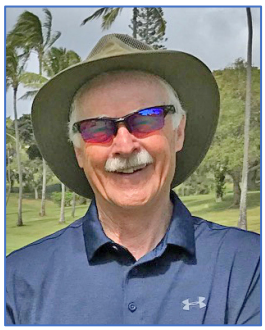
# Innovative Design of Denver Airfield Lighting Control System Sets Industry Standard

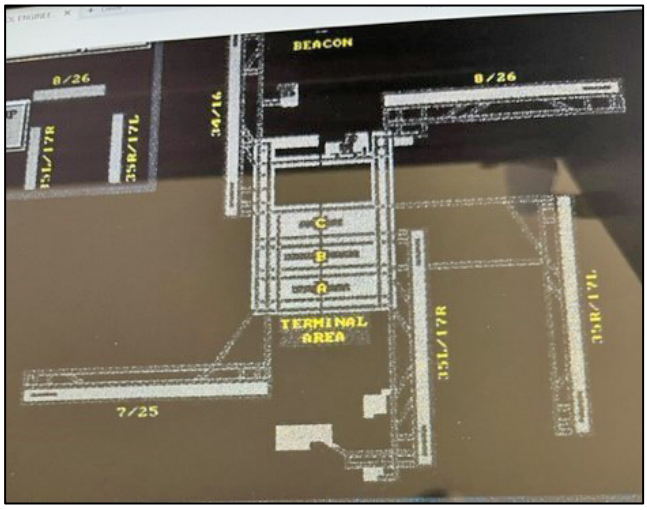
By Dean Rue and Mark Okey

The City and County of Denver started designing and constructing the New Denver International Airport (DIA) in the 1988-1989 timeframe. CH2M HILL was selected to design the two east-west runway-taxiway complexes, out of the five new initial runway-taxiway complexes that were planned. Dean Rue was the Design /Project Manager for the runways, and his team was in our Denver Office. The five new runway-taxiway complexes all included the design of the very complicated new low-visibility airfield lighting system required by the Federal Aviation Administration (FAA).



Dean Rue

The control system for the low-visibility lights was required to be a new system, as the existing control systems available in the industry were very rudimentary and not sophisticated enough to safely provide the necessary control. They were provided by a couple of airfield lighting equipment manufacturers and used on-off toggle switches. They could not respond quickly enough to safely meet the new FAA's low-visibility requirements to control the aircraft ground movements on multiple runway and taxiway systems. Since CH2M HILL was designing the airfield lighting system for the two runways, we were approached by DIA to provide technical information on the best way to control the lights.




DIA Layout Showing 3 N-S and 2 E-W Runways

Mark Okey

The design of the airfield lights for our two runways was led by Rod Berklund's team in our Corvallis office, and the design of the electrical circuiting for our two runways was led by John Turner's team in our Denver office. John was also involved in the design of the electrical circuiting for the other three runways, which were designed by others; but they were required for our control system for all five runways. Mark Okey was engaged as he was our lead controls programming engineer in our Denver office. Mark and his team had experience with providing Touch Screen Control Systems for other applications and recommended the

innovative use of a Touch Screen Control System for the control system for the airfield lights on all five runways.

Dean found an old VHS tape recently in his basement that is a 9-minute promotional for the completed system. CH2M HILL hired a local television news anchor to do the narration and a helicopter to film the operation of the 18,000 lights on the airfield.

The Landing Lights owned by FAA are located outside of the end of the runway and were designed and installed by the FAA. All the lights on and near the surface of the runway and taxiways are owned by DIA. They were designed by CH2M HILL for our two runways and installed by DIA.

The new FAA requirements were met by the system called Surface Movement Guidance Control System (SMGCS) and dictated the complicated requirements for the safe operation of aircraft on the ground during low-visibility conditions. The SMGCS provided white in-pavement runway centerline lights, green in-pavement taxiway centerline lights, red in-pavement stop bar lights, and yellow caution lights on the taxiways at the entrances to the runway.

When an aircraft landed on the runway during low visibility, the touch screen lighting control system provided a pre-programmed, safe pathway with centerline taxiway lights, from the centerline of the runway onto the taxiway system and then to the gate at the terminal/concourse where the aircraft parked. This required that of all the 18,000 lights, only the ones on this one pathway, were illuminated, so no other aircraft could be on the same path.

It was required that any action for a SMGCS command had to be under 2 seconds, and all other commands had to be under 6 seconds. The system automatically started a back-up diesel-powered generator after 8 seconds to power the runway lights in case the utility power failed. This was required to ensure the runway lights would remain on for an aircraft that was on a final decent for landing.

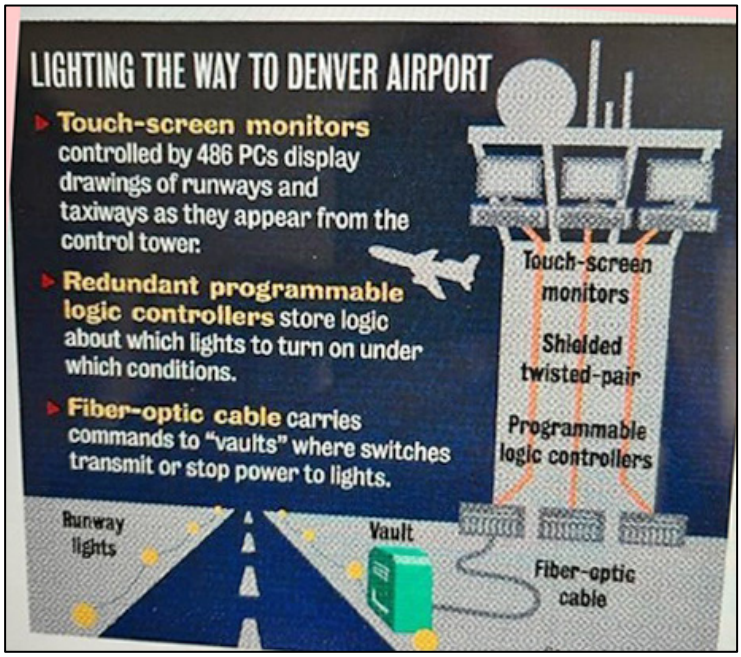

TOUCHSCREEN PCs help control runway lights at DIA

Mark Okey at the Controls

CH2M HILL custom designed a one-of-a-kind control system for DIA that had the capability to handle the sophisticated FAA requirements for a complicated airport system. Mark Okey was the project manager and lead programmer for the system. There was a design/programmer team of nine working on the system over approximately a 2-year period to meet the deadline for the original opening of DIA in 1993. The DIA opening was delayed by the automated

baggage system installation and operation, so the actual opening of DIA was in early 1995. But the Lighting Control System was fully operational by the original opening schedule for 1993.

Mark and his team spent 6 months manually testing the touch screen design in the office prior to installing and testing in the DIA Air Traffic Control Tower (ATCT). There were four touch screen systems installed in the ATCT as there are four active FAA controllers working the air traffic at the same time. As the lighting circuits were installed in the field, Mark had a hard-fought approval from DIA to require the construction contractor to work nights to activate the lights so the control system could be tested. Mark and his team spent many nights in the ATCT, working with FAA to test and accept the Touch Screen Control System. The FAA also had an inspector that was on the airfield, checking to make sure the correct lights came on as the Touch Screen Control System was activated from the ATCT. After extensive testing, DIA and FAA accepted the system. It went operational and was praised by the ATCT staff for its ease of use and accuracy.



DIA Touch Screen Lighting Control System Schematic

After the success of the Touch Screen Control System at DIA, CH2M HILL was selected to design a Touch Screen Control System at Bergstrom-Austin International Airport, TX.

However, the airfield lighting equipment manufacturers stepped up their game and responded by vastly improving their lighting control systems. They included their cost of design in their cost of the lighting equipment (lights, regulators, signs, transformers, etc.) and sold their control system with no extra cost for the design. Since CH2M HILL had to charge a normal design fee for the cost to design our system, clients saw no advantage in paying CH2M HILL "extra" for the design. So, the Denver system was the most sophisticated and largest system we designed and was installed. When upgrades were needed, the lighting manufacturers designed and replaced the CH2M HILL lighting control system for "free" when they supplied all the other electrical equipment for their system.

The design and programming of the DIA Touch Screen Lighting Control System was truly innovative and set the industry standard for the future Touch Screen Lighting Control Systems.