

# Tutorial on Flight Mechanics 2024



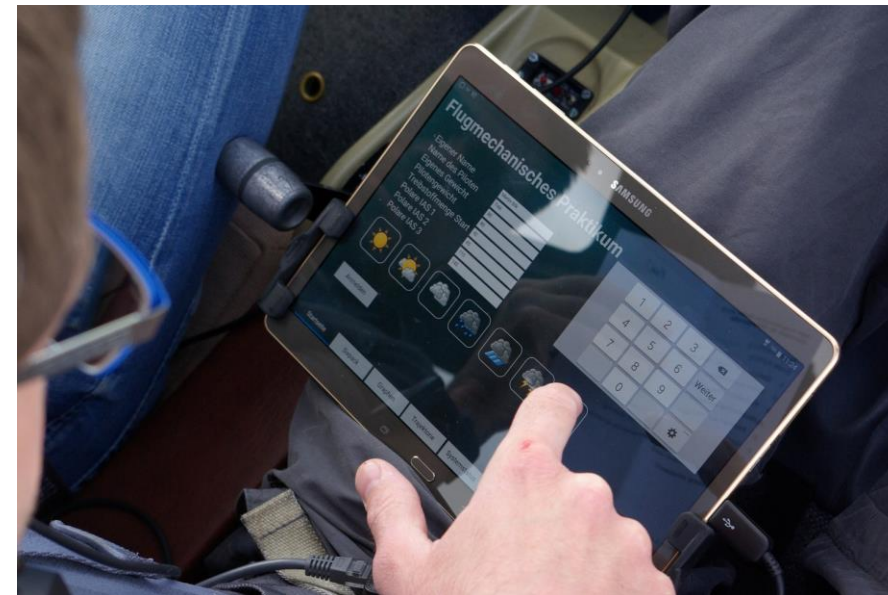
# Content of this Kickoff

- General information
- Flight Tests
  - Test facilities
  - Test execution
- Goal of this tutorial
- Organizational matters
  - Procedure of the tutorial
  - Grading
  - Dates and Deadlines
  - Expectations of the participants
  - Registration process



Some information in advance!

# ORGANIZATIONAL MATTERS



# Organizational matters

- Type of course: **Tutorial**
- Credit Points: **4**
- Target group:  
Primarily students in the **Master's program**



# FMP Team at FSR

## Execution & Organization:



Pascal Menner

## Additional SLA team:

- 2 pilots
- WiMis
- Airfield personnel



Martin Stenger



Dennis Patzig

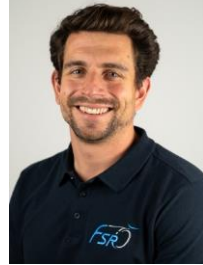
## Measuring system, preliminary tests, data processing:



Sebastian Stern



Maximilian Bauer



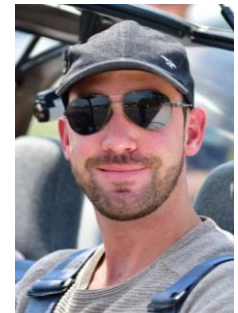
Lorenz Dingeldein



Florian Coors



Tobias Hofmann



Markus Jenkner

Simulator and test aircraft  
**FLIGHT TESTS**



# Content: Flight Performance and Flight Dynamics

## Flight Performance

- **Speed Polar and Lilienthal Polar:** Determination of the velocity for best gliding and the velocity for the best sink rate
- **Turning Flight:** Determination of the vertical sink rate during turning flight

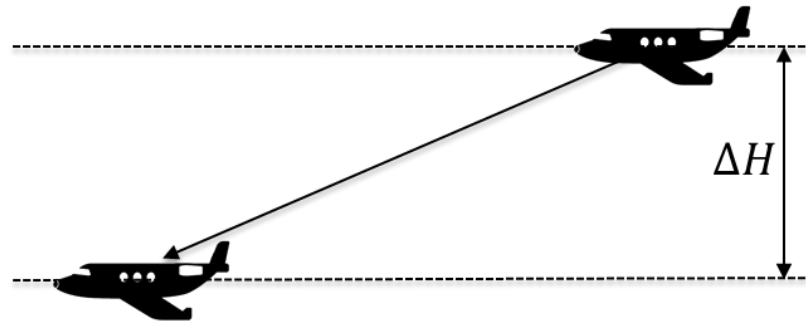
## Flight Dynamics

- Excitation of natural frequencies, determination of characteristic parameters of the **phugoid**.

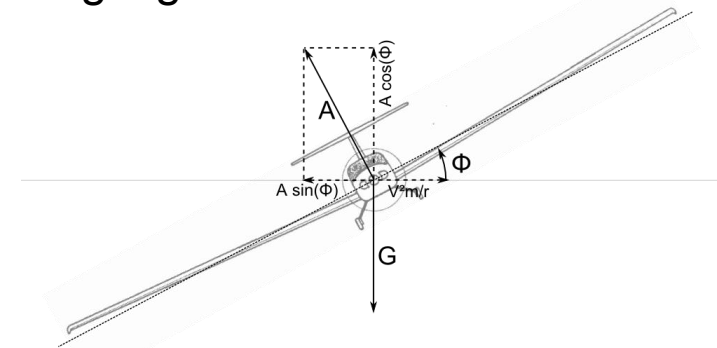
*Recording of relevant data during the flight,  
subsequent analytical and numerical evaluation  
using MATLAB.*



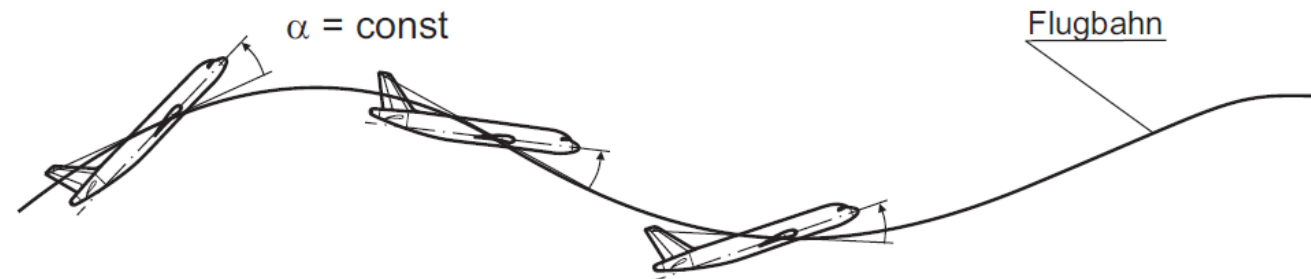
## Speed Polar while gliding



## Turning flight



## Phygoid





## Simulator

- Diamond DA 40-180 - Diamond Star
- Demonstration of the flight maneuvers in the simulator



## Test aircraft

- Grob G109b (motor glider)
- Test flights for all participating students (voluntary)



# Test facility: Special airfield Griesheim



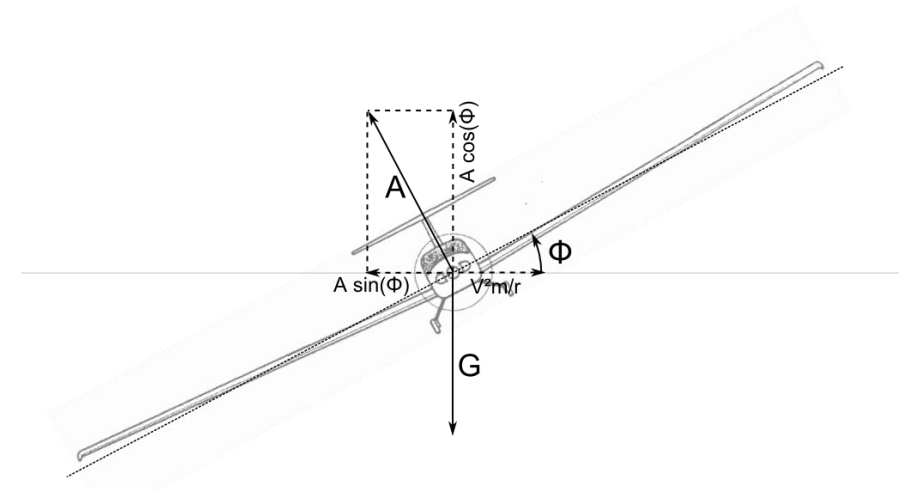
# Flight test execution

One (voluntary) test flight per participant

- Duration: approx. 45 - 60 minutes
- Test location: August-Euler-Airfield, Griesheim
- Experienced pilot or flight instructor
- Flying of all three flight tests during the flight
  - Speed Polar
  - Turning flight
  - Phygoid



*All details of the flight tests  
in the script*



# Goals of this tutorial

- Gaining **practical experience** in flight performance and flight characteristics measurement  
→ working as a flight test engineer.
- Familiarization with the used **measurement technology** and **procedures**
- Gaining knowledge of the **practical execution of a general aviation flight**.
  - Meteorology
  - Navigation
  - Flight preparation and post-processing
  - Flight procedures
  - Technology used in aircraft
  - Data processing with Matlab and Latex





What, how, when, and where?

# ORGANIZATIONAL MATTERS, AGAIN

# Documents

- All information, including the theory of the experiments and the tasks to be completed, can be found in the **lecture notes (German + English)**.
- In the **Moodle course** you will also find all further required documents and assistance (automatic registration in Moodle when you register for the FMP in TUCaN)



# Expectations of the participants

- **Commitment** (e.g. on flight day, preparation of the experiments, training with Matlab, etc.)
  - Everyone helps prepare the aircraft before and after the flight tests
  - Decision on flight execution at Pilot in Command
- **Flexibility** in time
  - Everyone follows the safety instructions at the airfield
  - Necessary equipment: drinking water (min. 1,5l), headgear (cap or similar), sunglasses, sunscreen, work

# Procedure of the Tutorial

1. **Application** for the tutorial and election by FSR & **formation of groups** (teams of 3/4)
2. One Lecture and preliminary flight tests in the simulator  
→ flight mechanic theory and further explanation of the flight test
3. Submission of the **first report** by each group  
→ tasks can be found in the lecture script
4. **Flight tests** at the airfield Griesheim (individually)
5. Submission of the **final report** by each group  
→ Analysis and discussion of the data recorded during the flight tests, tasks in the lecture script
6. **Oral exam** at FSR



# Timeline of the tutorial

★ today	Kickoff
29.03.2024 (18 Uhr)	End of the application period
until 04.04.2024	Feedback group formation
probably 08.04 at 15:00h	Lecture (about the content of this tutorial and as preparation for the simulator tests)
09.04 - 19.04.2024	Simulator tests
05.05.24 (23:59 h)	Submit first report (feedback two week later)
May	Flight tests Additional time for flight tests
24.06.2024 (09:00 h) (or 01.07.2024)	Submit final report
from 15.07.2024 (flexibel)	Oral exam at FSR

März	April	Mai	Juni	Juli	August	September
1 Fr	1 Mo Ostermontag 14	1 Mi Tag der Arbeit	1 Sa	1 Mo ★	1 Do	1 So
2 Sa	2 Di	2 Do	2 So	2 Di	2 Fr	2 Mo 38
3 So	3 Mi	3 Fr	3 Mo	3 Mi	3 Sa	3 Di
4 Mo 10	4 Do	4 Sa	4 Di	4 Do	4 So	4 Mi
5 Di	5 Fr	5 So ★	5 Mi	5 Fr	5 Mo 32	5 Do
6 Mi	6 Sa	6 Mo	6 Do	6 Sa	6 Di	6 Fr
7 Do	7 So	7 Di	7 Fr	7 So	7 Mi	7 Sa
8 Fr	8 Mo Lecture	8 Mi	8 Sa	8 Mo 28	8 Do	8 So
9 Sa	9 Di	9 Do Christi Himmelfahrt	9 So	9 Di	9 Fr	9 Mo 37
10 So	10 Mi	10 Fr	10 Mo 24	10 Mi	10 Sa	10 Di
11 Mo 11	11 Do	11 Sa	11 Di	11 Do	11 So	11 Mi
12 Di	12 Fr	12 So Muttertag	12 Mi	12 Fr	12 Mo 33	12 Do
13 Mi	13 Sa	13 Mo	13 Do	13 Sa	13 Di	13 Fr
14 Do	14 So	14 Di	14 Fr	14 So	14 Mi	14 Sa
15 Fr	15 Mo	15 Mi	15 Sa	15 Mo	15 Do	15 So
16 Sa	16 Di	16 Do	16 So	16 Di	16 Fr	16 Mo 38
17 So	17 Mi	17 Fr	17 Mo 25	17 Mi	17 Sa	17 Di
18 Mo 12	18 Do	18 Sa	18 Di	18 Do	18 So	18 Mi
19 Di	19 Fr	19 So Pfingsten	19 Mi	19 Fr	19 Mo 34	19 Do
20 Mi	20 Sa	20 Mo Pfingstmontag 21	20 Do	20 Sa	20 Di	20 Fr
21 Do	21 So	21 Di	21 Fr	21 So	21 Mi	21 Sa
22 Fr	22 Mo 17	22 Mi	22 Sa	22 Mo 30	22 Do	22 So
23 Sa	23 Di	23 Do	23 So	23 Di	23 Fr	23 Mo 39
24 So	24 Mi ★	24 Fr	24 Mo ★	24 Mi	24 Sa	24 Di
25 Mo	25 Do	25 Sa	25 Di	25 Do	25 So	25 Mi
26 Di	26 Fr	26 So	26 Mi	26 Fr	26 Mo 35	26 Do
27 Mi	27 Sa	27 Mo 22	27 Do	27 Sa	27 Di	27 Fr
28 Do	28 So	28 Di	28 Fr	28 So	28 Mi	28 Sa
29 Fr	29 Mo 18	29 Mi	29 Sa	29 Mo 31	29 Do	29 So
30 Sa	30 Di	30 Do Fronleichnam	30 So	30 Di	30 Fr	30 Mo 40
31 So Beginn der Sommerzeit		31 Fr		31 Mi	31 Sa	

- Grades are assigned individually for each participant
  
- The grade is composed of:
  1. First report 25%
  2. Final report 55%
  3. Simulator test and oral exam 20%

Requirements for grading:

- Reports must be submitted before the deadline
- Participants must be present at the lecture, the simulator test, and the flight test

# Election criteria / Requirements

FM I

- no experience, visited, passed, planned for ...

FM II

- no experience, visited, passed, planned for ...

Study progress

- Bachelor, Master

semester

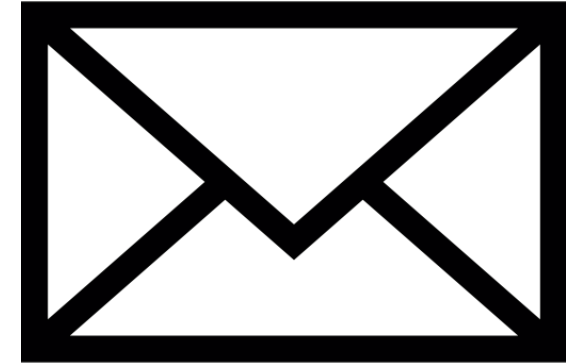
- Number of semester in the current study program

previous tutorials

- Number of already passed tutorials

# Application by email

- Personal data:
    - Name, first name, email, matriculation number
    - preferred partner (if available)
    - preferred language
  - Data on the study program:
    - Study program (MB, Aerospace, WiMB, CE, ... → Bachelor or Master?)
    - Semester (start again at 1 for Master's degree)
    - When planned graduation
    - Number of previous tutorials
  - Prior knowledge of flight mechanics:
    - Flight Mechanics I (no experience, visited, passed, planned for...)
    - Flight Mechanics II (no experience, visited, passed, planned for...)
- } Proof if not attended at TUDA



*Response until 29.03.24 18:00h at  
menner@fsr.tu-darmstadt.de*

**TUCAN registration** at the responsible study offices must be done individually by the participants. Exams start at the beginning of April (date of the lecture)!



**QUESTIONS?**

# Responsible employee at the FSR

## Pascal Menner, M.Sc.

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