



OPTIMAT BLADES

Task Group 1: Variable Amplitude, Phase 1, WP 3 Detailed Plan of Action (2nd draft), 14.6.2002

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According to the aim of task 3.2 in WP3, this DPA contains the description of the constant amplitude fatigue tests (task 3.3) and the variable amplitude tests (task 3.4). The lay ups and the specimen geometry are expected to be fixed at the Risø meeting. Compared to the 1st draft of the DPA there are major changes only in the foreseen block tests in task 3.4 what is already agreed in a discussion between Rogier and DLR and also expressed in Arno's overview of the DPA's.

The benchmarking of lifetime prediction models in task 3.1 has uncovered various questions which could not be solved at the moment. They will be discussed in detail at Risø. Eventually we must continue the discussion over the whole project.

The DPA of WP 4 is prepared by Holger/DEWI.

Our statements to the present status:

1. Foreseen test series (15 specimens/series), see following tables. Are proposed under the estimate that we need 3 months for one data set, either s-n curves, or W, RW, NW (WX, RWX, NWX shorter), or block testing. For a testing frequency of 5 to 7 Hz cooling will be necessary. Constant strain rate for all fatigue tests should however be discussed. This is also necessary in view to the strain rate for static tests which was discussed to be related to that of the fatigue tests.
2. The instrumentation: still matter of discussion.
3. The size of the plates to be produced will be depending on the type of specimens.

Materials for test program

GFRP with two different lay-ups (Decision at Risø):

1. UD/±45° (DLR, TUDT)

2. Quasi-Isotropic (UP, CRES)

Specimens geometry

Decision at Risø

Static Tests

For each test five specimens have to be tested.

	Tensile		Compressive	
	Lay-up 1	Lay-up 2	Lay-up 1	Lay-up 2
DLR	5		5	
TUDT	5		5	
UP		5		5
CRES		5		5
Total	10	10	10	10

Tab. 1: Static test program

For each cell 3 additional specimens needed.

Total specimens Lay-up 1: 32

Total specimens Lay-up 2: 32

Constant Amplitude Tests

S-N-Curves at different R-Ratios have to be established. For each S-N-Curve three stress levels will be selected during establishing a preliminary S-N-Curve. 4 stress levels under discussion at Risø.

	Lay-up 1							Lay-up 2		
	R=2	R=10	R=-2.5	R=-1	R=-0.4	R=0.1	R=0.5	R=10	R=-1	R=0.1
DLR			6	6		6	6			
TUDT	6	6		6	6					
UP								6	6	6
CRES										
Total	6	6	6	12	6	6	6	6	6	6

Tab. 2: Preliminary S-N-Curve

For each cell 3 additional specimens needed.

Total specimens Lay-up 1: 72

Total specimens Lay-up 2: 27

Establishment of S-N-Curves

Testing at 3 selected stress levels. 5 specimens at each stress levels. Targeted lifetime 10^3 , 10^5 , 10^7 load cycles.

	Lay-up 1	Lay-up 2
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	R=2	R=10	R=-2.5	R=-1	R=-0.4	R=0.1	R=0.5	R=10	R=-1	R=0.1
DLR			15	15		15	15			
TUDT	15	15		15	15					
UP								15	15	15
CRES										
Total	15	15	15	30	15	15	15	15	15	15

Tab. 3: Test program for S-N-Curves

For each cell 3 additional specimens needed.

Total specimens Lay-up 1: 144

Total specimens Lay-up 2: 54

Variable Amplitude Tests

Load spectra testing

	Lay-up 1						Lay-up 2
	W	WX	RW	RWX	NW	NWX	W, WX, NW
DLR	15			15	15		
TUDT		15	15			15	
UP							
CRES							15 each
Total	15	15	15	15	15	15	45

Tab. 4: Load spectra tests

For each cell 3 additional specimens needed.

Total specimens Lay-up 1: 108

Total specimens Lay-up 2: 54

Block-Tests - I

Same R-Ratio in each block same maximum stress/strain levels as used during load spectra tests. AB denotes possible sequence variations with 2nd block to failure, e.g. 1st block R=0.1, 2nd block R=0.5.

	2-block, 1 st to 0.5 N _F , 2 nd block to failure					
	R=0,1 / AB	R=-1 / AB	R=10 / AB	R=0,1 / HL	R=-1 / HL	R=10 / HL
DLR	15	15		15		
TUDT			15		15	15
Total	15	15	15	15	15	15

Tab. 5: Block-Tests Part 1

For each cell 3 additional specimens needed.

Total specimens Lay-up 1: 108

Block-Tests – II

	2-block, repeated					
	R=0,1 / AB	R=-1 / AB	R=10 / AB	R=0,1 / HL	R=-1 / HL	R=10 / HL
DLR	15	15		15		
TUDT			15		15	15
Total	15	15	15	15	15	15

Tab. 6: Block-Tests Part 2

For each cell 3 additional specimens needed.

Total specimens Lay-up 1: 108

Summary of specimens

- Static testing

Lay-up 1: 32 (16 tensile, 16 compressive)

Lay-up 2: 32 (16 tensile, 16 compressive)

- Dynamic testing

Lay-up 1: 540

Lay-up 2: 135

General remarks

- Given number of specimens (15) thought to be maximum for each data set
- Frequency for dynamic testing should be 5-7 Hz
- Specimens geometry still to be agreed.