



# IDEATHON

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## Ansys' Challenge

Technical card



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**EUROAVIA** 

**Entity providing the challenge:** ANSYS, Inc.

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**Title of the challenge:** Design and mission optimization of a crisis response aerial vehicle

## Background

The conceptual design parameters of any aerial vehicle are implicitly related to its intended mission. Therefore, it is easily inferred that the optimization of either of the two is equally essential for achieving the best possible configuration and operational envelope for the final design. The aim of this challenge is to provide insight on how digital mission engineering (DME) tools and simulation are useful in streamlining the above process, by providing an answer to the “what if’s” during design, testing, and operations in a mission context. Given a specific mission and access to DME tools you will be tasked with conceptually designing your own aircraft that best satisfies its objectives and simulating the performance of your final design within the mission envelope. Note that you will have complete freedom to tackle and prioritize the challenge objectives according to the strengths and limitations of your team expertise. Best of luck!

## Objectives

The design, at a conceptual level, of a medium size aircraft for use in crisis response scenarios, such as search & rescue missions. Planning of an example mission flight path, utilizing your design’s characteristics and Ansys System Tools Kit (STK) DME software.

## Description

As described above, the performance requirements for your design, in more detail:

- Minimum cruise range: 1300 [km]
- Loiter endurance: 30 [min]
- Minimum flight speed (stall): 150 [km/h]
- Maximum flight speed: 500 [km/h]
- Service ceiling: 10.000 [m]
- Rate of Climb: 10 [m/s]
- Take-off (ground roll) distance: 800 [m]
- Crew of 4 people, up to 10 passengers, 200 [kg] of miscellaneous supplies

Using these requirements as performance goals and by following a simplified conceptual design workflow, as described in Daniel P. Raymer’s “*Aircraft Design: A Conceptual Approach – 6<sup>th</sup> edition*” and John D. Anderson’s “*Aircraft performance and design*” you are tasked to come up with the basic performance parameters of an aircraft that best satisfies



the above requirements. Keep in mind that aircraft design, even at a conceptual level is a lengthy, iterative, and complex process. The purpose of this challenge is to give you an insight of how it works and introduce you to the world of digital mission engineering tools. For this reason, you are asked to focus mainly on your design satisfying the given performance criteria and not go into the details of configuration, structural and stability characteristics.

You are free to prioritize the performance requirements and streamline the proposed by the authors workflow in a way that best suits your expertise and given timeframe, even if that means making simplifying assumptions, taking educated guesses for some parameters, and even omitting calculations if you see fit. Remember, with the right justification there is no such thing as a wrong answer, so don't be afraid to stand with whatever doesn't work out for you as you will be evaluated on your engineering approach as a whole and not explicitly on the discrete challenge objectives.

Important: Take extra care in the unit conversions you use during your calculations!

On the second leg of the challenge, the mission planning aspect involves using some of the basic performance characteristics of your design to plan out the optimal flight path to, from and within a predetermined search area for best coverage with onboard imaging sensors while satisfying your fuel and performance constraints. To help you perform this analysis and as an introduction to Digital Mission Engineering tools, you will have access to the Ansys Systems Tools Kit (STK) DME software.

## Skills required to face the challenge

- Aircraft design fundamentals
- Mission planning
- Critical thinking, prioritization, and time management

## Useful information to face the challenge

Textbooks:

[RAYMER AIRCRAFT DESIGN: A CONCEPTUAL APPROACH](#)

JOHN D. ANDERSON, "Aircraft Performance and Design"

Related links:

[STK help](#) – the go-to resource for looking or searching for anything STK related

[AGI Search Page](#) – Resource for lots of FAQs, blogs, videos, papers etc

[General working with aviator](#) – Introduction to Aviator's GUI, capabilities

[Aviator for Aircraft mission modelling](#) – Example of flight planning with Aviator



[Introduction to coverage](#)

[Computing coverage over regions](#) – Overview of area coverage capabilities

[Quadcopter design and performance analysis](#) – Detailed example mission combining the above