LPT BACKUP DESIGN

(I) ROTOR SHOCK INSTABILITY STUDY

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73.10.1

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1. INTRODUCTION

This report is describing the LPT rotor shock instability problems in the worst case of LPT operation.

The following is the analysis procedure:

1) LPT AERO requests performance group to offer the performance analysis cycle sheets corresponding to the worst cases of LPT operation.

2) Using TAPS program, AERO must check out the cycle which has the maximum rotor exit critical Mach no. and maximum blade axial force from the AERO’S and MCD’ s points of view respectively.

3) According to the cycle sheet selected and the blade tape files from AERO, MCD analyzes the vibration problems and determines the maximum deflection blade coordinates for aerodynamic analysis.

4) AERO group compares the deflected blade and the original blade, and calculates how much the throat area and exit critical Mach no. varied when flutter phenomenon happened.

5) It must be determined whether the rotor blade needs to be redesigned or not.

2. PERFORMANCE ANALYSIS

As previously stated, this analysis is requested by AERO, and needs to be done by performance group.

The purpose of this analysis is to find the worst cases for the LPT operation at peak aerodynamic loads such as the maximum rotor exit critical Mach no., maximum flow rate, and maximum pressure ratio or the combined cases of the above parameters.

Appendix l shows some of cycle sheets offered by performance group.
The reason why we only choose these cycles is that the maximum rotor exit critical mach no. will happen when LPT operates within these cases (i.e. with maximum nozzle area as shown on cycle sheets).

3. STREAMLINE ANALYSIS

Basically, AERO needs to run TAPS at the cycle far from the design point, say, the higher altitude to get the worst case. But, from the MCD point of views, the cycle the cycle that has the maximum blade axial is required.

Therefore, AERO needs to choose a cycle with lower altitude because the axial force of blade increases with the inlet pressure (at station 4.5), which increases when the altitude is reduced as cycle sheets indicated. And it makes no much difference about rotor exit critical Mach no. throughout all the altitudes for aerodynamic analysis.

Using TAPS program, AERO obtained the maximum rotor exit critical Mach no. M_1^* of 1.498 with the maximum nozzle area, and the corresponding tape files were transferred to MCD.

4. EVALUATION OF LPT BLADE TO AN INSTABILITY PROBLES (MCD)

MCD must evaluate the LPT blade design to a shock instability problem. What AERO group needs is the coordinates of maximum deflection blade when the flutter phenomenon happened.

Appendix 2 shows the deflected blade coordinates given by MCD.

5. AERODYNAMIC ANALYSIS TO THE SHOCK INSTABILITY PROBLEM

In order to compare the deflected blade with the original blade, the blade profiles and channels need to be plotted to both blades.

5.1. DEFLECTED BLADE

For convenience, only three sections were chosen for hub, mean and tip sections from the deflected blade coordinates.

Due to the cylindrical sections, the average radius was taken for the three sections.

The spaces from blade to blade were calculated by the formula.

$S_i = 2\pi R_i$/BLADE COUNT, where blade count is 50.

The detailed procedure of calculation and programs are in appendix 3.

5.2. ORIGINAL DESIGN BLADE

Taking the three average radius of hub, mean and tip as interpolation sections in LABLAD, the blades were plotted. The input of LABLAD and plot are in appendix 4.

5.3. SHOCK INSTABILITY

Overlapping the two plots in appendix 3&4, it is easy to see that the downstream parts of blade are deflected down when the shock wave is there.

The shock wave occurs when the critical Mach no. is greatly larger than one (M^* is 1.498 here). Due to the shock wave, the blades deform to widen the throat area and M_1^*will decrease (to M_2^*) when the shock isn't there.

5.3.1. M_2^* CLOSE TO M_1^*

By the blade plots in appendix 3&4, we can easily measure the throat areas and calculate the percent throat area increases as table 1 shown. From Mach table and the calculated throat area (A/A_*) changes, M_2^* can be determined.

TABLE 1: The Percent Throat Area Increase When The Blade Deforms

RADIUS	M_1*	THROAT WIDTH			M_2*
		ORIGINAL	DEFLECTED	% INCREASED	
6.4609		3.75	3.71	-1.07*	
9.72132	1.49	4.73	4.79	1.27	1.48
8.32277	1.46	5.49	5.75	4.74	1.42

Mass Aug. 1.498

From table 1, M_2* is close to M_1*, and the percent throat area increases are under 10.

Generally speaking, if the throat area change is under 10%, it will be no problem for the blade design.

*The percent throat area increase at hub section should be zero. The negative value here is due to the plot error, in addition, the throat widths were measured directly from the plots.

5.3.2. M_2* CLOSE TO 1

If M_2* is close to 1 (i. e. far from M_1*), it is supposed to input the new rotor exit angles of deflected blades in TAPS program for calculating the exact value of M_2*and getting the percent throat area increases from Mach table.

Besides, the blade needs to be checked with DENTON to see what the loading looks like when it deforms.

6. CONCLUSIONS

The purpose of this study is to make certain that whether the current blade design has the flutter problems when LPT operates far from the design point.
From the analysis results, we know that it is not necessary to modify the current 1042 rotor blades.

However, to this flutter problem, MCD has started to consider the redesigning work for the LPT backup design.

```
   1         2          16       133        304        312       383        807        809
 60000.    1.1750    .77000E-02 30.000     1.2100     393.82    1.0000    .80000E-02 .33000E-02
BYPASS AIR LT 699.7, OPEN OIL COOLER AIR VALVE, WBLD= .1286972956494
                              TFE1042-70  LPT OPERATION MAX. NOZZLE AREA  5-11-84
ALT   60000.00     MN          1.175    THRUST      134.58    WF       362.348    AFAN   74.42     CUSTOMER INSTALLATION LOSSES
PAM       1.04     V (TAS)   673.94     TSFC        2.6924    BPR         .913    AENG  282.68    LP WB/WA    0.000  HP WB/WA    0.000
TAMF    -69.70     V (CAS)   239.31     TT4F/C 1644.9/ 896.1 N-LP  16040./1.030   AEXIT 587.58    LP-HP       6.000  HP-HP       0.000
TAMC    -56.50     ETA RAM    .9929     TT4.5  1142.7/ 617.0 N-HP  19851./ .854   AMIN  393.82    FAN CUST DP.0.000  PRIMARY DP 0.000
*************************************************************************************************************************************
COMPONENT     COR FLOW   P/P      EFF     EFPOL   PCT N    COR N    AERO HP   AERO TQ    BETA     SURMAR          MAP VALUES        WF/PS3RT2
FAN TOTAL      87.435                             105.07   16370.   1066.84   349.32                       FLOW      P/P      EFF   FIG7 = 9.522
TIP(12-17)     41.730   2.267    .6853   .7188    105.07   16370.    456.44   149.46   11.354    58.029  171.181   2.302   .7000   FIG8 =  .453
HUB(2-2.1)     45.705   2.745    .7198   .7559    105.07   16370.    610.40   199.86   11.354    32.520  171.191   2.797   .7352   FIG9 = 5.592
LPC(2.2-2.3)   20.091   2.895    .8429   .8638     93.09   16747.    797.24   210.92    5.732    19.955   20.102   2.915   .8493   WFMIN= 1.021
HPC(2.4-3)      8.105   1.666    .8204   .8323     96.80   14102.    502.53   132.95    5.157    23.337    8.051   1.667   .8201   FIG10=44.242
HPT(4.1-4.3)    6.937   3.377    .8708            101.40    9855.   1329.61   351.77   TQDL4 158.62       6.371   3.377   .8849   FIG11=  .039
LPT(4.5-4.9)   22.063   3.309    .8689            113.76    9126.   1066.84   349.32   TQDL5 585.33      20.199   3.309   .9676   SOPTI=  .980
PWT(6.2-6.4)   64.061   1.000   1.0000              0.00       1.      0.00     0.00   TQDL6   1.00       1.000   1.000  1.0000
*************************************************************************************************************************************
STATION    PRESSURE    TEMP      FLOW      ENTHALPY        CYCLE POWER LOSSES         BURNER (NO MAR)           NOZZLE DATA
AMBIENT     1.040     390.0                  93.195                                          362.348    PRB 2.239       PRM  .713
2   (1)     2.424     498.0     14.717     119.035                                              .919    CDB .9458       CDC .7941
12(TIP)     2.424     498.0      7.024     11                                                           CFB .9317       CDF1.0189
   (19)     5.494     689.1      6.80                                                                        561.       A/A 1.492
13 (16)     5.494     689.1
16 (17)     3.598     690.7                                                                               ****************
2 (HUB)     2.424     498.                                                                                              LEAKAGE
2.1 (2)     6.654     72                                                                                  .0700   FAN .0020
2.2 (3)     6.654     7                                                                                   0000    LPC .0010
2.3 (4)    19.260                                                                                          197    HPC .0020
2.4 (5)    19.260                                                                                          00     HPT .0000
3   (6)    32.097                                                                                          44     LPT .0030
3.9        30.283                                                                                                 LC-LC .0030
4.1 (7)    30.283                                                                                                 HC-HC .0000
4.3 (8)     8.967                                                                                                 HC-LC .0000
4.4 (9)     8.967     1
4.5(10)     8.967     166                                                                                .0071
4.9(11)     3.710     1233.                                                                          6)  .2767/ .095
5.1(13)     2.563     1229.2                                                                          )  0.0000
5.9(14)     1.899     1229.2                                                                      -2.2)  C.0000
6   (18)    2.563      982.5    14.6                                                        (2.3-2.4)  0.0000
6.3(19)     2.339      982.5    13.617                                                  NER(3-3.9/-4)  0.0000/ .0565
8  (20)     2.328      982.5    14.646     238.0                                     HPT-LPT(4.4-4.5)  0.0000
8 STATIC    1.239      786.0    14.646     189.340       T                     0.7         0.    CLOSS(4.9-5/5-5.1) .0228/ .032
12 STATIC   1.239      786.0    14.646     189.340       T SRG AREA   44.200   SPECIFIC    9.14  NLOSS(6-6.3)/N7CL  .0876/ .1446
*************************************************************************************************************************************
          REYNOLDS NUMBER CORRECTIONS             P-FACTORS          FNTC2          816.00    THETA2         .9601      AFTERBURNER
COMPO  OPT      REI       EFF       P/P      FLOW   FN   .9500       TSFCC2         2.7478    RT-THETA2      .9798    WF LB/HP       0.000
TIP     1      .1742     .9790     .9845     .9790  WF  1.0000       NFC2         16369.91    DELTA2         .1649    EFFICIENCY    1.0000
HUB     1      .1742     .9790     .9845     .9790  N1  1.0000       NLC2         19851.28    N1-TH-COR     1.0000    EQVMB           .2130
LPC     1      .2911     .9924     .9930     .9924  N2  1.0000       NHC2         20259.74    N2-TH-COR      .9798    EQVAB         0.0000
HPC     1      .5514    1.0004    1.0002    1.0004  T4  0.0000       WFC2          2242.20    WA-TH-COR      .9601    WFAB/P           -I
HPT            .4591     .9903     .4591     .9997  T5  0.0000       WAC2            85.672   T5-TH-COR      .9601    A/ANOZ        0.0000
LPT            .3425     .9844     .3425     .9958                   TT3C2          805.34    WF-TH-COR      .9798    ZONE             ***
PWT           1.0000    1.0000    1.0000    1.0000  WIOC     21.22   TT5C2         1209.29    FPR(14/2)     1.568     LHV           18400.
DATE - 84/05/15                           RH    0.0000  FR1       0.00   TT7C2          820.61    OCR(3/2)     13.24          MIXING DATA
TIME - 10:32:48   RAT(C)      -56.51      SH    0.0000  MN1       0.00   TT11C2         259.70    OER(7/4)     11.81     XMF            .6767
CPTIME -  13.42   FR          30.2528     ALPT  1.0888  FR2       0.00   PT3C2          194.61    OVRLEFF       .1062    XMD           1.1547
MODEL -           MN       20518.6611     ALPT  1.0923  MN2       0.00   PT7C2           15.54    PRPLEFF       .8320    XMM           0.0000
                  PLA           50.0      AZA7  1.0000  SEGMENT      0   PT11C2          21.81    THRMEFF       .1277    MIX EFF       1.0000
                  WF/PT2       149.50     IGV ANGL 1.0  IGV DELT   0.0
                                                        OVCEFF   .7395   EFFPOLY          .8124    EXSWIRL          -I     PRM            .7125
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   1          2          16          133          304          312          383          807          809
 56600.     1.2000     .177000E-02 31.000      1.4920       393.82       1.0000      .80000E-02 .33000E-02
BYPASS AIR LT 699.7, OPEN OIL COOLER AIR VALVE, WBLD= .155627031523
                              TFE1042-70  LPT OPERATION MAX. NOZZLE AREA  5-11-84
ALT    56600.00     MN          1.200    THRUST      165.93     WF         430.165      AFAN    74.42      CUSTOMER INSTALLATION LOSSES
PAM       1.22      V (TAS)   688.27     TSFC        2.5924     BPR           .904      AENG   282.68   LP WB/WA      0.000  HP WB/WA    0.000
TAMF    -69.70      V (CAS)   265.57     TT4F/C 1645.2/ 896.2 N-LP   16114./1.034  AEXIT  587.58   LP-HP         6.000  HP-HP       0.000
TAMC    -56.50      ETA RAM    .9915     TT4.5  1141.0/ 616.1 N-HP   19970./ .859  AMIN   393.82   FAN CUST DP,0.000  PRIMARY DP 0.000
**********************************************************************************************************************************
COMPONENT     COR FLOW   P/P     EFF    EFPOL   PCT N    COR N   AERO HP  AERO TQ    BETA    SURMAR        MAP VALUES         WF/PS3RT2
FAN TOTAL      87.910                           105.07   16370.  1305.49  425.48                     FLOW     P/P     EFF   FIG7 = 9.535
TIP(12-17)     41.730   2.266   .6877  .7210   105.07   16370.   554.68  180.78  11.426    58.727  171.188  2.292  .6987  FIG8 =  .349
HUB(2-2.1)     46.180   2.753   .7225  .7584   105.07   16370.   750.81  244.70  11.426    32.764  171.188  2.792  .7341  FIG9 = 5.592
LPC(2.2-2.3)   20.237   2.902   .8458  .8664    93.22   16771.   981.87  258.23   5.873    20.595   20.176  2.913  .8493  WFMIN= 1.016
HPC(2.4-3)      8.141   1.667   .8193  .8312    96.96   14125.   619.98  163.05   5.227    23.875    8.089  1.667  .8192  FIG10=44.307
HPT(4.1-4.3)    6.939   3.388   .8733          101.99    9913.  1632.06  429.22   TQDL4 158.07        6.371  3.388  .8850  FIG11=  .029
LPT(4.5-4.9)   22.129   3.310   .8717          114.35    9173.  1305.43  425.46   TQDL5 582.27       20.195  3.310  .9676  SQRTI=  .984
PWT(6.2-6.4)   64.220   1.000  1.0000            0.00       1.     0.00    0.00   TQDL6   1.00        1.000  1.000 1.0000
**********************************************************************************************************************************
STATION     PRESSURE    TEMP      FLOW     ENTHALPY       CYCLE POWER LOSSES         BURNER (NO MAR)          NOZZLE DATA
AMBIENT      1.225     390.0                93.195                                  FUEL FLOW    430.165   PR8 2.312      PRM  .713
2   (1)      2.944     502.6     17.889   120                                                     11.438   CD8 .9462      CDC .7955
12(TIP)      2.944     502.6      8.492                                                                    CF8 .9327      CDF1.0189
   (19)      6.670     694.7                                                                               VEL 1591.      A/A 1.492
13 (16)      6.670     694.7                                                                                   .8342
16 (17)      4.370     696                                                                                 **************************
2 (HUB)      2.944                                                                                         OLING              LEAKAGE
2.1 (2)      8.105                                                                                         DCT-NZ .0700   FAN .0020
2.2 (3)      8.105                                                                                            -4.6 .0000   LPC .0010
2.3 (4)     23.52                                                                                             TR .1197   HPC .0020
2.4 (5)     23.5                                                                                               R .0000   HPT .0000
3   (6)     39.                                                                                                  .0044   LPT .0000
3.9         36                                                                                                        LC-LC .0000
4.1 (7)     36                                                                                                        HC-HC .0000
4.3 (8)     10                                                                                                        HC-LC .0000
4.4 (9)     10.                                                                                                ES
4.5(10)     10.                                                                                                    .0085
4.9(11)      3.2                                                                                           6)  .2764/ .095
5.1(13)      3.11                                                                                               0.0000
5.9(14)      2.307                                                                                          .2)  0.0000
6  (18)      3.118                                                                                        -2.4)  0.0000
6.3(19)      2.844     9                                                                               3.9/-4) 0.0000/ .0569
8  (20)      2.832     984.                                                                             (4.4-4.5)  0.0000
8 STATIC     1.507     780.8                                                                        SS(4.9-5/5-5.1) .0230/ .032
12 STATIC    1.507     780.8    17                                                               NLOSS(6-6.3)/NZCL    .0877/  .1447
***************************************                                                       ***********************************
         REYNOLDS NUMBER CORRECTIONS                                                           THETA2          .9690        AFTERBURNER
COMPO  OPT      REI      EFF      P/P      FLOW    FN                              2.6335     RT-THETA2       .9844    WF LB/HR       0.000
TIP     1      .2089    .9843    .9884    .9843    WF  1.0000       NFC2       16369.91     DELTA2          .2003    EFFICIENCY    1.0000
HUB     1      .2089    .9843    .9884    .9843    N1  1.0000       NLC2       19969.93     N1-TH-COR      1.0000    EQVMB          .2070
LPC     1      .3505    .9960    .9963    .9960    N2  1.0000       NHC2       20286.52     N2-TH-COR       .9844    EQVAR         0.0000
HPC     1      .6665   1.0002   1.0001   1.0002    T4  0.0000       WFC2        2181.45     WA-TH-COR       .9690    WFAB/P           -I
HPT            .5604    .9929    .5604   1.0001    T5  0.0000       WAC2          86.538    T5-TH-COR       .9690    A/ANOZ        0.0000
LPT            .4173    .9876    .4173    .9990                     TT3C2        804.48    WF-TH-COR       .9844    ZONE             ***
PWT           1.0000   1.0000   1.0000   1.0000    W10C      21.21  TT5C2       1192.13    EPR(14/2)      1.568     LHV          18400.
DATE - 84/05/15                            RH      0.0000  FR1        0.00  TT7C2        806.05    OCR(3/2)      13.32          MIXING DATA
TIME - 10:33:25  RAT(C)      -56.51      SH      0.0000  MN1        0.00  TT11C2       258.85    OER(7/4)      11.86     XME            .6781
CPTIME -  17.45  FR          24.8282     AHPT    1.0892  FR2        0.00  PT3C2        195.69    OVRLEFF        .1127    XMD           1.1532
MODEL -          MN       20486.0137     ALPT    1.0958  MN2        0.00  PT7C2         15.56    PRPLEFF        .8325    XMM           0.0000
                 PLA           50.0      AZA7    1.0000  SEGMENT       0  PT11C2        21.82    THRMEFF        .1354    MIX EFF       1.0000
                 WF/PT2       146.12     IGV ANGL   1.0  IGV DELT    0.0
                                                          OVCEFF    .7419  EFFPOLY        .8143    EXSWIRL           -I    PRM            .7134
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    1           2          16        133          304         312        383          807          809
 47800.      1.2400     .77000E-02 32.000      1.4920      393.82      1.0000      .80000E-02 .33000E-02
                    MAXIMUM INLET CORRECTED AIRFLOW EXCEEDED VALUE RESET TO LIMIT
                              TFE1042-70  LPT OPERATION MAX. NOZZLE AREA  5-11-84
ALT    47800.00    MN         1.240   THRUST     291.16    WF       671.735     AFAN    74.42      CUSTOMER INSTALLATION LOSSES
PAM       1.87     V (TAS)   711.22   TSFC       2.3071    BPR         .881     AENG   282.68   LP WB/WA     0.000  HP WB/WA    0.000
TAMF    -69.70     V (CAS)   337.52   TT4F/C 1646.6/ 897.0 N-LP  16236./1.042   AEXIT  587.58   LP-HP        6.000  HP-HP       0.000
TAMC    -56.50     ETA RAM    .9891   TT4.5  1139.2/ 615.1 N-HP  20165./ .868   AMIN   393.82   FAN CUST DP.0.000  PRIMARY DP 0.000
****************************************************************************************************************************
COMPONENT    COR FLOW  P/P     EFF    EFPOL  PCT N    COR N    AERO HP  AERO TQ    BETA    SURMAR         MAP VALUES          WF/PS3RT2
FAN TOTAL      88.846                         105.07  16370.   2139.63  692.11                       FLOW     P/P     EFF    FIG7 = 9.556
TIP(12-17)     41.619  2.301   .6973  .7301  105.07  16370.    900.91  291.42   11.302    57.525   171.177   2.310   .7009  FIG8 =  .181
HUB(2-2.1)     47.228  2.788   .7322  .7673  105.07  16370.   1238.72  400.69   11.302    32.343   171.177   2.801   .7361  FIG9 = 5.592
LPC(2.2-2.3)   20.440  2.910   .8492  .8694   93.42  16807.   1621.83  422.41    6.056    21.608    20.287   2.909   .8489  WFMIN= 1.008
HPC(2.4-3)      8.198  1.667   .8175  .8295   97.21  14161.   1027.73  267.67    5.337    24.727     8.147   1.667   .8175  FIG10=44.416
HPT(4.1-4.3)    6.937  3.395   .8792         102.96  10007.   2680.38  698.11   TODL4 156.89          6.370   3.395   .8857  FIG11=  .014
LPT(4.5-4.9)   22.144  3.312   .8782         115.28   9248.   2139.5_           TODL5 577.72         20.188   3.312   .9678  SORTI=  .992
PWT(6.2-6.4)   64.216  1.000  1.0000           0.00      1                               1.00         1.000   1.000  1.0000
****************************************************************************************************************************
STATION    PRESSURE    TEMP      FLOW     ENTHALPY                                                        NOZZLE DATA
AMBIENT      1.870     390.0                93.1                                                  PR8 2.461        PRM  .714
2   (1)      4.725     510.2     28.801    12                                                         08 .9469        CDC .7953
12(TIP)      4.725     510.2     13.492    12                                                            .9348        CDF1.0196
   (19)     10.871     706.5     13.465                                                                  645.         A/A 1.492
13 (16)     10.871     706.5     13.46                                                                   423
16 (17)      7.098     708.1     13.4                                                                 ********************
2 (HUB)      4.725     510.2     15.                                                                  OLING                   LEAKAGE
2.1 (2)     13.174     746.6     15.                                                                   DCT-NZ .0700  FAN .0020
2.2 (3)     13.174     746.6     15                                                                    HC-4.6 .0000  LPC .0010
2.3 (4)     38.331    1051.7     15                                                                    HC-STR .1197  HPC .0020
2.4 (5)     38.331    1051.7     15                                                                    HC-BUR .0000  HPT .0000
3   (6)     63.906    1242.9     13                                                                    AIRMTR .0044  LPT .0000
3.9         60.231    2223.7     12                                                                                 LC-LC .0000
4.1 (7)     60.231    2106.3     14.                                                                                HC-HC .0000
4.3 (8)     17.743    1627.4     14.                                                                                HC-LC .0000
4.4 (9)     17.743    1598.8     15.2                                                                 UCT LOSSES
4.5(10)     17.743    1598.8     15.22                                                                 A             .0109
4.9(11)      5.358    1226.0     15.228                                                               13-15/15-16) .2783/ .095
5.1(13)      5.067    1222.1     15.434                                                                FAN(13-16)    0.0000
5.9(14)      3.749    1222.1     15.434    30                                                         N-LPC(2.1-2.2)  0.0000
6   (18)     5.067     988.4     28.893    239.                                                       LPC-HPC(2.3-2.4)  0.0000
6.3(19)      4.622     988.4     26.871    239.507                                                    BURNER(3-3.9/-4) 0.0000/ .0575
8   (20)     4.602     988.4     28.894    239.414                                            .85     HPT-LPT(4.4-4.5)  0.0000
8 STATIC     2.449     770.0     28.894    185.365      T SR                                 0./   0.   CLOSS(4.9-5/5-5.1) .0230/ .032
12 STATIC    2.449     770.0     28.894    185.365      T SRG AREA              ECIFIC        10.11   NLOSS(6-6.3)/NZCL   .0879/  .1450
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          REYNOLDS NUMBER CORRECTIONS                   P-FACTORS        FNTC2          905.56   THETA2         .9837      AFTERBURNER
COMPO  OPT     REI      EFF      P/P      FLOW      FN    .9500       TSFCC2          2.3261   RT-THETA2      .9918   WF LB/HP     0.000
TIP     1     .3287    .9948    .9961    .9948      WF   1.0000       NFC2          16369.91   DELTA2         .3215   EFFICIENCY  1.0000
HUB     1     .3287    .9948    .9961    .9948      N1   1.0000       NLC2          20165.03   N1-TH-COR     1.0000   EQVMB        .1934
LPC     1     .5589   1.0004   1.0004   1.0004      N2   1.0000       NHC2          20331.04   N2-TH-COR      .9918   EQVAB       0.0000
HPC     1    1.0000   1.0000   1.0000   1.0000      T4   0.0000       WFC2           2106.42   WA-TH-COR      .9837   WFAB/P        -I
HPT           .9123    .9989    .9123   1.0000      T5   0.0000       WAC2             88.121  T5-TH-COR      .9837   A/ANOZ      0.0000
LPT           .6795    .9947    .6795   1.0000                        TT3C2           803.78   WF-TH-COR      .9918   ZONE          ***
PWT          1.0000   1.0000   1.0000   1.0000      W1OC        21.24 TT5C2          1165.63   EPR(14/2)     1.508    LHV         18400.
DATE - 84/05/15                      RH   0.0000    FR1          0.00 TT7C2           782.59   OCR(3/2)     13.52        MIXING DATA
TIME - 10:33:35  RAT(C)     -56.51   SH   0.0000    MN1          0.00 TT11C2          260.16   OER(7/4)     11.89    XME          .6782
CPTIME -  14.33  FR       15.3865    AHPT  1.0891   FR2          0.00 PT3C2           198.76   OVRLEFF       .1308   XMD         1.1629
MODEL  -         MN    20434.6317    ALPT  1.0969   MN2          0.00 PT7C2            15.76   PRPLEFF       .8342   XMM         0.0000
                 PLA         50.0    AZA7  1.0000   SEGMENT         0 PT11C2           22.08   THRMEFF       .1568   MIX EFF     1.0060
                 WF/PT2    142.16    IGV ANGL  1.0  IGV DELT      0.0
                                                    OVCEFF      .7477 EFFPOLY          .8188   EXSWIRL         -I    PRM          .7139
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   1          2         16        133         304        312        683        807          809
 39000.     1.2500    .77000E-02 33.000      1.4920     393.82     1.0000     .80000E-02 .33000E-02
                   MAXIMUM INLET CORRECTED AIRFLOW EXCEEDED VALUE RESET TO LIMIT
                              TFE1042-70  LPT OPERATION MAX. NOZZLE AREA  5-11-84
ALT   39000.00     MN          1.250    THRUST      452.74    WF       1030.069    AFAN    74.42      CUSTOMER INSTALLATION LOSSES
PAM       2.85     V (TAS)    716.95    TSFC        2.2752    BPR         .880     AENG   282.68   LP WB/WA      0.000  HP WB/WA    0.000
TAMF    -69.70     V (CAS)    414.37    TT4F/C 1641.4/ 894.1 N-LP   16267./1.044   AEXIT  587.58   LP-HP         6.000  HP-HP       0.000
TAMC    -56.50     ETA RAM     .9885    TT4.5  1134.8/ 612.6 N-HP   20212./ .870   AMIN   393.82   FAN CUST DP,0.000  PRIMARY DP 0.000
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COMPONENT    COR FLOW  P/P      EFF    EFPOL   PCT N    COR N    AERO HP  AERO TQ    BETA     SURMAR          MAP VALUES          WF/PS3RT2
FAN TOTAL     89.315                            105.07   16370.   3328.58 1074.66                      FLOW     P/P     EFF     FIG7 = 9.559
TIP(12-17)    41.819   2.310   .7010   .7335   105.07   16370.   1402.37  452.77   11.298     57.491  171.177  2.310   .7010   FIG8 =  .139
HUB(2-2.1)    47.496   2.801   .7362   .7708   105.07   16370.   1926.20  621.89   11.298     32.331  171.177  2.801   .7361   FIG9 = 5.592
LPC(2.2-2.3)  20.458   2.904   .8487   .8689    93.46   16814.   2522.64  655.51    6.110     21.970   20.313  2.904   .8487   WFMIN= 1.006
HPC(2.4-3)     8.218   1.667   .8168   .8289    97.27   14171.   1600.41  415.87    5.380     25.060    8.167  1.667   .8168   FIG10=44.436
HPT(4.1-4.3)   6.937   3.395   .8805           103.32   10042.   4154.04 1079.44   TQDL4  156.38       6.369  3.395   .8860   FIG11=  .010
LPT(4.5-4.9)  22.141   3.313   .8829           115.66    9278.   3328.42 1074.61   TQDL5  575.89      20.185  3.313   .9679   SQRTI=  .994
PWT(6.2-6.4)  64.162   1.000  1.0000             0.00       1.      0.00    0.00   TQDL6    1.00       1.000  1.000  1.0000
*****************************************************************************************************************************************
STATION     PRESSURE    TEMP       FLOW      ENTHA                                                               NOZZLE DATA
AMBIENT       2.854     390.0                                                                    PR8 2.498          PRM  .714
2   (1)       7.305     512.2     44.67                                                              .9470          CDC .7947
12(TIP)       7.305     512.2     20                                                                 .9354          CDF1.0200
   (19)      16.875     709.2                                                                                       A/A 1.492
13 (16)      16.875     709.2
16 (17)      11.000     710                                                                            ****************
2 (HUB)       7.305     51                                                                                            LEAKAGE
2.1 (2)      20.463                                                                            NZ  .0700   FAN .0020
2.2 (3)      20.463                                                                                 .0000   LPC .0010
2.3 (4)      59.433                                                                                 .1197   HPC .0020
2.4 (5)      59.433                                                                                 .0000   HPT .0000
3   (6)      99.061                                                                                 .0044   LPT .0000
3.9          93.342                                                                                           LC-LC .0000
4.1 (7)      93.342                                                                                           HC-HC .0000
4.3 (8)      27.496                                                                                           HC-LC .0000
4.4 (9)      27.496     15                                                                   SSES
4.5(10)      27.496     1594                                                                               .0115
4.9(11)       8.300     1220.                                                                 15-16)  .2792/ .096
5.1(13)       7.851     1216.4                                                                3-16)    0.0000
5.9(14)       5.810     1216.4                                                                (2.1-2.2)  0.0000
6   (18)      7.851      986.6    44.                                                         HPC(2.3-2.4)    0.0000
6.3(19)       7.161      986.6    41.677                                                      BURNER(3-3.9/-4) 0.0000/ .0577
8   (20)      7.130      986.6    44.814   238.                                               HPT-LPT(4.4-4.5)  0.0000
8 STATIC      3.794      765.4    44.814   184.215                                    0.7   0.   CLOSS(4.9-5/5-5.1) .0229/ .032
12 STATIC     3.794      765.4    44.814   184.215      T SRG AREA              SPECIFIC    10.13  NLOSS(6-6.3)/NZCL   .0879/  .1450
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          REYNOLDS NUMBER CORRECTIONS                  P-FACTORS          FNTC2        910.85    THETA2         .9875      AFTERBURNER
COMPO  OPT      REI       EFF       P/P       FLOW     FN    .9500        TSFCC2        2.2895   RT-THETA2      .9937   WF LB/HP      0.000
TIP     1     .5055    1.0001    1.0000     1.0001     WF   1.0000        NFC2      16369.91   DELTA2         .4971   EFFICIENCY   1.0000
HUB     1     .5055    1.0001    1.0000     1.0001     N1   1.0000        NLC2      20211.52   N1-TH-COR     1.0000   EQVMB         .1960
LPC     1     .8641    1.0000    1.0000     1.0000     N2   1.0000        NHC2      20339.17   N2-TH-COR      .9937   EQVAR        0.0000
HPC     1    1.0000    1.0000    1.0000     1.0000     T4   0.0000        WFC2       2085.43   WA-TH-COR      .9875   WFAB/P          -I
HPT          1.0000    1.0000    1.0000     1.0000     T5   0.0000        WAC2         88.755  T5-TH-COR      .9875   A/ANOZ       0.0000
LPT          1.0000    1.0000    1.0000     1.0000                        TT3C2       803.06   WF-TH-COR      .9937   ZONE            ***
PWT          1.0000    1.0000    1.0000     1.0000    W10C        21.26   TT5C2      1154.96   EPR(14/2)     1.592    LHV          1840C.
DATE - 84/05/15                    RH       0.0000    FR1          0.00   TT7C2       772.19   DCR(3/2)     13.56        MIXING DATA
TIME - 10:33:42   RAT(C)     -56.51  SH       0.0000    MN1          0.00   TT11C2      260.17   DER(7/4)     11.89    XMF           .6778
CPTIME -  12.04   FR          9.9423  AHPT     1.0891    FR2          0.00   PT3C2       199.30   OVRLEFF       .1338    XMD          1.1675
MODEL -           MN      20418.6385  ALPT     1.0969    MN2          0.00   PT7C2        15.79   PRPLFFF       .8347    XMM          0.0000
                  PLA           50.0  AZA7     1.0000    SEGMENT         0   PT11C2       22.13   THRMEFF       .1602    MIX EFF      1.0000
                  WF/PT2      141.01  IGV ANGL    1.0    IGV DELT      0.0
                                                         OVCEFF      .7493   EFFPOLY       .8199   EXSWIRL          -I    PRM           .7137
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     1          2          16         133         304         312         383         807         809
 29730.     1.1000     .77000E-02 34.000     1.4920      393.82      1.0000     .80000E-02 .33000E-02
                 MAXIMUM INLET CORRECTED AIRFLOW EXCEEDED VALUE RESET TO LIMIT
                           TFE1042-70  LPT OPERATION MAX. NOZZLE AREA  5-11-84
ALT   29730.00      MN           1.100   THRUST       517.38    WF        1325.186     AFAN    74.42      CUSTOMER INSTALLATION LOSSES
PAM       4.42      V (TAS)     649.00   TSFC         2.5614    BPR           .878     AENG   282.68   LP WB/WA       0.000  HP WB/WA      0.000
TAMF    -47.02      V (CAS)     437.41   TT4F/C 1642.3/ 894.6 N-LP  16277./1.045   AEXIT 587.58   LP-HP          6.000  HP-HP         0.000
TAMC    -43.90      ETA RAM      .9966   TT4.5  1135.5/ 613.0 N-HP  20237./ .871   AMIN   393.82   FAN CUST DP,0.000   PRIMARY DP 0.000
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COMPONENT     COR FLOW   P/P     EFF    EFPOL   PCT N   COR N   AERO HP  AERO TQ    BETA    SURMAR          MAP VALUES          WF/PS3RT2
FAN TOTAL      89.336                           105.07  16370.  4285.47 1382.79                       FLOW     P/P     EFF    FIG7 = 9.566
TIP(12-17)     41.761   2.310   .7012  .7337   105.07  16370.  1803.02  581.78   11.299   57.499  171.177  2.310   .7010  FIG8 =  .126
HUB(2-2.1)     47.575   2.802   .7363  .7710   105.07  16370.  2482.45  801.01   11.299   32.334  171.177  2.801   .7361  FIG9 = 5.592
LPC(2.2-2.3)   20.488   2.907   .8486  .8689    93.52  16825.  3256.27  845.10    6.128   22.110   20.343  2.907   .8486  WFMIN= 1.006
HPC(2.4-3)      8.225   1.667   .8167  .8288    97.33  14178.  2066.41  536.30    5.387   25.110    9.174  1.667   .8167  FIG10=44.469
HPT(4.1-4.3)    6.937   3.395   .8806          103.43  10052.  5353.75 1389.46   TQDL4 156.23        6.369  3.395   .8861  FIG11=  .009
LPT(4.5-4.9)   22.140   3.308   .8828          115.70   9281.  4285.30 1382.74   TQDL5 575.10       20.184  3.308   .9678  SQRTI=  .994
PWT(6.2-6.4)   64.090   1.000  1.0000            0.00      1.    -0.00     0.00   TQDL6   1.00        1.000  1.000  1.0000
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STATION     PRESSURE    TEMP      FLOW     ENTHAL                               BURNER (NO MAR)                  NOZZLE DATA
AMBIENT       4.418     412.6                                                          1325.186      PR8 2.083       PRM  .713
2   (1)       9.400     512.8                                                              .720      CD8 .9443       CDC .7945
12(TIP)       9.400     512.                                                                         CF8 .9299       CDF1.0192
   (19)      21.717                                                                                  VEL 1501.       A/A 1.492
13 (16)      21.717                                                                                  .8166
16 (17)      14.20                                                                                   ****************************
2 (HUB)       9.                                                                                      OOLING                 LEAKAGE
2.1 (2)      2                                                                                       DCT-NZ .0700  FAN .0020
2.2 (3)                                                                                              HC-4.6 .0000  LPC .0010
2.3 (4)                                                                                              C-STR .1197   HPC .0020
2.4 (5)                                                                                              -BUR .0000    HPT .0030
3   (6)                                                                                              PMTR .0044    LPT .0090
3.9                                                                                                                LC-LC .0000
4.1 (7)                                                                                                            HC-HC .0000
4.3 (8)                                                                                                            HC-LC .0000
4.4 (9)                                                                                              LOSSES
4.5(10)      3                                                                                                       .0034
4.9(11)      10.                                                                                     15/15-16)  .2772/ .095
5.1(13)      10.1                                                                                    N(13-16)   0.0000
5.9(14)       7.504                                                                                  LPC(2.1-2.2)   0.0000
6  (18)      10.130                                                                                  C-HPC(2.3-2.4)  0.0000
6.3(19)       9.244     987.                                                                         BURNER(3-3.9/-4) 0.0000/ .0578
8  (20)       9.204     987.9                                                              .20       HPT-LPT(4.4-4.5)  0.0000
8 STATIC      4.898     806.3     57.6                                                 0.7     0.    CLOSS(4.9-5/5-5.1)  .0229/ .032
12 STATIC     4.898     806.3     57.647    19                                         IFIC    9.00  NLOSS(6-6.3)/NZCL    .0875/ .1443
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      REYNOLDS NUMBER CORRECTIONS                    P-FACTORS          FNTC2         808.90     THETA2         .9886      AFTERBURNER
COMPO  OPT     REI      EFF      P/P      FLOW      FN    .9500         TSFCC2        2.5760     RT-THETA2      .9943     WF LB/HP      0.000
TIP     1     .6494   1.0003   1.0002   1.0003      WF   1.0000         NFC2        16369.91     DELTA2         .6396     EFFICIENCY   1.0000
HUB     1     .6494   1.0003   1.0002   1.0003      N1   1.0000         NLC2        20236.52     N1-TH-COR     1.0000     EQVMB         .1958
LPC     1    1.0000   1.0000   1.0000   1.0000      N2   1.0000         NHC2        20352.40     N2-TH-COR      .9943     EQVAB        0.0000
HPC     1    1.0000   1.0000   1.0000   1.0000      T4   0.0000         WFC2         2083.74     WA-TH-COR      .9806     WFAB/P          -T
HPT          1.0000   1.0000   1.0000   1.0000      T5   0.0000         WAC2           88.827    T5-TH-COR      .9886     A/ANO7       0.0000
LPT          1.0000   1.0000   1.0000   1.0000                          TT3C2         803.46     WF-TH-COR      .9943     ZONE           ***
PWT          1.0000   1.0000   1.0000   1.0000   W10C          21.23   TT5C2        1153.80     EPR(14/2)     1.597      LHV         18400.
DATE - 84/05/15                          RH      0.0000   FR1           0.00   TT7C2         771.71     OCR(3/2)     13.58           MIXING DATA
TIME - 10:33:50   RAT(C)      -43.91     SH      0.0000   MN1           0.00   TT11C2        260.16     OER(7/4)     11.87      XME           .6765
CPTIME -  13.55   FR           7.7162    AHPT    1.0891   FR2           0.00   PT3C2         199.56     OVRLEFF       .1075     XMD          1.1573
MODEL -           MN       20424.4509    ALPT    1.0969   MN2           0.00   PT7C2          15.84     PRPLEFF       .8367     XMM          0.0000
                  PLA          50.0      AZA7    1.0000   SEGMENT          0   PT11C2         22.22     THRMEFF       .1285     MIX EFF      1.0000
                  WF/PT2      140.98     IGV ANGL   1.0   IGV DELT      0.0
                                                          OVCEFF      .7493   EFFPOLY         .8200     EXSWIRL          -I       PRM           .7129
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     1           2          16          133          304          312          083          407          809
  21680.      .90000     .77000E-02 35.000       1.4920       393.82       1.0000      .80000E-02 .33000E-02
                    MAXIMUM INLET CORRECTED AIRFLOW EXCEEDED VALUE RESET TO LIMIT
                               TFE1042-70  LPT OPERATION MAX. NOZZLE AREA   5-11-84
ALT   21680.00      MN            .900    THRUST      498.74    WF       1508.046    AFAN    74.42      CUSTOMER INSTALLATION LOSSES
PAM       6.29      V (TAS)     549.16    TSFC        3.0237    BPR          .873    AENG   282.68    LP WB/WA      0.000  HP WB/WA    0.000
TAMF    -18.31      V (CAS)     410.37    TT4F/C 1646.2/ 896.8 N-LP  16281./1.045  AEXIT  587.58    LP-HP         6.000  HP-HP       0.000
TAMC    -27.95      ETA RAM     1.0000    TT4.5  1130.6/ 614.8 N-HP  20262./ .872  AMIN   393.82    FAN CUST DP,0.000  PRIMARY DP 0.000
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COMPONENT      COR FLOW  P/P      EFF     EFPOL   PCT N    COR N    AERO HP  AERO TQ    BETA      SURMAR          MAP VALUES              WF/PS3RT2
FAN TOTAL        89.309                           105.07   16370.   4853.91 1565.82                        FLOW     P/P      EFF     FIG7 = 9.575
TIP(12-17)       41.622  2.313    .7013   .7339   105.07   16370.   2037.08  657.14   11.277     57.291   171.175   2.313    .7013   FIG8 =  .120
HUB(2-2.1)       47.687  2.803    .7365   .7711   105.07   16370.   2816.84  908.68   11.277     32.260   171.175   2.803    .7365   FIG9 = 5.592
LPC(2.2-2.3)     20.530  2.912    .8486   .8688    93.61   16842.   3703.60  959.99    6.138     22.204    20.386   2.912    .8486   WFMIN= 1.005
HPC(2.4-3)        8.229  1.669    .8169   .8289    97.39   14188.   2350.32  609.21    5.380     25.057     8.177   1.669    .8169   FIG10=44.519
HPT(4.1-4.3)      6.937  3.395    .8806           103.46   10056.   6084.97 1577.26   TODL4 156.19          6.369   3.395    .8861   FIG11=  .009
LPT(4.5-4.9)     22.141  3.294    .8826           115.62    9275.   4853.91 1565.82   TODL5 573.53         20.185   3.294    .9675   SQPTI=  .995
PWT(6.2-6.4)     63.848  1.000   1.0000             0.00       1.      0.00    0.00   TODL6   1.00          1.000   1.000   1.0000
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STATION      PRESSURE    TEMP      FLOW     ENTHALPY       CYCLE POWER LOSSES        BURNER (NO MAR)            NOZZLE DATA
AMBIENT        6.291    441.4               105.486      ACC G/B EFF   1.0000     FUEL FLOW   1508.046    PR8 1.671       PRM  .711
2   (1)       10.640    513.0     65.013    122.644      FAN G/B EFF   1.0000     WF/PS3RT2     10.741    CD8 .9366       CDC .7935
12(TIP)       10.640    513.0     30.299    122.644      FAN G/B HP    0.000      WF-(LPCSURG)   1.005    CF8 .9266       CDF1.0169
   (19)       24.610    710.6     30.238    170.1                                                .0133    VEL 1277.       A/A 1.492
13 (16)       24.610    710.6     30.238                                                         .0035    CFDA .7721
16 (17)       16.263    712.3     30                                                             0073    ********************************
2 (HUB)       10.640    513.0                                                                                       COOLING            LEAKAGE
2.1 (2)       29.820    750.                                                                            LT .0025  DCT-NZ .0700   FAN .0020
2.2 (3)       29.820    75                                                                                 .0033  HC-4.6 .0000   LPC .0010
2.3 (4)       86.841    1                                                                                   0077  HC-STR .1197   HPC .0020
2.4 (5)       86.841                                                                                        080   HC-BUR .0000   HPT .0000
3   (6)      144.923                                                                                        00    AIRMTR .0044   LPT .0000
3.9          136.553                                                                                        4                  LC-LC .0000
4.1 (7)      136.553                                                                                        0                  HC-HC .0000
4.3 (8)       40.226                                                                                        0                  HC-LC .0000
4.4 (9)       40.226                                                                                         DUCT LOSSES
4.5(10)       40.226                                                                                      AM              0.0000
4.9(11)       12.212    12                                                                                (13-15/15-16)  .2717/ .093
5.1(13)       11.558    1221                                                                             ST FAN(13-16)    0.0000
5.9(14)        8.591    1221.2                                                                          FAN-LPC(2.1-2.2)  0.0000
6  (18)       11.558     990.9                                                                          LPC-HPC(2.3-2.4)  0.0000
6.3(19)       10.561     990.9    60.69                                                        00.06    BURNER(3-3.9/-4) 0.0000/ .0578
8  (20)       10.515     990.9    65.218    24                                               1397.86    HPT-LPT(4.4-4.5)  0.0000
8 STATIC       5.596     860.1    65.218    207.497                              DRAG N/SP   0./   0.   CLOSS(4.9-5/5-5.1) .0227/ .032
12 STATIC      5.596     860.1    65.218    207.497       T SRG AREA    44.200   SPECIFIC        7.67   NLOSS(6-6.3)/N7CL   .0863/  .1424
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          REYNOLDS NUMBER CORRECTIONS                     P-FACTORS        FNTC2       688.88    THETA2          .9891         AFTERBURNER
COMPO  OPT      REI       EFF       P/P       FLOW     FN     .9500    TSFCC2       3.0402    RT-THETA2       .9946    WF LB/HR        0.000
TIP     1      .7346    1.0000    1.0000    1.0000     WF    1.0000    NFC2       16369.91    DELTA2          .7240    EFFICIENCY     1.0000
HUB     1      .7346    1.0000    1.0000    1.0000     N1    1.0000    NLC2       20261.93    N1-TH-COR      1.0000    EQVMB           .1964
LPC     1     1.0000    1.0000    1.0000    1.0000     N2    1.0000    NHC2       20372.88    N2-TH-COR       .9946    EQVAB          0.0000
HPC     1     1.0000    1.0000    1.0000    1.0000     T4    0.0000    WFC2        2094.35    WA-TH-COR       .9891    WFAB/P            -I
HPT           1.0000    1.0000    1.0000    1.0000     T5    0.0000    WAC2          88.823   T5-TH-COR       .9891    A/ANOZ         0.0000
LPT           1.0000    1.0000    1.0000    1.0000                     TT3C2        804.54    WF-TH-COR       .9946    ZONE              ***
PWT           1.0000    1.0000    1.0000    1.0000     W10C     21.14  TT5C2       1156.11    EPR(14/2)      1.613     LHV            18400.
DATE - 84/05/15                       RH    0.0000     FR1       0.00  TT7C2        774.91    OCR(3/2)      13.62          MIXING DATA
TIME - 10:34:23   RAT(C)    -27.96    SH    0.0000     MN1       0.00  TT11C2       260.41    OER(7/4)      11.81     XME             .6727
CPTIME -  13.77   FR        6.8037    AHPT  1.0891     FR2       0.00  PT3C2        200.17    OVRLEFF        .0771    XMD            1.1300
MODEL -           MN    20441.7772    ALPT  1.0969     MN2       0.00  PT7C2         15.96    PRPLEFF        .8360    XMM            0.0000
                  PLA         50.0    AZA7  1.0000     SEGMENT      0  PT11C2        22.46    THRMEFF        .0922    MIX EFF        1.0000
                  WF/PT2    141.74    IGV ANGL   1.0   IGV DELT   0.0
                                                       OVCEFF   .7494  EFFPOLY        .8201    EXSWIRL           -I     PRM             .7107
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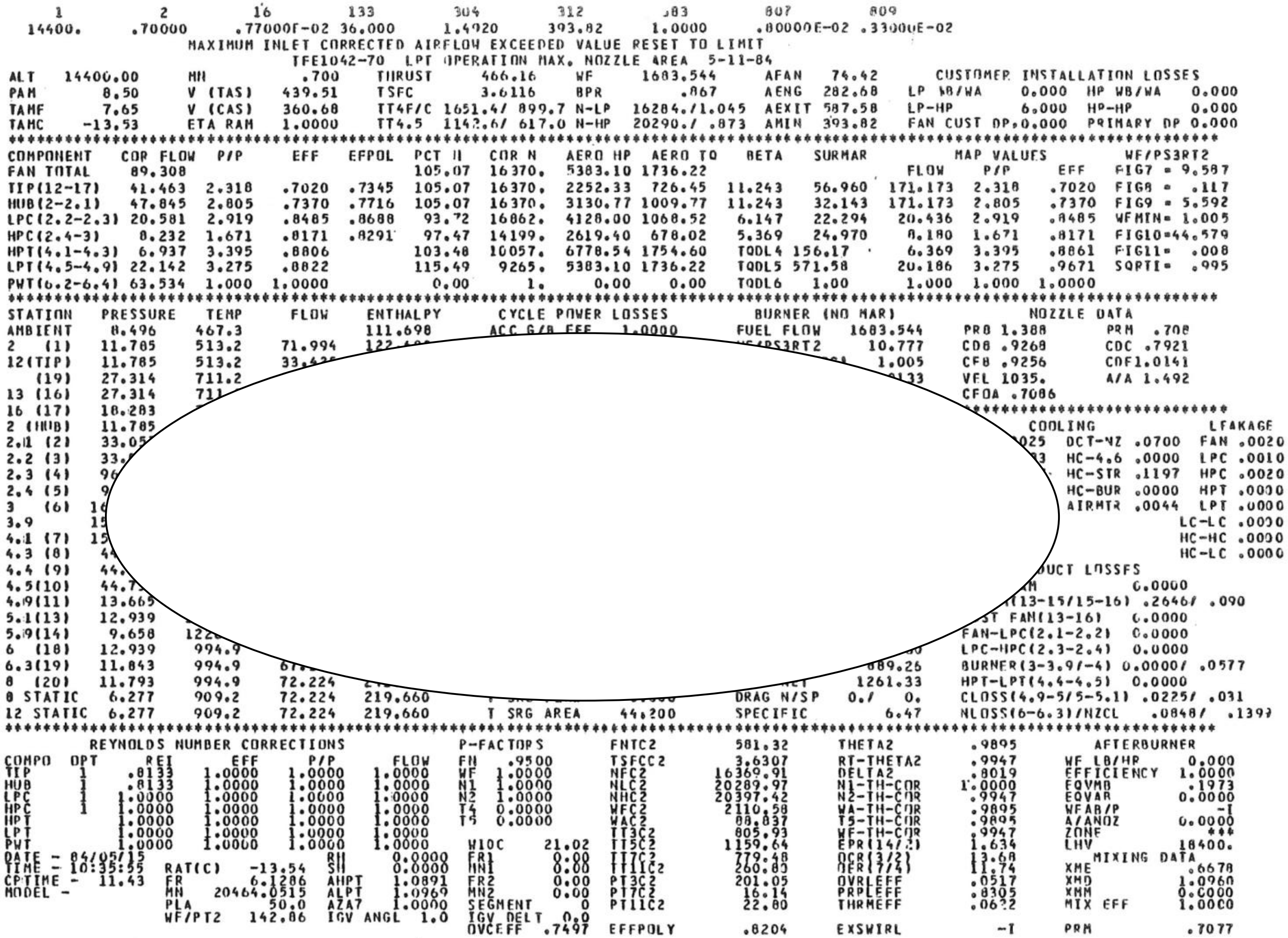

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    1          2          16         133        304        312        383        807        809
  14400.     .70000    .77000E-02 36.000      1.4920     393.82     1.0000     .80000E-02 .33000E-02
               MAXIMUM INLET CORRECTED AIRFLOW EXCEEDED VALUE RESET TO LIMIT
                          TFE1042-70  LPT OPERATION MAX. NOZZLE AREA  5-11-84
ALT  14400.00     MN          .700    THRUST     466.16    WF      1683.544    AFAN   74.42      CUSTOMER INSTALLATION LOSSES
PAM      8.50     V (TAS)   439.51    TSFC       3.6116    BPR         .867    AENG  282.68   LP WB/WA      0.000  HP WB/WA    0.000
TAMF     7.65     V (CAS)   360.68    TT4F/C 1651.4/ 899.7 N-LP  16284./1.045  AEXIT 587.58   LP-HP         6.000  HP-HP       0.000
TAMC   -13.53     ETA RAM   1.0000    TT4.5  1142.6/ 617.0 N-HP  20290./ .873  AMIN  393.82   FAN CUST DP.0.000    PRIMARY DP 0.000
*****************************************************************************************************************************
COMPONENT   COR FLOW  P/P     EFF    EFPOL   PCT N    COR N   AERO HP  AERO TQ    BETA    SURMAR          MAP VALUES          WF/PS3RT2
FAN TOTAL    89.308                          105.07   16370.  5383.10 1736.22                       FLOW    P/P     EFF    FIG7 = 9.587
TIP(12-17)   41.463  2.318   .7020   .7345   105.07   16370.  2252.33  726.45  11.243    56.960  171.173  2.318   .7020  FIG8 =  .117
HUB(2-2.1)   47.845  2.805   .7370   .7716   105.07   16370.  3130.77 1009.77  11.243    32.143  171.173  2.805   .7370  FIG9 = 5.592
LPC(2.2-2.3) 20.581  2.919   .8485   .8688    93.72   16862.  4128.00 1068.52   6.147    22.294   20.436  2.919   .8485  WFMIN= 1.005
HPC(2.4-3)    8.232  1.671   .8171   .8291    97.47   14199.  2619.40  678.02   5.369    24.970    8.180  1.671   .8171  FIG10=44.579
HPT(4.1-4.3)  6.937  3.395   .8806           103.48   10057.  6778.54 1754.60  TQDL4 156.17         6.369  3.395   .8861  FIG11=  .008
LPT(4.5-4.9) 22.142  3.275   .8822           115.49    9265.  5383.10 1736.22  TQDL5 571.58        20.186  3.275   .9671  SQRTI=  .995
PWT(6.2-6.4) 63.534  1.000  1.0000             0.00       1.     0.00    0.00  TQDL6   1.00         1.000  1.000  1.0000
*****************************************************************************************************************************
STATION    PRESSURE    TEMP      FLOW    ENTHALPY      CYCLE POWER LOSSES         BURNER (NO MAR)        NOZZLE DATA
AMBIENT     8.496     467.3              111.698      ACC G/B EFF    1.0000      FUEL FLOW   1683.544    PR8 1.388      PRM  .708
2  (1)     11.785     513.2     71.994                                                        10.777    CD8 .9268      CDC .7921
12(TIP)    11.785     513.2                                                                    1.005    CF8 .9256      CDF1.0141
   (19)    27.314     711.2                                                                             VEL 1035.      A/A 1.492
13 (16)    27.314                                                                                       CFDA .7086
16 (17)    18.283                                                                                       ***************************
2 (HUB)    11.785                                                                                          COOLING            LEAKAGE
2.1 (2)                                                                                                    DCT-NZ .0700   FAN .0020
2.2 (3)                                                                                                    HC-4.6 .0000   LPC .0010
2.3 (4)                                                                                                    HC-STR .1197   HPC .0020
2.4 (5)                                                                                                    HC-BUR .0000   HPT .0030
3   (6)                                                                                                    AIRMTR .0044   LPT .0000
3.9                                                                                                                        LC-LC .0000
4.1 (7)                                                                                                                    HC-HC .0000
4.3 (8)                                                                                                                    HC-LC .0000
4.4 (9)                                                                                                 DUCT LOSSES
4.5(10)                                                                                                                 0.0000
4.9(11)    13.665                                                                                       (13-15/15-16)  .2646/ .090
5.1(13)    12.939                                                                                       FAN(13-16)      0.0000
5.9(14)     9.658                                                                                       FAN-LPC(2.1-2.2)  0.0000
6  (18)    12.939     994.9                                                                             LPC-HPC(2.3-2.4)  0.0000
6.3(19)    11.843     994.9                                                              889.26         BURNER(3-3.9/-4) 0.0000/ .0577
8  (20)    11.793     994.9     72.224                                                  1261.33         HPT-LPT(4.4-4.5)  0.0000
8 STATIC    6.277     909.2     72.224   219.660                              DRAG N/SP    0./   0.     CLOSS(4.9-5/5-5.1) .0225/ .031
12 STATIC   6.277     909.2     72.224   219.660     T SRG AREA    44.200     SPECIFIC         6.47     NLOSS(6-6.3)/NZCL   .0848/ .1397
*****************************************************************************************************************************
          REYNOLDS NUMBER CORRECTIONS              P-FACTORS           FNTC2           581.32    THETA2          .9895        AFTERBURNER
COMPO  OPT    REI      EFF      P/P      FLOW     FN    .9500          TSFCC2          3.6307    RT-THETA2       .9947    WF LB/HR       0.000
TIP     1    .8133   1.0000   1.0000   1.0000     WF   1.0000          NFC2         16369.91     DELTA2          .8019    EFFICIENCY    1.0000
HUB     1    .8133   1.0000   1.0000   1.0000     N1   1.0000          NLC2         20289.97     N1-TH-COR      1.0000    EQVMB          .1973
LPC     1   1.0000   1.0000   1.0000   1.0000     N2   1.0000          NHC2         20397.42     N2-TH-COR       .9947    EQVAR         0.0000
HPC     1   1.0000   1.0000   1.0000   1.0000     T4   0.0000          WFC2          2110.58     WA-TH-COR       .9895    WFAB/P          -I
HPT         1.0000   1.0000   1.0000   1.0000     T5   0.0000          WAC2            88.837    T5-TH-COR       .9895    A/ANOZ        0.0000
LPT         1.0000   1.0000   1.0000   1.0000                          TT3C2          805.93     WF-TH-COR       .9947    ZONE            ***
PWT         1.0000   1.0000   1.0000   1.0000     WIOC       21.02     TT5C2         1159.64     EPR(14/2)      1.634     LHV          18400.
DATE - 84/05/15                  RH    0.0000     FR1         0.00     TT7C2          779.48     OCR(3/2)      13.68         MIXING DATA
TIME - 10:35:55   RAT(C)   -13.54  SH    0.0000     MN1         0.00     TT11C2         260.80     OER(7/4)      11.74     XME            .6678
CPTIME -  11.43   FR       6.1286  AHPT  1.0891     FR2         0.00     PT3C2          201.05     OVRLEFF        .0517    XMD           1.0960
MODEL -           MN   20464.0515  ALPT  1.0969     MN2         0.00     PT7C2           16.14     PRPLEFF        .8305    XMM           0.0000
                  PLA        50.0  AZA7  1.0000     SEGMENT        0     PT11C2          22.80     THRMEFF        .0632    MIX EFF       1.0000
                  WF/PT2   142.86  IGV ANGL  1.0    IGV DELT  0.0
                                                    OVCEFF   .7497     EFFPOLY           .8204     EXSWIRL           -I      PRM            .7077
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   1          2          16          133         304         312         o83         807         809
 8350.0     .50000     .77000E-02 37.000      1.4920      393.82      1.0000      .80000E-02 .33000E-02
                 MAXIMUM INLET CORRECTED AIRFLOW EXCEEDED VALUE RESET TO LIMIT
                          TFE1042-70  LPT OPERATION MAX. NOZZLE AREA  5-11-84
ALT    8350.00     MN           .500   THRUST       424.36    WF       1838.173     AFAN    74.42      CUSTOMER INSTALLATION LOSSES
PAM      10.77     V (TAS)    321.10   TSFC         4.3317    BPR          .861     AENG   282.58   LP WB/WA      0.000  HP WB/WA     0.000
TAMF     29.22     V (CAS)    285.52   TT4F/C 1656.3/ 902.4 N-LP  16286./1.045   AEXIT  587.58   LP-HP         6.000  HP-HP        0.000
TAMC     -1.54     ETA RAM    1.0000   TT4.5  1146.4/ 619.1 N-HP  20314./ .874   AMIN   393.82   FAN CUST DP.0.000   PRIMARY DP 0.000
*******************************************************************************************************************************
COMPONENT    COR FLOW  P/P      EFF     EFPOL   PCT N    COR N    AERO HP   AERO TQ   BETA     SURMAR           MAP VALUES          WF/PS3RT2
FAN TOTAL     89.306                            105.07   16370.   5843.44  1884.38                         FLOW     P/P      EFF    FIG7 = 9.597
TIP(12-17)    41.319   2.323    .7026   .7351   105.07   16370.   2438.41   786.34   11.208     56.632   171.170   2.323   .7026   FIG8 =  .113
HUB(2-2.1)    47.987   2.808    .7376   .7721   105.07   16370.   3405.03  1098.05   11.208     32.026   171.170   2.808   .7376   FIG9 = 5.592
LPC(2.2-2.3)  20.625   2.926    .8484   .8688    93.82   16879.   4500.66  1163.58    6.154     22.365    20.479   2.926   .8484   WFMIN= 1.005
HPC(2.4-3)     8.234   1.672    .8172   .8293    97.53   14209.   2855.51   738.25    5.359     24.888     8.183   1.672   .8172   FIG10=44.631
HPT(4.1-4.3)   6.937   3.394    .8806           103.48   10058.   7387.13  1909.84   TODL4 156.15          6.369   3.394   .8861   FIG11=  .008
LPT(4.5-4.9)  22.143   3.258    .8819           115.37    9255.   5843.72  1884.48   TODL5 569.84         20.187   3.258   .9668   SQRTI=  .995
PWT(6.2-6.4)  63.250   1.000   1.0000             0.00       1.      0.00      0.00   TODL6   1.00          1.000   1.000  1.0000
*******************************************************************************************************************************
STATION     PRESSURE    TEMP      FLOW      ENTHALPY      CYCLE POWER LOSSES        BURNER (NO MAR)              NOZZLE DATA
AMBIENT      10.771     488.9                116.862      ACC S/B EFF    1.0000     FUEL FLOW   1838.173     PR8 1.201       PRM  .705
2   (1)      12.776     513.4    78.038      122.728                                WF/PS3RT2     10.809     CD8 .9175       CDC .7908
12(TIP)      12.776     513.4    36.106                                                 SSURG)     1.005     CF8 .9256       CDF1.0116
    (19)     29.674     711.8    36.                                                               .0134     VEL  782.       A/A 1.492
13 (16)      29.674     711.8                                                                                CFNA .6132
16 (17)      20.092     71                                                                                   ******************************
2 (HUB)      12.776                                                                                              COOLING          LEAKAGE
2.1 (2)      35.870                                                                                          025  DCT-NZ .0700   FAN .0020
2.2 (3)      35.87                                                                                                HC-4.6 .0000   LPC .0010
2.3 (4)     104.9                                                                                                 HC-STR .1197   HPC .0020
2.4 (5)     104.                                                                                                  HC-BUR .0000   HPT .0030
3   (6)     175.                                                                                                  AIRMTR .0044   LPT .0000
3.9         165.                                                                                                                LC-LC .0000
4.1 (7)     165.                                                                                                                HC-HC .0000
4.3 (8)      48.7                                                                                                               HC-LC .0030
4.4 (9)      48.715                                                                                           UCT LOSSES
4.5(10)      48.715                                                                                           M             0.0000
4.9(11)      14.953                                                                                          (13-15/15-16) .2581/ .087
5.1(13)      14.166     1230                                                                                 ST FAN(13-16)   0.0000
5.9(14)      10.612     1230.7                                                                               FAN-LPC(2.1-2.2)   0.0000
6  (18)      14.166      998.6   78.2                                                            .21         LPC-HPC(2.3-2.4)   0.0000
6.3(19)      12.985      998.6   72.815                                                        706.33        BURNER(3-3.9/-4) 0.0000/ .0577
8  (20)      12.931      998.6   78.257     241.988                                ENG  NET    1054.08       HPT-LPT(4.4-4.5)   0.0000
8 STATIC      6.883      949.8   78.257     229.778      T SRG FLOW      0.000     DRAG N/SP   0./   0.      CLOSS(4.9-5/5-5.1) .0223/ .031
12 STATIC     6.883      949.8   78.257     229.778      T SRG AREA     44.200     SPECIFIC          5.44   NLOSS(6-6.3)/NZCL   .0834/  .1376
*******************************************************************************************************************************
          REYNOLDS NUMBER CORRECTIONS                  P-FACTORS          FNTC2          488.12     THETA2          .9898         AFTERBURNER
COMPO  OPT      REI      EFF       P/P       FLOW      FN   .9500         TSFCC2         4.3539     RT-THETA2       .9949     WF LB/HR        0.000
TIP     1      .8813   1.0000    1.0000    1.0000      WF  1.0000         NFC2         16369.91     DELTA2          .8694     EFFICIENCY     1.0000
HUB     1      .8813   1.0000    1.0000    1.0000      N1  1.0000         NLC2         20314.42     N1-TH-COR      1.0000     EQVMB           .1982
LPC     1     1.0000   1.0000    1.0000    1.0000      N2  1.0000         NHC2         20418.65     N2-TH-COR       .9949     EQVAB          0.0000
HPC     1     1.0000   1.0000    1.0000    1.0000      T4  0.0000         WFC2          2125.23     WA-TH-COR       .9898     WFAB/P            -I
HPT           1.0000   1.0000    1.0000    1.0000      T5  0.0000         WAC2            88.850    T5-TH-COR       .9898     A/ANO7         0.0000
LPT           1.0000   1.0000    1.0000    1.0000                         TT3C2          807.17     WF-TH-COR       .9949     ZONE              ***
PWT           1.0000   1.0000    1.0000    1.0000      W10C       20.91   TT5C2         1162.96     EPR(14/2)       1.654     LHV            18400.
DATE - 84/05/15                     RH      0.0000      FR1         0.00   TT7C2          783.72     OCR(3/2)        13.73          MIXING DATA
TIME - 10:36:06    RAT(C)     -1.55   SH      0.0000      MN1         0.00   TT11C2         261.19     OER(7/4)        11.67     XMF             .6636
CPTIME -  21.62    FR        5.6416   AHPT    1.0891      FR2         0.00   PT3C2          201.85     OVRLEFF         .0315     XMD            1.0662
MODEL -            MN    20483.2182   ALPT    1.0969      MN2         0.00   PT7C2           16.30     PRPLEFF         .8149     XMM            0.0000
                   PLA         50.0   AZA7    1.0000      SEGMENT        0   PT11C2          23.11     THRMEFF         .0386     MIX EFF        1.0000
                   WF/PT2    143.87   IGV ANGL   1.0      IGV DELT     0.0
                                                          OVCEFF     .7499   EFFPOLY          .8205     EXSWIRL           -I     PRM             .7051
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     1           2          16          133          304          312          .83          807          809
  4000.0      .30000     .77000E-02 38.000      1.4920       393.82       1.0000      .80000E-02 .33000E-02
                  MAXIMUM INLET CORRECTED AIRFLOW EXCEEDED VALUE RESET TO LIMIT
                              TFE1042-70  LPT OPERATION MAX. NOZZLE AREA  5-11-84
ALT     4000.00      MN          .300    THRUST      634.22     WF       2001.271      AFAN    74.42       CUSTOMER INSTALLATION LOSSES
PAM       12.69      V (TAS)   195.69    TSFC        3.1555     BPR          .840      AENG   282.68    LP WB/WA      0.000  HP WB/WA     0.000
TAMF      44.74      V (CAS)   184.77    TT4F/C 1675.1/ 912.8 N-LP  16288./1.045   AEXIT  587.58    LP-HP         6.000  HP-HP        0.000
TAMC       7.08      ETA RAM   1.0000    TT4.5  1161.1/ 627.3 N-HP   20393./ .877  AMIN   393.82    FAN CUST DP.0.000  PRIMARY DP 0.000
*********************************************************************************************************************************
COMPONENT     COR FLOW  P/P      EFF     EFPOL   PCT N    COR N    AERO HP  AERO TQ    BETA     SURMAR            MAP VALUES           WF/PS3RT2
FAN TOTAL      89.301                            105.07   16370.   6210.35 2002.48                           FLOW     P/P      EFF    FIG7 = 9.633
TIP(12-17)     40.761   2.344   .7054   .7379   105.07   16370.   2564.88  827.03   11.054     55.195   171.160   2.344    .7054  FIG8 =  .110
HUB(2-2.1)     48.540   2.818   .7401   .7744   105.07   16370.   3645.47 1175.46   11.054     31.511   171.160   2.818    .7401  FIG9 = 5.592
LPC(2.2-2.3)   20.785   2.951   .8482   .8687    94.16   16940.   4861.91 1252.10    6.168     22.548    20.639   2.951    .8482  WFMIN= 1.005
HPC(2.4-3)      8.238   1.678   .8180   .8301    97.76   14241.   3081.87  793.68    5.313     24.520     0.187   1.678    .8180  FIG10=44.820
HPT(4.1-4.3)    6.937   3.395   .8805           103.43   10052.   7975.51 2053.96   TQDL4 156.25         6.369   3.395    .8861  FIG11=  .008
LPT(4.5-4.9)   22.147   3.193   .8810           114.07    9214.   6210.07 2002.39   TQDL5 563.42        20.191   3.193    .9658  SQRTI=  .995
PWT(6.2-6.4)   62.160   1.000  1.0000             0.00       1.      0.00    0.00   TQDL6   1.00         1.000   1.000   1.0000
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STATION     PRESSURE              FLOW      ENTHALPY        CYCLE POWER LOSSES           BURNER (NO MAR)               NOZZLE DATA
AMBIENT     12.692                          120.576        ACC G/B EFF    1.0000      FUEL FLOW    2001.271      PR8 1.125      PRM  .695
2   (1)     13.510                          122.755        FAN G/B EFF    1.0000      WF/PS3RT2      10.952      CD8 .9132      CDC .7860
12(TIP)     13.510                                         FAN G/B HP      0.000      WF-(LPCSURG)    1.005      CF8 .9257      CDF1.0025
  (19)      31.668                                         FAN G/RATIO    1.0000      F/A4            .0136      VEL  636.      A/A 1.492
13 (16)     31.668                                           ACC HP        6.000      F/AB0           .0035      CFDA .5421
16 (17)     22.374                                                 HP      0.000      EFFICIENCY      .9970      *******************************
2 (HUB)     13.510                                                        -.091       V-REF          1784.9               COOLING              LEAKAGE
2.1 (2)     38.077                                                          .000      PT3**2/WA3    871.316     HB-LT .0025  DCT-NZ .0700  FAN .0020
2.2 (3)     38.077                                                                    PS3           183.656     TP-LT .0033  HC-4.6 .0000  LPC .0010
2.3 (4)    112.369    10                                                              PSE (PSIG)    170.963     LC-LT .0077  HC-STR .1197  HPC .0020
2.4 (5)    112.369    10                                                                              4.954     LC-HT .0080  HC-BUR .0000  HPT .0000
3   (6)    188.507    12                                                                                        HC-LT .0000  AIRMTR .0044  LPT .0000
3.9        177.678    22                                                                             ******     HC-HT .0664                LC-LC .0000
4.1 (7)    177.678    21                                                                                        LC-PT .0000                HC-HC .0000
4.3 (8)     52.333    16                                                                            1514.61     HC-PT .0000                HC-LC .0000
4.4 (9)     52.333    16                                                                             847.01              DUCT LOSSES
4.5(10)     52.333    16                                                              NET            667.60     1. - RAM          0.0000
4.9(11)     16.392    12                                                         FAN  GROSS            0.00     ARFAN(13-15/15-16) .2334/ .078
5.1(13)     15.560    12                                                         FAN  RAM            386.61     CUST FAN(13-16)   0.0000
5.9(14)     11.813    12                                                .558     FAN  NET           -386.61     FAN-LPC(2.1-2.2)  0.0000
6  (18)     15.560    10                                               0.000     ENG  GROSS         1514.61     LPC-HPC(2.3-2.4)  0.0000
6.3(19)     14.340    10                                   WB/WA      0.0000     ENG  RAM            460.40     BURNER(3-3.9/-4) 0.0000/ .0574
8  (20)     14.284    10                                 HPC T C/F    0.0/  32.0 ENG  NET           1054.21     HPT-LPT(4.4-4.5)  0.0000
8 STATIC    12.692     9                                 T SRG FLOW    0.000     DRAG N/SP    0./    0.         CLOSS(4.9-5/5-5.1) .0215/ .030
12 STATIC   12.692     9                     .489        T SRG AREA   44.200     SPECIFIC              7.69     NLOSS(6-6.3)/NZCL    .0784/  .1293
*********************************************************************************************************************************
           REYNOLDS NUM                  IONS           P-FACTORS          FNTC2          689.89     THETA2          .9900        AFTERBURNER
COMPO  OPT      REI                P/P       FLOW     FN    .9500          TSFCC2         3.1713     RT-THETA2       .9950     WF LB/HR       0.000
TIP     1      .9317       .0000   1.0000   1.0000    WF   1.0000          NFC2         16369.91     DELTA2          .9193     EFFICIENCY    1.0000
HUB     1      .9317      1.0000   1.0000   1.0000    N1   1.0000          NLC2         20393.47     N1-TH-COR      1.0000     EQVMB          .2018
LPC     1     1.0000      1.0000   1.0000   1.0000    N2   1.0000          NHC2         20495.84     N2-TH-COR       .9950     EQVAB         0.0000
HPC     1     1.0000      1.0000   1.0000   1.0000    T4   0.0000          WFC2          2187.86     WA-TH-COR       .9900     WFAB/P            -I
HPT           1.0000      1.0000   1.0000   1.0000    T5   0.0000          WAC2           88.855     T5-TH-COR       .9900     A/ANOZ        0.0000
LPT           1.0000      1.0000   1.0000   1.0000                         TT3C2          812.03     WF-TH-COR       .9950     ZONE             ***
PWT           1.0000      1.0000   1.0000   1.0000    W10C        20.46    TT5C2         1177.36     EPR(14/2)       1.733     LHV           18400.
DATE - 84/05/15                      RH     0.0000    FR1          0.00    TT7C2          801.32     OCR(3/2)        13.95          MIXING DATA
TIME - 10:36:14    RAT(C)      7.07  SH     0.0000    MN1          0.00    TT11C2         262.88     OER(7/4)        11.42     XME            .6477
CPTIME -  14.88    FR        5.2966  AHPT   1.0891    FR2          0.00    PT3C2          205.05     OVRLEFF         .0263     XMD           1.1005
MODEL -            MN    20559.0069  ALPT   1.0969    MN2          0.00    PT7C2           16.93     PRPLEFF         .6839     XMM           0.0000
                   PLA         50.0  AZA7   1.0000    SEGMENT         0    PT11C2          24.34     THRMEFF         .0385     MIX EFF       1.0000
                   WF/PT2    148.13  IGV ANGL  1.0    IGV DELT      0.0
                                                      OVCEFF      .7512    EFFPOLY         .8219     EXSWIRL            -I     PRM            .6954
```

1	-.8093756	-.1365306	6.465559	160
2	-.7235200	-.3301454E-01	6.466984	170
3	-.6237319	.6242249E-01	6.466708	180
4	-.5121656	.1444113	6.465391	190
5	-.3909750	.2075828	6.463691	200
6	-.2623143	.2465677	6.462268	210
7	-.1283376	.2559968	6.461782	220
9	.8801007E-02	.2305010	6.462891	230
10	.1050528	.1907664	6.464187	240
11	.1950568	.1382652	6.465520	250
13	.2778141	.7506096E-01	6.466564	260
14	.3489820	.6852357E-02	6.467109	270
15	.4136955	-.6652380E-01	6.466738	280
16	.4727568	-.1442885	6.465390	290
17	.5269681	-.2256628	6.463001	300
18	.5771314	-.3098677	6.459511	310
19	.6240489	-.3961242	6.454857	320
20	.6685229	-.4836533	6.448977	330
21	.7113554	-.5716761	6.441810	340
22	.7533486	-.6594134	6.433293	350
23	-.7790527	-.1726974	6.464694	370
24	-.6917511	-.1256090	6.465755	380
25	-.6005043	-.8344277E-01	6.466443	390
26	-.5061063	-.4797811E-01	6.466833	400
27	-.4093513	-.2099430E-01	6.466998	410
28	-.3110334	-.4270620E-02	6.467015	420
29	-.2119467	.4136059E-03	6.466956	430
30	-.1128854	-.8720924E-02	6.466898	440
32	-.1464342E-01	-.3345352E-01	6.466913	450
33	.8729288E-01	-.7201336E-01	6.466599	460
34	.1841546	-.1220849	6.465847	470
36	.2752933	-.1818747	6.464442	480
37	.3416686	-.2335919	6.462809	490
38	.4046541	-.2890335	6.460554	500
39	.4645383	-.3477317	6.457637	510
40	.5216099	-.4092187	6.454022	520
41	.5761573	-.4730265	6.449670	530
42	.6284692	-.5386875	6.444543	540
43	.6788340	-.6057339	6.438603	550
44	.7275404	-.6736977	6.431813	560
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170	-.6865524	.4350246	8.321206	1810
171	-.5903648	.4739113	8.319255	1820
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173	-.3869397	.4756692	8.319541	1840
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176	-.9299822E-01	.3430480	8.325857	1870
177	-.8355518E-02	.2773801	8.328310	1880
179	.6530488E-01	.2070686	8.330427	1890
180	.1546404	.1072990	8.332384	1900
181	.2382893	.3095247E-02	8.333052	1910
182	.3166412	-.1050435	8.332338	1920
183	.3900859	-.2166183	8.330145	1930
184	.4590130	-.3311299	8.326379	1940
185	.5238122	-.4480793	8.320944	1950
186	.5848732	-.5669675	8.313746	1960
187	.6425856	-.6872953	8.304689	1970
188	.6973391	-.8085638	8.293679	1980
189	-.7526228	.3312706	8.326413	2000

190	-.6570443	.3682292	8.324722	2010
191	-.5624022	.3798637	8.324274	2020
192	-.4694494	.3697526	8.324793	2030
193	-.3789386	.3414748	8.326004	2040
194	-.2916227	.2986090	8.327633	2050
195	-.2082545	.2447339	8.329405	2060
196	-.1295870	.1834282	8.331046	2070
197	-.5637298E-01	.1182708	8.332280	2080
199	.1063476E-01	.5284037E-01	8.332832	2090
200	.9383093E-01	-.3678915E-01	8.332970	2100
201	.1737535	-.1291419	8.332035	2110
202	.2507808	-.2238540	8.329993	2120
203	.3252913	-.3205617	8.326806	2130
204	.3976635	-.4189010	8.322438	2140
205	.4682758	-.5185081	8.316853	2150
206	.5375066	-.6190191	8.310014	2160
207	.6057345	-.7200702	8.301884	2170
208	.6733377	-.8212976	8.292428	2180
289	-.5731527	.6342002	9.712316	3000
290	-.4975688	.6402898	9.711916	3010
291	-.4221559	.6308890	9.712533	3020
293	-.3505483	.6060423	9.714114	3030
294	-.2656971	.5547343	9.717227	3040
295	-.1909660	.4915809	9.720578	3050
296	-.1238885	.4197815	9.723910	3060
297	-.6199852E-01	.3425359	9.726969	3070
298	-.2829597E-02	.2630435	9.729501	3080
300	.5608455E-01	.1845040	9.731251	3090
301	.1189454	.8910823E-01	9.732598	3100
302	.1800427	-.7424830E-02	9.733002	3110
303	.2394024	-.1050324	9.732433	3120
304	.2970501	-.2036517	9.730866	3130
305	.3530116	-.3032200	9.728272	3140
306	.4073125	-.4036744	9.724625	3150
307	.4599786	-.5049522	9.719897	3160
308	.5110357	-.6069906	9.714061	3170
309	.5605095	-.7097269	9.707089	3180
310	-.5701108	.6076255	9.714015	3200
311	-.4925392	.5944324	9.714831	3210
312	-.4181775	.5684612	9.716388	3220
314	-.3489876	.5310331	9.718503	3230
315	-.2747088	.4756884	9.721400	3240
316	-.2076407	.4127442	9.724244	3250
317	-.1459920	.3442277	9.726891	3260
318	-.8797086E-01	.2721656	9.729194	3270
319	-.3178583E-01	.1985851	9.731009	3280
321	.2435471E-01	.1255130	9.732191	3290
322	.8657294E-01	.3460166E-01	9.732967	3300
323	.1466899	-.5763706E-01	9.732849	3310
324	.2050492	-.1509742	9.731829	3320
325	.2619946	-.2451808	9.729897	3330
326	.3178696	-.3400279	9.727044	3340
327	.3730178	-.4352865	9.723262	3350
328	.4277830	-.5307276	9.718539	3360
329	.4825087	-.6261223	9.712869	3370
330	.5375385	-.7212416	9.706240	3380

```
.PROC,DBLADE5.
GET,TAPE4=DTAPE4,DTAPE7.
FTN,I=DTAPE7,L=0,OPT=0.
LGO.
GET,PLOTB1,DPLOTI.
REWIND,*.
PLOTREQ,DEST=Y,PEN=3,PA=TG.
PLOTB1,DPLOTI,P.
REVERT.---PLOTIT,PLOT.---.
```

```
      PROGRAM DRAVG(INPUT,OUPUT,TAPE4,TAPE5,TAPE7)
      DIMENSION RH(40),RM(40),RT(40),XH(40),XM(40),XT(40),
     1    YH(40),YM(40),YT(40),SH(40),SM(40),ST(40),
     2    YH2(40),YM2(40),YT2(40)
      PI=3.1415926
      READ(4,10)(XH(I),YH(I),RH(I),I=1,40)
10    FORMAT(6X,3E15.7)
      READ(4,10)(XM(I),YM(I),RM(I),I=1,38)
      READ(4,10)(XT(I),YT(I),RT(I),I=1,38)
      CALL AVG(RH,40,VMH)
      CALL AVG(RM,38,VMM)
      CALL AVG(RT,38,VMT)
      WRITE(5,40)VMH,VMM,VMT
40    FORMAT(3F10.5)
      DO 50 I=1,20
      SH(I)=2.*PI*RH(I+20)/50.
      SM(I)=2.*PI*RM(I+18)/50.
      ST(I)=2.*PI*RT(I+18)/50.
50    CONTINUE
      DO 60 I=1,20
      YH2(I+20)=YH(I+20)+SH(I)
      YM2(I+18)=YM(I+18)+SM(I)
      YT2(I+18)=YT(I+18)+ST(I)
60    CONTINUE
      WRITE(7,10)(XH(I),YH(I),RH(I),I=1,40)
      WRITE(7,10)(XH(I),YH2(I),RH(I),I=21,40)
      WRITE(7,10)(XM(I),YM(I),RM(I),I=1,38)
      WRITE(7,10)(XM(I),YM2(I),RM(I),I=20,38)
      WRITE(7,10)(XT(I),YT(I),RT(I),I=1,38)
      WRITE(7,10)(XT(I),YT2(I),RT(I),I=20,38)
      END
      SUBROUTINE AVG(A,N,VM)
      DIMENSION A(40)
      T=0.
      DO 1 I=1,N
1     T=T+A(I)
      VM=T/FLOAT(N)
      RETURN
      END
```

DTAPE7

```
TURBINE    9-4-84 PAGE    3 1 0
TFE 1042 LPT ROTOR
DEFLECTED
AVERAGE RADIUS= 6.4609
3,20,9.,13.,0,1,1,0
X                        R THETA

000
(6X,2E15.7)
(20(/),(6X,2E15.7))
(40(/),(6X,2E15.7))
-1.0,0.2,-1.0,0.2
TFE 1042 LPT ROTOR
DEFLECTED
AVERAGE RADIUS= 8.32277
3,19,9.,13.,0,1,1,0
X                        R THETA

000
(60(/),(6X,2E15.7))
(79(/),(6X,2E15.7))
(98(/),(6X,2E15.7))
-1.0,0.2,-1.00,0.2
TFE 1042 LPT ROTOR
DEFLECTED
AVERAGE RADIUS= 9.72132
3,19,9.,13.,0,1,1,0
X                        R THETA

000
(117(/),(6X,2E15.7))
(136(/),(6X,2E15.7))
(155(/),(6X,2E15.7))
-1.0,0.2,-1.00,0.2
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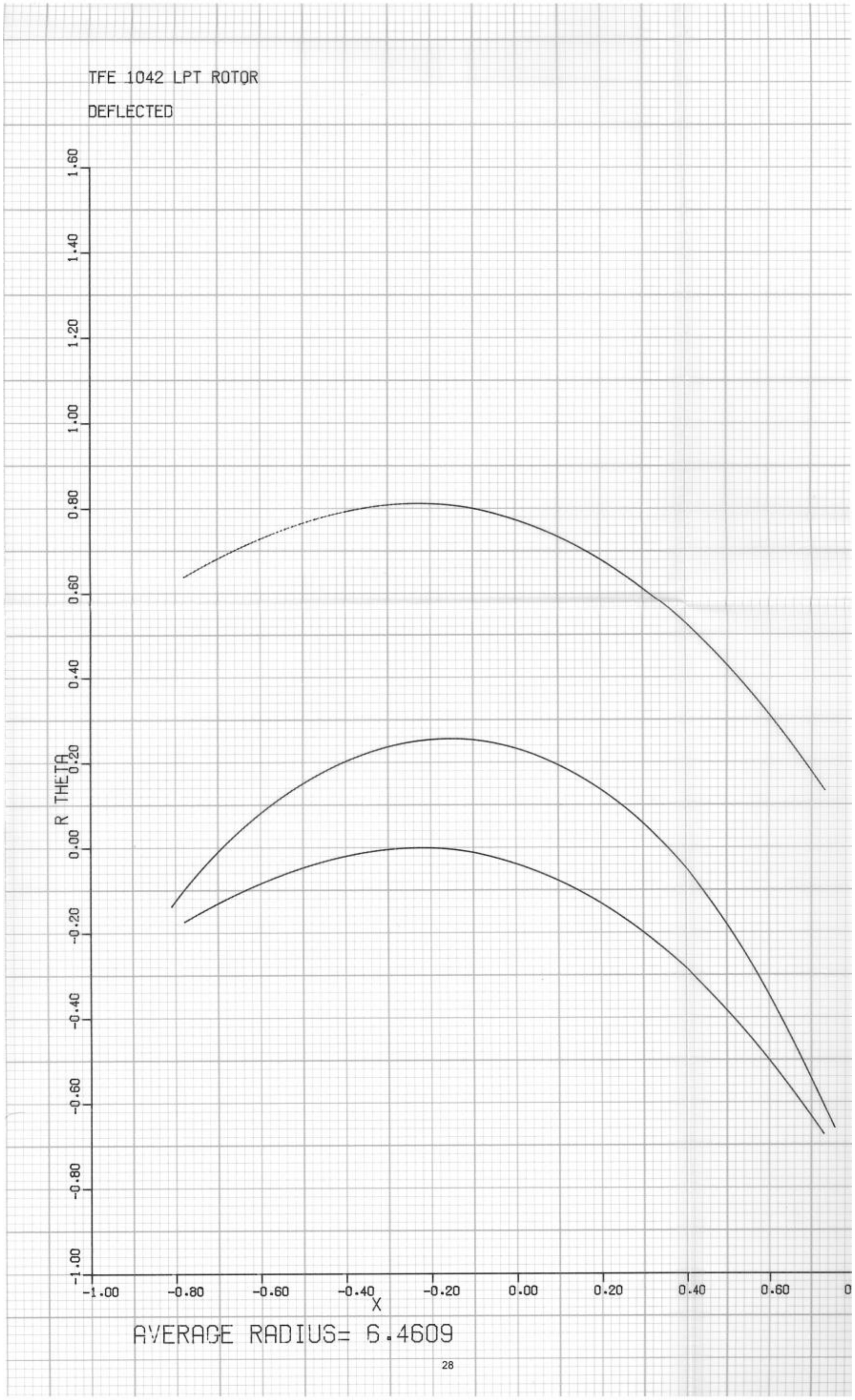
TFE 1042 LPT ROTOR
DEFLECTED
R THETA
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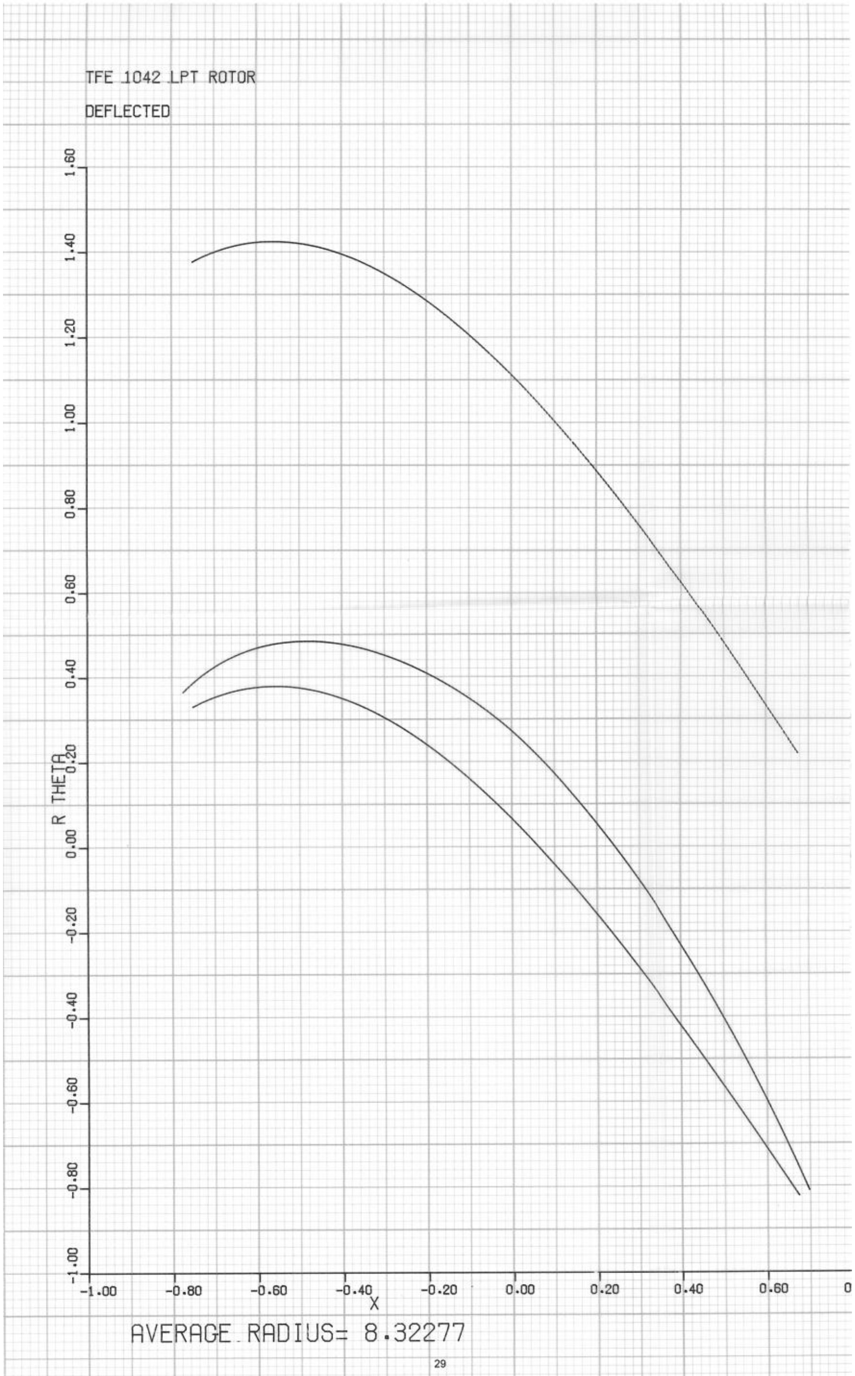
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.00
-0.80
-0.60
-0.40
-0.20
0.00
0.20
0.40
0.60
X
AVERAGE RADIUS= 6.4609
28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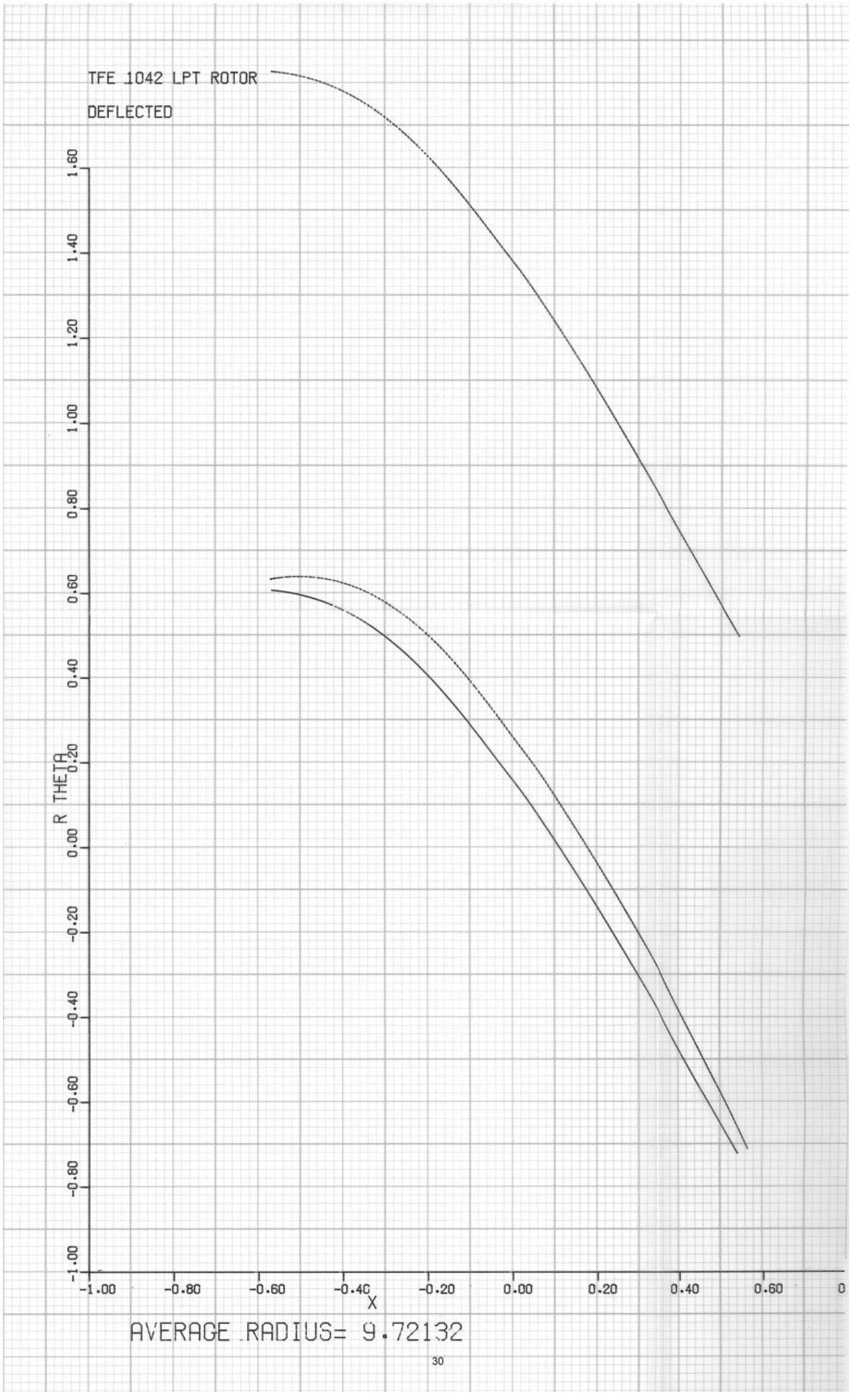
DEFLECTED
R THETA
X
AVERAGE RADIUS= 8.32277
29


TFE 1042 LPT ROTOR
DEFLECTED
R THETA
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1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.00
-0.80
-0.60
-0.40
-0.20
0.00
0.20
0.40
0.60
X
AVERAGE RADIUS= 9.72132
30

```
TFE1042-70 LP ROTOR  KLK  I70T1W2  9/20 DESIGN
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1.         10.
PART NUMBER
   6.46018   8.32277   9.72282
6.293      7.090      7.852      8.240      8.984      9.326      10.002
6.149      7.172      8.032      8.426      9.143      9.469      10.081
-2.74      5.90       9.49       10.71      11.53      11.24      11.73
-1.88      2.07       4.56       5.04       4.99       4.80       3.02
.0330      .0330      .0310      .0290      .0250      .0220      .0150
.0330      .0330      .0310      .0290      .0250      .0220      .0150
.0150      .0144      .0138      .0135      .0130      .0127      .0125
10.0       7.0        7.0        7.0        6.7        6.4        6.0
10.0       7.0        7.0        7.0        6.7        6.4        6.0
5.5        5.5        5.3        5.0        3.5        2.5        2.0
5.5        5.5        5.3        5.0        3.5        2.5        2.0
1.55       1.55       1.545      1.45       1.22       1.15       1.05
41.3       35.1       27.0       34.0       32.0       16.0        0.0
.2643      .2460      .2060      .1450      .0750      .0700      .0650

40.        0.0        0.0        10.0       10.        20.        20.
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    .29913
   6.16179    .94793  -3.01247
   6.14900   1.00000  -1.87735
   6.14900   1.02611   0.00000
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    .34673
   7.15802    .95470   2.60509
   7.17217   1.00000   2.06808
   7.19564   1.01690    .75683
    .39846    .76598    .51906    .98676   0.000001
 TFE1042-70 LOW PRESSURE TURBINE                     ROTOR    1 AT RIN =
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    .38688
   7.99442    .97673   6.46213
   8.03172   1.00000   4.55592
   8.06665   1.00175    .60570
    .40041    .77421    .57903    .99054   0.000001
 TFE1042-70 LOW PRESSURE TURBINE                     ROTOR    1 AT RIN =
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    .40671
   8.38175    .99170   7.32563
   8.42580   1.00000   5.04286
   8.46153    .99377    .58333
    .40589    .78126    .60629    .99140   0.000001
 TFE1042-70 LOW PRESSURE TURBINE                     ROTOR    1 AT RIN =
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    .44421
   9.09388   1.00082   7.57907
   9.14276   1.00000   4.98775
   9.17147    .97814    .39676
    .42644    .80380    .65686    .99204   0.000001
 TFE1042-70 LOW PRESSURE TURBINE                     ROTOR    1 AT RIN =
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    .46250
   9.41886    .99949   7.54220
```

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  9.49053    .97066    .23761                                                   790
   .43803    .81336    .67949    .99155   0.000001                              800
TFE1042-70 LOW PRESSURE TURBINE                    ROTOR    1 AT RIN =          810
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   .49872                                                                       830
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 10.08100   1.00000   3.01452                                                   850
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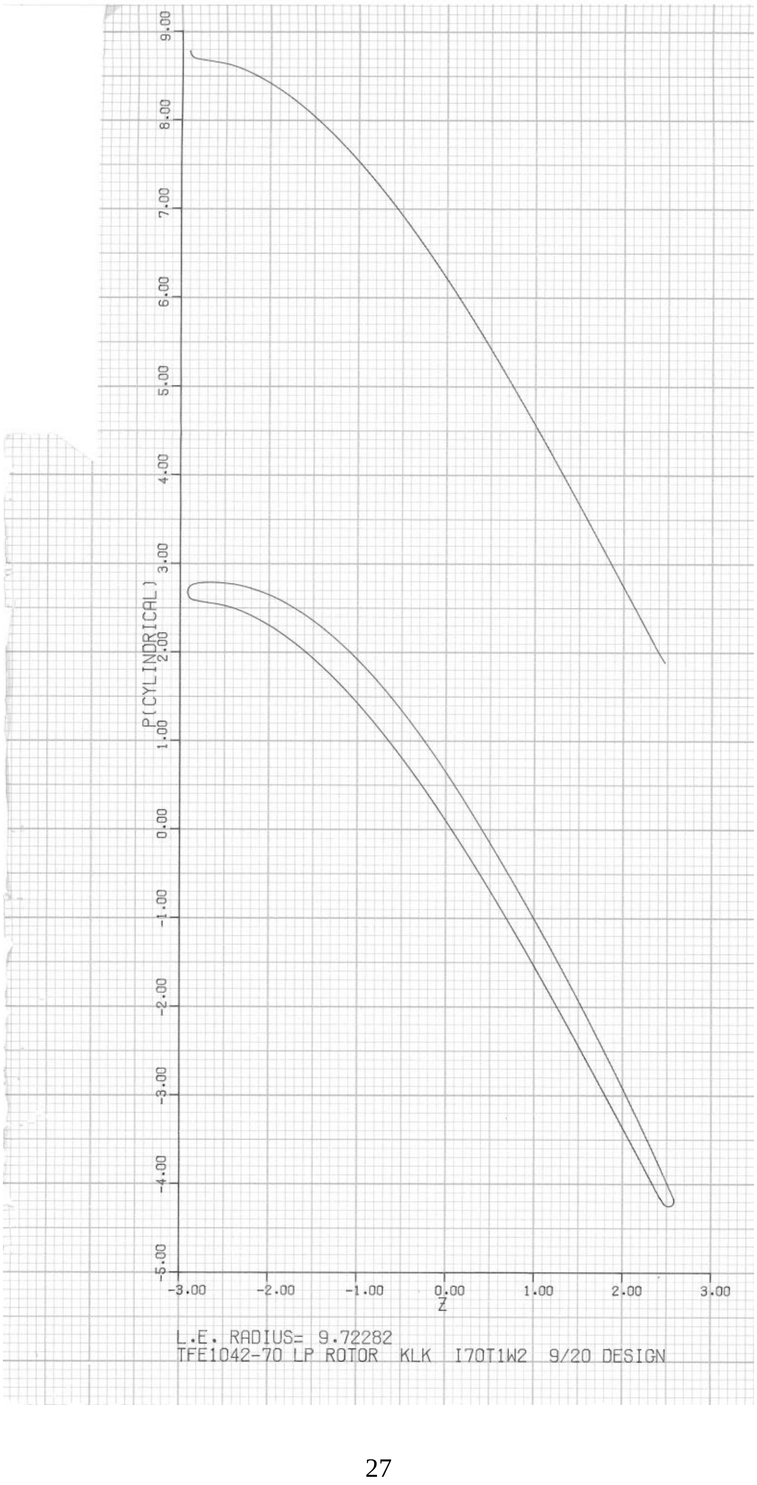

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-3.00
-4.00
-5.00
P(CYLINDRICAL)
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-2.00
-1.00
0.00
1.00
2.00
3.00
Z
L.E. RADIUS= 9.72282
TFE1042-70 LP ROTOR KLK I70T1W2 9/20 DESIGN