A Multi-disciplinary Design Optimization framework for integrated aircraft and mission design of a cruiser-feeder concept

**Background**
Research has shown that air transportation has detrimental effects on the environment due to the emissions of CO2, NOx and noise. In order to reduce the impact of the air transportation industry, the RESearch on a Cruiser Enabled Air Transport Environment (RECREATE) project proposes a new air transport paradigm in which cruiser-feeder operations are utilized. These operations entail that:

1) large aircraft (cruisers) fly fixed routes and rendezvous with smaller aircraft (feeders) that transfer passengers, fuel and other goods (figure 1).

2) long-haul passenger cruisers are refueled by tanker aircraft in-flight (figure 2).

**What is the Cruiser - Feeder concept?**
A Cruiser-Feeder concept implies that an aircraft (Cruiser) transport passengers (or cargo) for the largest part of a journey. It also implies a midair contact with another aircraft, the Feeder. Basically, the contact between Cruiser and Feeder can be done in two ways:

1) No transfer of Supplies.
2) Transfer of Supplies.

**Fig. 1:** Example of very large cruiser with smaller feeders

**Fig. 2:** Example of air to air refueling

The research effort presented herein is targeted at the latter cruiser-feeder concept, i.e., Air-to-Air (AAR) refueling.

**Air to Air Refueling (AAR)**
The feasibility and usefulness of AAR has long been proven in military operations. However, there is no similar experience in passenger aircraft operations. There are some differences between AAR in military and civil domain.

**The development of the AAR concept for passenger aircraft entails 2 major design aspects:**
1) AAR mission (network) design
2) Aircraft design (cruiser and feeder)

**Main question**
How the operational parameters and variables in AAR influence the aircraft design variables, and vice versa

**Other aspect emerges**
How can the analysis and optimization of the mission and aircraft design be wired together?

**The answers to those questions ...**

Reveal the need of designing new types of aircraft

Directly influence the selection of the design parameters within the available aircraft design space.

Certain operational concept is derived based on assumed aircraft characteristic

Optimum operational concept might demand certain aircraft performances

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**Promotor:** Prof. dr. R. Curran

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**Fig. 3:** Network for one transport cycle for different Cruiser-Feeder concepts.

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