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# MAKING DEEP SPACE MORE ACCESSIBLE FOR ALL THROUGH INCLUSIVE INVOLVEMENT IN A VOLUNTEER-BASED RESEARCH LAB

**Abstract**

Currently, entering the space industry is challenging, as the space sector is mainly targeted at a workforce with specific educational backgrounds. Early hands-on experience in a professional organization, accessible for both students and those wanting to change industry is severely limited, closing the doors to talents from non-traditional backgrounds. Next to that, formal education does not adequately provide the multidisciplinary skills needed for a successful career in space, including soft skills and experience in integrating individual methods into a successful space project. With the space industry estimated to triple in the coming decade, providing accessible learning opportunities for the next generation of researchers and engineers is critical.

In this paper, we discuss an educational concept of hands-on education through volunteer-based space technology development. We use the case study of Team Tumbleweed, an international, online-enabled volunteer research lab building a novel wind-driven Mars rover to reach Mars in 2030. The organization was initially founded out of an unmet need for a way to get involved in the industry without prior experience or expertise. Currently, the team has around 70 part-time members, aged 18-46, with 25+ nationalities from 5 continents situated in Delft and Vienna, as well as remotely from across the globe.

We show that an international, volunteer-based team setup that is diverse with respect to age, culture, and background, and is guided by a strong culture focussing on iterative, hands-on learning, plays an important role in space education and workforce development. This setup has been successful in attracting and educating people from a wide variety of backgrounds, curricula, and nations, coming together as an effective team, and making real strides in the space industry. We find that the option of remote work is crucial to making hands-on learning in the deep space industry more accessible. It also allows people outside the standard career path to get involved, and equips fresh university graduates to face the challenges of space innovation. However, his setup is prone to several limitations, such as reduced technical progress of the team and lack of compensation, which are further explored in the paper.

In this study, we discuss how a digitally-enabled, hybrid remote and global volunteer organization united by a strong vision can tackle innovation in the space industry in an integrated manner, and serve as an impactful learning experience to its members.