

## Lighting the way at Minneapolis-St. Paul International Airport

Technology at Work

At airports these days, more equals less. More flights, to more regions, on smaller planes that carry fewer passengers. It's the trend in aviation, and the Minneapolis-St. Paul (MSP) International Airport is leading the pack. At more than half a million take-offs and landings per year, MSP is the sixth busiest airport in the U.S. So much so that in 2005, MSP will open its fourth runway.

Five years after the airport was founded in 1921, fledgling Northwest Airways won the government's airmail contract and acquired the only hangar at the airport. Northwest Airlines is now the nation's fourth largest airline, and with its hub at MSP, it commands fifty-three percent of the airport's operations. The other half is split between 15 different major airlines, seven regional airlines, an increasing number of charter flights, and substantial air freight operations.

In the last two years, regional, charter, and freight activity has grown much faster than major airline passenger volumes. At the same time, MSP has managed to keep operating expenses low, compared to other U.S. airports.\* That trend extends all the way down to the runway, where electrical foreman Bob Litke is using the Fluke 1520 MegOhmMeter for preventive lighting maintenance.

### Let there be light!

While there's maintenance of all types to be done at a complex facility like MSP, keeping the runway lights and related systems lit and functioning is a large part of the electrical maintenance effort.

The MSP electrical department maintains a myriad of runway lights mandated by the FAA for

safe takeoffs, landings, and taxi maneuvers during darkness and in daylight poor visibility situations. The full scope includes runway edge lights (on each side of each runway, with lights placed about 200 ft. apart), threshold lights at each end of the runway (red or green depending on flight direction), centerline lights (flush lights on 50 ft. centers that go from white to red as end of the runway is reached), touchdown lights, and taxiway signs, that direct ground traffic.

The runway lighting also includes Precision Approach Path Indicators (PAPI) that sit along side and near the end of each runway. Using a red/white light signal system much like an automated carrier landing signal officer, the PAPI lights show pilots whether they're at the right altitude prior to landing.

\*Source: 1/03 Report by the Minnesota Office of the Legislative Auditor. [http://www.msppairport.com/MSP/MSP\\_Media\\_Center/News/Release/2003\\_01\\_28.as](http://www.msppairport.com/MSP/MSP_Media_Center/News/Release/2003_01_28.as)



MSP electrical foreman, Mark Temple, uses a Fluke 1520 MegOhmMeter to locate trouble spots.

### Safety first

Failure of any runway lights during airport operations is not an option. Under Bob Litke, the MSP electrical department regularly replaces runway lamps and checks wiring for insulation degradation.

Considering that many of these lights run in series circuits, even localized damage can have significant effects. Minnesota's harsh weather offers plenty of snow, rain, and freeze/thaw cycles. Rain and melting snow can find its way into wireways and compromise wiring integrity, especially at bad connections caused by defective splices. Minnesota is also the home of the gopher, and according to Litke, the animal has done its share of insulation damage.

And then there's the system's age. Even with constant upgrading, 30 year-old components can be problematic. Presently, ninety percent of all lighting wiring is in conduit and ten percent is buried. While the buried cabling will eventually end up in cable runs, their current exposure makes them a likely target for accelerated environmental and "gopher" degradation.

### Using Fluke's 1520 MegOhmMeter

Checking leakage to ground along wiring paths is the only sure way to identify potential lighting failure. Litke's department uses Fluke's 1520 MegOhmMeter for the job. The 1520 is a professional electronic test tool that combines insulation

resistance testing, ac/dc voltage measurement, and Lo-Ohms function in a single tool. It provides insulation testing up to 4,000 MΩ, with three output voltages: 250, 500, and 1000 V. The 1520 switches automatically to voltage sensing when connected to a live circuit with voltage over 30 V and provides ac/dc measurements up to 600 V.

Bob Litke's crew uses the 1520 for troubleshooting failures and performing preventive maintenance. It's especially key for locating trouble spots. "Our process in locating a problem varies with how many lights are out," says Litke. "Often, we must use the process of elimination to locate it. Technicians test the cable on each side of the failure at 1000 V for 2 minutes minimum. If resistance holds or goes up we eliminate that area of the run. The process continues until the degraded wires are located."

Once Litke's crew locates a damaged wire, they must repair it as soon as possible. But given 24/7 airport operations, "serious" maintenance has to be done at slow times, often at night when fewer flight operations are scheduled. Then, they use another Fluke tool, the T5 Electrical Tester, to check any "suspected" cable. Once they confirm that there's no power in that portion of the circuit, they can remove wires located in conduits, pull new ones and splice them in place. In other cases, they dig up buried cable and replace or repair it. At the end of every repair, the crew checks the new wiring with the 1520.

### Cost efficiencies

Given the harsh environment and constant risk of insulation degradation at MSP, preventive maintenance is essential. But thanks to several unexpected benefits, the 1520 MegOhmMeter has become more than just a tool to keep the lights on.



Using a Fluke T5-1000 electrical tester to check current.

As Litke explains it, each runway light is a 6.6 V unit sitting on its own transformer. The lighting string is fed through a constant wattage regulator that makes 6 amps available at each light. When all wiring is properly maintained, 500 volts will power the system need. However, as wires degrade and leakage to ground increases, the system self-corrects, increasing supply voltage as high as 3500 V just to keep 6 A at each light. Preventing that electrical cost puts wiring insulation integrity at premium importance.

Litke also believes the 1520 has lowered labor costs. "The 1520 is not only versatile and adaptable to our maintenance needs, but is so reasonably priced that we were able to buy 14 units. On a facility the size of MSP with technicians scattered anywhere across its acreage, it makes sense to have more than one or two. If the department can have one on each truck — and quickly locating an electrical problem often requires multiple vehicles — technicians never

have to make unnecessary trips across the airport to check one out of the maintenance building. Repairs get done quicker and more efficiently."

Fewer trips, says Litke, add up to lower costs and increased safety. "Less windshield time' is much safer at a busy airport. Fewer vehicle movements lessen the possibility of interfering with flight operations and runway accidents." And that's exactly what the airport wants to hear.

## Meanwhile, on the other side of the world

A far cry from the upper Midwest of the United States, New Zealand is comprised of a pair of islands, situated 1,200 miles southeast of southern Australia. New Zealand is a rugged land—three-fourths of its approximately 104,000 square miles is hills or mountains.

The Fluke 1520 MegOhmMeter has also become the electrical tool of choice for maintaining runway lighting at Airways New Zealand's multiple airport facilities. According to John Meyer, Wellington facilities manager for Airways Corporation of New Zealand Ltd., "We currently have 18 Fluke 1520 MegOhmMeters in service. Although adaptable to a wide variety of electrical troubleshooting and maintenance duties, they are mainly used to maintain Airways' Airfield Lighting systems (AFL) throughout New Zealand at 15 airports."

Just like airports worldwide, Airways New Zealand's AFL is a standard system that uses a series circuit to feed the runway lighting. The circuit runs at 6.6 A when at the lights are at full brilliance. Each circuit has about 1- 2 KV applied to it by a constant current regulator power supply. Each light has an individual transformer in an underground 'pot' that runs the light. An individual circuit can be many kilometers in length and can have 100 or more lights.

Because insulation degradation can be a problem, even in the equable and moist New Zealand climate, Mr. Meyer's crew of electricians and technicians use the Fluke 1520 to monitor insulation integrity. "Our methodology for checking circuits is standard for all facilities we operate and is the same as used worldwide by other airport facilities. The 1520 is used to check for leakage to ground of a series circuit using its 1,000 V range. This gives a technician a good indication of circuit insulation condition. If the resistance falls below 1.5 MΩ, repairs are initiated to bring the insulation resistance back up to above 4 mΩ," Meyer says.

The capabilities and ruggedness of the Fluke 1520 have given Airways New Zealand an efficient method for making and checking repairs. John Meyer comments, "During repairs, it is necessary to measure the insulation resistance of sections of the circuit in the field and the Fluke 1520 has stood up to this work well. The 1,000 MΩ dynamic range of the 1520 is essential for accurate leakage testing of current transformers. During these tests, it is necessary to detect leaks in the order of 8 MΩ because transformer leakage is in parallel and there may be 100 or more lights/transformers on a circuit. At 8 MΩ per transformer and 100 transformers, total leakage would reach 800 MΩ. We have used 1520s since 2001 and have not had any meters go faulty or go out of tolerance."

John Meyer is also delighted with the 1520's ease of use. "Our technicians and electricians like the 1520s. They are simple and quick to use. Their readouts are clear and easy to read. We are very pleased with the product."

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Printed in U.S.A. 7/2004 2155809 A-US-N Rev B