

## COMMUNIQUÉ DE PRESSE

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**World premiere: ONERA establishes an adaptive optics corrected laser link with the geostationary orbit on the 60 cm diameter full aperture of the FEELING optical ground station.**

**On 5th June, ONERA's optical ground station FEELINGS established a stable two-way laser link with the Airbus Defence and Space TELEO payload in geostationary orbit. This world first was made possible by the adaptive optics system and high-power lasers developed by ONERA. This success paves the way towards the development of secure very high throughput ground-space optical links.**

ONERA recently has succeeded in establishing a reliable and stable two-way laser link corrected by Adaptive Optics (AO) from its optical ground station FEELINGS at ONERA site of Fauga-Mauzac, near Toulouse. Featuring unique characteristics, FEELINGS (FEEder LINKs Ground Station) takes advantage of the extreme directivity of the used "antenna" (a 60 cm diameter telescope) and its specific means of atmospheric turbulence mitigation to gain an order of magnitude on the optical power delivered to the satellite. With this achievement, ONERA has taken a major step towards the implementation of secure very high throughput optical links with satellites in geostationary orbit. This remarkable result was made possible by ONERA's expertise of two key technological building blocks. First, a unique adaptive optics system compensates the detrimental effects of atmospheric turbulence by the simultaneous actuation of nearly 300 actuation points at 2 kHz. Second, a dedicated high quality optical amplifier provides the power increase required for very high throughput data transmission over 38,000 km while preserving the integrity of the data.

This first AO pre-compensated laser link over such a large diameter has enabled ONERA to confirm the relevance of the technical choices made when developing the FEELINGS station. It also enabled to collect valuable data for characterising the propagation channel. The challenge is now to consolidate the performance models under demanding environmental conditions in order to ensure a future availability rate close to 100% in clear sky conditions. This is an essential step towards achieving ground-to-space data rates comparable to those already available on the ground via optical fibered networks.

FEELINGS is a unique research infrastructure specifically built by ONERA to study the constraints of the propagation environment on optical links: atmospheric turbulence, cloud cover and aerosols. The use of optical links will enable intrinsically secured very high throughput data transfer thanks to the laser directionality (an optical wave is 10,000 times more directive than a radio-frequency wave). On the other hand, the use of optical frequencies requires expertise in controlling and mitigating the

effects of the propagation channel, which compromise the data link. ONERA has developed unique expertise in these phenomena and their correction methods over many years.

ONERA's participation in this demonstration is supported by the French Defence Procurement Agency (Direction Générale de l'Armement). The TELEO payload, designed to demonstrate high-speed optical links, was developed by ADS, with financial support from CNES. Two French optical ground stations are taking part of the demonstration with a complementary approach: ONERA-FEELINGS, notably for the research aspects and understanding of the physics of the propagation channel and the performance achievable with ground/space optical links; CNES-FrOGS equipped with CO-OP technologies, which prefigures future commercial stations. Lessons learnt from the experiments carried out in parallel by these two French ground stations are shared at national level to enable all stakeholders to reap the maximum benefit of these opportunities.

*Bruno Sainjon, CEO of ONERA, commented: "This world first has been made possible thanks to the support of the DGA, our supervisory authority, and our partners such as CNES. It demonstrates the importance of the work carried out by ONERA scientists: developing breakthrough technologies for the benefit of the French aerospace industry. With the growing importance of data transmission needs and control of space, the high-speed space laser link meets the challenges of both competitiveness and sovereignty. This successful experiment gives France a head start in a highly sensitive and vital capability".*



**FEELINGS ground station in Fauga-Mauzac ONERA center near Toulouse©ONERA**

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### **À propos de l'ONERA, le centre français de recherche aérospatiale**

L'ONERA, acteur central de la recherche aéronautique et spatiale, emploie environ 2000 personnes. Placé sous la tutelle du ministère des Armées, il dispose d'un budget de 289 millions d'euros (2023) dont plus de la moitié provient de contrats commerciaux. Expert étatique, l'ONERA prépare la défense de demain, répond aux enjeux aéronautiques et spatiaux du futur, et contribue à la compétitivité de l'industrie aérospatiale. Il maîtrise toutes les disciplines et technologies du domaine. Tous les grands programmes aérospatiaux civils et militaires en France et en Europe portent une part de l'ADN de l'ONERA : Ariane, Airbus, Falcon, Rafale, missiles,

hélicoptères, moteurs, radars... Reconnus à l'international et souvent primés, ses chercheurs forment de nombreux doctorants.

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