up specific modules of on-the-job training to which the typical student is to be exposed.

Such a program would not be easy to establish or administer. Perhaps a central clearing house for participating schools, and employers and operators could be established. Industry organizations such as Flight Safety Foundation (FSF), National Business Aircraft Association (NBAA) or Professional Aviation Maintenance Association (PAMA) could be candidates for this administrative function, with each participant or training agency paying a fee to cover the costs of administration. Such costs should be more than offset by the reduced need for costly training aids at the participating training schools.

Under this program, a number of operators would contract to use one or more of the "student-apprentices" and agree to provide guidance, supervision and the opportunity to gain experience in various areas of their operation. Specific guidelines governing material to be covered and practical experience to be provided would need to be established. For instance, in order to assure a constant manpower level, the employer would accept two participating individuals on alternating classroom/practical schedules and thus have one trainee on duty at all times. Work rules, shift assignments and job assignments would be the prerogative of the employer, so long as the areas of work experience are covered. The pay scale of the student-apprentice could be established as a percentage of the regular technician salary.

Operators Can Benefit

For the participating operator, there are benefits:

- The operator could select the criteria for candidate students, i.e., only second year students in the top 10 percent of the class might be considered eligible.
- The capability to prescreen and evaluate potential employees with no obligation as to future employment.
- Assurance of the availability of qualified technicians who are already familiar with the operator's operation.
- Availability of technicians who are well-qualified and at least partially trained on the operator's specific equipment.
- The opportunity to participate in improving the overall quality and level of knowledge of the typical A & P or avionics technician.

This sort of cooperative education is well-accepted in other fields and could be a tremendous benefit to the aviation community. In order to accommodate this concept, FAR Part 147 may need revision to include the concept of cooperative training in lieu of practical experience within the training agency shops and hangars. The aviation community can help promote the development of such new concepts and innovative methods of providing meaningful and useful training for tomorrow's technicians, and can help ensure that any new regulation provide for such options.

Training Aids Can be Donated

Another way in which operators can participate in the improvement of technician training is by donating state-of-the-art equipment which is no longer useful to their operations. The schools could thereby be provided with modern training aids on which future technicians can be trained. Even parts or components which have been damaged or are found to be beyond economical repair by the operator can be an invaluable training aid to the typical technician training school. A caution here would be to avoid "dumping" obsolete equipment on the schools that would only serve to exacerbate the training aid dilemma. ♦

About the Author

Robert A. Feeler is a technical consultant with more than 30 years of experience in maintenance and quality control with major airlines.

Feeler previously served as vice president of technical services for Aspen Airways and director of maintenance and engineering for the Metro Express Division of Allegheny Airlines. Before that he was director of quality control for Lake Central and Allegheny Airlines, having worked his way up from mechanic to lead mechanic to inspector.

At Aspen Airways, Feeler reorganized the maintenance and quality control sections. He originated and directed an in-house safety and accident prevention program at Allegheny Airlines and directed safety inspections of work procedures and facilities. He participated in major and minor accident investigations as a member of the U.S. National Transportation Safety Board (NTSB) team representing the operator. He also has participated in aviation safety audits with emphasis on maintenance, quality control, facilities and support equipment.

Photograph not available.

NEWS & TIPS

Troubleshooting Taught by Computer

A specialized two-day computerized troubleshooting course for aviation maintenance technicians utilizes an advanced graphics-based computer simulation program. The "Professional Troubleshooting Skills" course developed by SimuFlite Training International provides unlimited interaction between the student and the lesson, that is claimed to bring realistic aircraft responses into the classroom.

The instructor-led course is presented on a Zenith computer using a flat-screen, high-resolution graphics monitor and a SummaGraphics digitizing tablet and multi-function probe. No keyboard is used, and the system is said to be easy to use even for computer novices.

The "Professional Troubleshooting Skills" course is generic, designed for technicians working on all types of aircraft. It includes an electrical review, discussion of tools and techniques, and an introduction to the analytical approach of problem solving. Hands-on troubleshooting exercises use actual schematics and simulated aircraft systems that respond in the same manner that the aircraft would in response to each troubleshooting procedure. The system also reports the time and cost involved for each solution. The course is presented monthly at the company's SimuFlite Center located at Dallas/Fort Worth International Airport, U.S. Because the entire training system is portable, it can also be transported to client locations.

Neil Casey, SimuFlite president, noted that the course focuses on the philosophy and logic of troubleshooting, and helps to develop systematic processes and decision-making skills to develop more effective technicians. "It is an excellent complement for our current aircraft-specific maintenance training programs and an excellent prototype for type-specific troubleshooting courses," he said.

Piper Gear Leg Checks Called For

Citing numerous accidents where the main landing gear on Piper PA-34-200T aircraft separated during the landing roll because of a trunnion failure within the gear assembly, the U.S. National Transportation Safety Board (NTSB) has called for a mandatory inspection procedure. The manufacturer had issued a service bulletin (Piper SB 787A) in 1985 that prescribed inspections and replacement of the landing gear assembly trunnions with modified units.

The Board has recommended that the U.S. Federal Aviation Administration (FAA) issue an airworthiness directive (AD) for Piper aircraft having main landing gear trunnions with part numbers 67926 or 38486 followed by a single- or double-digit dash number to be subjected to periodic, non-destructive inspections of the lower filet of the web in the aft surface of the trunnion for evidence of cracks (dye penetrant or eddy current) and grinding marks or scratches (one-time detailed visual inspection that does not disturb the trunnion metal surface).

The NTSB recommended that trunnions found to contain cracks should be removed from service and those that show grinding marks or scratches should be reworked by polishing.

Recognition for Helo Technicians

Are you a rotary wing technician with a great record? The Helicopter Association International (HAI) honors helicopter technicians worldwide who have five or more years of full-time consecutive accident- and violation-free professional civilian helicopter experience.

Nominees must be employed by an HAI-member firm as a full-time certified or licensed technician working on helicopters, and certified by company management. Award certificates are processed quarterly for career milestones of 5, 10, 15 or 20 consecutive years of qualifying experience.

Nomination forms for the Aviation Mechanic/Technician Safety Award Program for Helicopter Professionals are available from HAI, 1619 Duke Street, Alexandria, VA 22314.

Technical Educator Recognized by FAA

George Brush, Ph.D., president emeritus of the College of Aeronautics, Flushing, N.Y., U.S., received a Certificate of Appreciation from the U.S. Federal Aviation Administration (FAA). Brush, an aviation educator for more than 40 years, was cited for his "exemplary life-long devotion to the aviation industry as a leading national educator."

Photo not available.

During an awards ceremony at New York's John F. Kennedy International Airport, Daniel J. Peterson (r), FAA regional administrator, presents FAA Certificate of Appreciation to educator George Brush, Ph.D., president emeritus of the College of Aeronautics.

Brush, who retired this year, joined the Academy of Aeronautics in 1950 and brought it to full college status. He instituted computer requirements to many courses, introduced electronic log-book procedures and was responsible for obtaining a patent for an interactive welding simulator (see "Welding Training on the Tube", May/June *Aviation Mechanics Bulletin*). He also founded the Marotta Laboratory that provides state-of-the-art Boeing 727/737 systems familiarization.

Meeting the Demand For Aviation Technicians

Pointing to a "continuing critical shortage for the foreseeable future" of aviation technicians, East Coast Aero Technical School at Hanscom Field, Lexington, Mass., U.S., is expanding its facilities. The school, a division of Wentworth Institute of Technology, has purchased a 12,000-square-foot hanger to accommodate increasing enrollment.

The school expects its enrollment of 400 students to grow to 500 before the end of this year and quotes a placement rate of 96 percent for its graduates. Evening classes in aircraft maintenance technology leading to airframe and powerplant certificates will be offered this fall. ♦

MAINTENANCE ALERTS

This information on accidents and incidents is intended to provide an awareness of problem areas through which such occurrences 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 accurate.

Assumption Leads To Takeoff Abort

At the beginning of the takeoff, the captain was not able to attain more than 1.25 EPR on any of the Boeing 747's engines. He elected to abort the takeoff while the aircraft was still at a low speed and returned to the gate.

Maintenance personnel discovered a "part power maintenance fixture" installed on the throttle pedestal. The fixture was removed and the flight departed without further incident.

Investigation into the incident revealed that the aircraft had arrived the previous evening with a deferred item for out-of-rig throttle cables. The "part power" stop was installed on the throttle pedestal to accomplish the rigging procedure, but it was not removed by the maintenance crew since they assumed that an engine runup would be accomplished. However, a post-maintenance trim runup was not required and the installation of the power stop was not detected either by the maintenance or the flight personnel until full power could not be attained during the takeoff.

Fatigued Brakes Couldn't Take the Heat

The BAC One Eleven had backtracked on the runway prior to takeoff. The crew noticed a loss of hydraulic fluid on the number two system and taxied off the runway to check out the problem. They found that the number four main wheel (outside right) inner half had broken up and damaged the hydraulic system on the gear leg. There was no indication that the tire had failed. Several small pieces of the wheel rim and other parts were found along the runway.

When maintenance personnel examined the damage, they found that the inner half of the number four wheel had fractured around its diameter, separating the entire cylindrical portion and its rim from the flange face near the attachment bolts. A metallurgical examination of the fractured surfaces revealed that the fracture had started at a small area of metal fatigue at the flange end of the brake rotor drive blocks. Unrelieved stresses were evident in the fractured parts. A similar incident previously had resulted in a requirement for nondestructive testing of the wheel halves at every tire change and for stress-relieving and shot-peening during manufacture. The failed parts in the incident noted above had not been stress-relieved during the manufacturing process. The wheel had completed 48 landings since inspection by the manufacture; however, the particular area where the fracture began was not covered by the existing inspection requirements.

Fouled Valve Squanders Fuel

The Boeing 747 was en route from Singapore to Sydney. In accordance with standard operating procedures, the center tank was selected for fuel feed. However, the number four crossfeed valve was found to be stuck in the closed position. The crew recycled the valve's circuit breaker with no effect and decided to return to the airport. Fuel was jettisoned to bring the landing weight within limits and the widebody landed without incident.

Maintenance personnel at Singapore manually opened the valve and deactivated it in that position, according to normal procedures, and released the aircraft for service so it could proceed to its destination where the valve actuator was changed. A teardown inspection of the offending part revealed that the rotor and stator of the unit had seized because of moisture, electrical arcing and corrosion. An on-condition item, the actuator had been last overhauled 15,603 hours previously. Because the same valve was fitted to the low pressure and jettison nozzle valves, a program was begun to replace the actuators with new ones that had improved sealing and reliability.

Expensive Fix

The McDonnell Douglas DC-10 was climbing through 3,500 feet on a flight from Honolulu, Hawaii, U.S., to Tokyo. The second officer reported that the number one engine oil pressure was fluctuating between 40 and 45 psi. The fluctuation continued to decrease and reached a reading of 24 psi. All other instrument indications were normal.

The decision was made to return to the departure airport and 55,000 pounds of fuel were dumped to decrease the aircraft weight to within the prescribed limits for landing.

After investigation by maintenance, the oil transmitter and indicator for engine number 1 were replaced.

Unset Sealant Restricts Visibility

The captain's windshield on the Boeing 737 had just been replaced. Maintenance personnel told the captain there were no restrictions on airspeed and altitude. However, the crew was informed that the sealant may not have set due to the cold December temperatures in the northern United States, and that, if the tape or sealant failed, the sealant could run onto the windshield.

During takeoff, the tape did fail and the sealant did run onto the windshield. It created a stain over 50 percent of the windshield, but, although visibility was somewhat restricted, the flight was able to continue to its destination. After landing, maintenance resealed and retaped the windshield.

Loose Fit Sinks Airplane

The Cessna 152 gave no indication of impending trouble during the preflight checks. The crew of two took off from the U.K. airport for an airworthiness inspection test flight. As the aircraft was climbing through 500 feet, there was a slight vibration felt throughout the fuselage. Within a short time the vibration became severe and the engine began to lose power. The crew decided to return to the airport while the engine was still producing some power.

A downwind landing was made and the aircraft touched down approximately two-thirds along the runway. The pilot was unable to stop the aircraft before it ran off the end of the runway and collided with a bush. There was slight damage to the wingtip but the two crew members evacuated the aircraft without injury. Engine examination revealed that the rough running had been caused by one inoperative cylinder that had a loose valve adjuster.

Unexpected Retraction

After the pilot of the four-seat Socata ST 10 Diplomate had taken off alone from the U.K. airfield, he did some practice takeoffs and landings, and departed for the local area. He returned approximately a half-hour later for a full-stop landing. Nothing unusual occurred during the approach and touchdown, but during the landing roll the left main landing gear slowly retracted. The aircraft departed the runway to the left and came to rest on the grass. The aircraft sustained damage to the left main gear and the left flap, but the pilot evacuated without injury.

Inspection of the aircraft revealed that the threaded end fitting of the left landing gear actuating rod assembly had broken. This had allowed the mechanism to unlock and the gear to retract. A manufacturer's service bulletin calls for inspection of the general area, including the threaded end fitting, at 25-hour intervals. There was no indication that the fitting had been changed since the aircraft had been built, 1,700 flying hours and 18 years previously.

Half a Shim Not Enough

The captain of the Boeing 757 that had landed at Heathrow, after a flight from Glasgow, reported that the aileron control had been stiff during all phases of the flight and exhibited little centering action. Maintenance personnel found that the aircraft had a history of lost motion in the aileron control system, and previous investigation had indicated excess play in the control column bevel gear mechanism. Two days previous to the incident, the mechanism had been adjusted by shimming. After the most recent incident, it was again inspected and the center bearing was changed because of slight notching and sticking. The assembly was reshimmed and there was no further trouble with the aileron control. After consultation with the aircraft manufacturer, information was published by the carrier that shimming of only one side of the bevel gear is not recommended.

Powered-Down Ferry Flight

During a routine preflight inspection of the Concorde for a flight preparing to depart Liverpool, U.K., it was found that a piece of the primary nozzle of the number three engine had broken away and caused impact damage to the secondary nozzle. The aircraft was rescheduled to be flown to Heathrow for maintenance.

During the ferry flight, the captain shut down the number three engine as a precautionary measure to prevent further damage. Maintenance replaced the primary nozzle and repaired the secondary one.

Subsequent analysis of the primary nozzle revealed that the incident had been caused by the primary nozzle jack at the 12 o'clock position operating more slowly, because of internal leakage, than the others. This resulted in the two adjacent petals coming out of synchronization, which led to excess stress and subsequent failure of the connecting link. The primary nozzle had completed 1,084 hours of operation since certification and is an on-condition item. The carrier added a requirement to remove all primary nozzles for overhaul during major checks of Concorde aircraft. Further, each time a nozzle was in the maintenance shop, a full crack detection would be made of the links and a leak check of each jack would be accomplished. ♦

NEW PRODUCTS

Cylinder Coating Process Promises Longer Life

A cylinder coating process — called Cermicrome — combining the long wear of chrome with the rapid break-in and low oil consumption of steel, has been introduced to the United States by Engine Components Inc., of San Antonio, Tex. This engine component supplier uses patented technology from Laystall Engineering Company, Ltd., of England, to mechanically lock silicon carbide particles into chrome cylinder plating under high pressure.

The process impregnates the cylinder barrel with microscopic bits of silicon carbide locked in the hard chrome surface. The silicon carbide combines hardness of chrome with high oil wettability.

Photograph not available.

Phillips 66 participated in the development of Cermicrome processed cylinders and found test engines to run 10 to 15 degrees cooler with Cermicrome-processed cylinders. For further information contact Bill Coleman or George Bukota, G+A Communications, 49 West 45th Street, New York, NY 10036, U.S. Telephone (212) 221-2267.

Fluid Service Carts Go to the Aircraft

Hydraulic and engine servicing units permit servicing fluids to be dispensed directly from the manufacturer's five-gallon containers to reduce the possibility of dispensing the wrong fluid into the aircraft.

The new units also eliminate the need to handle heavy 55-gallon shipping containers. These dispensing units are equipped with 15-micron filters that are cleanable and are located, for ease of access, in the end of the service hoses themselves.

The hydraulic reservoir servicing units also incorporate a 3-micron filter, with a replaceable element as an integral part of the unit. A high-displacement hand pump (seven strokes to the quart) transfers the fluid directly to the aircraft's reservoir. This gives absolute pumping and shut-off control to the pump operator.

The manufacturer has two units available. One is a hand cart with room for one five-gallon container, and is easy to move to the aircraft. The other unit is larger and is mounted on a four-wheel cart that can be towed or moved by hand, and has room for a spare five-gallon container.

Photograph not available.

The service carts are designed to make a critical and necessary job safer and easier for the maintenance technician. Additional information can be obtained from Tronair, S. 1740 Eber Rd., Holland, OH 43528 U.S. Telephone 800-426-6301. FAX 419-867-0634.

Drip Pan Catches Leaks

Oil and hydraulic drips can be a hazard as well as a mess on the hangar floor. The Slikwik® Sorbents' new Slikwik® Drip Pan™ is designed to make it easy to contain and control problem leaks in a wide range of applications.

Photograph not available.

Placed under a leaky engine, dripping hose, or anywhere a problem drip occurs, the 12-inch-square drip pan collects up to one gallon of most hazardous and non-hazardous liquids. The rigid pan prevents spillage during handling, and enables personnel to clean up work areas without using expensive shop towels or absorbent clay. The drip pan's low three-inch profile fits into small spaces and minimizes the danger of drip pails tipping over.

For more information, contact Slikwik Sorbents, P.O. Box 119, Maumee, OH 43537 U.S. Telephone (419) 893-5050.

Hydraulic Lift Table Eases Manual Strain

A foot-operated hydraulic lift table can ease back stress for maintenance and shop personnel both on the line and in the hangar or shop. Available from Lee Engineering Co., Inc., this wheeled device can lift and move heavy objects from high shelves down to working height, then to a working area and into place on the bench or into position for installation on the aircraft. The hydraulic lift table has a high-tensile steel telescoping carriage and a cantilevered table that extends in height from 36 inches to 60 inches and has a 2,000-pound weight-carrying capacity. The unit rolls on two five-inch phenolic wheels and has two casters for steering and two separate floor locks to prevent creeping or moving while loading or unloading. There are other models available with lift heights from 24 inches to 36, inches and 30 inches to 48 inches.

Photograph not available.

The unit can be used in a powerplant overhaul facility to safely move heavy engine assemblies during the overhaul and maintenance processes, and in any general overhaul and repair facility in order to improve efficiency and reduce personal injuries.

Further information may be obtained from Lee Engineering Co., Inc., 505 Narragansett Park Drive, Pawtucket, RI 02861 U.S. Telephone 800-343 9322 or 401-725-6100. ♦