Flightmechanical Project „i-con 2" (integrated-configurations)
Aircraft Name: „Talarion-B2"

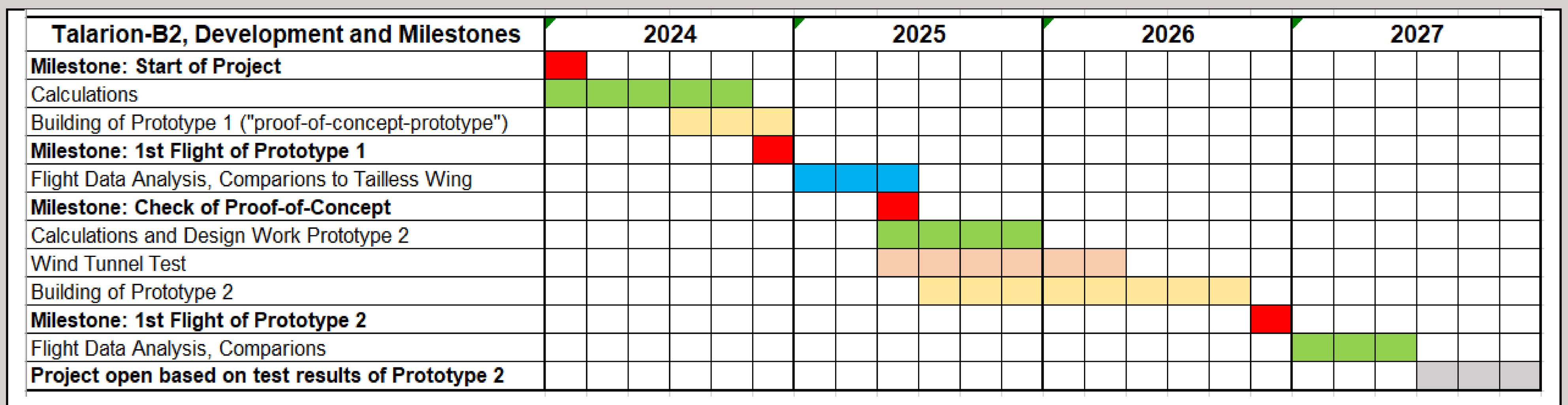
Details given in Extended Abstract

Aircraft-System-Engineering-Service

Project Introduction:

General Layout of Talarion-B2:

- Using a Tailless Wing and move Horizontal Stabilizer to Wing Tips.
  -> Better Performance than conventional configuration.
  -> Better Controllability than conventional configuration.
- Using „i-con Patent“ DE 10 2017 128 164 B4 in order to obtain optimized Stabilizer size.
  Refer to DLRK 2020 „Das Flugmechanische Konzept des Gepfeilten Nurflügel und ein Vorschlag zu dessen Weiterentwicklung“
- Using existing wing from DLRK 2023 „Auslegung und Flugtests einer Nurflügel Drohne“. This ensures a reliable basis for comparison.



Design Detail of Prototype 1


1st Flight of Prototype 1

Introduction of i-con Theory

On the Search for a Higher Efficient Configuration:

- Aim: Using best properties of tailless wing and tail-controlled configuration and integrate it into a better configuration.
- Performance optimized stabilization of lateral axis by tailless wing measure and tail-stabilizer leads to size reduced stabilizer.
- Lift coefficient of stabilizer for trim-flight adjusted to $ca_{stab} = 0$.
- „i-con Formula“ for calculation of stabilizer size, given in DLRK 2020 „Das Flugmechanische Konzept des Gepfeilten Nurflügel und ein Vorschlag zu dessen Weiterentwicklung“:

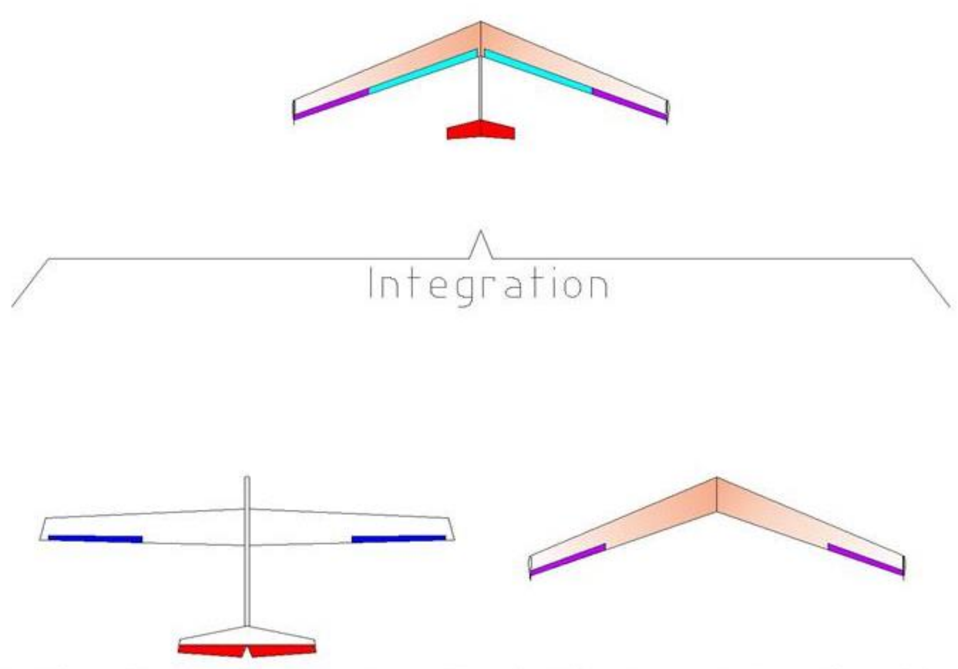
i-con Formula: Gives relative size of stabilizer, for $ca_{stab} == 0$

$$\frac{A_{stab}}{A} = \frac{1}{a_{stab} * a_F} * \left[\frac{-S1 - S2 + S3}{1 + S1 + S2 - S3}\right]$$

$$S1 = \frac{Cm_0 * l\mu}{Ca * \Delta xn}$$

$$S2 = \frac{CMS * l\mu}{Ca * \Delta xn}$$

$$S3 = \frac{\sigma * l\mu}{\Delta xn}$$



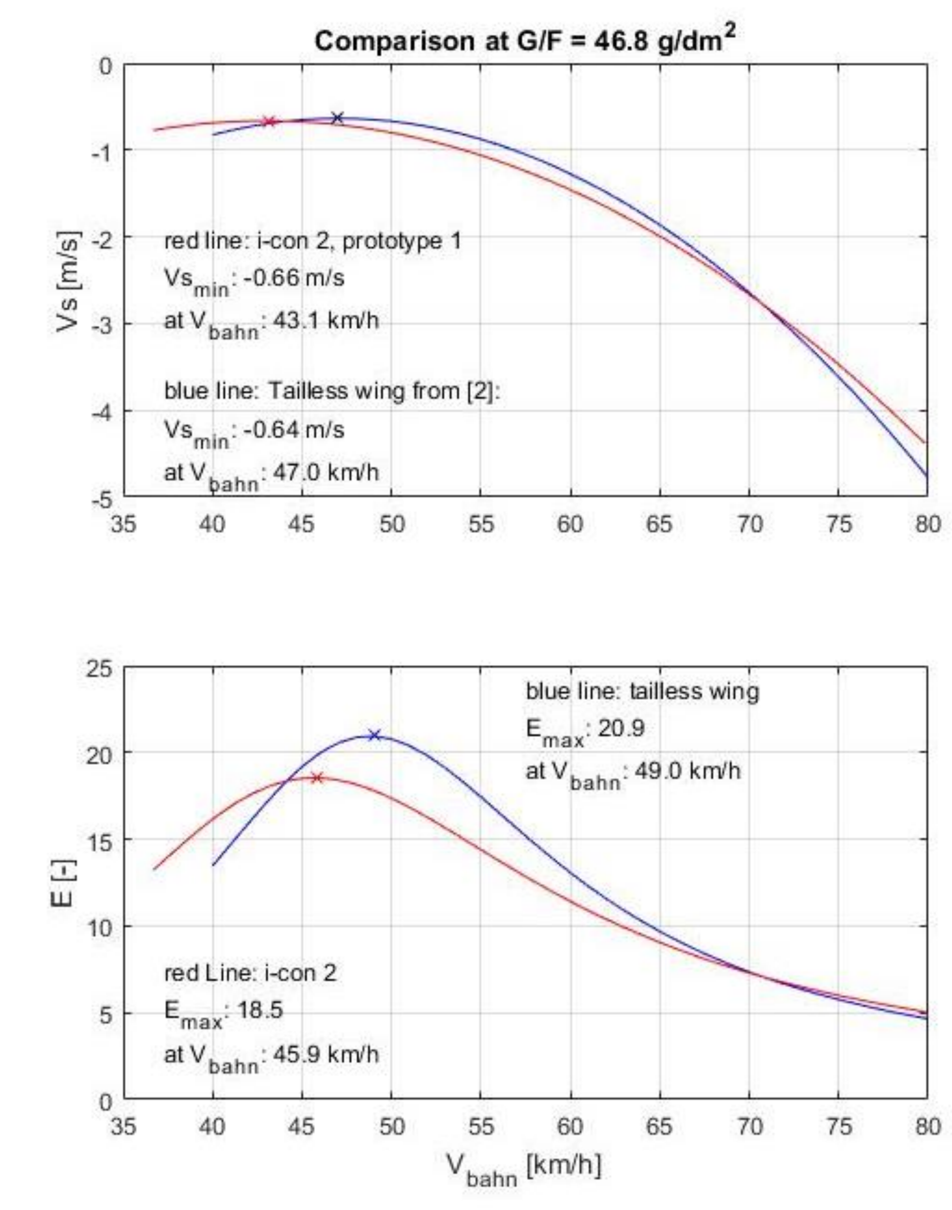
Details given in Extended Abstract to the Poster

So Far: Flight Test Results of Talarion-B2 Prototype 1

- Since the i-con 2 Prototypes use identical wing as Tailless Wing Drone from DLRK 2023 „Auslegung und Flugtests einer Nurflügel Drohne“, the performance can be directly compared. Method of flight test measurements also given in this report.
- Note: Tailless Wing Drone needs elevon offset in oder to achieve lateral axis balance -> not necessary for Talarion-B2.
- Results of Comparison:

-> Both aircrafts shows a nearly identical E.
-> Talarion-B2 slightly better on low speeds.
-> Handling Quality of Talarion-B2 better at low speeds (stall behaviour).
-> Adverse yaw effects considerable of Talarion-B2.
-> High mechancial sensitivity of stabilizers (Landing on rugged area!)

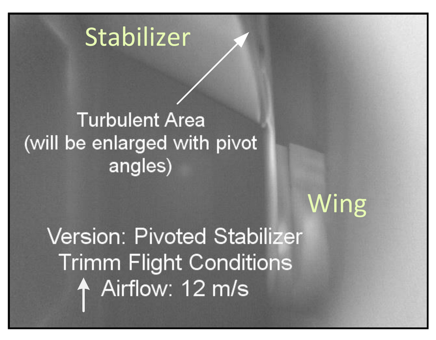
-> This leads in conjunction with the wind tunnel results to the improved Prototype 2

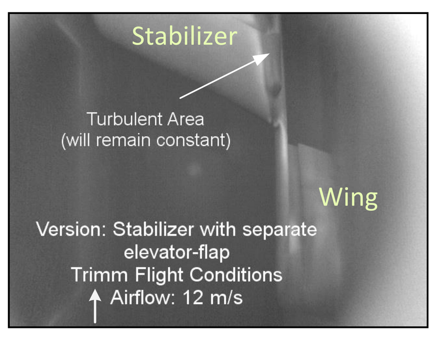


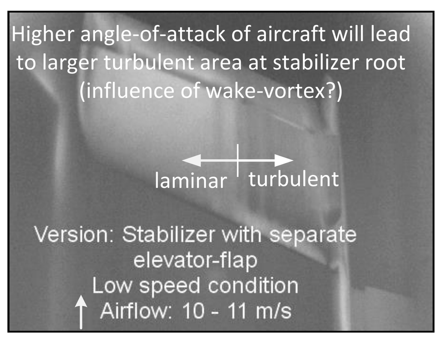
Wind Tunnel Test Results and Talarion-B2 Prototype 2

Main Results of Wind Tunnel Tests (Tunnel of Aerosolution Hansen):

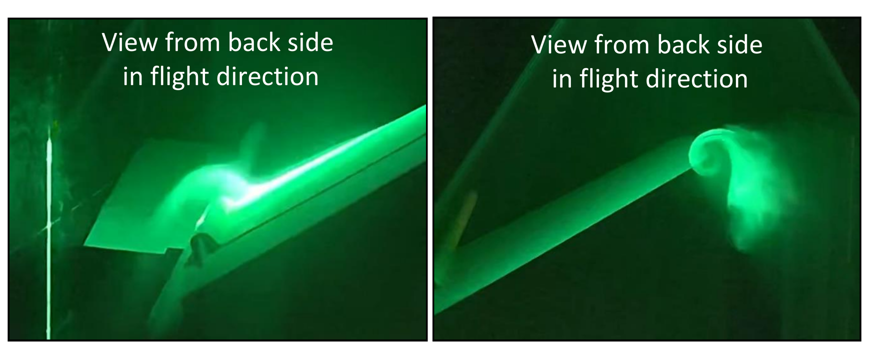
- Stabilizer design with separate elevator-flap better than pivoted Stabilizer due to expected less drag.



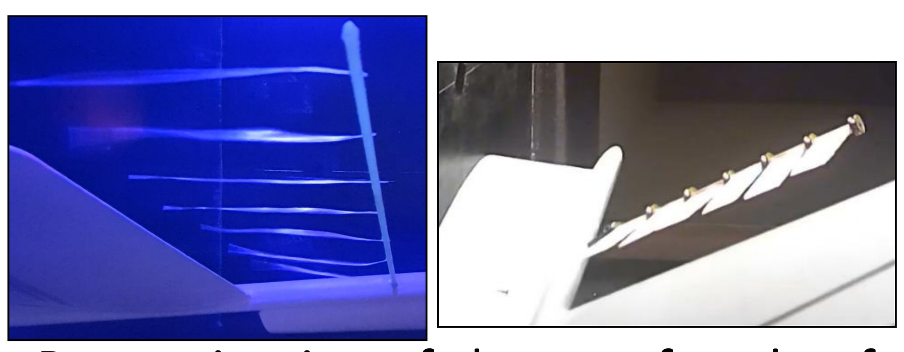




- Two wake vortex can be observed: One at wing tip (interface to Stabilizer), one at tip of Stabilizer. This leads to change of angle-of-attack at Stabilizer.

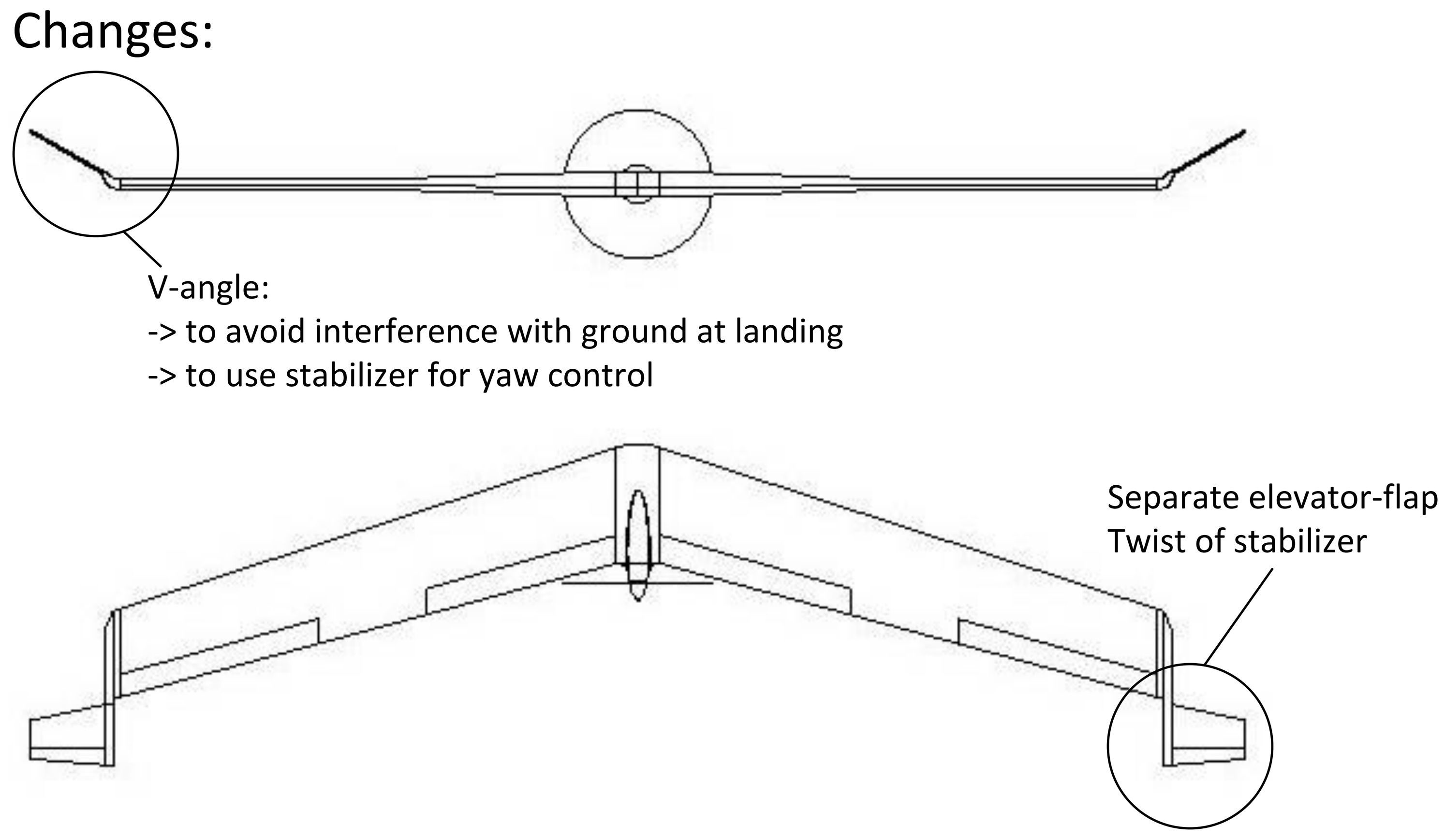


Observation of the two Wake-Vortex


Determination of change of angle-of attack at Stabilizer

Generally, the relative size of the stabilizer (7%) is not changed wrt to (proof-of-concept) Prototype 1

Changes:



Patent Status: Patent 10 2024 100 372.3 B4 granted by DPMA