



Tropospheric Emissions: Monitoring of Pollution

TEMPO

NASA's Tropospheric Emissions: Monitoring of Pollution (TEMPO) mission observes Earth's atmosphere in ultraviolet and visible wavelengths to determine concentrations of ozone, nitrogen dioxide, sulfur dioxide and other pollutants across North America. This data will advance the research of chemical concentrations in our atmosphere by determining how these particulates impact weather patterns and human health on a continental scale.

BAE SYSTEMS

Overview

TEMPO utilizes a geostationary ultraviolet/visible (UV/Vis) spectrometer to provide regional, hourly measurements of ozone, nitrogen dioxide, sulfur dioxide, formaldehyde and aerosols during daylight hours. For the first time, the spectrometer is providing scientists with high resolution and frequency observations from Mexico City to Canada and from coast to coast. The instrument tracks atmospheric constituents at micro-urban scales (an area approximating 1.25 by 2.8 miles), which will improve 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

BAE Systems was responsible for building TEMPO's spectrometer and telescope using a two-axis scan mirror. With more than 40 years of experience developing UV/Vis spectrometers, BAE Systems leveraged its other successful programs, such as Solar Backscatter Ultraviolet Radiometer (SBUV/2), Stratospheric Aerosol and Gas Experiment II/III, and the Ozone Mapping and Profiler Suite for the TEMPO mission.

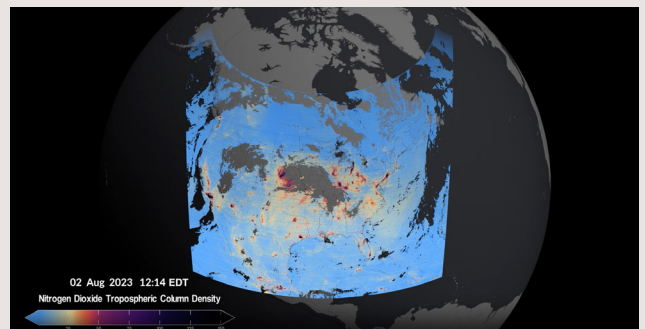
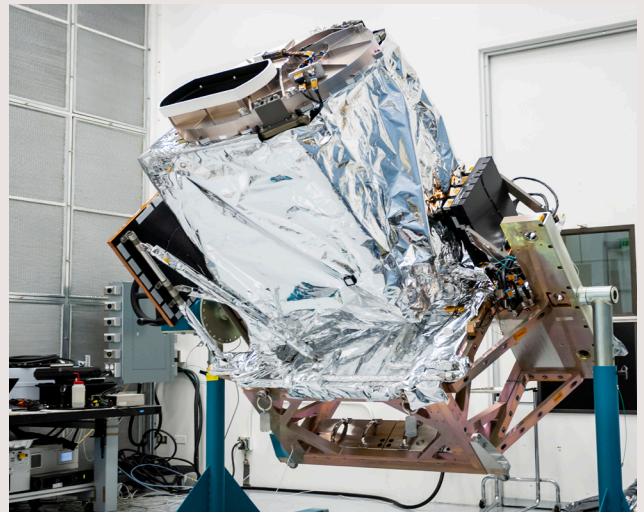
In tandem with TEMPO, we produced the Geostationary Environmental Monitoring Spectrometer (GEMS), a joint development effort with the Korea Aerospace Research Institute (KARI), South Korea. Integrated onto KARI's GEO-KOMPSAT-2B satellite, GEMS launched successfully on February 18, 2020. The two instruments 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.

BAE Systems is part of a team with 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.

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 collects regional, hourly readouts of atmospheric 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 BAE Systems and KARI
- TEMPO is a firm fixed-price contract



Top: TEMPO pre-shipment; Bottom: Credit: NASA's Scientific Visualization Studio, first light image from TEMPO