

<p><b>Current Spacecraft (Problems)</b></p> <ul style="list-style-type: none"> <li>• Slow</li> <li>• Bulky</li> <li>• Lack of adaptability</li> </ul>	<p>Solution →</p>	<p><b>Transformable Spacecraft</b></p> <ul style="list-style-type: none"> <li>• Fast</li> <li>• Agile</li> <li>• Multi-mission purpose</li> </ul>	<p>How?</p> <ul style="list-style-type: none"> <li>• Adopting <b>different geometries</b> depending on the mission needs</li> <li>• Triggering <b>natural phenomena (Dzhanibekov effect)</b> which current spacecraft do not have access to (improved Attitude Control and Determination System – i.e., how spacecraft orientate in space-)</li> </ul>
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Research Objective: develop and test in microgravity a new Attitude Control Method for these Transformable Spacecraft by making use of the natural phenomenon called: “Dzhanibekov Effect”

Research Platform: a **parabolic flight** to achieve microgravity conditions

An overview of a parabolic flight (Aircraft A310 Zero-G by Novespace)

Microgravity Testing at the 77<sup>th</sup> ESA Parabolic Flight Campaign

Dzhanibekov effect at the International Space Station (ISS). Source: NASA

The Transformable Spacecraft: a remarkable **engineering challenge** to prove the research

Prototype Computer-Aided-Model  
(Left: Inner Structure; Right: Flight configuration)

Experimental Set-up  
(Left: Free-floating Area to achieve microgravity; Middle: Prototype Inner Structure; Right: Prototype Flight configuration)

Successful Results from microgravity experimentation

Angular rates of the prototype under the Dzhanibekov effect

EFFECT ON    EFFECT ON/OFF    EFFECT OFF/ON    ACROBATIC

VIDEOS of the results in microgravity (1 min each)

Angular rates of the prototype (from effect ON to effect OFF)

‘Since its discovery around 1852, this is the **First Time** it is experimentally demonstrated that the Dzhanibekov effect can be controlled’

‘The **microgravity testing** shows the **benefits of Transformable Spacecraft** and the use of the **Dzhanibekov’s effect** for future space missions’