



DEPARTMENT OF AUTOMOTIVE AND AERONAUTICAL ENGINEERING

## An Optional APU for Passenger Aircraft

### Background

All passenger aircraft are equipped with an Auxiliary Power Unit (APU). Its main purpose is to provide the aircraft on the ground with electric, hydraulic and pneumatic power. Either the APU provides all three forms of power directly, or conversion of power takes place with additional on board equipment. The APU often provides only electric and pneumatic power, but no hydraulic power. Hydraulic power can in this case e.g. be provided from an electric motor driven pump. The three power forms are called secondary power. Secondary power is used to drive all aircraft systems (avionics and utility systems). Secondary power is contrasted by propulsive power used to move the aircraft forward. Any device that produces secondary power could be an APU. Traditionally APUs are small gas turbines because of their high power-to-mass ratio. Aircraft in general are allowed to fly without an APU. Airports prefer if the APU is not operated due to environmental and financial reasons.

The idea is to design an aircraft with means for APU installation. The APU is offered, however, only as an option. Operating an aircraft without an APU should reduce the aircraft's purchase price, aircraft empty mass, fuel burn and maintenance costs. If the aircraft is resold the new owner has the option to have an APU installed, if deemed necessary. In this way the "missing" APU should not reduce the residual value of the aircraft beyond the price of an APU.

### Task

Task is to investigate the idea of an aircraft operating without an APU, looking at possible "show stoppers", disadvantages, and advantages. These steps should be followed when working on the project:

- APUs on passenger aircraft.
- The operation with an APU: ground, flight, ETOPS.
- Stake holder's views of the APU: pilots, airlines, manufacturers, airports.

- Gas turbine alternatives for an APU.
- The operation without an APU: ground, flight, scheduling, sales.
- Trade studies among APU alternatives and no APU.
- Final proposal submitted.

The report will be written in English based on German or international standards on report writing.