CEAS 2009 European Air and Space Conference 26-29 October 2009, Manchester, UK

Flying Car Design and Testing

Prof. Stefan Klein, Academy of Fine Art and Design, Bratislava, Slovak Republic
Dr. Ing. Ladisalv Smrcek, Department of Aerospace Engineering, University of Glasgow, UK

Introduction

This paper is primarily concerned with the inverted design process and manufacture of a flying car prototype which can overcome the problem of traffic management in the world today. A possible solution to the problem of overcrowded roads would be to design a flying or hovering car. Given technological advances in aircraft construction, navigation and operation, flying cars or personal aircraft are now a feasible proposition. The viability of such a concept was investigated in terms of producing a conceptual design for a two-person carrying flying vehicle, manufacturing a flying prototype followed by ground and initial flight testing.

Flying cars have featured heavily in science fiction writing and films for many years, however the idea of actually building such a vehicle only came into fruition at the start of the twentieth century. The latest production of other types of flying cars manufactured in the USA have been reported in 2009 [Ref. 1]. Also, in the 1990's the most successful vertical take-off and landing (VTOL) flying car was introduced in the USA [Ref. 2].

Traffic congestion on roads all over the world has become an overwhelming problem. Larger roads and motorways are especially overused which causes the average speed of vehicles at peak times to be reduced to around 35 miles per hour in some countries. This, in turn, means that fuel is wasted and the amount of exhaust emissions in the atmosphere rapidly increased.

One solution to the problem would be to merely build more roads, however this is a very expensive process and is not very viable in large built up areas.

An alternative to expanding current traffic networks would be to develop a new system of highways in the sky for future flying cars.

Much like the road cars of today, flying cars would require regulatory controls in order to make them safe in operation. I would therefore be necessary to develop;

- virtual "highways in the sky". These skyways would be a network of predetermined routes controlled by the flying cars air traffic control and management.
- automated systems which would maintain the flying cars motion in terms of speed and direction.
- rules and legislations to maintain the system.

The folded wing flying car Aeromobile as a solution to the future flying car concept is presented in this paper.

Design History

Aeromobile Base Technical Specification:

- Empty Weight: 400 kg
- Two seats/Payload: 200 kg
- Wing span: 7.8 m
- Wing area: 10.3 m^2
- Length: 5.5 m
- Width: 1.8 m
- Height: 1.80 m
- Engine: Honda Blackbird 1200 ccm, 140 HP, 9500 rpm
- Propeller: 3 blades, ϕ = 1.45 m (fixed pitch)
- Max ground speed: 140 km/h
- Flight Cruise speed: 220 km/h

Figure 1 - Aeromobile II (S. Klein)

Aeromobile II (Figure 1) is designed as a two seater flying car and has been under development since 1993. It represents natural development in the following areas:

- The air traffic composition is constantly changing.
- Autonomy of transport.
- Integration of modern communication.
- Accessibility of a new technology.
- Dynamic and attractive design.
- On road and in-flight comfort.
- Integration of automotive technology.
- Open borders.
- Overcrowded roads.
- New lifestyle of developed countries.

Figure 2 – Functioning Prototype

Automobile development has been arranged into several phases. First model scale 1:4 was tested in a wind tunnel. Modification in geometry was needed and model scale 1:1 was manufactured. This has been developed further in order to test the model on the ground. The last development was functioning prototype when the flight control surfaces have been tested during short straight level flight.

The following is a technical description of the functioning prototype (Figure 2).

The wing is taken from the ultra light certified aircraft [Ref. 3] and modified so that it can be rotated to the "folded" position. The fuselage which is made from a tube structure is covered with composite panels. The tail unit is manufactured to support a rear undercarriage and control surfaces a rudder and an elivator. The main undercarriage is designed to allow comfortable steering on the road, is retractable to lower drag and also moves vertically to change angle of attack for take-off ground run. The engine is from a Honda motorbike and together with the gearbox weighs 80kg (140hp). The propeller is in the rear of the fuselage (pusher) with three fixed pitch blades.

The testing of this functioning prototype has been conducted to the following level:

- Working of engine/propeller and shaft made from carbon composite structure.
- Undercarriage vibration, stability and stearing (integrated system for road and flying).
- Take-off and straight flight.

Conclusion

There are still technical problems to overcome before so-called roadable aircraft or flying car can become main means of personal transport. The future of the aeromobile will depend on successful airworthiness and road certification.

References:

1. www.terafangie.com
2. www.moller.com
3. www.aerospool.sk