



I don't fly F1D
because I think I'm great at it;
I fly because I think F1D
is great and I want to be a part of it.



”Det abe gang ich nüme”

”Make it stiff stiff stiff”

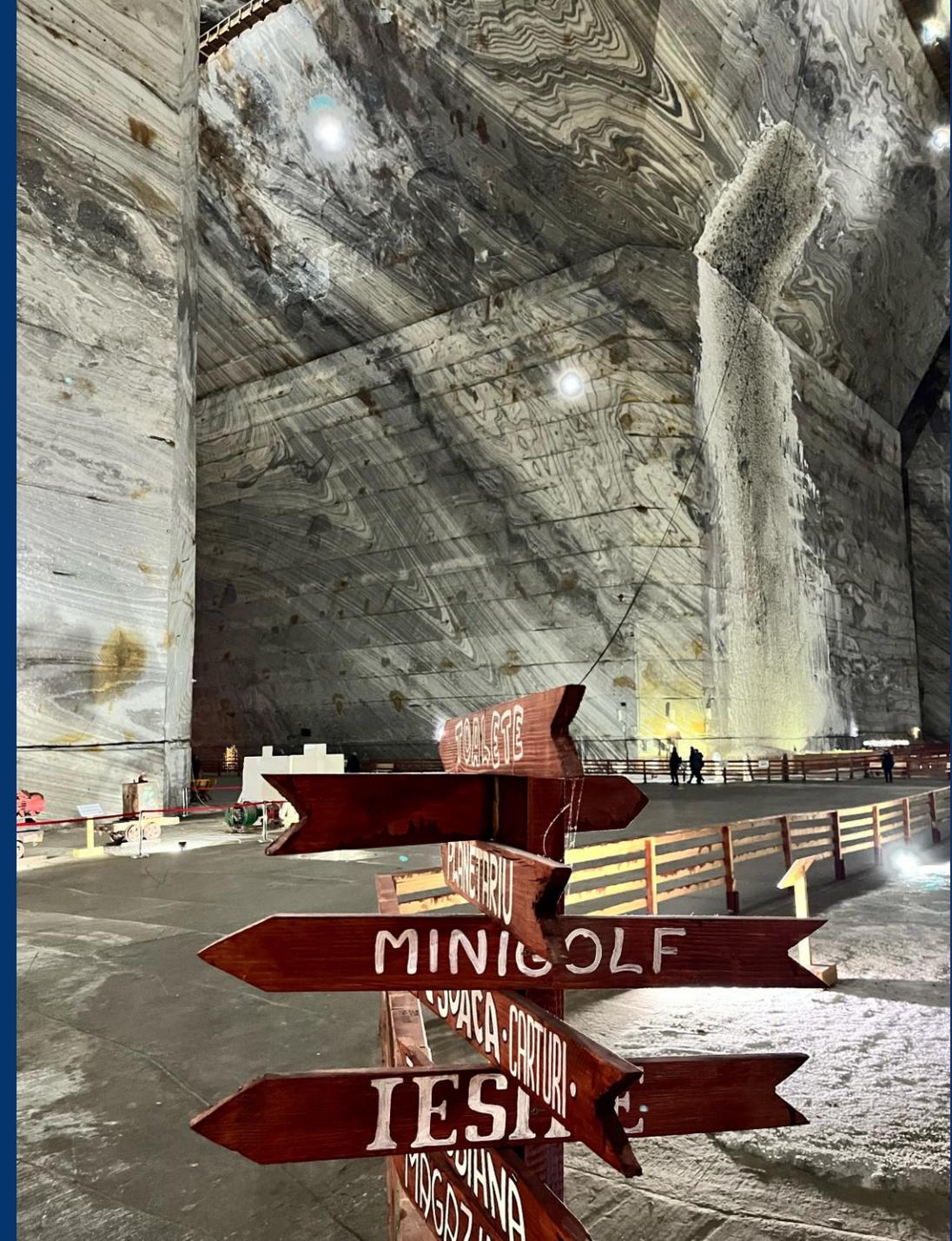
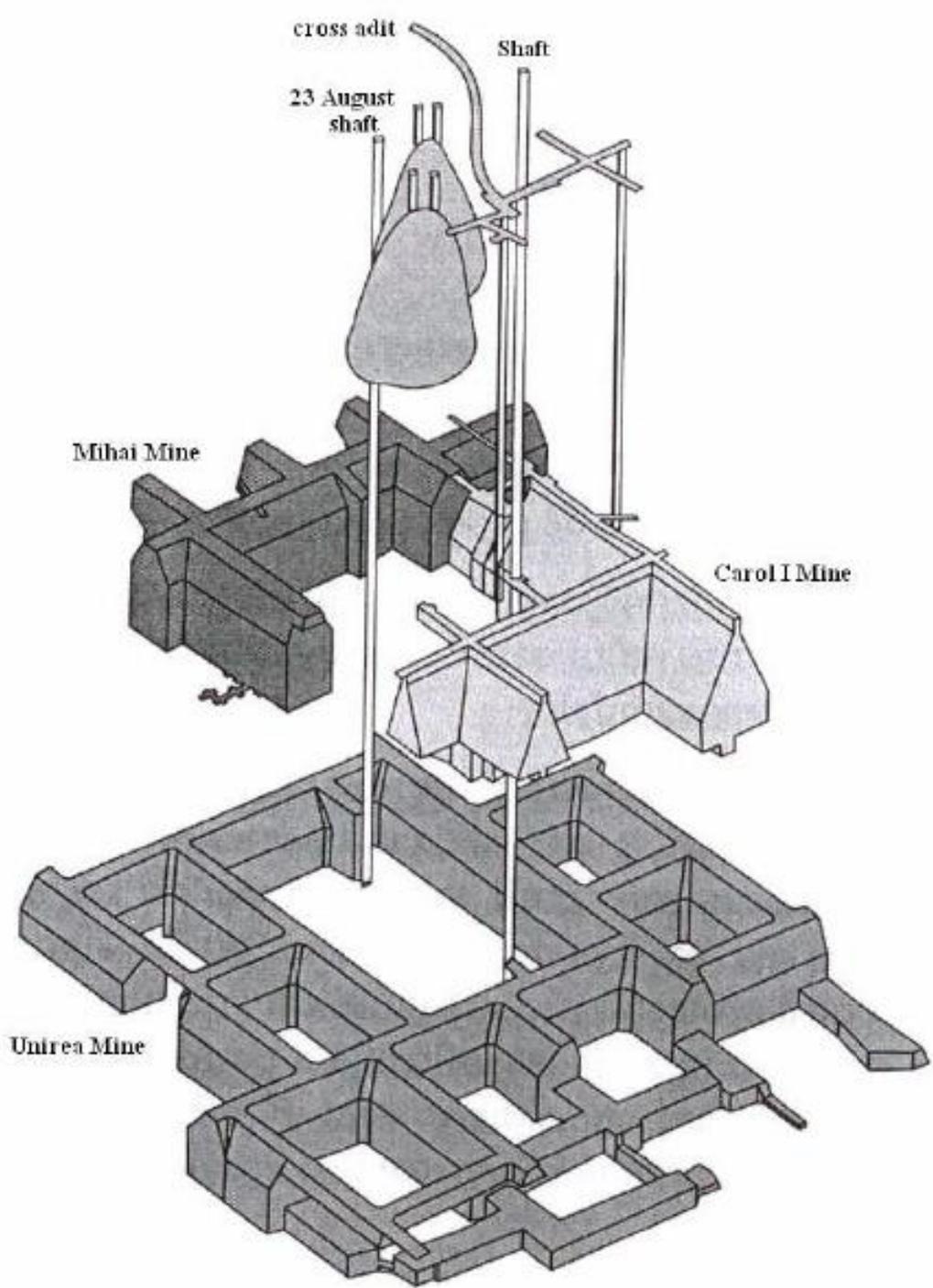
”No one winds as hard as Kang does”

Agenda

1. Journey to the saltmine (Slanic Prahova)
2. Twist
3. Rescue
4. Motor
5. Students







Agenda

1. Journey
2. Twist of motor stick: $\sim 9^\circ$ between wing posts @ 4 Nmm
3. Rescue
4. Motor
5. Students

Twist of motor stick @ 4 Nmm

~7°



Twist of motor stick @ 4 Nmm

~7°



Agenda

1. Journey
2. Twist
3. Rescue team (France)
4. Motor
5. Students

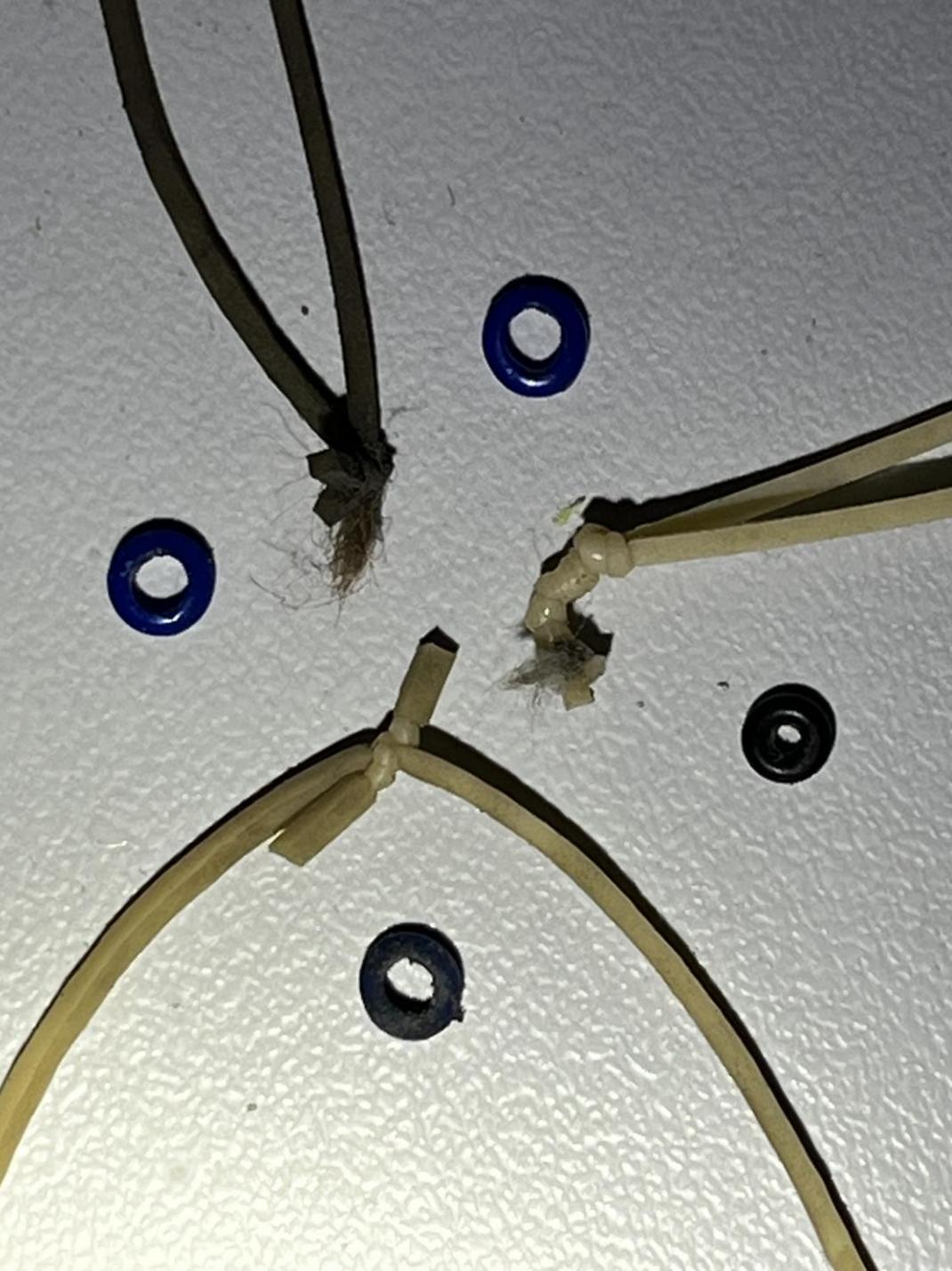






Agenda

1. Journey
2. Twist
3. Rescue
4. **Motor: 1'400 turns @ 3 Nmm torque (best practice)**
5. Students



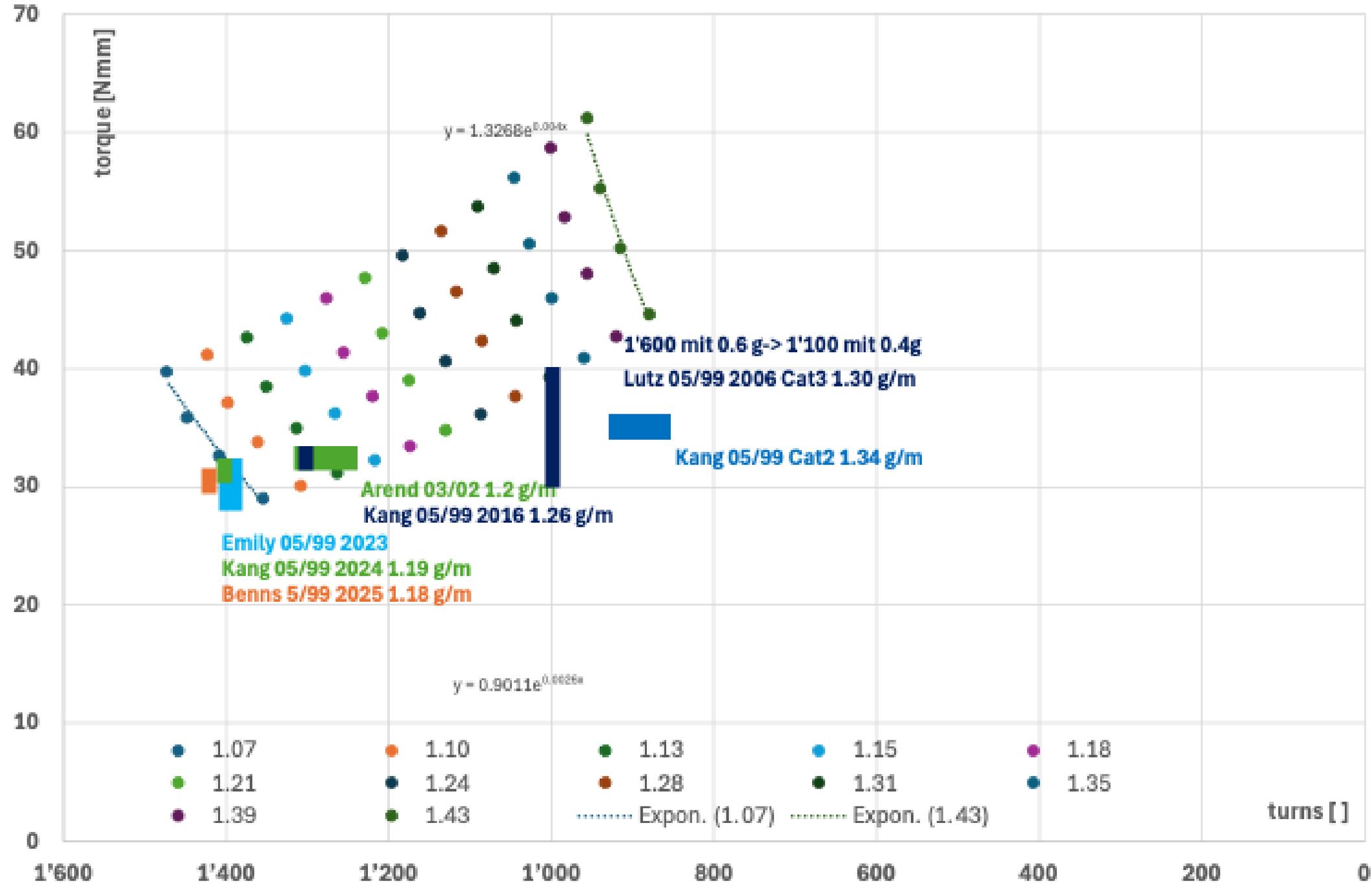
F1D motors max turns and torque calculation for March 02 Tan 2
 0.60g motor, torque in gcm. "Wind" = max torque x max turns/1000

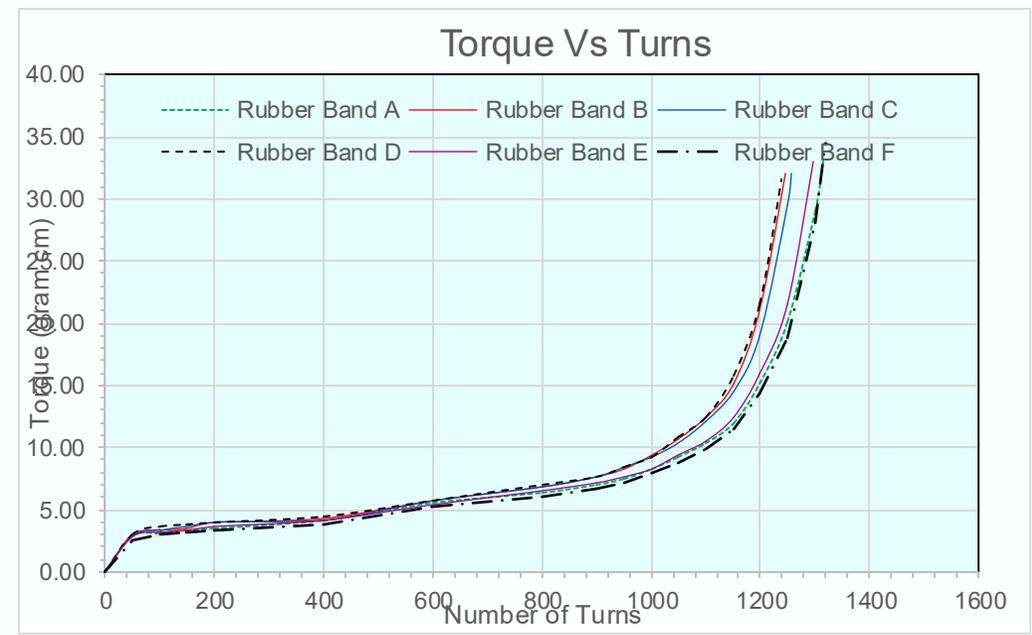
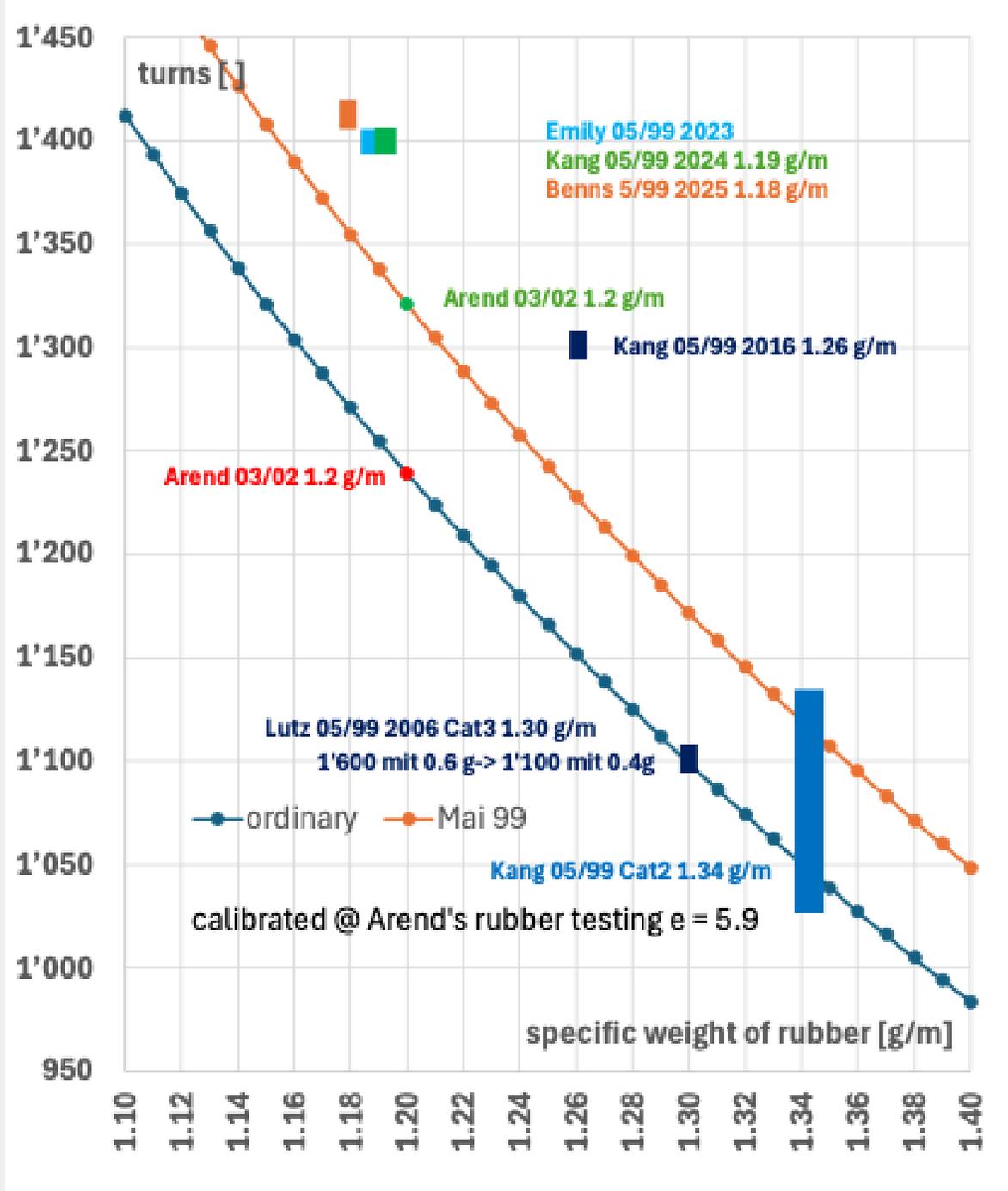
(1)			(2)			(3)		
weight (g)	length of strip (mm)	thickness (mm)	weight (g)	length of strip (mm)	thickness (mm)	weight (g)	length of strip (mm)	thickness (mm)
0.60	559	1.11	0.60	546	1.14	0.60	533	1.17
	turns	torque		turns	torque		turns	torque
60K wind	1325	2032	60K wind	1309	1963	60K wind	1263	1895
70K wind	1409	2113	70K wind	1361	2041	70K wind	1313	1970
80K wind	1448	2172	80K wind	1395	2098	80K wind	1351	2026
90K wind	1471	2210	90K wind	1423	2135	90K wind	1374	2061
(5)			(6)			(7)		
weight (g)	length of strip (mm)	thickness (mm)	weight (g)	length of strip (mm)	thickness (mm)	weight (g)	length of strip (mm)	thickness (mm)
0.60	508	1.23	0.60	495	1.26	0.60	483	1.29
	turns	torque		turns	torque		turns	torque
60K wind	1174	1761	60K wind	1130	1695	60K wind	1087	1631
70K wind	1221	1831	70K wind	1175	1763	70K wind	1131	1696
80K wind	1255	1883	80K wind	1208	1812	80K wind	1162	1743
90K wind	1277	1916	90K wind	1229	1844	90K wind	1183	1774
(9)			(10)			(11)		
weight (g)	length of strip (mm)	thickness (mm)	weight (g)	length of strip (mm)	thickness (mm)	weight (g)	length of strip (mm)	thickness (mm)
0.60	457	1.35	0.60	445	1.38	0.60	432	1.41
	turns	torque		turns	torque		turns	torque
60K wind	1002	1503	60K wind	961	1441	60K wind	920	1380
70K wind	1043	1564	70K wind	999	1499	70K wind	957	1435
80K wind	1071	1607	80K wind	1027	1541	80K wind	983	1475
90K wind	1091	1636	90K wind	1045	1568	90K wind	1001	1501

The turns achieved depends on how

The higher the "K" of the wind, the higher the rubber input energy, the higher the output energy and the higher the flight
 A break in wind does not increase the energy but risks damaging the motor. A gentle stretch wind (70% of 60K turns @
 A 90K wind gives 50% more input energy than a 60 K wind and gives about 20% more output energy (say 5300 flb/lb v
 You can choose to stop at any "K" or continue winding with increased risk of the motor blowing above 60K.
 Mar 02 rubber is not consistent throughout the batch. Some boxes will take 90K but others only 60K.
 On a good box, you should expect to achieve a 60K wind every time without blowing, a 70K wind 3/4 of the time, 80K ab
 If a wind is < 70K then the motor can be reused but above 70 K, a motor should only be used once as it frequently blows
 Above 70K, motors are liable to blow when loading on the model so extreme care is needed - a protective device is worth
 The principle of using the "K" of winds can be applied to any batch of Tan 2 but the numbers will be different (but not by r

h/r L^{4.5} F 317 145





turns as f(e, l, Q)

$$n = e [] \cdot l [mm] / \sqrt{Q [mm^2]}$$

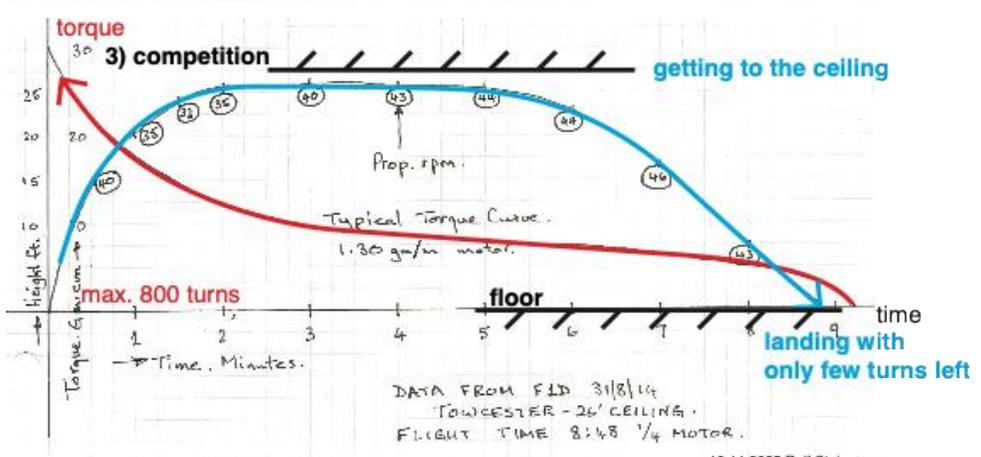
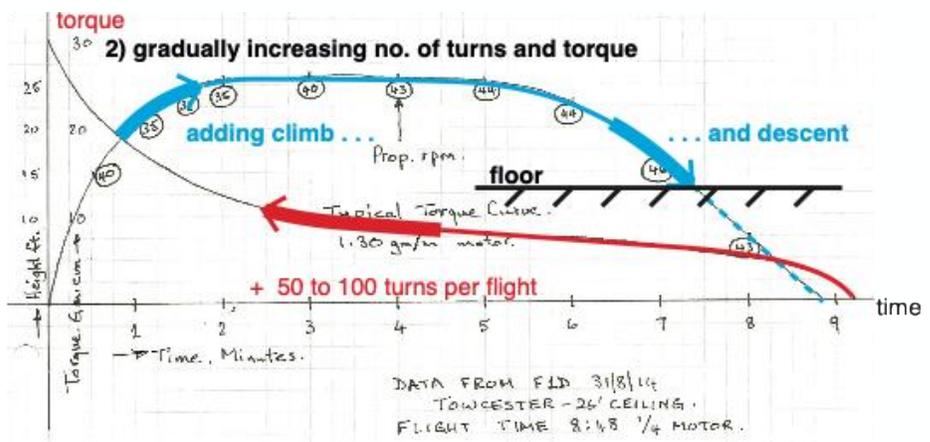
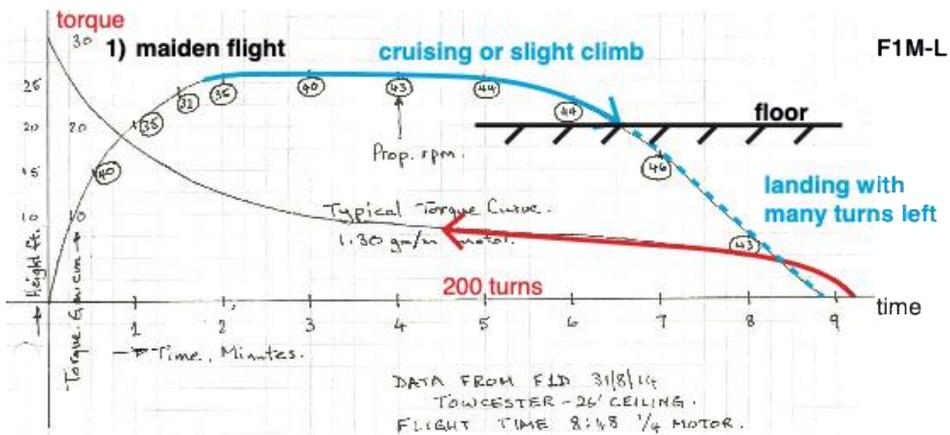
expansion ratio

l = loose length ~ from hook to hook

Q as Σ of both bands

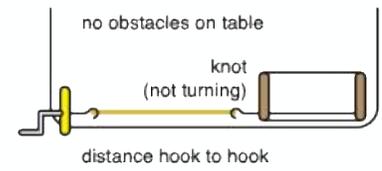
n_{min}	=	0 turns	
$n_{malden\ flight}$	~	200 turns	e < 3
$n_{competition}$	=	f (ceiling)	use [Nm]
$n_{max, F1H-L}$	<	1'000 turns	e < 7

life span of rubber = f(e, no. of flights)



winder and torque meter

- 1) fix winder and torque meter on table with clamps distance hook to hook is the same as on the model
- 2) create an obstacle free zone for the model
- 3) wind clockwise and hold winder if necessary

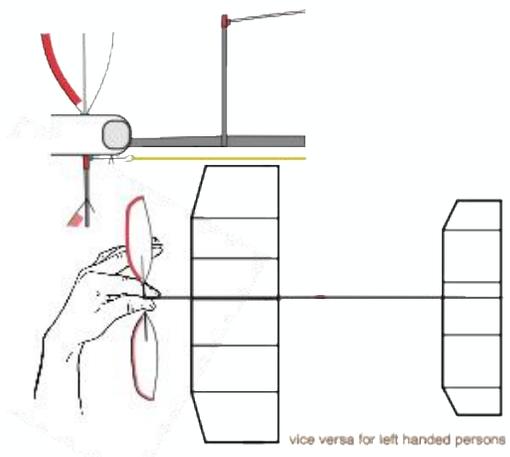


preparation of model

- 1) check for loose parts (thrust bearing and rear hook)
- 2) check fit and tilt of elevator

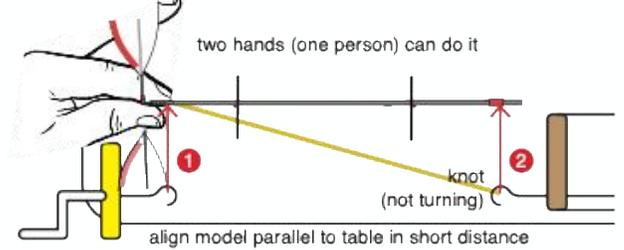
holding the model

- 1) hold model firmly at the motor stick between thumb and index finger
- 2) place the model above the table, parallel to the table in short distance



hooking up the rubber

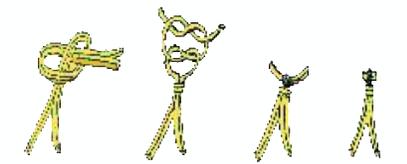
- with your free hand: 1) hook up front end and 2) hook up rear end
- ! keep length of rubber and orientation of model (minimize forces on airframe)
- ! the model shall not touch the table, torque meter etc.



preparation of rubber

F1M-L

- 1) wash and moisten,
- 2) thread connecting ring(s),
- 3) one double knot,
- 4) one or two single knots,
- 5) cut for exact weight



FAI rubber 1.0 * 2.2 mm, max. 1.5 g

winding up for flight

- 1) stretch several times to 4-5 times length,
- 2) lubricate (Armor all),
- 3) wind up to 50 % of intended turns,
- 4) slowly move in keeping up torque ...
- 5) ... until the last handle cranks occur right at the length of the motor.



turns as f(e, l, Q)

$$n = e \cdot l \cdot \sqrt{Q}$$

expansion ratio
l = loose length ~ from hook to hook
Q as Σ of both bands

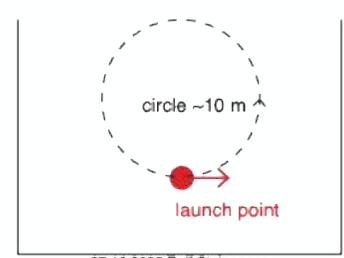
n_{min}	=	0 turns	$e < 3$
$n_{maiden flight}$	=	200 turns	
$n_{competition}$	=	f (ceiling)	use [Nm]
$n_{max. F1M-L}$	<	1'000 turns	$e < 7$

life span of rubber = f(e, no. of flights)

For your first flight, start with 200 turns (20 on handle of winder), then increase no. of turns until you reach the ceiling.

launching the model

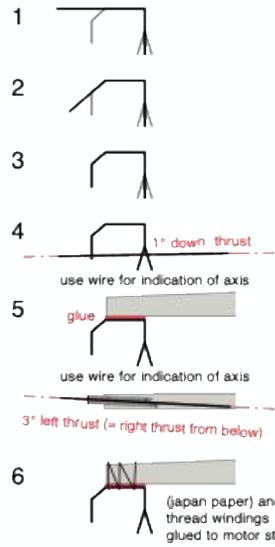
- 1) let the propeller turn and shortly after ...
- 2) let the model fly (do no throw, simply let go)



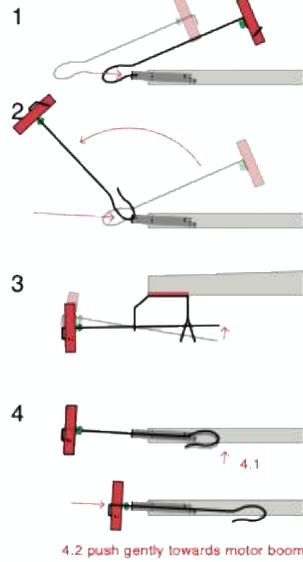
Agenda

1. Journey
2. Twist
3. Rescue
4. Motor
5. Students: F1M-L competition / principles of flight

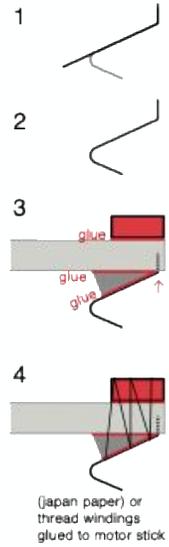
Alu bearing (2024 AlCu4Mg1)



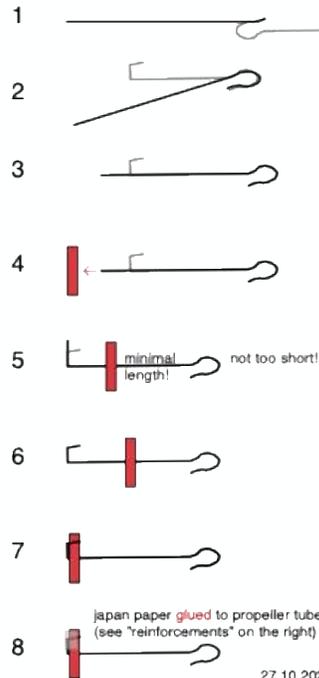
mounting of propeller



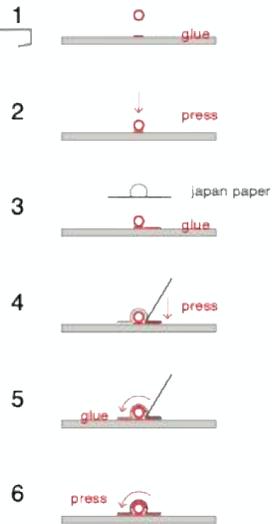
rear hook d 0.5 mm



shaft with driver 50 * d 0.5 mm



reinforcements (japan paper)



film specification

1 micron [µm] mylar [®] by [®] PET Polyethylenterephthalat

lubricant

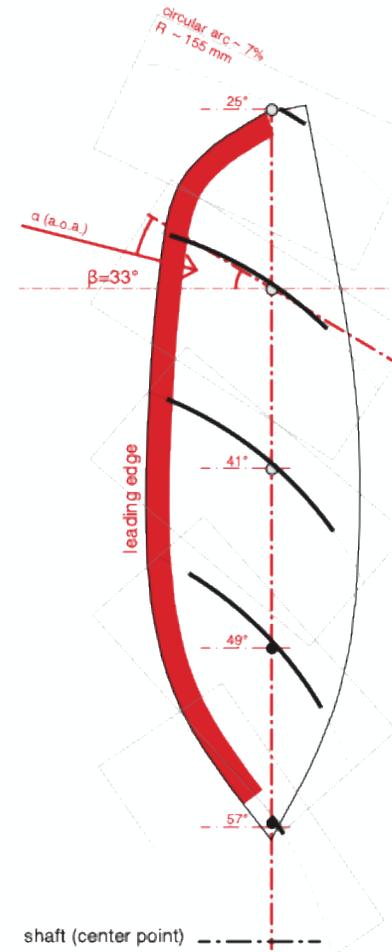
to attach film to frame temporarily (or use water)

handling of glue



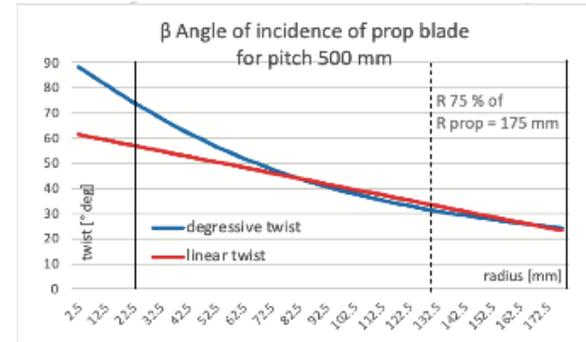
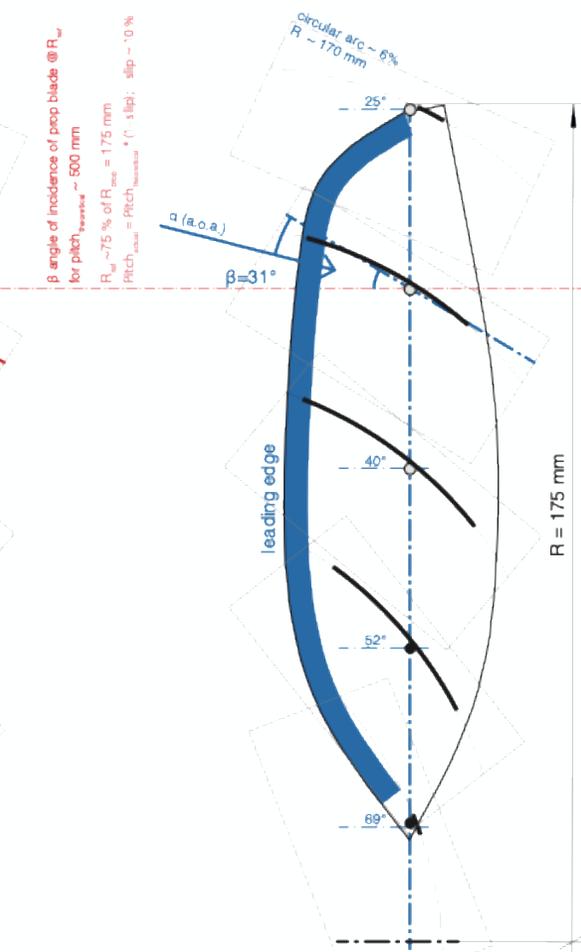
After a pause, make one or two test dots on paper before applying small dots to the model. Empty and clean with Acetone after use.

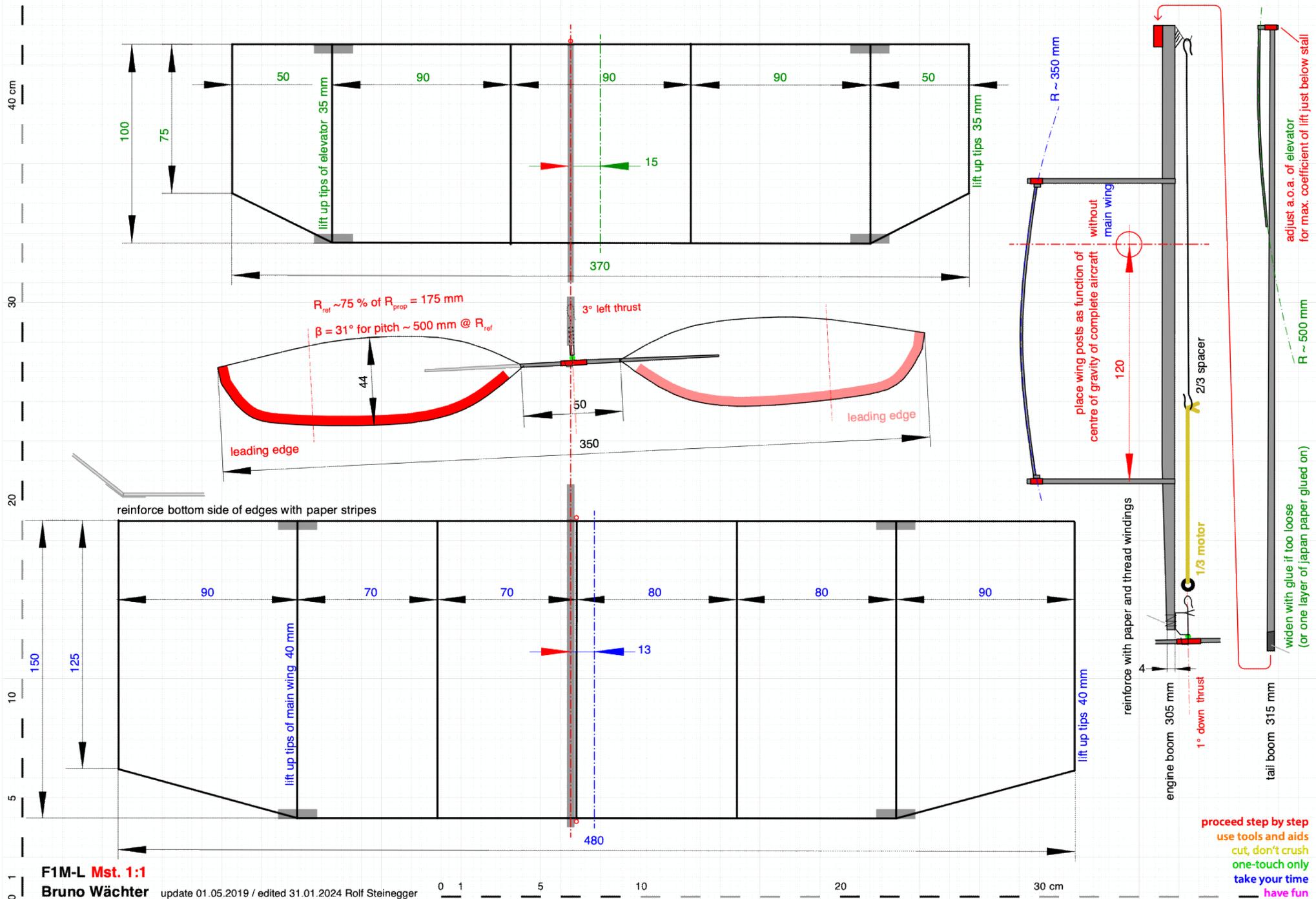
propeller blade with simple 3D-shape:
linear twist on PE* tube Ø 150 mm,
rotation of 15° deg *max. 50 °C!



propeller blade with
degressive twist as
 $\beta = \arctan(\text{Pitch} / 2 \cdot \pi \cdot R)$

F1M-L
Mst. 1:1

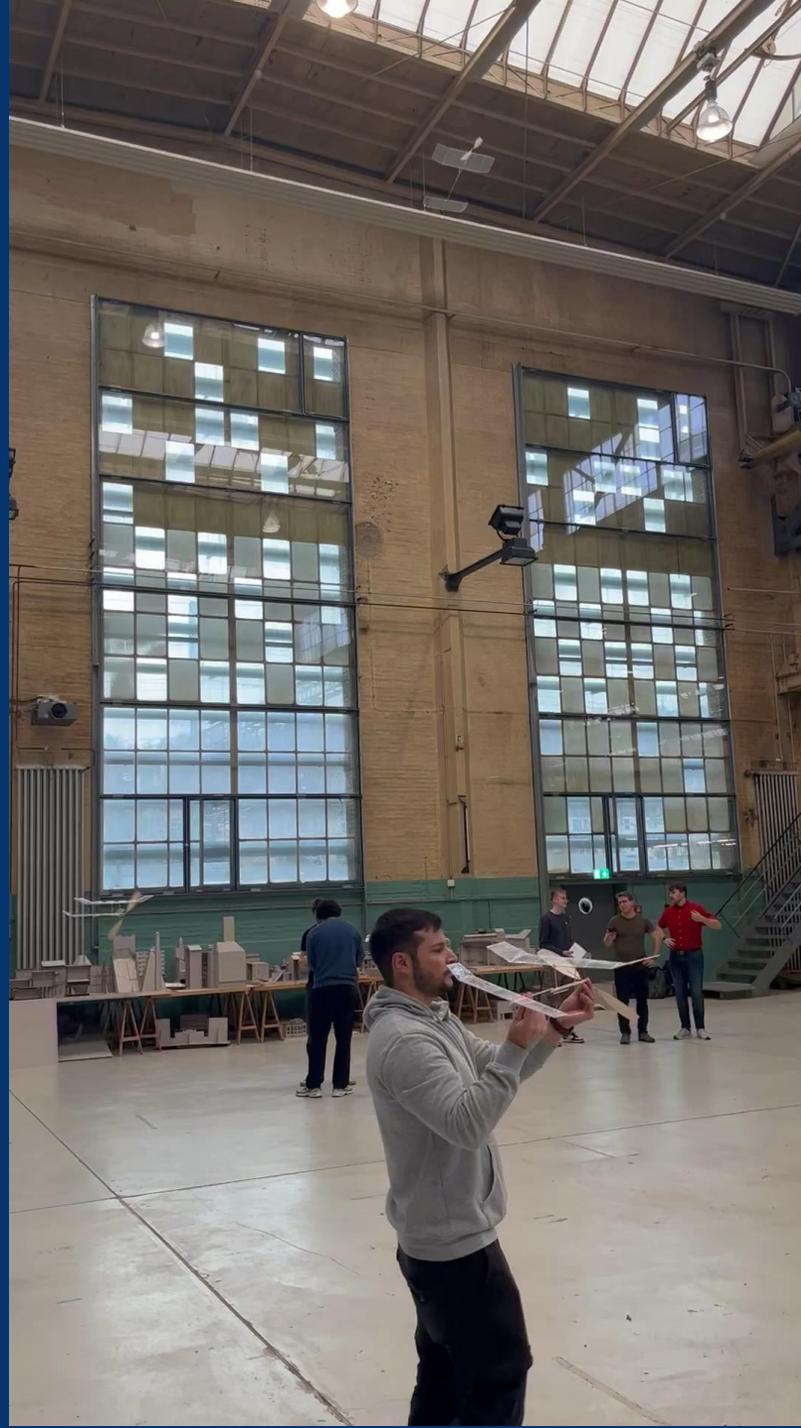




F1M-L Mst. 1:1

Bruno Wächter update 01.05.2019 / edited 31.01.2024 Rolf Steinegger

- proceed step by step
- use tools and aids
- cut, don't crush
- one-touch only
- take your time
- have fun



Learning objective: Make it generally valid,
i.e. include wings and blades with **symmetrical section**

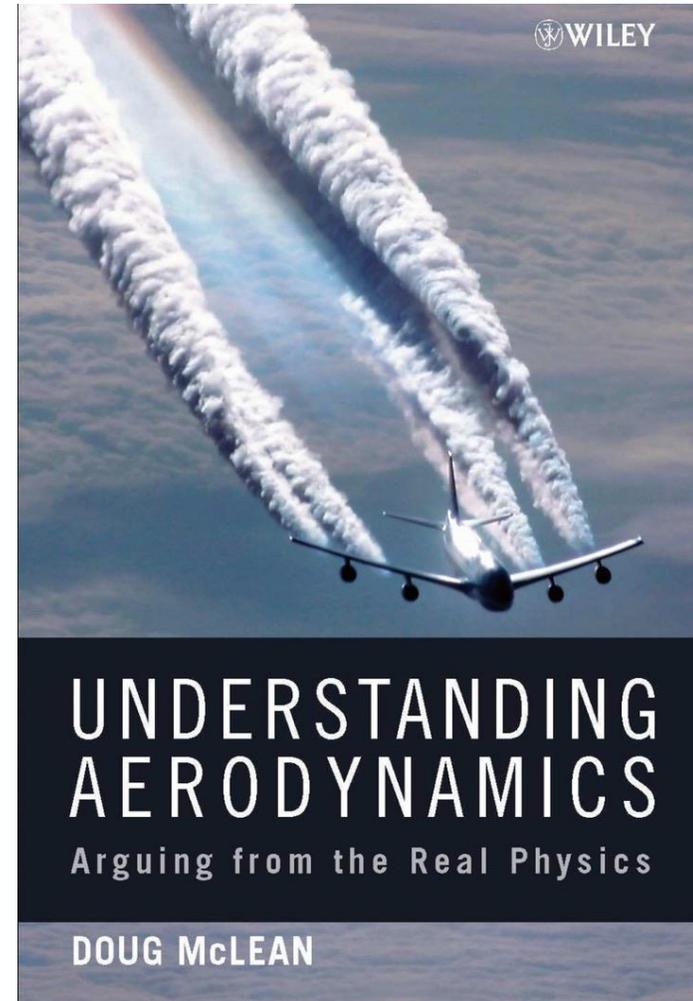
**Hughes/Schweizer 300 series
S-300C**



EA 300 L for aerobatics



Learning objective: Make it generally valid,
i.e. include wings and blades with **cambered section**



Learning objective: Make it generally valid, i.e. include sails* and foils in **different fluids** (air und water)



* **zero thickness**

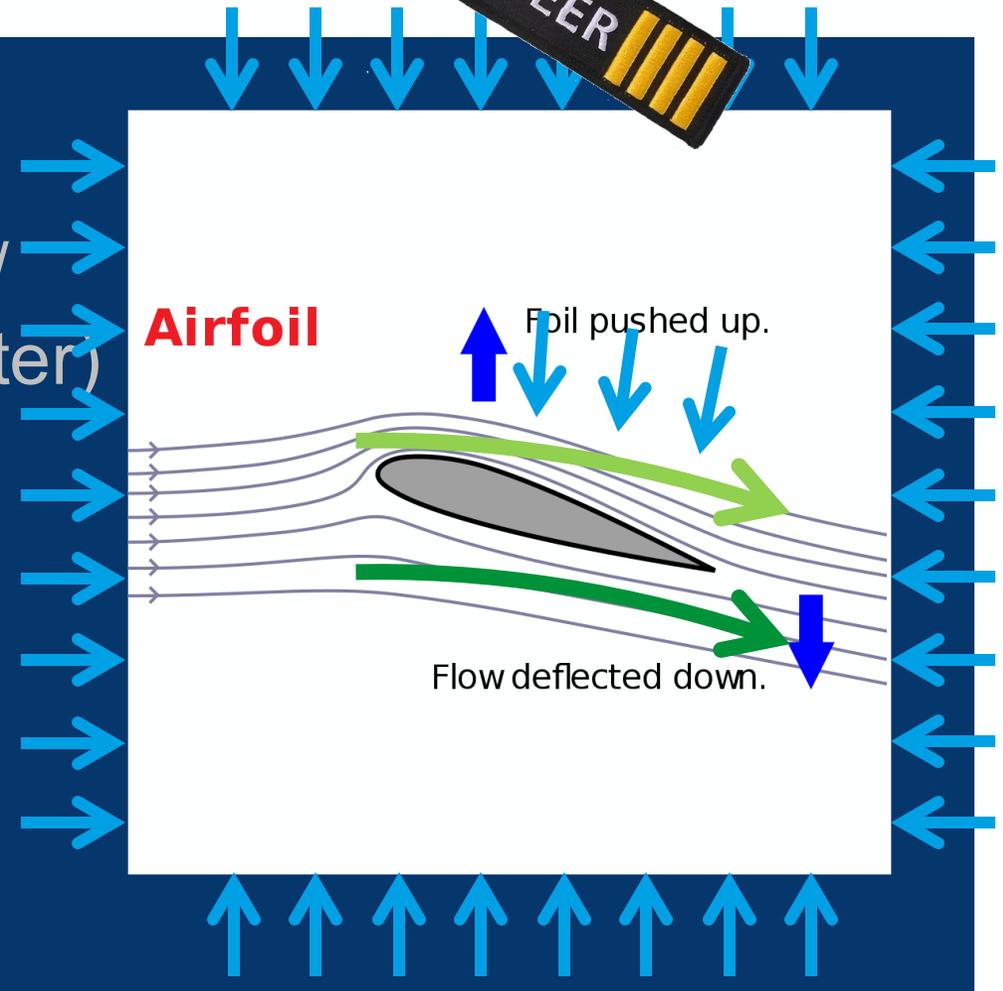
Learning objective: Make it generally valid



The flowfield and its deflection caused by the object (plate / wing / foil / sail) moving through the fluid (air or water) and by the pressure of the surrounding fluid that keeps the laminar flow of the fluid attached to the object.

Newton's 2nd law

Newton's 3rd law



Learning objective:

Focus on the most principle (basic) explanations

Mass flow rate [kg/s]

= mass [kg] / time [s]

= **Density ρ [kg/m³]** * **velocity [m/s]** * **area A [m²]**

The mass of fluid is accelerated from 0 to a certain velocity

Integration with respect to velocity : $\int(\text{mass flow rate } (v)) dv$

$$= \int(\rho * v * A) dv = \rho * A * \int(v) dv = \rho * A * \frac{1}{2} * v^2$$



nevergiveupdreaming