

**Category:** Engineering

**Integration of Attitude Control Simulations in Mixed Reality Engineering Toolkit**

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The inclusion of attitude control systems in a virtual reality (VR) environment provides a visual representation that can be used to inform mission design and planning in a more effective manner. Virtual reality allows for visibility of conceptual components, such as orbital patterns and spacecraft surroundings, components that can be added to a simulated model for increased understanding of said model's behavior. The program 42 models spacecraft attitude dynamics, and the Mixed Reality Engineering Toolkit (MRET), a collaborative engineering tool in virtual reality, is perfectly suitable for 42's integration to VR. This integration explored the relationship between real data and virtual simulations and how this relationship can be enhanced to fulfill the potential VR holds in its ability to revolutionize the way NASA employees work. The Goddard Mission Services Evolution Center (GMSEC) was used to facilitate communication between 42 and MRET, with data from 42 being used to determine the positions and scales of the instruments representing attitude control factors in the simulated environment. Each instrument was able to be added and removed through the use of a menu that provides brief explanations of its significance. Users can select vectors indicating the relative position of the sun, local vertical-local horizontal axes, an inertial frame grid, and other 3D objects that illustrate significant variables. In terms of spacecraft surroundings, a feature was added to the existing Restore-L simulation that allowed users to choose between eleven cameras in differing positions and 'photograph' the view, emphasizing further understanding of object orientation. Because of virtual reality's capability to produce impossible situations, like allowing every engineer to see a spacecraft's angular momentum in space from the comfort of their desk, the benefits of its abilities are limitless. An example of this integration's application can be seen in the dilemma of safe material retrieval from Bennu in the OSIRIS-REx mission. Creating a VR simulation of OSIRIS-REx and adding spacecraft attitude components can provide engineers with more "tangible" key factors of the mission, therefore assisting in the process of finding the safest time and place to extend the spacecraft's mechanical arm.