



## HELICOPTER SLIP RINGS

PROVEN RELIABILITY IN THE MOST DEMANDING OF APPLICATIONS AND ENVIRONMENTS



Today's rotorcraft applications place unique demands on slip ring technology because of equipment requirements and environmental conditions. From de-ice applications (with their need for high rotational speed, exposure to weather conditions and high vibration) to weapon stations and electro-optic sensor systems (with high bandwidth signal transmission), helicopter slip rings must perform in a highly reliable mode with the latest product advancements.

Our many years of experience in this arena has allowed Moog to be a leader in slip ring technology for rotorcraft applications. Employing a combination of precious metal fiber and composite brush technology for signal and power transfer, we are qualified to meet the most demanding applications effectively and economically. Contact us with your requirements so we can help you find a solution.

### FEATURES

- Multiple contact technologies suited for the application
  - Monofilament wire brush
  - Multiple precious metal fiber brush
  - Composite brush
- Environmental sealing
- EMI Shielding
- FEA structure analysis
- High shock and vibration capabilities
- Wide operating temperature envelope
- Vertical integration of position sensors and ancillary products
- High frequency bandwidth
- High reliability and life
- Redundant bearing designs

### TYPICAL APPLICATIONS

- Blade de-ice
- Blade position
- Tip lights
- Flight controls
- FLIR systems
- Target acquisition systems
- Weapon stations

# HELICOPTER SLIP RING DESIGN CRITERIA

Electrical slip rings are used in helicopter, tilt-rotor and rotorcraft applications for a variety of applications. Historically, slip rings were initially intended for use in blade de-ice and tip-light applications where electrical power was required for the main and tail rotor blades. Today, with the advent of tilt-rotor aircraft, slip rings are transmitting flight control and blade position data. Reliability and data integrity has never been more important.

Advanced aircraft now carry infrared and electro-optic sensors, target acquisition systems and weapon stations requiring unrestrained rotation. As a result, slip rings (and our related motion technology components) play a much broader and important role.

In addition to producing compact, light weight and highly reliable slip rings, we have provided units that combine conventional electrical slip rings with resolvers, encoders, fiber optic rotary joints and other commodities.

## Design

Moog can offer the most valuable design assistance by being involved early in the development of the aircraft and related subsystems. The internal design of the slip ring capsule will be driven by the circuit

requirements, need for ancillary products and the space available for mounting the slip ring capsule. We can offer the following design criteria:

- Use of existing designs
- Single drum
- Concentric drums
- Single pancake
- Stacked pancakes
- Combination of designs
- Clear through-bore to allow for another device or bearing structure
- Connectors - case mounted or attached to cables
- Mechanical support - on either side of the rotating interface including the stand pipe

## Power Circuits

Theoretically, there is no limit to the amount of power that can be transferred by the slip ring assembly. Most rotorcraft de-ice slip rings carry less than 100 amperes of current. It is important that the power duty cycle be defined as early as possible in the design stage. Thermal design requirements can affect other design parameters. If the space available for the slip ring capsule is limited, it may be advantageous to transfer the power at higher voltages. Power can be grounded either through the case of the slip ring or insulated from the case.

## Signal Circuits

Signal requirements for a rotorcraft slip ring capsule continues to be increasingly demanding, particularly with the advent of tiltrotor aircraft, electro-optics and target acquisition systems. The circuit functions and electrical isolation requirements have a significant impact on the design of the slip ring. While a de-ice system has few signal requirements, tiltrotor aircraft require flight control circuitry and electro-optic sensors often requiring high-bandwidth video, analog and digital control circuitry.

It is often important that sensitive circuits have additional isolation from other circuits and impedance matching for high bandwidth. Such requirements can be much better addressed early in the design stages.

## Slip Ring Experience

Rotorcraft applications pose a variety of design challenges. High vibration, harsh environments and high reliability demands products from a proven supplier. Moog has a long history of supplying slip ring and motion technology (motors, resolvers, fiber optic and subsystem) products to the rotorcraft industry. Current fielded systems include Apache, Blackhawk, Seahawk, EH-101, S-92, V-22, CV-22 and BA-609 to name a few. Let us put our experience to work for your next rotorcraft application.

## COMPONENTS FOR HELICOPTER SYSTEMS

