

Cryogenic and Non-Cryogenic Optical Liquid Level Instrument for Stratified Conditions

A simplified, cost-saving measurement device using optical transmission properties



Innovators at NASA's Marshall Space Flight Center have developed a unique prototype for measuring the liquid level in a tank, employing a novel process. The technology can operate in a wide range of environments, including high and low temperatures and pressures, and is simpler and less expensive than other optical sensing techniques. The instrument also provides far greater accuracy and faster results in cryogenic conditions than typical cryogenic liquid metering methods. It is ideal for cryogenic and non-cryogenic ground tank metering applications, and zero-gravity systems that include stratification or settling techniques.

Benefits

- **Versatile:** Operates at high and low temperatures and pressures, functions in corrosive environments, and provides highly accurate metering for both cryogenic and non-cryogenic liquids
- **Precise:** Allows accurate liquid level measurements to 0.1% of the optical fiber length
- **Safe:** Avoids an explosion hazard—requires no electrical signals in the tank
- **Fast:** Offers a very rapid response time (up to gigahertz data rates), enabling measurement of rapidly changing fluid levels or sloshing liquids
- **Flexible:** Accommodates snaking through access ports or shaping to fit tank contours
- **Economical:** Incorporates directly into a plastic tank, reducing cost and eliminating the need for holes in the tank in some applications



The Technology

What it is

NASA's technology provides highly accurate and versatile liquid level metering in a wide range of operating environments.

NASA's device for measuring liquid levels in tanks was initially developed for rocket engine testing. Scientists needed to determine the amount of cryogenic liquid that was being used in the testing quickly and accurately—data often very difficult to obtain because such systems usually involve constant mixing between gaseous and liquid states, which can lead to turbulent flow, cavitation, and sloshing.

Why it is better

Other sensors that measure liquid levels in tanks require complicated tank modifications and detection instruments, increasing cost and complexity. Other cryogenic metering systems register the thermal change between liquid and gas fluid phases, limiting accuracy in cryogenic conditions. In contrast to these systems, NASA's device allows operation at high temperatures and pressures in corrosive environments and can precisely measure liquid levels to 0.1% of the sensor length with gigahertz data acquisition rates.



Licensing & Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to inquire about the licensing possibilities for the Cryogenic and Non-Cryogenic Optical Liquid Level Instrument for Stratified Conditions technology (MFS-32642-1) for commercial applications.

Commercial Applications

Aerospace

- Rocket propulsion testing
- Engine fuel tanks
- Cryogenic tanks

Automotive

- Liquid hydrogen fuel tanks
- Petroleum, gasoline, and liquid natural gas tanks

Foods and Pharmaceuticals

- High temperature, contamination-free storage and transportation

Aviation

- Jet engine fuel tanks

For More Information

If you would like more information about these technologies, please contact:

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