4^{th} InDeWo 2026:

Concurrent Hover and Forward Flight

Multi Disciplinary Optimization

Table of Contents

1. Aim of this task

This year, we will share and cross-validate the so far generated designs. Whether or not people utilized the proposed parameterization or procedures to arrive at these improved designs is irrelevant.
The design task is recapped for clarity, and a few sections have been updated for further clarification. For the structural section, the new design is specified, but also separately specified.

2. Task 3+ Overview

Up to three individual tasks are now given. Please feel free to engage as many or as little as you can. A fourth task is given being the synchronization of the three previous tasks.

- Aerodynamic Optimization: Rotor planform & twist
    - it is encouraged to go to the optional 6 and 8 parameters
- Aerodynamic Optimization: Airfoil family
- Structural Optimization

3 Aerodynamic Optimization: Rotor planform & twist (Gunther)

3.1 *Rotor and flight condition*

The chosen baseline or reference rotor is the HART II rotor. More details on the rotor can be found under https://www.dlr.de/en/site/hart-ii/about-hart-ii. The target configuration is therefore similar to the Bo105; however, we assume that higher blade loadings can be achieved, and that for other purposes, the rotor can be scaled to a sufficient degree.
Similar to last task, the flight conditions are deduced from the HART II baseline test case. They are however modified to a hovering and forward flight/cruise condition with a corresponding c_L/σ= 0.1. In order to avoid conversion difficulties, the flight condition is detailed in Table 1.
In hover, the thrust shall only be trimmed with the collective pitch. In cruise flight, the pitching & rolling moment shall be canceled out with the cyclic pitch, while the horizontal force is to be overcome with the shaft angle. The trim law may be chosen freely during the optimization (3 or 4 components), as long as the reference and final design achieves the trim goals.

For polars of required power or $L/D_q = Lv_\infty/P_{req}$ over speed, the drag area may be multiplied with ½ ρ v_∞^2 to arrive at the according horizontal force. For those not being able to do a four component trim, add 10% to the drag area to account for rotor drag.

Table 1: Flight conditions of WP 3

	hover	cruise
Lift	5582 N	
Horizontal Force	0 N	527 N
Drag Area	0 m^2	0.2 m^2
Roll & Pitching Moment	0	
c_L/σ	0.1	
c_x/σ	0.00944	
Horizontal speed	0 m/s	66 m/s
Ambient Temperature [K]	290.46	
Ambient Pressure [Pa]	100970	
RPM	1042	
c_{ref} [m]	0.121	
σ	0.077	

3.2 *Goal Functions and Design Variables*

For the baseline task, a total of 4 design variables is to be used. Two goal functions are to be considered, the Figure of Merit in hover and the effective glide angle L/D_q in cruise flight. Both of which are synonymous with the reduction of required power as the lift is fixed through the trim conditions. An additional constraint is therefore to be imposed, as the peak-to-peak pitching moment at the blade root shall not exceed 1.2 times that of the HARTII rotor obtained by the simulation if using sweep and/or dihedral for the blade. This is summarized in Table 2.

Table 2: Goal function and constraints for 3D rotor optimization

function	Equivalent to	purpose
Figure of Merit in hover	Required power	Goal function
L/D_q	Required power	Goal function
Peak-to-peak pitching moment at blade root in forward flight		Constraint < 1.2 HART II value

The planform is to be parameterized in the following:

- 2 twist parameters which are added to the HART II baseline parameterization. It is similar to the one previously used by the JAXA-ONERA-DLR cooperation (https://link.springer.com/article/10.1007/s13272-022-00580-8). Two control points using cubic splines are to be used. The first parameter is simply the linear twist over the blade span, Θ/R. On top of the linear twist section, a cubic spline is super positioned, which has zero slope and value at r/R=0.75. At r/R=1, the twist offset is specified with $\Delta\Theta_2$ being the second parameter.
- 2 chord parameters: the chord length distribution of the rotor is controlled by three control points of a cubic spline. The first is at r/R=0.5 and fixed to c_{ref} with zero slope. The second control point is at r/R = 0.75 and a value of $chord_1$ being the first parameter. The second parameter is $chord_2$ being located at r/R=1 and having a free slope. The values shall be specified as fractions of c_{ref}. The final distribution shall be weighted as to maintain a constant thrust weighted solidity albeit chord length:
  $\int_{r/R=0.22} c(r)\, r^2\, dr \;/\; \int_{r/R=0.22} r^2\, dr = c_{ref}$
  It shall be ensured after the blade is constructed by integrating the chord length of the current design. The ratio of the reference to the current value is then to be multiplied against all chord lengths. Integration is to be done from the root section of 0.44m up to 2m using the mid-point rule on the given discretization.

The parameter bounds are listed in Table 3 and the in Figure 1 sketches of the respective functions are given. For reference, the result for the DLR balanced 6 design are given there as well.

Optionally, more parameters may be used. It is noted that for comparison, the baseline case is more suited, while for showing the absolute potential the optional set is more suited. The anhedral and sweep parameters are to be treated similarly as the chord parameter. They all share the common starting point of r/R=0.5 with a zero slope, the second control point place at r/R=0.75, with the final one at the tip. However, in contrast to the chord parameter, which is scaled to maintain solidity, these parameters shall be chosen freely.

This may also be done in two steps, e.g. first add sweep, and secondly add anhedral.

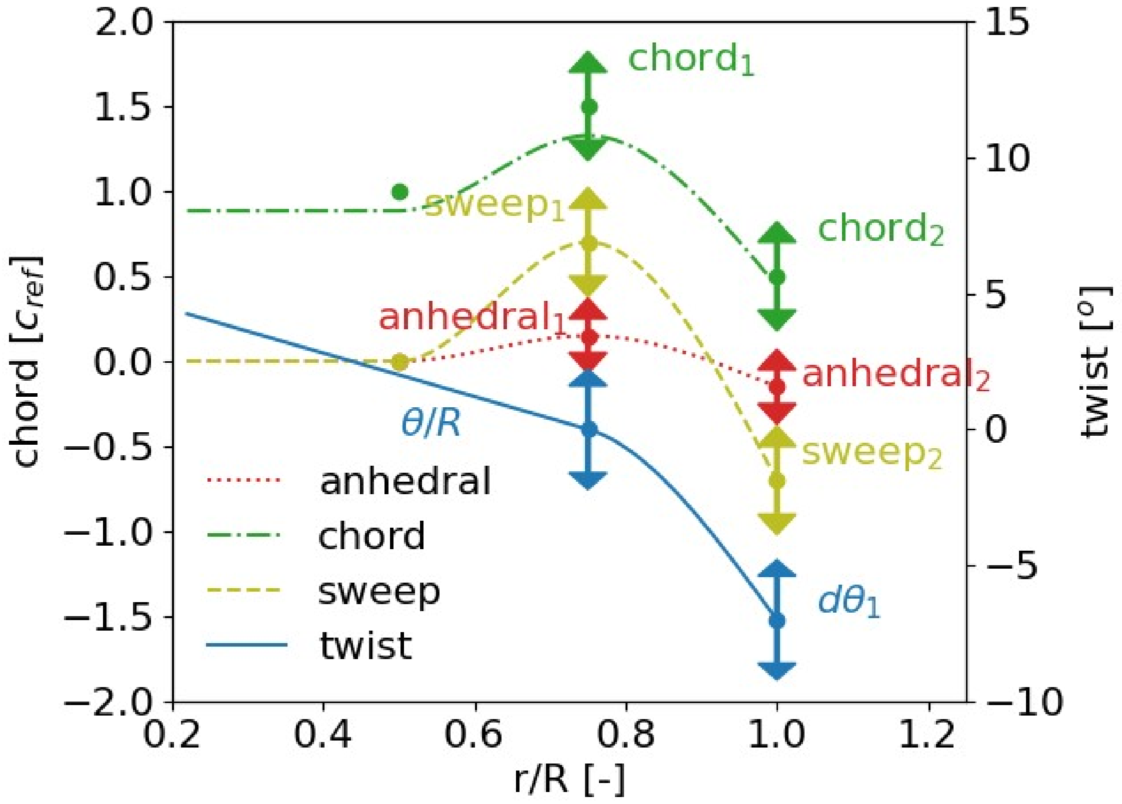

Figure 1: Sketch of the design variables. Dots are the control points of the cubic spline, arrows show the design variables. Note: actual chord distribution is offset from the control points due to the solidity constraint.

Table 3: Parameter limits – chord, sweep, anhedral scaled with c_{ref} = 0.121m. Chord to be rescaled to match thrust weighted solidity of HART II

Parameter	Lower bound	Upper bound	DLR balanced 6
Baseline parameters stage 0			
θ/R	-15	0	-9.477
$\Delta\theta_1$	-5	5	-4.278
$chord_1$	1.	1.5	1.226
$chord_2$	0.5	1.	0.5907
Optional parameters stage 1			
$sweep_1$	-1.0	0.0	-0.4278
$sweep_2$	0.0	1.0	0.0142
Optional parameters stage 2			
$anhedral_1$	-0.5	0.5	0.
$anhedral_2$	-1.0	1.0	0.

3.3 Approach

It is fully left to the participants on how to tackle the proposed optimization – be it a true multi-objective optimization or a weighted single-objective optimization. The idea of the workshop is to grow and learn from others! However, for comparison we propose the following steps:

- Compute the FM polar for the HART II blade and compare it with the reference data (supplied separately). You may use a higher fidelity for this than for your optimization.
- Compute a sweep of varying cruise speeds, i.e. 33 to 76 m/s for the baseline rotor to be compared (DLR can provide wind tunnel data for a lift of 3567 N and CFD data at the specified condition)
- Optimize the blade with the specified parameters and/or your own design variables and fidelity level of simulation of your choice.
  - Preferable you search the anchor points, i.e. the best hover and cruise blade.
  - Find an intermediate design, preferable with an equal weighting between hover and cruise. Please scale the results in each flight condition with the respective baseline value for better weighting and comparability.
  - This could be achieved with one multi-objective optimization or two single-objective optimizations.
- Compute an FM polar and speed sweep of your optimized blades using the same fidelity as for the baseline blade. Report your root peak-to-peak torsional moment accordingly.

NOTE: for comparison of sectional forces, we propose to look sectional lift $c_z M^2$ and torque $c_q M^2$. They are computed as follows:

$$\bar{c}_z M^2 = \frac{dF_z}{dr} \frac{2}{\rho c_{ref} a_\infty^2}$$

$$\bar{c}_q M^2 = \frac{dQ_z}{dr} \frac{2}{\rho c_{ref} R a_\infty^2}$$

$$\frac{\overrightarrow{dQ}}{dr} = \left(\frac{\overrightarrow{dF}}{dr} \otimes \vec{r}_{deformed} + \frac{\overrightarrow{dq}}{dr} \right)_z$$

In contrast to classical values like c_n, these coefficients are scaled with the reference chord length instead of the local chord length as we believe this is more suited for design and see which section delivers thrust and draws torque.

NOTE: You may go fully turbulent for simplicity for now, at least have results for comparison at hand!

4 Aerodynamic Optimization: Airfoil Family (Gunther)

4.1 *Airfoil specifications and flight conditions*

The baseline airfoil is the NACA23012 with the a tab. The geometry may also be found on the HART II website (https://www.dlr.de/en/site/hart-ii/about-hart-ii). For basic consideration, please allow for a manufacturing tab of 5mm length and 1mm thickness on the 3D rotor. For the HART II rotor with a reference cord length of 121mm, this is roughly 4% length and 0.8% thickness, and maybe the numbers used during 2D airfoil simulations. Obviously, when a varying chord length is applied on the rotor, the 5mm length and 1mm thickness have to be set in absolute values.

Three airfoils are designed for the radial stations of r/R=80%, 90%, 100%. The chosen thicknesses are 12%, 10% and 8%. The airfoils shall be linearly interpolated in between the stations. For the airfoiled sections from r/R=22% to r/R=80%, use the 12% airfoil.

Table 4: Specifications for the 12% airfoil at radial station r/R=0.8

12% airfoil (r/R=0.8)	Mach	Reynolds / 1e6	C_l range
Retreating side	0.32	0.75	maximize
hover/mean	0.52	1.2	0.50..0.80
Advancing side	0.77	1.8	0.03..0.23

Table 5: Specifications for the 10% airfoil at radial station r/R=0.90

10% airfoil (r/R=0.90)	Mach	Reynolds / 1e6	C_l range
Retreating side	0.39	0.90	maximize
hover/mean	0.58	1.3	0.56..0.76
Advancing side	0.81	1.9	-0.08..0.18

Table 6: Specifications for the 8% airfoil at radial station r/R=1.0

8% airfoil (r/R=1.0)	Mach	Reynolds / 1e6	C_l range
Retreating side	0.42	0.97	maximize
hover/mean	0.64	1.5	0.38..0.58
Advancing side	0.83	1.9	-0.07..0.13

Please abstract the corresponding flow conditions from your 3D rotor simulations. As a reference, and for those wanting to only engage in 2D airfoil optimizations, Table 4 to Table 6 list the corresponding flight conditions as determined by DLR. Abstracting these is the most demanding part, and therefore part of the work.

When creating the complete family, the reference airfoils will be the NACA 23012, NACA 23010 and the NACA 1208 airfoils including a the aforementioned tab size.

4.2 Parameterization

For now, no explicit parameterization is given. The idea here is to find what is best suited to optimize airfoils and is likely even more challenging than the planform & twist optimization. Obviously, we are seeking the best aerodynamic shape, and splitting the task into airfoil, planform & twist optimizations is only a model to simplify the effort. If you can run all three parts concurrently, go for it!

One important aspect is the airfoil alignment – in order to not perform a twist optimization through too much camber, align the airfoils at their with the respective angle they have at c_l 0.6 in the hover condition. Important is the relative changes in angle of attack between the airfoils, for a single airfoil design it will just lead to a pitch offset.

4.3 Goals & Constraints

The goals and constraints remain the same for the extended planform & twist exercise. In the end, the vibrations on the rotor should not go up, nor show the pitch link loads increase. Therefore, please abstract those numbers from your simulation. A slack of 5% is allowable.

As for the goal functions, similarly, improve Figure of Merit and L/D_q for the rotor by employing improved airfoils. However, when going for only 2D optimizations, the following approach is recommended:

a) optimize the drag for the given c_l range in hover.

b) stay below the absolute pitching moment of the reference airfoil in the hover condition, except for the tip airfoil, where the pitching moment shall be decreased by 60% of the NACA 1208.

c) stay above the maximum lift of the the reference airfoil in the respective condition, except for the tip airfoil, where 1.1 times of the reference shall be achieved.

c) stay below the 1.2 times the advancing side drag over the reference airfoil for the inboard airfoil, stay below 1.0 times the advancing side drag of the intermediate and tip airfoil.

The functions for 2D airfoil optimization are recapped in Table 7. If you directly optimize with 3D rotor simulations, please refer to Table 2

Table 7: Goal functions and constraint of 2D airfoil optimization

function/airfoil	12%	10%	8%
$C_{D,avg}$ (hover)	minimize	minimize	minimize
$C_{D,avg}$ (advancing)	Constraint **<1.2 NACA 23012**	Constraint <1.0 NACA 23010	Constraint <1.0 NACA 1208
$C_{L,max}$ (retreating)	Constraint >1.0 NACA 23012	Constraint >1.0 NACA 23010	Constraint **>1.1 NACA 1208**
$C_{m,avg}$ (hover)	Constraint <1.0 NACA 23012	Constraint <1.0 NACA 23010	Constraint **<0.6 NACA 1208**

NOTE: You may go fully turbulent for simplicity for now, at least have results for comparison at hand!

5 Structural optimization task (Gunther)

For those pursuing an improved structural design, the following tasks may be performed. However, the DLR reference design now shall the balanced 6 design with new airfoils.

5.1 HART II common structural data comparison

A common structural data set for the HART II rotor is supplied. Using this structural data set, the blade natural frequencies are to be computed with the each participant's comprehensive code. Afterwards, the fan plots are compared and deviations are discussed.

The structural data should be defined and used identically for the:

- Rotor head area
- Rotor blade root
- Aerodynamic rotor blade region

The goal here is to assess the comprehensive/FEM codes similar to the exercise of the HART II workshop. This should be a quick exercise, but reviews the current status in contrast to the HART II workshop a decade ago.

5.2 *New blade structural design specifications*

A new blade structural design is to be performed. Here, either the in-house design is to be used, or for those not involved in the aerodynamic design, the DLR balanced 6 design may be used. For consistency, please use the material properties listed in Table 8.

Table 8 Material properties

	ρ	E_1	$E_2 = E_3$	$G_{12} = G_{13}$	G_{23}	$\nu_{12} = \nu_{13}$	ν_{23}
	kg/m^3	Pa	Pa	Pa	Pa	-	-
Resin	1124	3.4e+09	3.4e+09	1.3e+09	1.3e+09	0.33	0.33
Foam	52	7.5e+07	7.5e+07	2.5e+07	2.5e+07	0.49	0.49
UD GFRP (Spar)	2010	4.5e+10	1.2e+10	4.1e+09	3.7e+09	0.24	0.33
±45° GFRP (Skin)	1830	4.6e+10	1.0e+10	4.2e+09	3.8e+09	0.27	0.35
Tungsten (Nose weight)	17800	9.4e+10	9.4e+10	3.7e+10	3.7e+10	0.28	0.28

You may simplify your effort, buy assuming the same root/rotor head as HART II.

The structural design layout of the airfoil section shall have a C-spar layout as shown in Table 8. The airfoil skin layers shall be arranged in the following. The number of applied skin layers is left to the designed, however, the orientation angle should alternate, as exemplary shown in Table 9. The estimated dimensions the HART II section are shown in Figure 3.

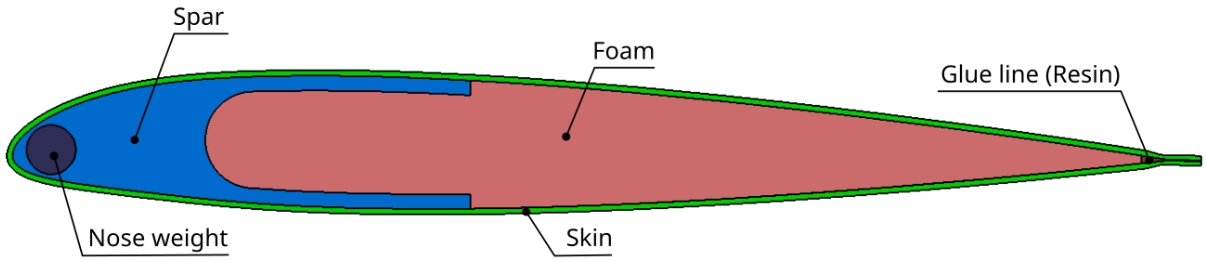

Figure 2: cross section layout for the airfoiled section

Table 9: Skin layer orientation

Layer Num.	Material	Layer thickness [m]	Fiber angle [deg]
1	Resin	1e-04	0

2	±45° GFRP (Skin)	8e-05	+45
3	±45° GFRP (Skin)	8e-05	-45
4	±45° GFRP (Skin)	8e-05	+45
5	±45° GFRP (Skin)	8e-05	-45
6	±45° GFRP (Skin)	8e-05	+45
7	±45° GFRP (Skin)	8e-05	-45
	Laminate thickness [m]:	**5.8e-04**	

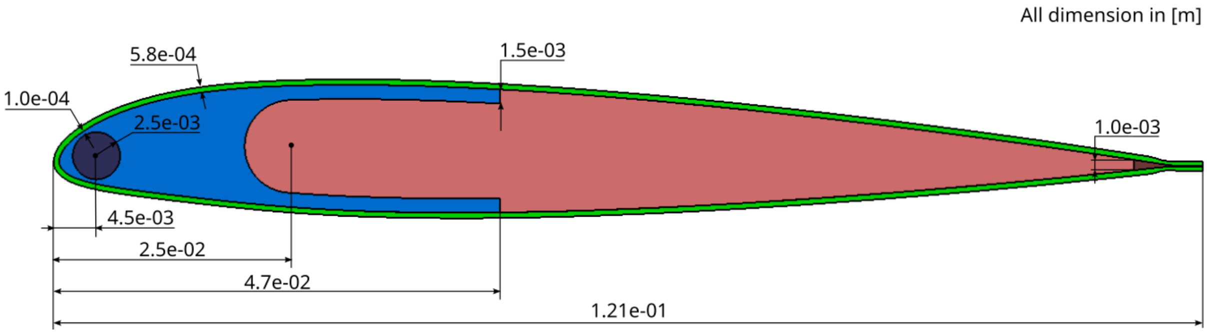

Figure 3: cross section dimensions roughly coinciding with the HART II design.

The resulting achieved structural properties shall be compared amongst the participants. The idea is to assess the capabilities of the structural design tools, such as Ksec2D, iVABs, RBG, etc.

5.3 Goal functions and constraints

The goal function of the structural optimization is to minimize vibrations while obeying to specific constraints. These constraints include keeping the blade natural frequencies away from multiples of the rotation frequency, limiting the blade mass, but also ensuring that the axis are within reasonable limits, which are likely already necessary to keep vibrations low. These constraints are formulated below:

Objective:

- $$min(VI),\ VI=\sum_{i=4}\left[\frac{\sqrt{(0.5F_{x,i})^2+(0.67F_{y,i})^2+(F_{z,i})^2}}{W_0}+\frac{\sqrt{M_{x,i}{}^2+M_{y,i}{}^2}}{RW_0}\right]$$

Constraints:

1 Rotating frequencies at 100% NR

a $|\omega_i - NP| \geq 0.1 (i=1,\ldots,6)$ lowest 6 modes

- $NP = n/rev (n=1,2,\ldots)$
- The first flap mode is an exception. (could be close to 1/rev, but it is stable)

2 Maximum blade mass $m_b \leq M$

- m_b is blade mass
- M is maximum allowable blade mass shall be less than 1.5 times the HART II mass

3 Elastic axis (shear center)* $0.20c < elastic\ axis < 0.30c$

4 Tension center* $0.20c < tension\ center < 0.30c$

5 Center of gravity* $0.20c < c.g. < 0.30c$

6 Structural Margin of Safety $M.S. > 0$

* Elastic axis, tension center, and c.g. locations are chordwise locations from LE.

Hub System

The hub of the rotor system considered in this optimization is assumed to be identical to HART II (hingeless rotor with CCW rotating direction).

Analysis

The data to be shared is specified in the next sections.

6 Synchronization & Cross-validation (all new!)

This is the actual 2026 task. In order to assess the viability of the individual outcomes, the data shall be shared in easily accessible formats. Therefore, the data to be shared is specified individually. If you have not participated in a specific section, feel free to skip it.

The data shall be shared for the HART II rotor, as well as the optimized design, but possible also for the shared designs.

6.1 *Rotor planform and twist data*

Independent of the parameterization used, please specify your planform and twist of the respective rotors. The requires:

- non-dimensional radius
- anhedral (+ up, - down)
- chord
- sweep (+backward, -forward)
- twist (- nose down)

Please share this as a Tecplot ASCII file as it can also be read in by Excel and other tools.
For the zone names, specify it in the following way: organization, method and number of parameters used or other. I.E. DLR CFD balance 6 would be one such wording. HINT is to be freely interpreted, it should be short, and distincive. It should yield a readable label for plots. The filename should then read plansform_ORG.tec

```
VARIABLES = r/R, anhedral, chord, sweep, twist
ZONE T="ORG METHOD HINT PARAM ", I=1, F=POINT
 2.357000e-01 -0.000000e+00  1.210000e-01 -0.000000e+00  4.114400e+00
```

<u>Important: Please keep the order of variables the same for automated processing!</u>
Additionally, if you used the proposed parameterization, feel free to share the parameters in a simple text file.

6.2 *Rotor performance data*

Here, two files shall be shared:

- hover polar containing thrust, collective pitch angle and the Figure of Merit over a range of thrusts, at least including the range of c_T/σ= 0.06 .. 0.12.
- forward flight polar. Here, the required power is to be computed over a range of speeds at a c_T/σ= 0.12. The data shall be output over advance ratio. Additionally, the root peak-to-peak pitching moment and the Vibration index (see previous section) along the pitch control angles.

The Tecplot ASCII format is proposed as it can also be read-in by Excel and other tools. For hover, please use the following header:

```
VARIABLES= c<sub>t</sub>/<greek>s</greek>, FM, <greek>q</greek><sub>0</sub>
ZONE T="HARTII ORG METHOD", I=3, F=POINT
 4.000591042e-02  5.363553972e-01  5.425000000e+00
 1.000058182e-01  7.234169819e-01  1.023500000e+01
 1.199998155e-01  7.098760110e-01  1.179500000e+01
ZONE T="ORG METHOD HINT PARAM", I=2, F=POINT
 5.999990775e-02  6.537878692e-01  7.135000000e+00
 8.001182083e-02  7.077400118e-01  8.732000000e+00
```

And for forward flight, be use the following format:

```
VARIABLES= <greek>m</greek>,c<sub>t</sub>, c<sub>p</sub>, L/D<sub>q</sub>, VI, ptp-
rtm,<greek>q</greek><sub>0</sub>,<greek>q</greek><sub>1c</sub>,<greek>q</
greek><sub>1s</sub>
ZONE T="HARTII ORG METHOD", I=2, F=POINT
1.500604e-01  7.927672e-03  3.930957e-04  3.026310e+00  7.855945e-05  5.705811e-06
8.708000e+00  2.859000e+00 -2.796000e+00
2.000805e-01  7.930796e-03  3.793098e-04  4.183382e+00  4.874963e-05  6.195474e-06
8.808000e+00  2.310000e+00
```

The file name convention shall be hvpolar_ORG_METHOD.tec with ORG being your organization and METHOD indicating either CA or CFD to acknowledge the employed method.

Similarly, please name the forward flight file ffpolar_ORG_METHOD.tec.

Important: Please keep the order of variables the same as this helps to facilitate automatic process. Similarly, the ZONE TITLE should reflect you design, i.e. DLR CFD balance 6 as stated before.

6.3 Rotor air loads data

In order to keep the sent data minimal, but still have an idea of why and where blades have improved, the averaged rotor airloads shall be distributed for the two design conditions. This data shall included:

- non-dimensional radius r/R
- sectional thrust coefficient $c_z M^2 = 2\ dF_z / (\rho\ c_{ref}\ a^2\ dr)$
- sectional torque coefficient $c_q M2 = 2\ dM_z / (\rho\ c_{ref}\ R\ a^2\ dr)$
- sectional pitching moment coefficient $c_m M2 = 2\ dM_x / (\rho\ c_{ref}^2\ a^2\ dr)$

NOTE: Please use the reference chord length of 0.121m.

```
VARIABLES = r/R, czM2, cqM2, cmM2
ZONE T="HARTII ORG METHOD", I=1, F=POINT
 3.169363e-02  -5.401016e-03  2.749319e-05  3.992989e-04
```

The file names shall be label as hv_cM2_ORG_METHOD.tec and ff_cM2_ORG_METHOD.tec with a similar nomenclature as before

Important: Again, keep the order of variables!

6.4 Deformations

Similar to the airloads, the deformations of the rotor blades shall be reported in the for design conditions. Here, simply the tip deformation is meant. The format is as follows:

```
VARIABLES = <greek>y</greek>, <greek>y</greek>y/R, <greek>y</greek>z/R,
<greek>q</greek><sub>el</sub>
ZONE T="ORG METHOD HINT PARAM", I=2, F=POINT
 0.000000e+00  8.834523e-03  1.125411e-01 -8.762815e-01
 3.600000e+02  8.834523e-03  1.125411e-01 -8.762815e-01
```

For hover, this can be a single line and I would recommend producing bar charts for comparison, whereas for forward flight these may be line plots. The file names should be hv_defo_ORG.tec and ff_defo_ORG.tec

6.5 Airfoil coordinates

Airfoil coordinates may simply be the point coordinates:

```
VARIABLES=x,y
 1.000000e+00   4.000000e-03
 0.000000e+00   0.000000e+00
 1.000000e+00  -4.000000e-03
```

Moving from upper T.E. to L.E. to lower T.E. Name your files accordingly: airfoil_ORG_THICKNESS_RR.tec, i.e. airfoil_DLR_12_80.tec would be a 12% airfoil to be placed at r/R=80%. Please remark in a separate file, if the airfoil has an alignment angle, i.e. if it should be rotate when placed on the rotor to produce zero lift, hence superimposed to the existing blade twist.

6.6 Airfoil Polars

The airfoil polars shall be supplied in the following format:

```
VARIABLES= alpha, mach, re, N, xtrtop, xtrbot, cl, cd, cm, valid
  9.000000e+00   3.200000e-01   7.500000e+05   9.000000e+00   1.683498e-05   1.755616e-
04   1.193187e+00   1.995955e-02  -1.359859e-02   1.000000e+00
```

If you have done fully turbulent simulations, simply set xtrtop, xtrbot to zero. Valid is simply a flag set to be 1 for good data points, and 0 for data points where convergence might have been questionable.

If possible, send also the NACA 23012/23010/108 results as well. The file name convention follows polar_ORG_THICKNESS_RR.tec for your new airfoils, whereas polar_ORG_NACA23012.tec for the NACA series.

6.7 *Structural Data*

The achieved vibrations shall be reported within the forward flight polar of Section 6.2. The structural properties of the novel blade design shall also simply be written into a Tecplot file

```
VARIABLES=r/R, chord, x<sub>ea</sub>, x<sub>cg</sub>, x<sub>tc</sub>, mass/dr,
EI<sub>lag<sub>, EI<sub>flap</sub>, GI, I<greek>q<greek><sub>cg</sub>,
I<greek>q<greek><sub>polar</sub>,EA
ZONE T="ORG METHOD HINT PARAM", I=1, F=POINT
0.1 ….
```

to list the structural properties along the blade span. The elastic axis shall be specified w.r.t to the quarter chord location of the airfoil, whereas the center of gravity and the tensions center are to be specified with respect to the elastic axis. It runs positive towards the leading edge. Feel free to skip inboard stations, IF you have not altered the HART II structural data there.

Multiple rotors may be marked in one file. The naming convention shall be structprop_ORG.tec

6.8 *Fan plot data*

For the respective blades, the fan plots are to be generated. Therefore, please evaluate it from the 0 to 1.1. nominal RPM. The format is as follows:

```
VARIABLES= <greek>w</greek>/<greek>W</greek><sub>ref</sub>,
<greek>w</greek><sub>mode</sub>/<greek>W</greek><sub>ref</sub>
ZONE T="flap_1", I=11, F=POINT
0.0 0.1
0.5 0.5
1.1 0.6
ZONE T="lag_1", I=11, F=POINT
...
ZONE T="torsion_1", I=11, F=POINT
...
```

and one file per rotor shall be generated, i.e. fanplot_ORG_HARTII.tec and fanplot_ORG_METHOD_HINT_PARAM.tec

Likely, only the 1st torsion mode will be investigated, but this is still open.