WORK-ENERGY-POWER

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Why We're Not Driving the Friendly Skies

Slide Show

INTRODUCTION: **The Terrafugia carplane at left is said to have a 100 HP engine and attains altitude of 7000 ft flying at 100 mph. It's quite light at 1430 lb. Power = work/time , work done by the engine we will assume to be 20 % efficient. $W = 0.20\ P\ t$ Work done by the engine causes the carplane to Gain kinetic energy (K) and gravitational potential energy (U). The work energy equation is appropriate here: $W = \Delta K + \Delta U$ or $0.20\ P\ t = K + U$**

QUESTIONS: **(a) Find mass of carplane? (b) Convert 100 HP to ft. lb./s.? (c) Convert 100 mph to ft./s.? (d) Find time (t) to achieve 7000 ft. altitude and 100 mph from rest on the runway?**

A number of us can thank a cartoon character from the future, George Jetson, for instilling our longing. Students of aviation history might look for inspiration to the **Autoplane** prototype built in 1917 by the flight pioneer Glenn Curtiss. And tens of millions of motorists who have been stuck in traffic jams stretching toward the horizon must also feel a need to know: Where are the flying cars?

It's a dream that has reduced many would-be inventors to despair as they grasped the immensity of the engineering and design challenges rooted in the widely divergent natures of airplanes and cars. Cars must provide occupants with comfort, decent handling and braking and protection in the event of an accident — while complying with government air-pollution and fuel-economy standards. **Keeping weight to a minimum is important, but a few extra pounds here and there can be tolerated.**

Airplanes are quite a different matter. Weight is everything in a flying machine; it determines the engine power and the wingspan required to get off the ground. Thus, **aircraft make extensive use of lightweight materials that their designers fashion into the most efficient structures they can dream up .** Several small companies are working on flying car designs that they think will be the ones to finally crack the nut. One of these, Terrafugia of Woburn, Mass., has flown a prototype with self-folding wings and a pusher propeller nestled between two tail booms. The company is working on an advanced hybrid design capable of vertical takeoff and highway driving using electric motors powered by batteries, along with a piston engine turning a pusher propeller during forward flight.

HINTS: **Assume friction is negligible. $K = \frac{1}{2}\ m\ V^2$, $U = m\ g\ h$, $g = 32$ ft./s.^{2} , weight = $m\ g$, HP = 550 ft. lb./s. ,**

ANSWERS: **(a) 44.69 slugs , (b) 55,000 ft. lb./s., (c) 146.67 ft./s. , (d) 952.5 s or 15.9 minutes**

AUTHORS COMMENTS: **With a gasoline engine, which are only about 20 % efficient, taking ~16 minutes to achieve 7000 ft. at 100 mph seems quite plausible.**