

Common Research Model  
 Test 11-0215  
 NASA ARC UPWT  
 PSP Data Summary

Introduction: The luminescence lifetime technique was used to make pressure-sensitive paint (PSP) measurements on a 2.7% Common Research Model in the NASA Ames 11ft Transonic Wind Tunnel. PSP data were obtained on the upper and lower surfaces of the wing and horizontal tail, as well as one side of the fuselage. Data were taken for several model attitudes of interest at Mach numbers between 0.70 and 0.87. Image data were mapped onto a three-dimensional surface grid suitable both for comparison with CFD and for integration of pressures to determine loads. Data were obtained at the following model configurations and tunnel conditions:

Configuration	Mach	Re/ft	$\alpha$ (°)
WB	0.7, 0.85, 0.87	$8.06 \times 10^6$	0, 0.5, 1.0, 1.5,
WBT+2	0.7, 0.85, 0.87	$8.06 \times 10^6$	2.0, 2.5, 3.0,
WBT0	0.7, 0.85, 0.87	$8.06 \times 10^6$	3.5, 4.0

PSP data are provided in Plot3D format files. Following standard Plot3D conventions, each configuration is described by a grid file, and the data for each tunnel condition at which the configuration was tested are provided in a solution file.

The CRM grid files for each configuration are listed in the table below:

Configuration	Grid File Name	Description
WB	CRM_WB.formatted.p3d	Wing/Body without horizontal tail or nacelles
WBT+2	CRM_WBH_iH+2.formatted.p3d	Wing/Body with horizontal tail at +2° incidence angle
WBT0	CRM_WBH_iH0.formatted.p3d	Wing/Body with horizontal tail at 0° incidence angle

The PSP pressure data are provided as LOT3D binary solution files. Files are named according to run and sequence number, where run and sequence number refer to tunnel conditions and configuration as follows:

Run	Configuration	Mach	Angle-of-attack ( $\alpha$ ) for each sequence #								
			1	2	3	4	5	6	7	8	9
34	WB	0.70	0°	0.5°	1.0°	1.5°	2.0°	2.5°	3.0°	3.5°	4.0°
35	WB	0.85	0°	0.5°	1.0°	1.5°	2.0°	2.5°	3.0°	3.5°	4.0°
36	WB	0.87	0°	0.5°	1.0°	1.5°	2.0°	2.5°	3.0°	3.5°	4.0°
46	WBT+2	0.70	0°	0.5°	1.0°	1.5°	2.0°	2.5°	3.0°	3.5°	4.0°
47	WBT+2	0.85	0°	0.5°	1.0°	1.5°	2.0°	2.5°	3.0°	3.5°	4.0°
48	WBT+2	0.87	0°	0.5°	1.0°	1.5°	2.0°	2.5°	3.0°	3.5°	4.0°
56	WBT0	0.70	0°	0.5°	1.0°	1.5°	2.0°	2.5°	3.0°	3.5°	4.0°
57	WBT0	0.85	0°	0.5°	1.0°	1.5°	2.0°	2.5°	3.0°	3.5°	4.0°
58	WBT0	0.87	0°	0.5°	1.0°	1.5°	2.0°	2.5°	3.0°	3.5°	4.0°

PSP files are named RRRRSS.c3d where RRRR is run number and SS is sequence number, each with leading zeroes. Files are PLOT3D binary solution files, which contain 5 values per grid point. The 1st value is the pressure data in Cp units. The 2nd thru 5th values are used internally by the PSP data reduction program and are not needed for display of the PSP data. (For completeness, Val 2 = a coefficient which indicates how well the camera sees that point on the model, Val 3 = the camera ID number, and Vals 4 & 5 are set to constants.)

All PSP data files are stored on Aerocompass in a single zipped archive labeled “CRM PSP Data”.

Additional information concerning the conditions at which PSP data were taken can be found in the wind tunnel data files, which are stored on Aerocompass in a single zipped archive labeled “CRM PSP Wind Tunnel Data”.

The wind tunnel data files are ascii text files containing data from the wind tunnel systems taken as the PSP data were being acquired. Each file holds data for a single run, and each line in the file holds data for one tunnel condition (sequence) at which the PSP data were taken. The first line contains explanatory names for the data values, which are:

TEST	UPWT Official Test Number
RUN	Run number
SEQUENCE	Sequence number
YEAR	Year
DAY	Day of month
MONTH	Month number
TIME	Time in HHMMSS format
CONFIG	Configuration number
MREF	Mach number
QREFFT	Dynamic pressure (lbs / ft <sup>2</sup> )
PTPSI	Total pressure (lbs / in <sup>2</sup> )
PSPSI	Static pressure (lbs / in <sup>2</sup> )
PINFPI	Static pressure (lbs / in <sup>2</sup> ) corrected for tunnel effects
TTEMP	Tunnel temperature (°F)
CREYN	Reynolds number based on model chord
REYNFT	Reynolds number / ft
RHOSF	Air density (lb/ft <sup>3</sup> )
VINFFS	Air velocity (ft/s)
ALPHA	Model angle of attack (°)
BETA	Model sideslip angle (°)
ROLL	Model roll angle (°)
QINFPI	Dynamic pressure (lb/ft <sup>2</sup> )
RSG_LW	Strain gauge readout, left wing
RSG_LW_RMS	Root-mean square of strain gauge readout, left wing
RSG_RW	Strain gauge readout, right wing
RSG_RW_RMS	Root-mean square of strain gauge readout, right wing

PREFFSP2_1_MEAN	Wind tunnel reference pressure
A1 ... I26	Model pressure tap readings (in pressure coefficient)
PS1X ... PS6X	Pressure sensor calibration readings
CP01_01 ... CP05_64	Pressure sensor calibration readings
DPPSI01_1_MEAN ... DPPSI05_30_MEAN	Tunnel wall pressure tap readings