

# Novel Vent Design Features Variable Flow Control, Rain Protection



Scientists at NASA's Marshall Space Flight Center have designed a vent that can be useful for purging closed compartments, while preventing backflow and foreign object entry. The technology uses a system of configurable devices to provide variable flow control and prevent water, insects, or undesired gases from entering a vented space. The technology is effective even in high winds, while conventional rocket vent systems that use mesh screening, flapper valves, and high flow rate purge gas to protect sensitive equipment are not completely effective in extreme weather conditions. Developed for venting and balancing flow in closed rocket compartments, which is critical for NASA, the military, and commercial rocket manufacturers, the design is useful for any device needing a one-way purge valve, flow balancing between compartments, or a general air vent where rain and gas reverse entry must not occur. The system also concentrates generated acoustic energy in a forward cone and can direct noise away from certain areas such as work platforms.

## Benefits

- **Adaptable:** Accommodates variable flow rates, maintaining a low, settable differential pressure for both high and low purge flow rates
- **Simple:** Leverages readily available devices that have been widely used for dozens of years and have few moving parts
- **Configurable:** Features a design effective in a wide variety of arrangements and conditions
- **Durable:** Offers a passive design with no high-wear parts
- **Self-adjusting:** Optimizes the flow of purge gas by opening as gas flow increases and closing as flow decreases; in cases of zero flow, the vent closes automatically
- **Economical:** Utilizes standard parts and materials and leads to more efficient use of purge gas
- **Reduced noise:** Directs noise away from workers or noise-sensitive areas



## For More Information

If you would like more information about this technology or about NASA's technology transfer program, please contact:

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## The Technology

### How it works

Rockets must have a dry gas purge system to keep flammable vapors and water out of closed compartments while they are assembled, await launch, and undergo actual flight. The system protects sensitive equipment and instruments from animal and insect entry, gas back flow, rain entry, condensation, and flammable gas accumulation. While conventional systems purge closed compartments with a combination of mesh screening, flapper valves, and high flow rate purge gas, NASA innovators have designed a configurable system that works with variable flow rates. The innovation can withstand high winds and blowing rain without allowing outside contaminants and water entry.

The system operates in a single-flow direction, creating a one-way vent design. By changing its configuration, gas flow can be optimized. Similarly, the system can greatly increase the operational flow range of the vent, as the device automatically adapts to higher or lower flow conditions. Devices within the system can possess different operational flow characteristics, enabling gas balancing or control that directs flow where needed. The system can be configured for a rocket purge application that requires low flow purge conditions, such as rocket storage. As the purge requirement increases (pre-flight tank loading or rocket ascent), the gas flow rate increases. If the purge gas flow stops, the system closes completely and automatically, protecting the compartment from water, insects, animals, humidity, and outside contaminants.

### Why it is better

Conventional gas purge systems use high flow rate purge gas with mesh screening and flapper valves to protect sensitive electronics. These systems operate only at high flow rates and even then are not always effective. For example, high wind conditions encountered on launch pads allow humid air into purge spaces, and the mesh screening can sometimes be ineffective in preventing small insect entry. Conversely, this new NASA design can control and balance flow rates across multiple vent locations operating at different gas flow ranges while protecting sensitive electronics from animal and insect entry, gas back flow, rain entry, condensation, humidity, and flammable gas accumulation.

Also, while gas flow through screens or openings generates a great deal of noise, this NASA innovation vectors generated acoustic noise in a forward cone so that it can be directed away from noise-sensitive areas, such as work platforms.

## Patent

Marshall has applied for patent protection for this technology.

## Licensing & Partnering Opportunities

This technology is part of NASA's technology transfer 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 licensing the Novel Vent Design technology (MFS-32857-1) for further development and commercial applications.

## Potential Applications

- Rockets (space, military, commercial)
- Building HVAC systems
- Automobile ventilation systems