

# TEMPO



## Tropospheric Emissions: Monitoring of Pollution

NASA's Tropospheric Emissions: Monitoring of Pollution (TEMPO) mission will observe Earth's atmosphere in ultraviolet and visible wavelengths to determine concentrations of key atmospheric pollutants across North America. This data will advance air quality research by determining how air pollution affects climate change and air quality on a continental scale.

*Image: TEMPO Instrument.*



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## Overview

TEMPO utilizes a geostationary ultraviolet/visible (UV/Vis) spectrometer to provide regional, hourly measurements of ozone, nitrogen dioxide, sulfur dioxide, formaldehyde and other pollutants during daylight hours. For the first time, the spectrometer will provide scientists with high resolution and frequency observations from Mexico City to Canada and from coast to coast. The instrument will track pollution at micro-urban scales (an area approximating 1.25 by 2.8 miles), improving air quality prediction accuracy by an expected 50 percent.

TEMPO launched on a commercial satellite April 7, 2023 as a hosted payload to an orbit about 22,000 miles above Earth's equator. TEMPO is NASA's first Earth Venture Instrument mission. Earth Venture missions are small, Principal Investigator-led, cost-capped and focused research investigations that support larger NASA missions.

## Our Role

Ball Aerospace was responsible for building TEMPO's spectrometer and telescope using a two-axis scan mirror. With more than 30 years of experience developing UV/Vis spectrometers, Ball leveraged its other successful programs, such as the James Webb Space Telescope and the Ozone Mapping and Profiler Suite (OMPS), for the TEMPO mission.

In tandem with TEMPO, Ball produced the Geostationary Environmental Monitoring Spectrometer (GEMS), a joint development effort by Ball and the Korea Aerospace Research Institute (KARI), South Korea. Integrated onto KARI's GEO-KOMPSAT-2B satellite, GEMS launched successfully on February 18, 2020. The two instruments share much of the same technology, resulting in design and production efficiencies.

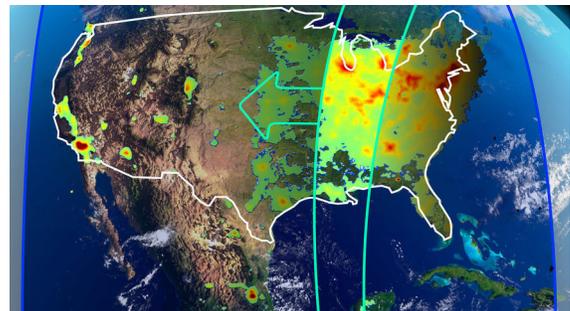
Built under a firm fixed-price contract with NASA's Langley Research Center, TEMPO's spectrometer exemplifies our long-standing expertise in producing cost-effective solutions for Earth observation and remote-sensing missions.

TEMPO is our first civil instrument in geostationary orbit and the first Ball instrument to be hosted on a geostationary communications satellite.

## Quick Facts

- TEMPO is the first NASA Earth Venture Instrument
- TEMPO and GEMS are the first space-based UV/Vis light air quality spectrometers in geostationary orbit
- The TEMPO instrument will collect regional, hourly readouts of atmosphere data over North America
- TEMPO is flying 22,000 miles above Earth's equator
- TEMPO's spectrometer is like GEMS, which was developed jointly by Ball Aerospace and KARI
- The TEMPO instrument is Ball Aerospace's first geostationary instrument for NASA

Ball is part of a team that has extensive experience in measuring the components of air quality from low Earth orbit. The TEMPO team includes the Smithsonian Astrophysical Observatory; NASA's Langley Research Center; NASA's Goddard Space Flight Center; the U.S. Environmental Protection Agency; and several U.S. universities and research organizations.



*Credit: NASA,  
Pollution measurement from space*



### Ball Aerospace

303-939-4000 • Fax: 303-939-6104  
info@ballaerospace.com • www.ball.com/aerospace