



## CASE STUDY:

**Micro Systems, Inc. and NKK Switches  
Develop the Next Generation Unmanned  
Aerial Target Vehicle Control System**

## Introduction

Micro Systems, Inc. designs, develops and manufactures electronic components, subsystems and systems that are used in military and defense applications. They are the leading supplier of unmanned aerial target command and control systems. These systems are used by the US Department of Defense and allies for advanced aerial target drone operations.

## Challenges

Micro Systems' command and control systems have been used with most every U.S. aerial target drone system for the past decade. These systems are used for both weapons testing and training evaluations. They simulate threats ranging from cruise missiles to supersonic aircraft flying at altitudes ranging from 7 feet to 40,000 feet.

Their equipment needs to meet high-performance requirements, stringent safety, and reliability requirements. To meet these requirements Micro Systems is extremely selective when choosing component vendors to support their systems. Potential vendors are rated on material quality, contract compliance, and on-time delivery.

Maynard Factor, Micro Systems, Inc.'s business development engineer explains:

“ There is a significant effort required for target drone operations and our customers demand high quality, reliable systems to support their missions. Target drone missions are very expensive and there is no tolerance for equipment malfunction. Micro Systems recently recognized a need in the industry for a new, portable, low-cost system that would be easy to use and maintain. As a portable command and control system, we knew this system would also have to be extremely durable if it was to live up to our standards as well as the standards of our customers.

Micro Systems leveraged the design of the new portable command and control system from its existing Modular Networked Target Control Equipment (MONTAGE). MONTAGE is a field proven and successful design that has supported over 1,000 high reliability missions worldwide.

The engineers wanted a new hardware command and control system that was portable, durable, and cost-effective. The solution was the Portable Aerial Target System (PATs) and the challenge was to develop the new system in less than 6 months. Among the key challenges faced by engineers on this new design was the quality and durability of the individual switching components PATs would require.

Factor commented: “For the command panel design we looked at many different vendors of pushbutton and toggle switches but it always came back to quality and lead time. We needed a supplier that could provide switches that could function reliably and safely in adverse environmental conditions and also support an accelerated delivery schedule of only 6 months; a schedule that is almost unheard of in the industry.”

Micro Systems also needed the solution to have gold contacts and feature a solder lug connection option. “Gold contacts were a requirement due to the low electrical current that was available in various measurement circuits used in the system,” said David Ault, lead engineer on the PATS project. “The solder lug requirement was driven by cost and manufacturability considerations.”

In short, Micro Systems wish list to create their new unmanned aerial target vehicle control system was:

1. They need to meet stringent safety and reliability requirements. There is a zero tolerance for equipment malfunction and breakdown. It also needs to be a low cost and easy to maintain solution, that is very durable.
2. They needed to develop the new PATS in less than 6 months, which requires quick vendor delivery.



## Solution

Micro Systems selected NKK's bushing mount toggle switches. They incorporated 31 of NKK's toggles that feature black bat lever caps.

"We looked at a number of top vendors," Ault said. "In the end, competitive solutions weren't a good fit as we felt the quality was not suited for our applications or had extremely long delivery times that simply would not meet our schedule. NKK had the best quality solution and offered a satisfactory lead time."



NKK's miniature toggle switches feature several distinguishing characteristics, including:

- A high torque bushing construction to prevent rotation or separation from the frame during installation
- An anti-rotation design on all non-cylindrical levers
- An interlocked actuator block to prevent switch failure due to biased lever movement
- A stainless-steel construction to resist corrosion.

In addition, the anti-jamming actuator protects the switch from mechanism damage caused by downward force on the toggle. The terminals are epoxy sealed to prevent the entry of flux, solvents, and other contaminants. The toggles are UL Recognized, C-UL Recognized, and CSA Certified. All models feature UL 94V-0 flammability ratings. Water-tight and dust-tight versions are available and qualify to IP 67 of IEC60529 Standards. The series meets RoHS directives for environmental safety.



NKK was also able to quickly provide Micro Systems' engineers with sample switches to aid them in their design and prototyping efforts. This allowed Micro Systems to ensure that they had the right solution before fully committing to a purchase. Factor said:

“ When developing a new command panel, it's always nice to be able to fabricate a functional prototype with the potential system components before fully committing to one solution. It's one thing to see specifications on a datasheet, but when it comes to cutting holes in metal as part of the manufacturing process, you want to make sure that you've got all your ducks in a row. We really appreciated the fact that NKK was so good about getting us samples to use in our prototypes.

NKK was able to meet Micro Systems wish list, with:

1. *Superior quality and design of their switches. Including epoxy sealing and an anti-jamming actuator.*
2. *NKK meeting their timeline with delivery speeds that are unheard of the in the industry. They were also able to get samples to them quickly, as well.*

PATS' innovative design debuted at the National Defense Industry Association annual symposium in Savannah, Georgia, in late October 2009. PATS emerged as the gold standard for many aerial target applications. The new command panel is a sleek, with an ergonomic design that uses a light weight molded plastic enclosure and precision joystick. The entire system can be broken down and stowed in convenient ruggedized transit cases for high mobility. The design allows for PATS to be transported to any flight test range and become functional in minutes.



# Meet the M Series

## Miniature Toggles

- Antirotating design, standard on noncylindrical levers, mates toggle and bushing; bottom of toggle has two flattened sides which fit into a complementary opening inside bushing.
- Antijamming design protects contacts from damage due to excessive downward force on actuator.
- High torque bushing construction prevents rotation or separation from frame during installation.
- High insulating barriers increase isolation of circuits in multipole devices and provide added protection to contact points.
- Molded diallyl phthalate case has a UL flammability rating of 94V-0.
- Epoxy sealed terminals prevent entry of solder flux and other contaminants.
- Prominent external insulating barriers increase insulation resistance and dielectric strength.
- Interlocked actuator block, lever, and interior guide prevent switch failure due to biased lever movement.
- Clinching of frame to case well above base and terminals provides 1,500V dielectric strength.



## Waterproof Miniature Toggles

- Inner o-ring and external rubber washer seal the switch to achieve IP67 of IEC60529 Standards (dust tight and water protected for temporary immersion).
- Waterproof boot at base of toggle further ensures protection against wet environments.
- Actuation provides smooth, sturdy tactile feel.
- Polished, chrome-plated actuator paired with the waterproof boot not only delivers in terms of sleek design, but also functionality and reliability.
- Superb quality and construction design prohibit entry of harmful particles that may otherwise compromise lever operation.

## About Micro Systems, Inc.

Since 1976, Micro Systems has been exceeding its customers' expectations in engineering, production, and services. They design and manufacture airborne transponders, GPS-tracking pods, real-time microprocessor-based control systems, unmanned vehicle control stations, Flight Termination Systems (FTS), Electronic Warfare (EW) threat simulators, radar environment simulators, Electronic Counter Measure (ECM) target generators, digital RF memories, and associated test equipment.

Micro Systems, Inc., a wholly owned subsidiary of Kratos Defense & Security Solutions, Inc. is an AS9100D: 2016 & ISO 9001: 2015 certified company headquartered in Fort Walton Beach, Florida. For more information, visit their website at: [www.kratosdefense.com](http://www.kratosdefense.com).

## About NKK Switches

NKK is a leading designer and producer of electromechanical switches. They offer one of the industry's most extensive selections of switches. These include: tactile, tilt, touch screen, membrane, illuminated, process sealed, miniature, specialty, surface mount and programmable switches. NKK has produced more than 3.5 million toggle, rocker, pushbutton, slide, rotary, DIP rotary, keypad, and keylock switches. Each switch can be used as the foundation for a customized design. All of NKK's switches are designed and manufactured for quality and dependability. NKK has been the benchmark for reliability for over half a century.

NKK leads the marketplace with a commitment to constant innovation, high reliability, customization, and excellence. The company provides a full suite of customized solutions that include: design, programming, printing, and support. Downloadable 3D CAD models of the company's switches are available, allowing design engineers to quickly integrate complex models into their designs at no charge. NKK maintains a complete network of qualified representatives and distributors through the United States, Canada, Central and South America, Europe and Asia.

Engineers rely on the broad product line, specialized design expertise, and customer support of NKK Switches. For more information, visit: [www.nkkswitches.com](http://www.nkkswitches.com)

