National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Mechanical and Fluid Systems

Adaptive Camera Assembly

Ergonomic system enables full functionality camera use by individuals with limited mobility & finger dexterity

During the Apollo missions, lightly modified off-the-shelf cameras were used by astronauts to take imagery while performing extravehicular activities (EVAs). These cameras were cumbersome to operate in spacesuits that limit body mobility and pressurized gloves that limit finger dexterity and strength, making it difficult to interact with small camera buttons. Additionally, on the lunar surface, several environmental factors pose risks to continued camera operations (e.g., extreme temperatures, intrusive lunar regolith, radiation effects, vacuum conditions, etc.).

To address these challenges, NASA has developed an adaptive camera assembly designed to enable astronauts dawning spacesuits to easily control all functions of a Nikon Z 9 camera. Not only does this NASA invention address human factors considerations (i.e., ease-of-use), but also functions as an environmental protection system, defending the camera against the effects of extreme environments. NASA's adaptive camera assembly may provide advantages for terrestrial photography and videography applications involving hazardous environments where thick gloves and other thermal protective equipment are required (e.g., industrial foundries, Arctic/Antarctic research, welding, etc.). Additionally, the camera assembly may enable individuals with disabilities or health conditions that limit hand control to participate in photography.

BENEFITS

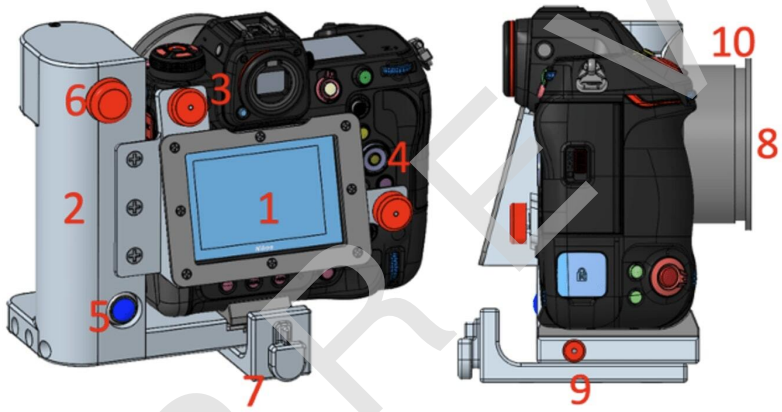
- Ease of use in low mobility and finger dexterity scenarios: Given NASA's adaptive camera assembly was originally designed for use by astronauts on EVA, it enables users with limited mobility and finger dexterity (e.g., individuals with disabilities or wearing personal protective equipment) to easily and intuitively control the Nikon Z 9 camera.
- Ruggedizes the Nikon Z 9 camera: This NASA invention effectively ruggedizes the Nikon Z 9 camera, enabling it to operate in the harshest of environments (extreme high and low temperatures, vacuum, radiation, and more).
- Tested: NASA's adaptive camera assembly has undergone thermal and vacuum testing (demonstrating its ability to withstand harsh environments) and ease-of-use testing, which was performed by astronauts in spacesuits, all with excellent results.

THE TECHNOLOGY

NASA's adaptive camera assembly possesses a variety of unique and novel features. These features can be divided into two main categories: (1) those that improve "human factors" (e.g., the ability for target users with limited hand, finger, and body mobility to operate the device), and (2) those that enable the camera to survive harsh environments such as that of the moon. Some key features are described below. Please see the design image on this page for more information.

NASA's adaptive camera assembly features an L-shaped handle that the Nikon Z 9 camera mounts to via a quick connect T-slot, enabling tool-less install and removal. The handle contains a large tactile two-stage button for controlling the camera's autofocus functionality as well as the shutter. The size and shape of the handle, as well as the location of the buttons, are optimized for use with a gloved hand (e.g., pressurized spacesuit gloves, large gloves for thermal protection, etc.). In addition, the assembly secures the rear LCD screen at an optimal angle for viewing when the camera is held at chest height. It also includes a button for cutting power – allowing for a hard power reset in the event of a radiation event. Two large button plungers are present, which can be used to press the picture review and "F4" buttons of the Nikon Z 9 through an integrated blanket system that provides protection from dust and thermal environments.

Overall, NASA's adaptive camera assembly provides a system to render the Nikon Z 9 camera (a) easy to use by individuals with limited mobility and finger dexterity / strength, and (b) resilient in extreme environments.



Design images of NASA's adaptive camera assembly. Key features include: (1) 10-degree angled screen to improve visibility when the camera is mounted to a user's toolbelt, (2) 3D-printed nylon-composite L-shaped handle, (3) spring-loaded button allowing users to click the "F4" camera button, (4) spring-loaded button enabling picture review directly after a photo is taken, (5) battery power interrupt button triggering a camera hard reset, (6) two-stage shutter button (enabling focusing of lens and image capture), (7) interface for mounting the camera to an astronaut tool mount, tool cart, or rover, (8) lens cover for dust protection, (9) quick release button to disconnect the assembly and camera, (10) groove in the lens cover to hold a protective blanket over the camera.

APPLICATIONS

The technology has several potential applications:

- Camera use by astronauts dawning spacesuits during EVA
- Camera use by individuals wearing thick gloves and other personal protective equipment (PPE)
- Camera use by individuals with disabilities or health conditions limiting finger dexterity and strength
- Camera use in harsh environments (e.g., for Arctic/Antarctic research, winter sports / alpinists, industrial foundries, etc.)

PUBLICATIONS

Patent Pending

More Information

National Aeronautics and Space Administration

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