

<http://ewade2013.AircraftDesign.org>
<http://dx.doi.org/10.5281/zenodo.546427>

The New Aircraft Design Course at the Technical University of Munich (TUM)

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Design at TUM – a broad topic

- Unique boundary conditions at TUM
- Course content/curriculum/scope
- Prescribed design methods and tools
- Course development, (short) history, past years
- Lessons learned
- Future of aircraft design education at TUM

Presentation overview

- Background
- Goals
- Course content
- Moving forward

Background – student exposure to design

Credited coursework

Aircraft design lecture



New: aircraft design practical course

- Project-based (learn by doing!)
- For advance students – lecture course as prerequisite
- Not a compulsory course

Extracurriculars

AkaFlieg

AkaModell

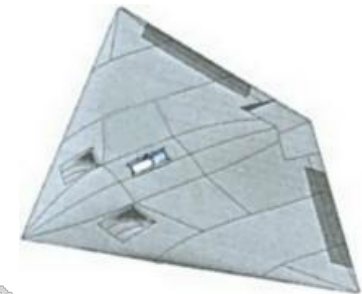
Euroavia/symposium



Department projects

Student assistantships

Student theses (bachelor, semester, & master)



Goals – overview

- Goals
 1. Learning value: make each student a capable conceptual designer
 2. Good result: learn by doing... right



- Boundary conditions
 - ‘Customer’-oriented
 - Popular (or else no participants)
 - Appropriate workload
 - ...



Goals – learning objectives

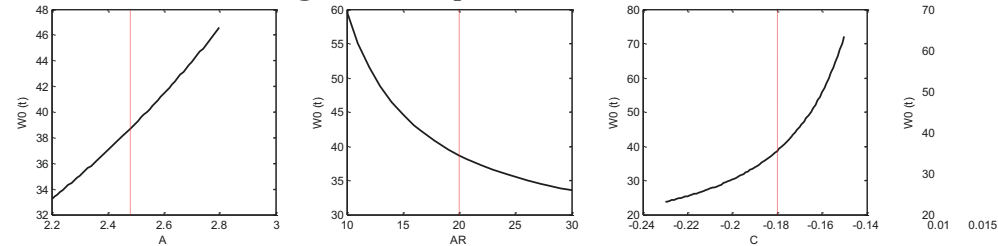
Work in multidisciplinary team



Solve iterative/ open-ended problems



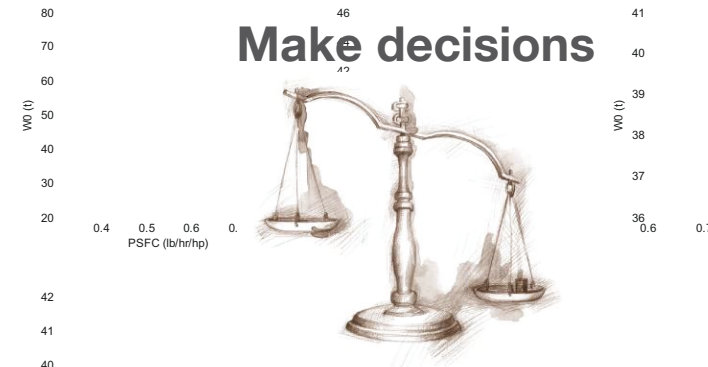
Analyze requirements



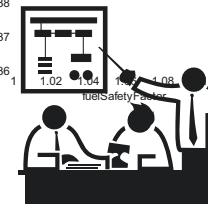
Appreciate history



Make decisions




Communicate



Course content – structure

AIAA design task: HALE UAS for missile defence with directed energy laser

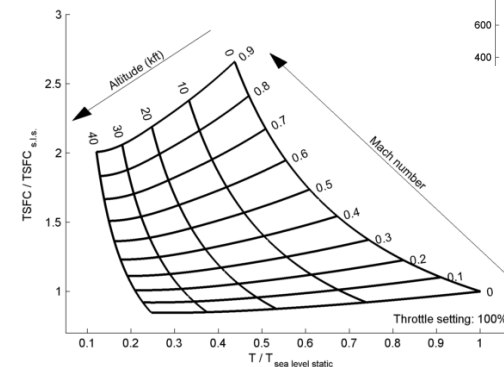
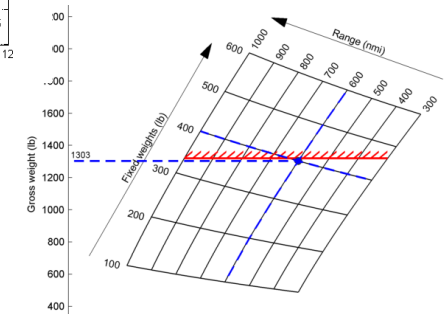
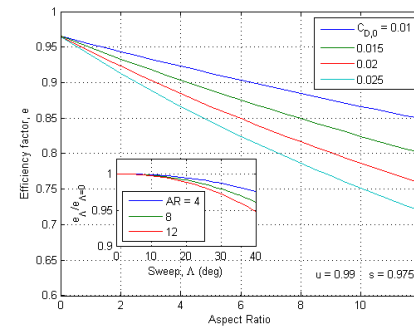


Design activity	Weeks	End milestone
Recruiting & selection	~10	Annotated concept sketches
Design basics & “first shot” design	3	Individual sizing project submission
Concept exploration Issue reports	3	Initial design review (IDR) 
Preliminary design	7	Preliminary design review (PDR)
Refinement	4	Design report submission
Revision	8	AIAA proposal submission

4 ECTS /
15 weeks /
3 contact
hours/week

Course content – prescribed tools & methods

- **No provided tools!** (almost)
 - But many resources
- Some small exceptions:
 - Cookbook for individual project
 - Cookbook for engine modeling
 - Some basic provided software (but almost all open/free)



Course content – soft skills emphasis

Team environment

- Management
- Collaboration
- Data control
- Specialization

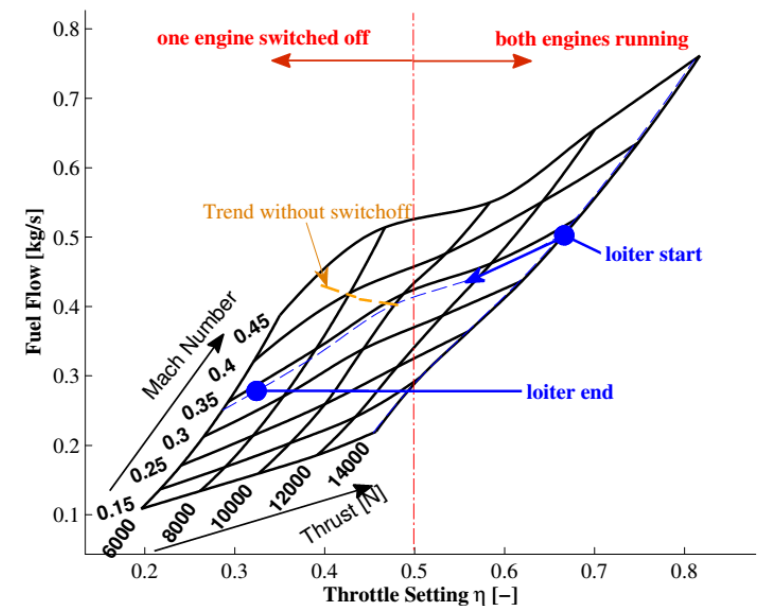
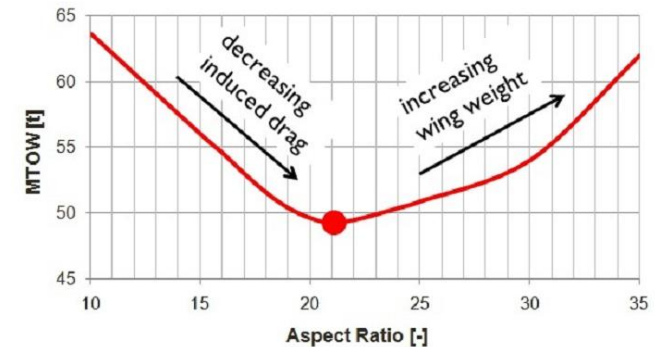
Communication

- Writing
- Technical drawing
- Audio/visual presentation
- Technical conversation

Course content – decision-making emphasis

A good trade study...

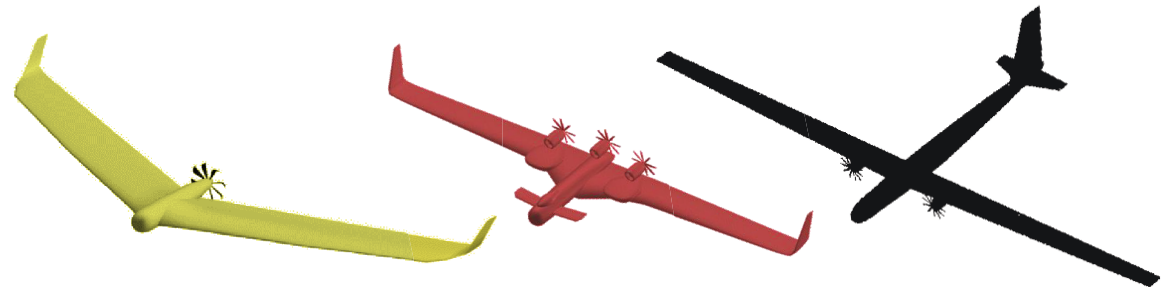
1. is well **chosen**
 - Recognize important trades to be made & where to focus efforts
2. is well **executed**
 - Appropriate tools & methods for study process and technical analysis
3. is well **communicated**
 - Make results clear to the decision-maker and other stakeholders
4. leads to a good engineering design **decision**



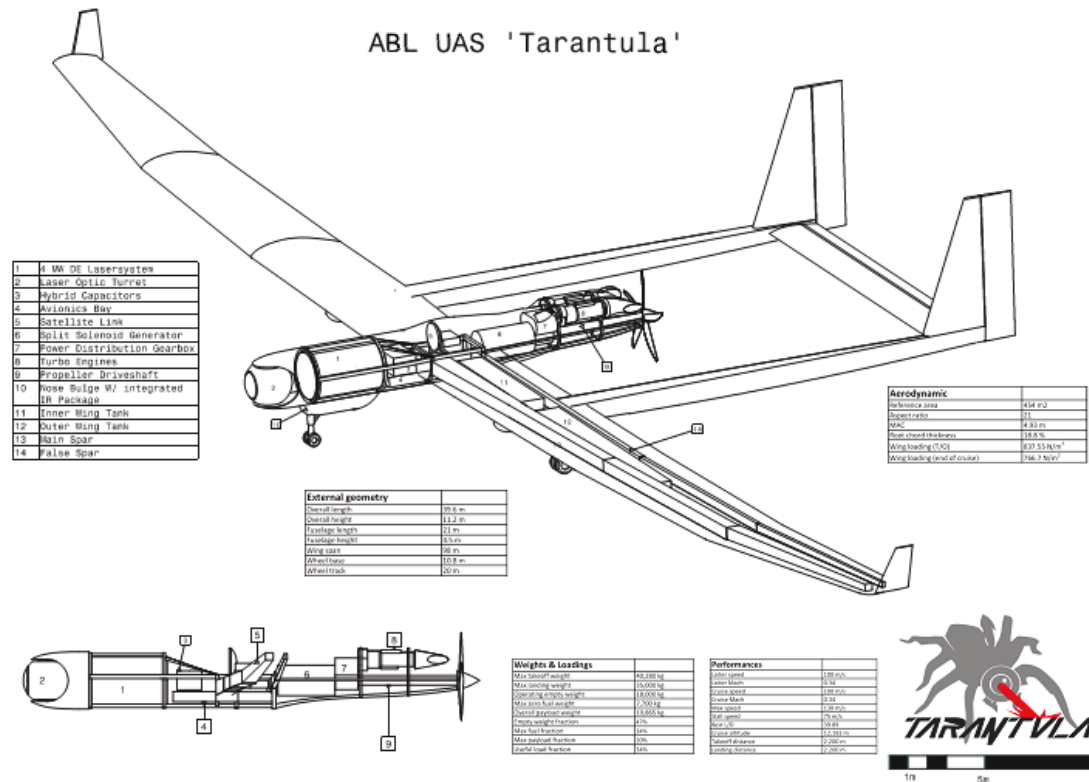
Results

Student feedback:

- “I learned a **LOT!**”
- “I’m proud of our design”
- “It’s too much work!”



ABL UAS 'Tarantula'



AIAA Graduate Team Aircraft Design Competition 2nd Prize

Moving forward

Evolutionary approach: shrink course scope

- Simpler design task
- Easier and/or fewer deliverables
- Spread workload with largest practical team size
- No competition
- Compensate with gap-semester offering

Revolutionary approach: grow boundary conditions

- Offer thesis credit
- No structured course offering
- Add another milestone (e.g., design review, report)
- Smaller teams
- Competition-focused

Acknowledgements

- Instruction team members:
 - Sebastian Speck
 - Hannes Ross
- Design review attendees
- Design education community
- Students