Phase 1B Reporting Guidelines
Helicopter Quieting Program

REQUIRED FLIGHT CASES: All teams are required to submit results for the one MDART and four SMART rotor cases defined in previous documents. The results should include airloads, structural loads, performance and acoustic predictions submitted in accordance with the guidelines below. The requirement is for the teams to submit their "best results" for each case in a single submittal.

The teams are encouraged to submit other cases including model data or concept calculations that have been considered. Please include any other results in the AUX_INFO folder.

TRIM REQUIREMENTS FOR CALCULATIONS: During previous rounds of calculations, differences in the method used to trim the rotor made comparisons between the teams and experimental measurements difficult. During this round of calculations, it is desired to have the teams match the experimental conditions as closely as possible. Therefore, the method for trimming during calculations is as follows:

Rotor Ct/sigma = prescribed value
Rotor shaft angle = prescribed value
Thrust-weighted solidity = sigma = 0.0750

Rotor trimmed to zero 1/rev out-out-of-plane bending as measured by the flexbeam flap bending gage at 9 in radial station.

Modeling of entire hub is desired with instrumentation hat included. Recall that all wind tunnel hub loads and moments will include aerodynamic forces experienced on all hub/shaft hub hardware exposed to free stream.

REPORTING GUIDELINES: All data should be provided in electronic format in tab or space delimited files. All file and folder names should conform to the example directory and file tree included with this document. This structure has been created to streamline the development of tools to read, display and analyze the data.

Folder and files names should contain no spaces or hyphens and be case sensitive. All data files should end with the extension .dat. The use of readme files in each directory is encouraged. All readme files should be called README.TXT and should be formatted to be easily readable on a PC-based editor such as Notepad.

The folder directory will follow:

```
NAME_DATA/
    AUX_INFO/
    SMART_X/
        CASE_DESCRIPTOR_X/
        …
        CASE_DESCRIPTOR_Y/
        Flight_condition.dat
        README.TXT
    MDART/
        CASE_DESCRIPTOR_X/
        …
        CASE_DESCRIPTOR_Y/
        Flight_condition.dat
        README.TXT
```

The team should modify the main folder NAME_DATA by substituting SUUMD or GTRC for NAME in the designation. The team may include plots, code information, method descriptions, papers, reports and optional data that they deem relevant in the AUX_INFO folder. DO NOT PLACE ANY ADDITIONAL FILES IN ANY OTHER FOLDERS.

Each team is only required to submit a single solution for each flight case. However, a team may provide more solution cases (i.e. other solution cases may use other computational methods to analyze the same flight condition). The team may choose the names for CASE_DESCRIPTOR_X but the names must contain no spaces or hyphens and all case names should be listed on a single line in the flight_condition.dat file. The flight_condition.dat is set up to produce a structured array with the appropriate values used by the team. Please modify the values in the example file or produce a similar file but be careful to leave the structure and line labels unchanged. If a value cannot be reported, leave it blank. If additional parameters are needed, please add lines to the file – DO NOT REORDER THE LINES IN THE EXAMPLE FILE.

Within each case directory, the information provided should follow:

CASE_DESCRIPTOR_X/
- Rotor_Performance/
- Control_Inputs/
- Cn_Cc_Cm/
- LOAD_DATA/
- ACOUSTIC/
- README.TXT

The data structure in these folders will be described below.

Rotor_Performance/

This directory will contain two files SS_values.dat and 5P_values.dat

In the SS_values.dat file report the integrated loads referenced to hub center. These will include the 3 steady-state forces (lbf) and 3 steady-state moments (in-lbf) from the rotor balance expressed in the shaft axis system. An example file is included.

In the 5P_values.dat file report the integrated loads for 5 per rev force and moment response (all 6 components) from rotor balance (again referenced to hub center expressed in the shaft axis system).

Amplitude/phase format (blade number 1; 0 deg over tail)
Harmonic amplitude format (Anc, Ans, n= 5)
Time history format (1 rev; 64 or more points)

The file format will be:

```
X_Force     <Amplitude>       <Phase>     <Anc>       <Ans>
Y_Force     <Amplitude>       <Phase>     <Anc>       <Ans>
Z_Force     <Amplitude>       <Phase>     <Anc>       <Ans>
X_Moment    <Amplitude>       <Phase>     <Anc>       <Ans>
Y_Moment    <Amplitude>       <Phase>     <Anc>       <Ans>
Z_Moment    <Amplitude>       <Phase>     <Anc>       <Ans>

Azimuth(deg)      X_Force(lbf)      Y_Force(lbf)      Z_Force(lbf)
X_Moment(in-lbf)  Y_Moment(in-lbf)  Z_Moment(in-lbf)
(<azimuth>        <xforce>          <yforce>          <zforce>
<xmoment>         <ymoment>         <zmoment>)*64
```

The files are set up to produce a structured array and the team should substitute the values produced by the method used in each case. Please modify the values in the example file or produce a similar file but be careful to leave the structure and line labels unchanged.

Control_Inputs/

This directory will contain a single file for the Rotor Control Inputs for trim called control_inputs.dat. The inputs will include collective, longitudinal and lateral cyclic (degrees) based on rotation at snubber. The file format will be:

(<azimuth deg> <Collective> <Longitudinal> <Lateral Cyclic>)*64

ACOUSTIC/

The team should reproduce the final experimental microphone locations only. There is no requirement to predict any other locations.

The data should be reported as time history data for one complete revolution at 1024 locations. The data should be reported in Pascals. The overall noise as well as the break out of loading and thickness noise components is required.

For the files should be named M0XX.dat (i.e. M001.dat, M002.dat, etc).

The format for these files is:

(<time> <Overall Noise> <Thickness> <Loading>)*1024

At present the final locations for the microphones has not been established. The microphone locations will be sent in a later correspondence.

MDART/…/Cn_Cc_Cm/

Report non-dimensional $C_n M^2$, $C_c M^2$ and $C_m M^2$ in increments of 1 degree of rotation. The radial stations for these values are:

r = 150 in, 168 in, 186 in

The values for $C_n M^2$, $C_c M^2$ and $C_m M^2$ should be reported in 3 files called:

Cn_M2.dat
Cc_M2.dat
Cm_M2.dat

The format for these files is

0 <radial coordinates>
(<azimuth> <CxM2>)*360

The files should include only numeric data and no string-like labels.

SMART/…/Cn_Cc_Cm/

Flap Loads:

Report non-dimensional $C_n M^2$, $C_c M^2$ and $C_m M^2$ in increments of 1 degree of rotation for the flap. The reported values will include **integrated values for the entire flap** and sectional values for the following three radial stations:

r = 150.5 in, 168 in, 185.5 in

The values for $C_n M^2$, $C_c M^2$ and $C_m M^2$ should be reported in 3 files called:

Cn_M2_flap.dat
Cc_M2_flap.dat
Cm_M2_flap.dat

The format for these files is

0 0 <radial coordinates>
(<azimuth> <CxM2>)*360

Airfoil Loads:

Report non-dimensional $C_n M^2$, $C_c M^2$ and $C_m M^2$ in increments of 1 degree of rotation for the total airfoil section (including flap when present). The radial stations for these values are:

r = 149in, 150.5 in, 168 in, 185.5 in, and 187 in

The values for $C_n M^2$, $C_c M^2$ and $C_m M^2$ should be reported in 3 files called:

Cn_M2.dat
Cc_M2.dat
Cm_M2.dat

The format for these files is

0 <radial coordinates>
(<azimuth> <CxM2>)*360

The files should include only numeric data and no string-like labels.

LOAD_DATA/

The teams are required to report calculations of pitch link and all blade structural loads (flap bending, chord bending, and torsion) at all stations listed in the table below. All calculations should be for blade number 1; 0 deg over tail.

1. With rotor at zero rpm at zero shaft angle with the collective pitch at 0.75R equal to 10.0 deg (i.e., gravity tare) for blade number 1 over the tail, report the values in the file grav_tare.dat in the following format:

Station	Pitchlink	Flap bending	Chord Bending	Torsion
(<STA>	<value>	<value>	<value>	<value>)* Station No.

Note: The first line of this file contains string-like labels.

2. Report Pitchlink loads (positive in tension; lbs), Flap bending (in-lbf; positive tip up), chord bending (in-lbf; positive lagging direction of rotation), and torsion (in-lbf; leading edge up) defined relative to the local

cross section principal axes and about the local elastic center at the stations listed in the table further below. The following values are required:

Amplitude/phase format for steady and first 10 harmonics
Harmonic amplitude format (Anc, Ans, n= 0, 1, … 10)
Time history format (1 rev; 64 or more points)

Report the data in subdirectories /Pitch /Flap /Chord /Torsion as appropriate. Within the subdirectories there should be 15 (MDART) or 17 (SMART) files called STAXXX.dat. The naming convention will be the 3 digit location removing any fractional inches. So, the name for the data file associated with STA 19.5 will be STA019.dat. The format of each file should be:

Harmonic	<0 … 10>
Amplitude	<11 values>
Phase	<11 values>
Anc	<11 values>
Ans	<11 values>

Azimuth	Value
(<deg>	<value>)*64

Note: This file contains string-like labels. Please preserve the format of the example file.

SUMMARY OF STRAIN GAGE LOCATIONS

	SMART STA	MDART STA
FLEXBEAM	9	9
	19.5	19.5
	26.5	25
PITCHCASE	20	20
	25.5	25.5
	33.25	33.25
BLADE	42.75	42.75
	51	51
	70	70
	71	71
	87	87
	120	120
	130	
	152	152
	164	164
	165	
	180	181

STA = Blade station in inches from center of rotation