



NEW YORK UNIVERSITY





Noel Joyce, an Industrial Designer and wheelchair user, shares his story of how he reignited his love for mountain biking, the sport that caused his life-altering injury. In 2006, he broke his back at vertebrae T6 and T7 while mountain biking, losing all feeling and function from just below his chest. This accident ended his career in the Irish Military, dissolved his relationship, and left him with a fraction of his former life. While in the hospital, Noel began contemplating his future, leading him to consider design as a career. He subsequently pursued and obtained a degree in Industrial Design in 2010.



After college, Noel worked as the Head of Design at HAX, a hardware startup accelerator based in Shenzhen, China. In late 2019, Noel returned to Ireland from China and began teaching design and innovation remotely at NYU.

During the pandemic, Noel took up hand cycling and reconnected with mountain biking through his neighbor, Robert Ziabek. They rode the Slieve bloom mountains in the midlands of Ireland, and he found the thrill of mountain biking to be as exhilarating as ever. However, the basic handbike he was using was not suitable for the more difficult trails he desired to ride, and the bike's limitations led to safety concerns. Noel explored purchasing an adaptive mountain bike, but they were costly, starting at around 10,000 USD. Additionally, there were no options available for renting or trying out adaptive bikes.



To solve this issue, Noel offered his design capabilities to several companies, hoping to collaborate on building the ideal adaptive mountain bike. However, no company was interested in his ideas until he found a company in Spain willing to take on the project. The company had extensive experience building road bikes for hand cyclists but no experience with mountain bikes. After almost a year of hard work, Noel received the world's first Carbon Fibre full suspension adaptive mountain bike in September 2021, which enabled him to enjoy mountain biking again with increased safety and capability.



Noel's new bike opened up new possibilities for him as it had an assistive drive, enabling him to reach places he previously couldn't. However, it was closer to a prototype than a finished bike and was a source of trouble with various elements. He experienced a lot of failures with off-the-shelf components such as motors. Despite being a step forward, the bike was a costly and frustrating process due to subsequent problems.

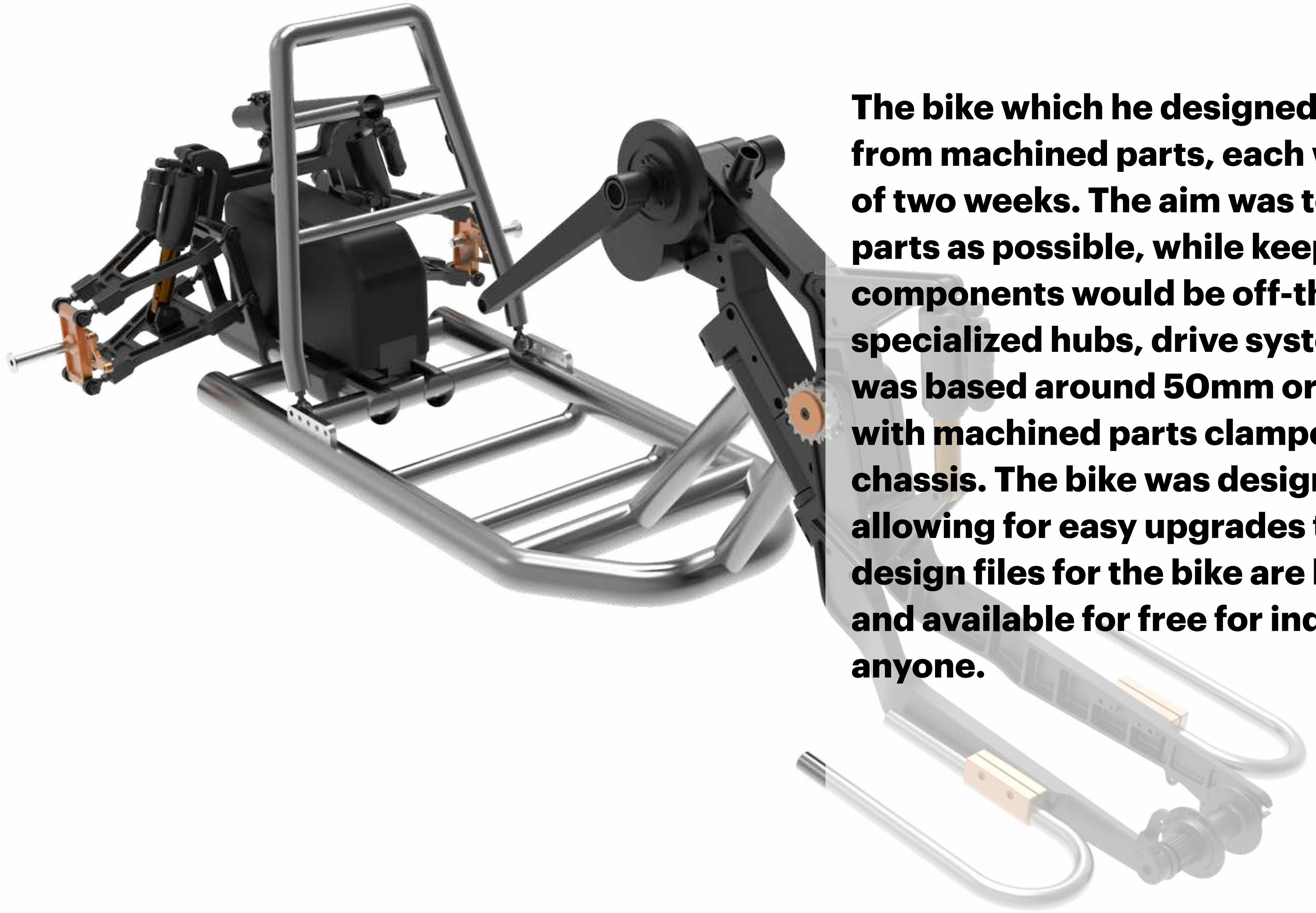
On April 2022, while riding the bike, Noel hit a triple jump at high speed, resulting in a hard landing and a catastrophic failure of one of the key frame components.



A rear suspension A arm completely failed due to his own error, leaving him stranded five kilometers from the trail head in the middle of the woods. After a few makeshift repairs, he was able to get out of the woods. Upon reaching home, Noel contacted the bike makers to inquire about the cost and lead time for a replacement part. The quote he received for the custom-made carbon fiber part was €500, and it would take six weeks to make. This unexpected cost and delay served as the catalyst for what would eventually become Project Mjolnir.



Noel felt frustrated and upset that he had no choice but to pay for and wait for this part due to his disability. He understood that people with disabilities require specialist equipment, which costs more and takes longer to produce. Unlike able-bodied individuals, Noel couldn't order a new frame or go to his local bike shop for the part. He found it difficult to accept that he had no choice and was compelled to wait longer. As a result, he began designing a brand new bike from scratch to avoid a similar situation in the future. He realized that the sport was prohibitively expensive for people with disabilities, as a broken part could result in a long time away from the sport and decreased capability to enjoy the bike over time due to the deterioration of their bodies.



The bike which he designed was to be constructed from machined parts, each with a maximum lead time of two weeks. The aim was to use as few specialist parts as possible, while keeping costs low. All bike components would be off-the-shelf with no need for specialized hubs, drive systems or brakes. The design was based around 50mm or 2 inch aluminum tubes, with machined parts clamped to them to form the chassis. The bike was designed to be modular, allowing for easy upgrades to be made as desired. The design files for the bike are being made open source and available for free for individual private use by anyone.

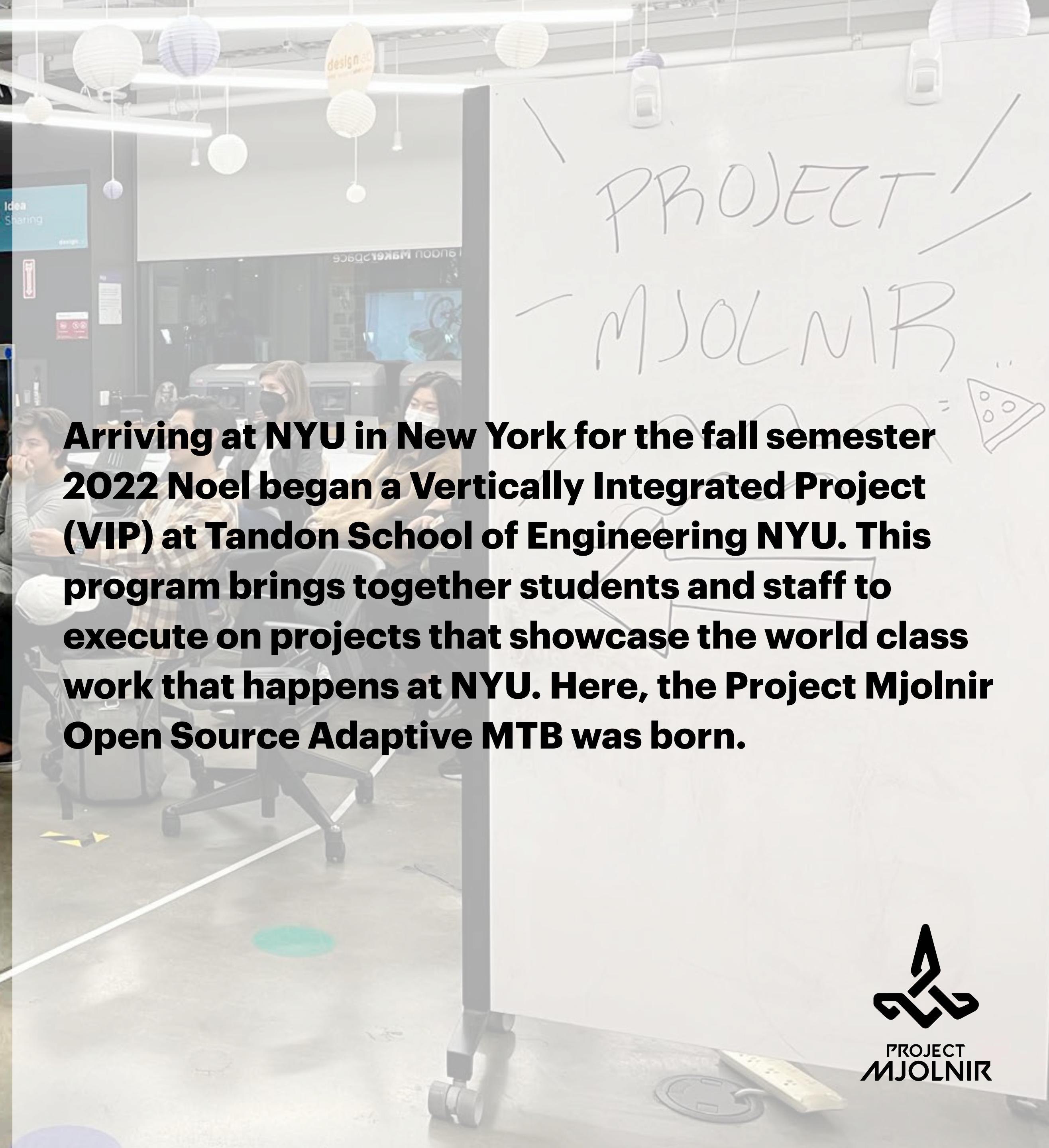


Noel began designing the most complex version of the bike in May 2022, with the first design files completed by the end of June.

The first set of parts arrived in July, and the assembly of the front and rear suspension modules was carried out to test their fit and function.



The next stage was to design the frame set that would join the suspension modules together and complete the bike.



Arriving at NYU in New York for the fall semester 2022 Noel began a Vertically Integrated Project (VIP) at Tandon School of Engineering NYU. This program brings together students and staff to execute on projects that showcase the world class work that happens at NYU. Here, the Project Mjolnir Open Source Adaptive MTB was born.





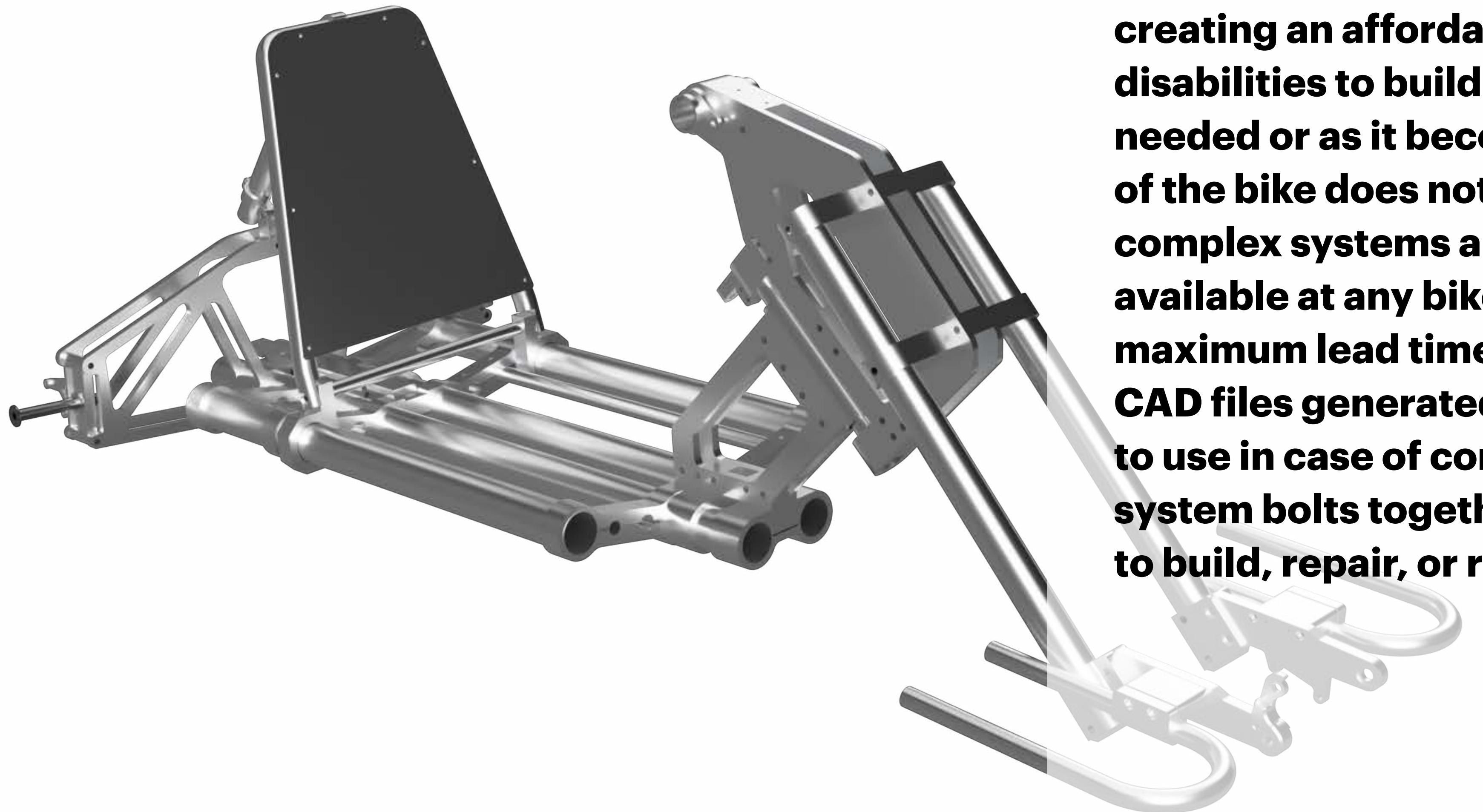
By December 2022, Mjolnir FS 1.0 (FS = Full Suspension) the first version of the Open Source Adaptive MTB was assembled in Noel's kitchen in Ireland.





In early January 2023, it began to be subjected to rigorous testing in real world conditions. This testing is being continuously carried out and the resulting information from this work is informing the development of the VIP project at Tandon.

Since January 2023, Noel and his team have been designing a simplified version of the bike, named Mjolnir R 1.0 (R = Rigid). This version is aimed at creating an affordable platform for people with disabilities to build a bike they can upgrade as needed or as it becomes affordable. This version of the bike does not feature any suspension or complex systems and uses standard bicycle parts available at any bike shop. All frame parts have a maximum lead time of 2 weeks to produce, and the CAD files generated in Fusion 360 will be available to use in case of component breakage. The entire system bolts together, requiring no specialist skills to build, repair, or replace a part.





The team's objective is to complete four bikes in four locations over the next four months. The locations are NYC, Ireland, Abu Dhabi, and Shanghai. The first bike was assembled and tested in NYC April 2023 and was showcased at Tandon School of Engineering. It is the first Adaptive MTB in NYC and will be the first Adaptive MTB to be used on MTB trails in NYC.

The second bike will be assembled and deployed in Abu Dhabi by mid June. We already have our frame components ordered and they will be manufactured and delivered to NYUAD by the end of May 2023. This will to the the best of our knowledge the first Adaptive MTB in the UAE and the first Adaptive MTB to be used on a trail in the UAE.



The third bike will be deployed in Ireland in June 2023 and will be utilized at the Kinnitty trailhead to enable people with disabilities to try adaptive mountain biking in Ireland. The fourth bike will be completed in Shanghai in July/Aug 2023 and will be available for people with disabilities to try adaptive mountain biking. A location has yet to be decided for the trial, and this will likely be the first adaptive mountain bike ever in China.



The project aims to create a bike that can be built anywhere in the world and ultimately hopes to see an adaptive mountain bike at every trail in the world. The project seeks to break down barriers and help people with disabilities achieve things they never thought possible. In the spirit of the legend of Thor's hammer, Project Mjolnir will break the norms and aims to liberate, exhilarate, and give back independence to people with disabilities, creating a community of like-minded adventurers with or without disabilities who will contribute to its further development.





When I am on the bike the disability disappears, I am in a state of focus that draws me away from the things I cannot do and energises me to explore. I get to do things and see things I never thought I would. I can go to the furthest reaches of the mountains and have experiences many don't. Project Mjolnir is the first action in the mission to enable as many wheelchair users as we can to do and feel the same!



Mjolnir in Abu Dhabi.

We are currently engaged with Circuit X at Hudayriyat Island. They are willing to help us hold a cycling session at Trail X.

We hope to speak to Wolfis, the premier cycling store in Abu Dhabi to see if they are interested in supporting the project.

We have reached out to wheelchair user Mohamed Almutawwa, government official and urban planner who is interested in trying the bike.





Mjolnir in Abu Dhabi.

What's the plan?

We have formed a team comprising of staff and students at NYUAD to do the following:

6th June - 9th June = Assembly of the bike at NYUAD.

10th and/or 11th June = Trialing the bike at Hudayriyat Island MTB trail.



Mjolnir in Abu Dhabi.

Benefits of being involved!

Being part of a truly global project at a global university.

Being part of the deployment of the first adaptive MTB in the UAE. (TBC)

Helping those with disabilities to be able to participate in the sport of mountain biking.

Media exposure and marketing opportunities.

Helping develop the worlds first Open source adaptive mountain bike.



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