The FP7 GABRIEL project focuses on the feasibility and preliminary design of a system to launch and recover medium sized aircraft on a track powered by Magnetic Levitation. Such a system will allow a substantial saving of fuel since the aircraft weight can be reduced as no landing gear is needed, no undercarriage fairings are needed which also reduces drag and smaller engines can be used. This will result in substantial savings in fuel cost during take-off and landing as well as cruise and CO2 emissions. Further cost savings are possible as no maintenance is needed on the landing gear and engine thrust reversers. The cart on which the aircraft is placed will allow electric taxi at the airport and autonomous push back from the gate, thereby further reducing emissions and cost.

The GABRIEL project investigated the following issues:

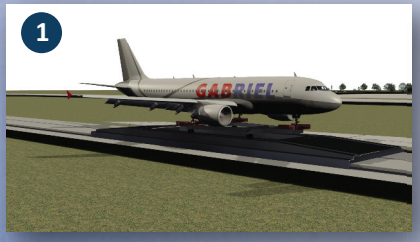
- Design of an appropriate MAGLEV system and the sledge that is attached to the MAGLEV ramp;
- Design of a cart that will connect the aircraft with the sledge;
- The design of appropriate flight control systems to make automated precision landings;
- Small scale demonstrations to validate the concept;
- The safety issues connected to the proposed solutions both related to passengers and flight safety, the security issues and certification;
- Solutions for emergency landings of aircraft without landing gear;
- The environmental impact assessment;
- The usability of the system at large, small and regional airports as well as for inner city locations;
- The cost benefits of the proposed system compared to current practice.

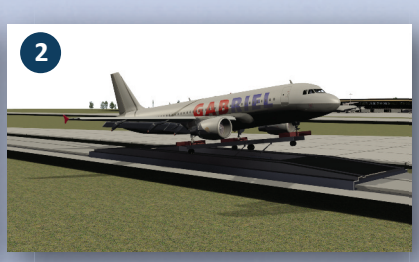
The conclusion is that the concept results in large cost benefits, saving of scarce aviation fuel and reduction of CO2 and noise at the airport. This conclusion was also supported by IATA. It is highly recommended to continue European research and investigations into this aviation step change and to continue with a detailed design effort. The project also showed that in some areas like automated precision landings further research and development is needed.

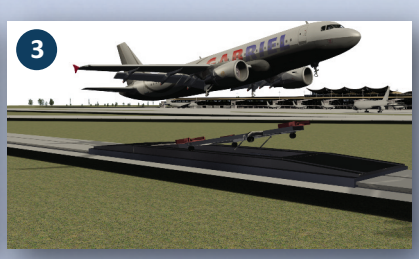
For more information please visit:
www.gabriel-project.eu

PARTICIPANTS:

- **REA** - REA Tech Engineering (Hungary), **coordinator**
- **SLOT** - Slot Consulting Ltd. (Hungary)
- **TUD** - Delft University of Technology (The Netherlands)
- **ONERA** - French Aeronautics and Space Research Centre (France)
- **RwTH** - Aachen Technical University (Germany)
- **DRogg** - Dieter Rogg Consulting (Germany)
- **ADC** - AD Cuenta Consulting (The Netherlands)
- **NLR** - National Aerospace Laboratory (The Netherlands)
- **RzUT** - Rzeszow Technical University (Poland)
- **WrUT** - Wroclaw Technical University (Poland)
- **CIRA** - The Italian Aerospace Research Centre (Italy)
- **UoS** - University of Salerno (Italy)





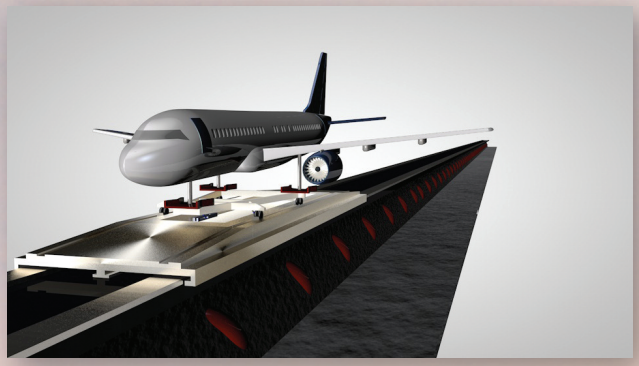


This project has received funding from the European Union's **Seventh Framework Programme** for research, technological development and demonstration under grant agreement n°605007. This change is based on a new EC rule: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos).
Project co-funded by the European Commission
Research area: AAT.2011.6.3-2. GA No. FP7- 284884

GABRIEL

CONSORTIUM

The consortium is based on vast and complementary expertise of the partners in different domains like MAGLEV technology, aircraft design, system design, airport and safety operations, environmental research, economic analysis etc.



THE CONCEPT

Launching aircraft with the help of ground power is not a new concept however launching and recovering an aircraft with the size of an Airbus A320 using magnetic levitation is a breakthrough. The team has made the preliminary design of an appropriate MAGLEV ramp and a sledge that will be permanently attached to the ramp. The aircraft will be placed on a cart on which it can manoeuvre at the airport. The cart is attached to the sledge and the combination will be accelerated until the aircraft has sufficient speed to fly. Engines will spool up during the launch and will be at full power when the aircraft leaves the cart.

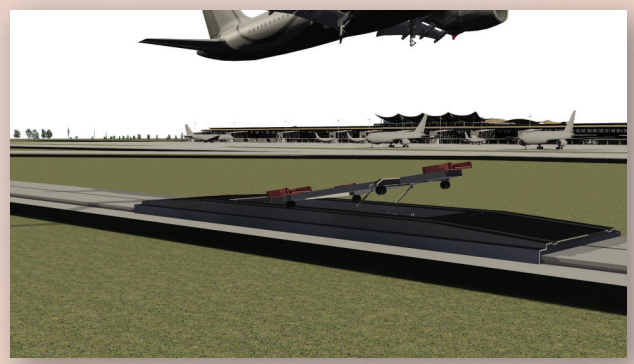
Since the aircraft will not have an undercarriage, the same cart/sledge combination will be used for landings. The aircraft will make a fully automated precision landing on the cart/sledge which will have the same speed as the landing aircraft at the moment of touch down. The sledge will allow cross wind landings to be performed.

At the end of the ramp the cart and aircraft will be detached from the sledge and the cart will manoeuvre the aircraft to the gate. As the remotely controlled cart operates under its own electric power, aircraft movements will be emission free and push back from the gate can be done independently from ground infrastructure.

The omission of the undercarriage and smaller engines without a thrust reverser will reduce the aircraft weight which will allow less fuel to be carried for take-off and cruise. This will save fuel and reduce CO2 emissions. Noise levels at and around the airport will be substantially reduced. Although the initial investment for the MAGLEV system will be higher than for a traditional runway, the MAGLEV system will have a much longer lifetime with less replacements and maintenance cost.

THE COST BENEFIT

Compared to the traditional take-off and landing on a regular runway the proposed system shows remarkable cost benefits. This is mainly due to the reduced aircraft weight, the engines and the electric taxi and autonomous push off at the gate. This can result in a €3000 saving per flight for an A320 type of aircraft.



GABRIEL: A SUCCESS STORY...

The GABRIEL project has demonstrated the feasibility of ground power assisted take-off and landing. The concept is safe and secure. It will enable flying with much lower CO2 and other emissions whilst reducing the noise levels at and around airports.

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