

# Temperature Sensor Applications for Aerospace

*Sensing throughout the interior and exterior of the aircraft*

## Overview

Minco has supplied temperature sensors for aerospace applications for over 50 years. During this long history, the ultra-high reliability needs of the aerospace market have become engrained in our methods and processes. As with most good stories, it starts at the beginning – with our New Product Introduction (NPI) process. Our team based approach is a phased multi-step program highlighted by customer requirement analysis, risk assessments and design for manufacturability (DFM) reviews at the bid stage, followed by a comprehensive design and process risk analysis, leading to prototyping and post-build reviews targeted at confirming or further refining the design and processes. This meshes well with the various stages of typical aerospace projects including the kick-off meeting (KOM), preliminary design review (PDR) and critical design review (CDR) and the approach allows Minco to have fewer product development iterations, ensure robustness of the final product, and minimize delays in time to market. Finally, our project management team ensures deliverables are well-understood and delivered on-time.

Minco’s advanced temperature sensor technology and manufacturing capabilities support high quality, fast responding, light weight and innovative solutions for a wide variety of aerospace applications. The most common aerospace temperature sensor is the platinum Resistance Temperature Detector (RTD) due to its wide temperature range and superior repeatability and stability over time. However, thermocouples and thermistors are also used in select applications.

Our selection of custom and standard RTDs, thermocouples and thermistors are available in a range of configurations to meet specific application requirements for installation, performance, and reliability. The temperature sensor construction has a direct impact on the sensor’s measurement stability, resistance to vibration and shock, thermal time response, resistance to corrosive media and other key performance characteristics. Requirements for our temperature sensors may include

- Single, dual or triple sensing elements
- RTD Temperature ratings up to 600 degrees C
- Time response values below 1 second
- RTCA DO-160G requirements including vibration, shock, altitude, temperature variation and humidity

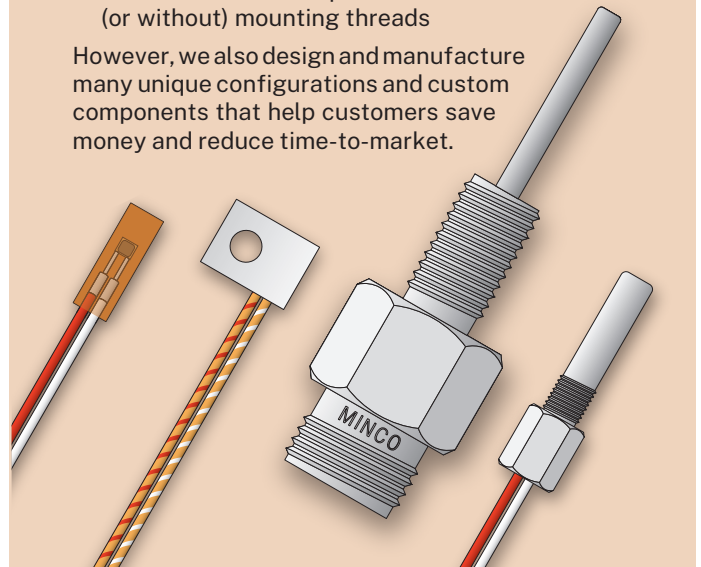
Minco aerospace temperature sensor applications are numerous and found throughout various aircraft systems. Minco sensors are found in the following Air Transport Association (ATA) chapters: Air Conditioning/Air Management, Galley Food and Beverage Equipment, Flight Controls, Fuel, Hydraulic Power, Ice

## Typical Configurations

Over the years, Minco has supplied a wide variety of temperature sensor designs, most of which fall into four basic styles:

- Surface-mount temperature sensor
- Bolt-on temperature sensor
- Temperature probe with threaded fitting and integral connector
- Miniature cased temperature sensor with (or without) mounting threads

However, we also design and manufacture many unique configurations and custom components that help customers save money and reduce time-to-market.



and Rain Protection, Navigation, Water/Waste, APU, Rotors, Powerplant and Bleed Air. Refer to specific applications on the following pages.

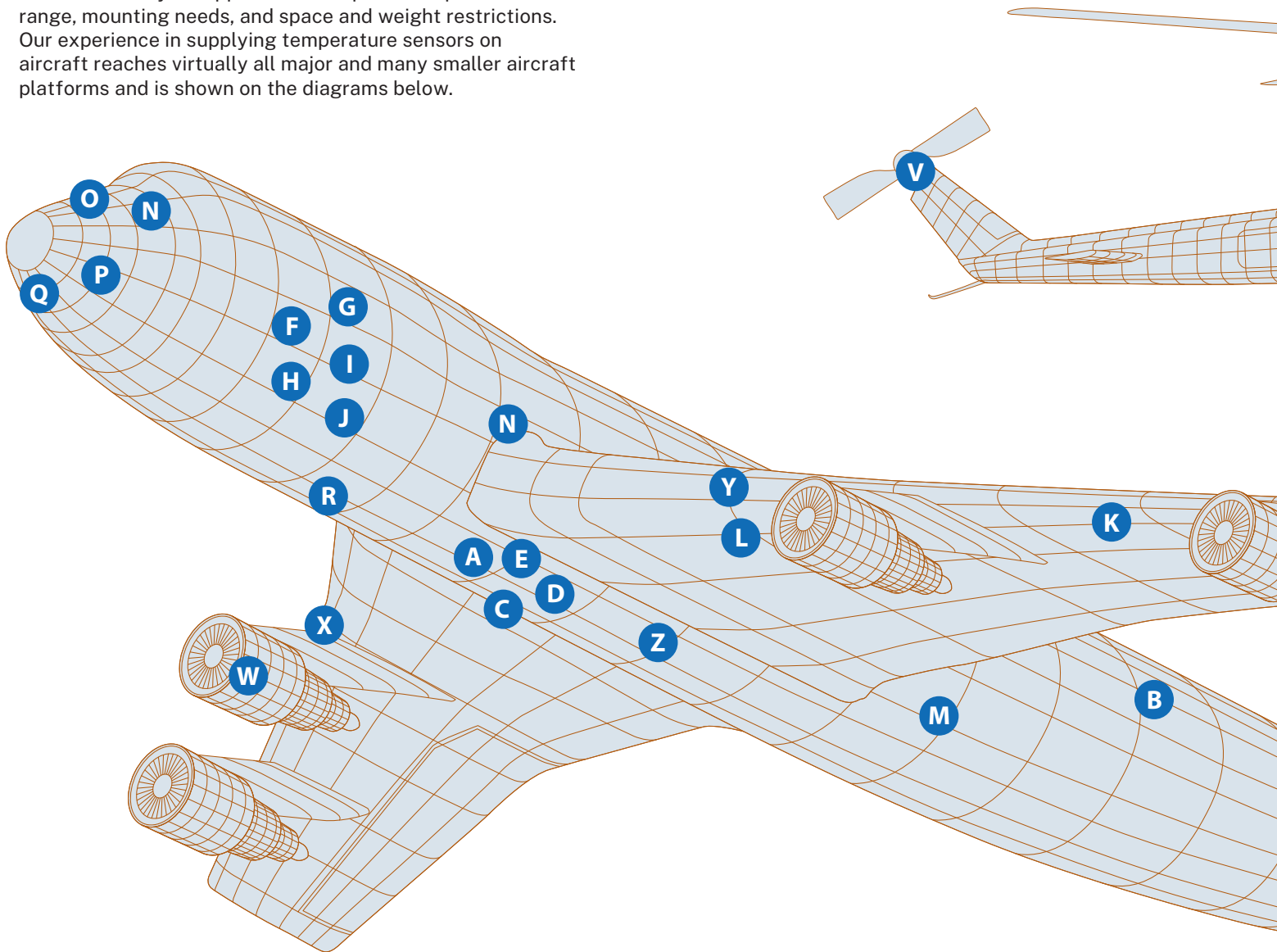
Minco’s aerospace offerings are bolstered by our experience in other markets. We integrate knowledge gained from the small, fast responding needs of sensors for medical diagnostics equipment with the cannot-fail aspect of nuclear power sensor applications. Moreover, we have equipment and processes in house, normally not available to a temperature sensor manufacturer from our instrumentation, flexible heater and flexible circuit product lines. For more about our sensor, instrument, heater and flexible circuit capabilities, please visit [www.minco.com](http://www.minco.com).

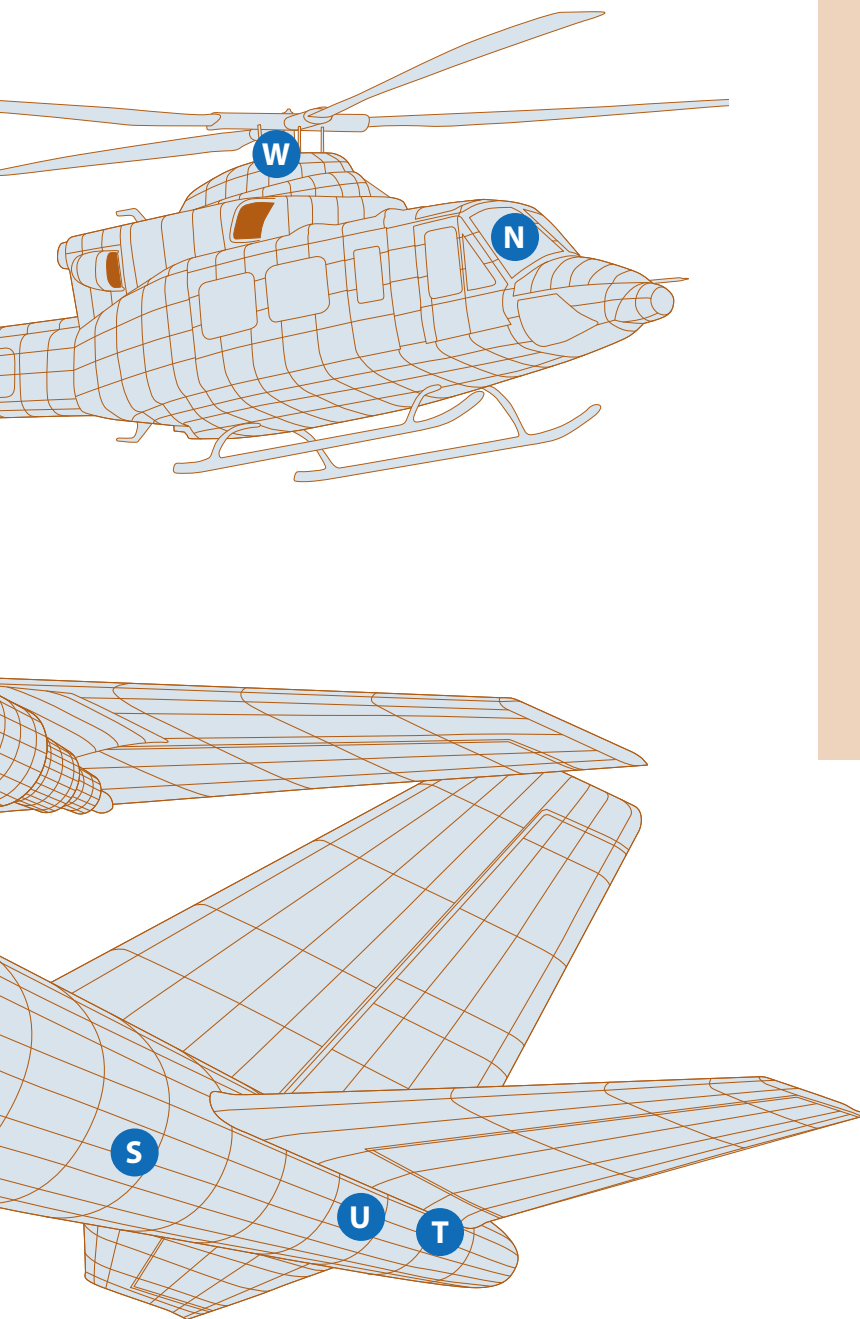
# Temperature Sensing Throughout the Aircraft

*Minco offers sensor solutions for every part of the aircraft*

## Application Overview

Minco aerospace customers regularly ask for “lighter, faster and smaller” products. We are able to meet these needs by leveraging our decades of design experience and proprietary manufacturing capabilities. The end result is a solution suited to meet your application’s required temperature range, mounting needs, and space and weight restrictions. Our experience in supplying temperature sensors on aircraft reaches virtually all major and many smaller aircraft platforms and is shown on the diagrams below.





## Minco's Aerospace Strengths

The following list represents our most common applications:

### ATA 21 Air Conditioning

A B C D E

### ATA 25 Equipment/ Furnishings

F G H I J

### ATA 27 Flight Controls

K

### ATA 28 Fuel

L M

### ATA 30 Ice and Rain

N

### ATA 34 Navigation

O P Q

### ATA 35 Pneumatic

R

### ATA 38 Water/Waste

S

### ATA 49 APU

T U

### ATA 62 Rotors

V

### ATA 71 Powerplant

W X

### ATA 75 Bleed Air

Y

### ATA 79 Oil

Z



# Integrate With Heaters and Flex Circuits

*Deliver superior results with Minco heaters and flex circuits*

## Integrate and Save

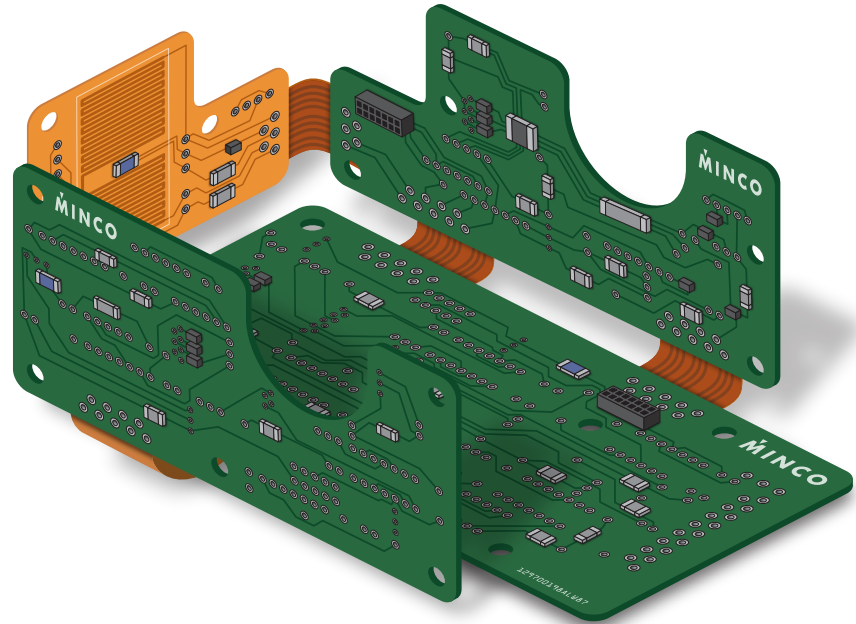
During Minco's six decades of operation, we have come to master a diverse—but related—set of competencies.

In addition to our extensive portfolio of aircraft temperature sensors described in this brochure, Minco supplies numerous custom heaters, heater assemblies and flexible circuits in many for applications such as:

- De-icing heater for airflow sensor
- Galley and floor heaters
- Water and waste-water heaters
- Electrical wing de-icing heaters
- Cockpit display heaters
- Business class seat heaters
- Flex circuits for in-seat entertainment system
- Flex circuits for instrumentation and control systems

Many challenges brought to us require advanced expertise that spans all of Minco's engineering disciplines. Critical systems like avionics, satellites, and medical imaging devices—the purpose of which is too important to be allowed to fail—all benefit from Minco's broad array of specialties. Our application solutions are reliable, innovative, practical, and often include the integration of thermal, flexible printed circuit board (PCB), as well as sensor and instrument design, into a single package.

When Minco Engineers work closely with customers on a project, they often can make cost-saving suggestions. One example might be the wires or flex leads connecting the heater



to other components in the enclosure. Old-fashioned wiring bundles pose installation difficulties due to their bulk and the possibility of miswiring the rig. By combining the various wires into a flat package and adding connector plugs, wiring challenges are eliminated—it's impossible to connect the plugs the wrong way.

Greater space efficiency and lower cost to market make Integrated Solutions a winner in most projects. Contact Minco to learn how our diverse capabilities can be put to work for you.

## Certifications

Minco's Quality Management System complies with a variety of market-specific standards. Minco's experience in each of our market areas enables us to understand their unique quality requirements and what it takes to meet them. We work closely with national and international standards bureaus to develop manufacturing and quality assurance procedures.

Our Quality Management System has been audited and certified compliant with these internationally recognized

standards. In addition, individual products also possess a variety of product-level certifications and accreditations. To view all certifications that Minco carries, please visit our list on Minco.com.

Minco's core quality certifications are noted below:

AS9100/EN9100: 2016

ISO 9001:2015

Nadcap: Electronics AC7119 and AC7119/2