PressMap 7.0.3
User Guide

PressMap is an aerodynamic loads mapping program developed by ATA Engineering, Inc. For Windows, the user can start the program by typing *pressmap* in the **Command Prompt** window or by double-clicking on the PressMap.exe icon. For command-line and batch mode operations, see Appendix B.

When the user runs PressMap, the following screen will appear. The various PressMap fields are numbered, and a description of each is provided below.

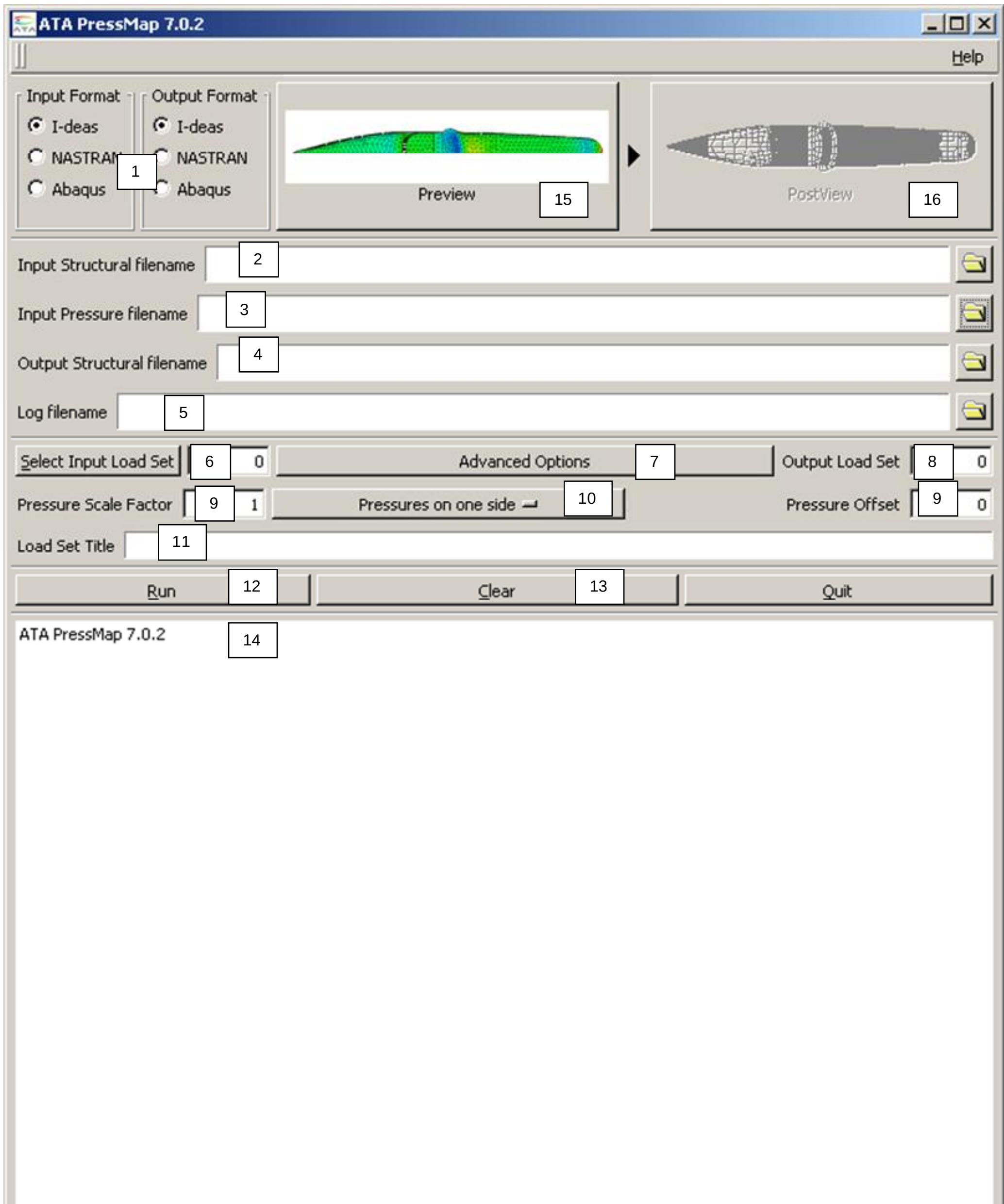

Figure 1. PressMap interface showing the key input and output fields.

[1] Input/Output Formats
These toggles allow the user to define the type of structural file that will be used for input and output. Currently, PressMap can read and write I-deas universal file, NASTRAN, and Abaqus input files. By default, when the input type is changed, the output type is automatically changed to match the input type. I-deas input data can also be written out in NASTRAN format, and NASTRAN data can be written out in I-deas format. However, Abaqus input can only create Abaqus output, and Abaqus output can only be created by Abaqus input.

[2] Input Structural Filename
This is the finite element model (FEM) that contains the target surface(s) for the pressure mapping. It must also include an appropriate dummy pressure load definition to identify which element faces will receive the mapped pressures. The direction of the pressures on an element face in the dummy pressure load defines the direction of a positive pressure load on that face, since the direction of the positive pressure load may be opposite of the element normal.

For I-deas, the user will need to write out a universal file of the FEM. This FEM must contain at least one boundary condition load set containing element face pressures on the appropriate element faces. Face Pressures can be applied to both shell and solid elements.

For NASTRAN, the model must contain loads written as PLOAD4 cards. No other pressure cards are currently recognized by PressMap. Pressures must be applied only to the following elements: CHEXA, CPENTA, CQUAD4, CQUAD8, CQUADR, CTETRA, CTRIA3, CTRIA6, and CTRIAR. For shell elements, PSHELL cards are read and stored. In addition to loads and elements, grids and coordinate systems are read, and the grid coordinates are transformed to Coordinate System 0.

For Abaqus, the following keywords are read: *ASSEMBLY, *END ASSEMBLY, *PART, *END PART, *INSTANCE, *END INSTANCE, *SYSTEM, *NODE, *ELEMENT, *ELSET, *SURFACE, *SHELL SECTION, and *DSLOAD. PressMap only reads *DSLOADs that use *SURFACE, with TYPE=ELEMENT, and *SURFACEs that use *ELSETs. All *DSLOADs read will be used for mapping. Unless the user updates the Abaqus element types read by PressMap as described in Appendix D, pressures must be applied only to the following element types: S3, S3R, S4, S4R, C3D4, C3D6, C3D8, C3D8R, STRI65, S8R, C3D10, C3D10M, C3D15, and C3D20. *NODE and *SYSTEM are read, and the grid coordinates are transformed to Global Coordinate System.

For any input model type, the model must use the same length units as the pressure data, i.e., if the pressure model has length in inches, the input model file must also be in inches.

[3] Input Pressure Filename
Enter the name of the file containing the computational fluid dynamics (CFD) pressure data the user wants to apply to the input FEM. The format and contents of this file are defined in Appendix A.

The name of the input file will also be used to seed the default output structural file and log file names.

[4] Output Structural Filename

This file contains the mapped pressure load set data. The name must not be the same as the input structural and pressure files.

I-deas loads will be written out to Data Sets 790 and 2414.

NASTRAN loads will be written as PLOAD4 or FORCE cards.

Abaqus loads will be written as *ELSETs, *SURFACEs, and *DSLOADs. The user will need to edit the PressMap output so that the *ELSETs and *SURFACEs are above the first *STEP, and the *DSLOADs are below the appropriate *STEP in the final model where these pressures are intended to be applied.

[5] Log Filename

This file contains the log of all processing messages.

[6] Select Input Load Set

The user selects a boundary condition set containing the face pressures that define the surface to which pressure loads should be mapped. If the user presses the button, PressMap will determine all of the load sets in the structural model and give the user a list to choose from. The user can also enter the load set ID manually.

PressMap ignores the pressure magnitudes in this set, but uses the sign on the pressure to determine if the element normal is in the positive pressure direction. A positive sign indicates that the pressure is applied opposite of the normal, and a negative sign indicates that the pressure is applied in the same direction as the normal.

[7] Advanced Options

By clicking on this button, PressMap brings up the **Advanced Options** window, as shown in Figure 2 below.

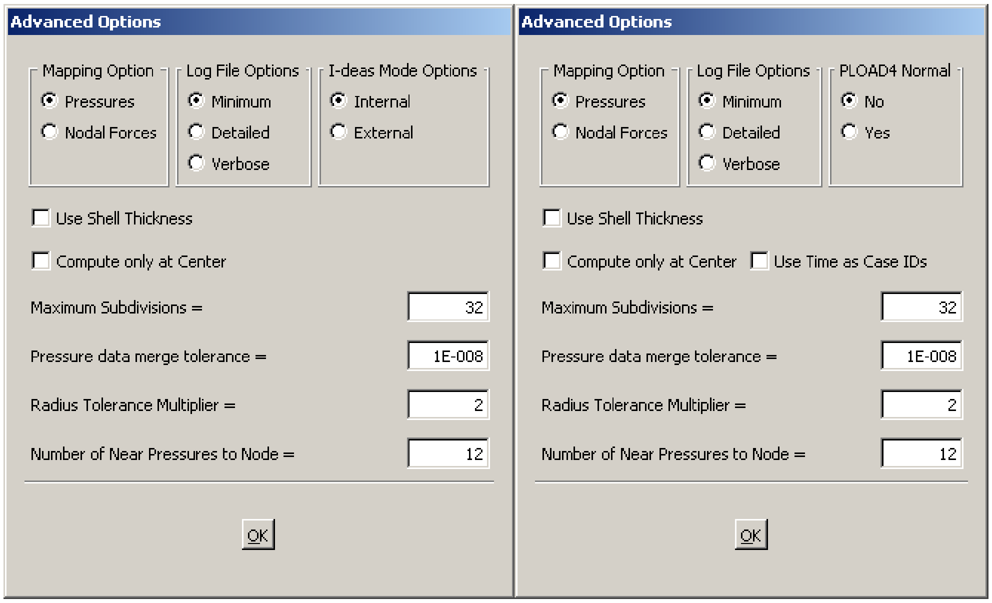

Figure 2. Advanced Options window, showing additional options for I-deas and NASTRAN.

Mapping Option allows the user to map the pressure data as pressures on element faces or as nodal forces. If the results are to be used with I-deas for transient analysis, PressMap automatically maps the pressure data as nodal forces, and will give a warning to the user. For the nodal option, forces are only applied at the corner nodes, even for parabolic elements.

Log File Options adjusts the amount of information written to the log file. It is suggested to use the minimum for most cases. Prior to PressMap 5.3, PressMap wrote out data equivalent to the **Detailed** option.

I-deas Modes Options is used for I-deas transient simulations. The user can select if the modes and mode shapes to be used are from I-deas (default), or from an external file, such as a NASTRAN OP2 file. This option is not shown for NASTRAN or Abaqus outputs, and is ignored for static simulations. See Appendix C for details.

The **PLOAD4 Normal** option appears for NASTRAN output. The user can select if the PLOAD4 cards are written with or without the element normal. The default is without the element normal.

The **Use Shell Thickness** option uses the element thickness to determine when a point is considered on the face of an element. This option is used when computing directional pressures (see [10]). This will exclude pressure values that fall within the volume of the element. The default is not to use the shell element thickness.

The **Compute only at Center** option allows the user to only compute the pressure at the center of the element. Otherwise, it will compute the pressures at the element nodes.

The **Use Time as Case IDs** option will use the times from the pressure file as the load set IDs. When active, PressMap ignores the data in **Output Load Set** box (see [8]). This option is only available for NASTRAN, and should only be used if times are integer values.

The **Maximum Subdivisions** option allows the user to set the maximum subdivisions along the edge of a structural element. PressMap subdivides an element based on the local separation distance of the pressure data points. It uses the maximum subdivision to prevent the element from being subdivided into millions of subelements. If the user sets this value to 1 (the minimum value), the element pressure will only be computed using the pressures at the corner nodes of the element. The default is 32, and the maximum is 1024. (Note: for PressMap version 5.3.0 and earlier, this value was fixed at 100.)

The **Pressure Data Merge Tolerance** option sets the radius at which two pressure data points are considered to be coincident. The default is 1E-08, and the minimum is 0.0. With this option, if one pressure point lies within the radius of another pressure point, it is removed from the list of pressure points, and the pressure at the remaining pressure point is the average of the two points. If N points are within the radius of another pressure point, the N points are removed and the pressure at the remaining point is the average of the N+1 points.

The **Radius Tolerance Multiplier** option allows the user to select a multiplier on the radius that is used for finding the nearest CFD point. This option is useful if there is significant space between the CFD data and the representative structure. For example, if there is a nonstructural thermal protective coating on a structure, the CFD mesh may be on the outer surface of the protective coating, and the structure may be on the inner mold line. The user should change this value only if PressMap issues a warning about not finding pressures for elements. The default is 2.

The **Number of Near Pressures to Node** option allows the user to select the maximum number of pressure points near a node that are used to calculate the pressure mapping. Increasing the number of points helps in computing accurately mapped pressures for data that are densely distributed in one direction but sparsely distributed in another direction, as shown in Figure 3 below. The default is 12 pressure points near the node. Please note that increasing the number of pressure points used to create the mapping will cause PressMap to run longer.

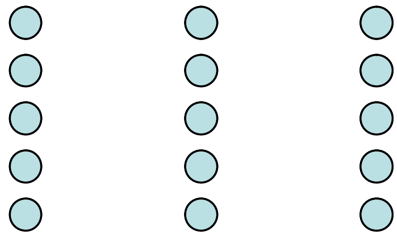

Figure 3. Example pressure distributions where increasing the number of points will improve the pressure mapping.

[8] Output Load Set

I-deas requires a unique load set number for each load set in a FEM. The program automatically defaults to a unique load set number based on the input structural file when the user presses **Select Input Load Set**. If performing multiple pressure mappings, the user should make sure that all of the user load set IDs are unique.

For the I-deas output option, PressMap also creates a result set containing the computed pressures so that the user can view contour plots of the data in postprocessing. The result set has the same name as the load set, and its data type is Hydrostatic Pressure.

[9] Pressure Scale Factor and Pressure Offset

PressMap will multiply all computed pressure values by the Pressure Scale Factor, so the user must enter a non-zero value. This allows the user, for example, to use coefficients of pressure (Cp), and create actual pressures in the output file by entering the free-stream dynamic pressure here. The Pressure Scale Factor is set to 1.0 by default.

PressMap will add the Pressure Offset to all pressures. The Pressure Offset is set to zero by default.

[10] Pressures on One Side, One Side – Direction Dependent, or Both Sides

This option allows for shell surface with pressures on both sides to be accurately calculated. By default, PressMap assumes that there are pressures only on one side, and the nearest pressures are found independent of direction.

When the user selects **Pressure on one side – direction dependent**, PressMap looks only for pressures in the direction of the pressure load (see [6] above), and will use these pressures in the mapping. This option should only be used for parts of the structural model that are bounded by the pressures data (see Figure 4 below). Otherwise, there will be errors in mapping.

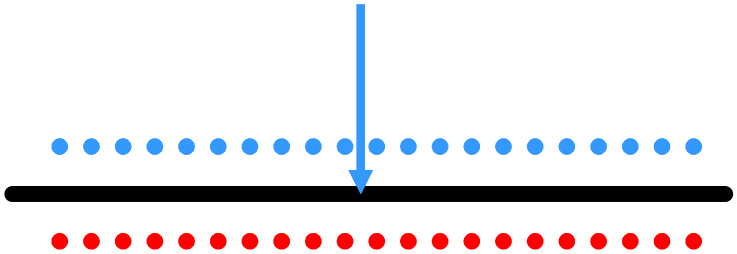

Figure 4. Conditions to use the **Pressure on one side – directional dependent** option. The pressure is applied to the top surface (blue arrow), and the pressure points above the element surface (blue dots) will be used in the pressure calculation. The pressure points on the below the element surface (red dots) will be ignored.

By selecting both sides, PressMap looks for pressures in the direction of the pressure load and computes the pressure on this side. Then, PressMap looks for the pressures in the opposite direction, and subtracts this pressure from the front side pressure, resulting in the delta pressure load for each element. This should only be used by shell surfaces bounded by the pressure data (see Figure 5 below). Otherwise, there will be errors in mapping.

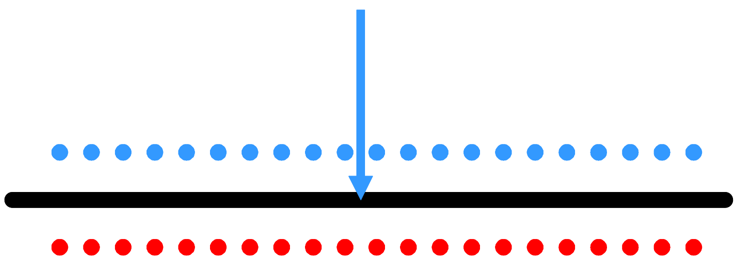

Figure 5. Conditions to use the **Pressure on both sides** option. The top surface pressure (blue arrow) will be calculated using the pressure points above the element surface (blue dots), and the pressure on the bottom surface will be calculated using the pressure points below the element surface (red dots). The net pressure will be calculated by subtracting the bottom pressure from the top pressure.

For models where shell elements have a combination of these options (i.e., for a thin wing or flap), the user will need to create two or three dummy pressure sets, one for the elements for each option. Then, the mapping must be run for each dummy pressure set. The user should write the data to unique output files. For I-deas output, the user should use unique load case IDs, and then combine the resulting loads in I-deas. For NASTRAN and Abaqus output, the same load case ID can be used for all mappings.

If the user selects to use the shell thickness for directional options (see [7]), any pressure point that lies between Z1 and Z2 in Figure 6 below will be excluded from the pressure calculations. Z1 and Z2 are the Z-fiber distances, and are typically one half the thickness of the shell. Therefore, only the points above the top surface will be used for the top pressure calculations, and only the points below the bottom surface will be used for bottom pressure calculations.

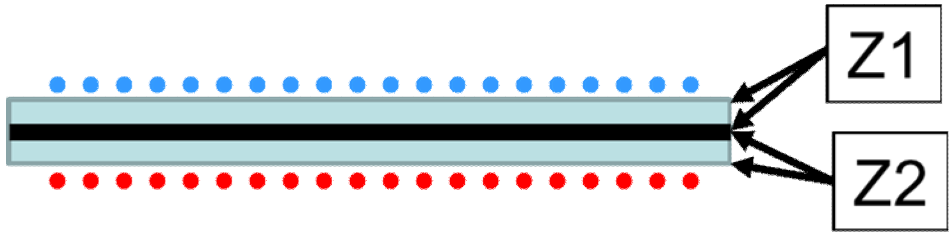

Figure 6. Using the shell element thickness excludes pressures that fall within Z1 and Z2.

[11] Load Set Title

The title is used in the output file as a description of the model. If the pressure file has a title, it will be used as the load set title by default.

[12] Run

Pressing this button begins the mapping process.

[13] Clear

This will clear all input.

[14] Output window

This window will contain the output messages from the mapping procedure. Typical output from the program is shown below.

```
Running ATA PressMap 7.0.3...

* Scanning universal file ...
  - 9599 Nodes in universal file
  - 3692 Elements in universal file
  - Mapping data on Face Pressure Set:
    4 - DUMMY PRESSURES
    Output Load Set and Results Set will be:
    5 - PRESSMAP EXAMPLE INPUT FILE

* Reading Nodes from universal file ...
  - 9599 Nodes stored

* Reading Elements from universal file ...
  - 425 Elements skipped
  - 3267 Elements stored
  - 3267 Element faces stored

* Reading Face Pressures from universal file ...
  - 2021 Face Pressures stored

* Reading CFD pressure data ...
  - 76879 Pressure data points read

* Computing bounding boxes for FEM and CFD models ...
  - 100% of FEM within CFD model boundary

* Sorting Pressure data ...
  - Pressure data sorted

* Mapping CFD pressures to FEM ...
  - 2021 Element mapped pressures computed
```

```
* Writing mapped element pressures ...
  - 2021 Element mapped pressures written to output file

* 0 Warnings

* 0 Errors

* PressMap completed successfully
```

If less than 95% of the FEM lies within the CFD pressure model, the program issues a warning but continues mapping. If the overlap is less than 1%, it stops processing and shows the user an error message (see below). This error typically occurs when the coordinate transformation definition (Appendix A) is not correct. PressMap writes full details of the two bounding boxes to the log file.

```
* Computing bounding boxes for FEM and CFD models ...
  -   0% of FEM within CFD model boundary

* 1 WARNINGS - SEE LOG FILE

* 1 ERRORS - SEE LOG FILE

* PressMap COMPLETED WITH ERRORS
```

Finally, while PressMap is designed to be a robust tool to map pressures from a CFD model to a finite element model, the user should look at the results of the pressure mapping to ensure that the data are correct. Differences in results can be due to differences in geometry, double-sided pressure being incorrectly calculated, or insufficient element subdivisions.

[15] Preview and [16] PostView

The **Preview** and **PostView** buttons allow the user to display the model and the pressure point cloud. In **PostView**, the user can display the mapped pressures. **Preview** can be used for just the structural model, just the pressure point cloud, or both. **PostView** is disabled until a mapping is completed. The pressures are shown on a relative scale, with the blue end of the color spectrum representing lower pressures and the red end representing the higher pressures. A color bar showing the minimum, average, and maximum pressures is included in the display, and the limits can be changed by the user.

The view screen, shown in Figure 7 and Figure 8 below, operate the same for both views. The left mouse button rotates the model, the center mouse button zooms the model in and out, and the right mouse button translates the model. In addition, there are icons for fixed standard orientations. Also, in the **Controls** window, there is an **Angles** tab that gives the user fine control over the view orientation. Finally, the user can toggle on or off perspective.

With the **Controls** window, the user can turn on and off the point cloud, elements, or grids. The size of the point cloud and grids can also be adjusted here.

If there are multiple time sets, the user can view any of these sets. A **Time Step Selection** tab will appear under the **Controls** menu, and the user selects from a pull-down menu (Figure 9).

When the user is done with the viewer, the window can be closed by clicking on the window **X** button.

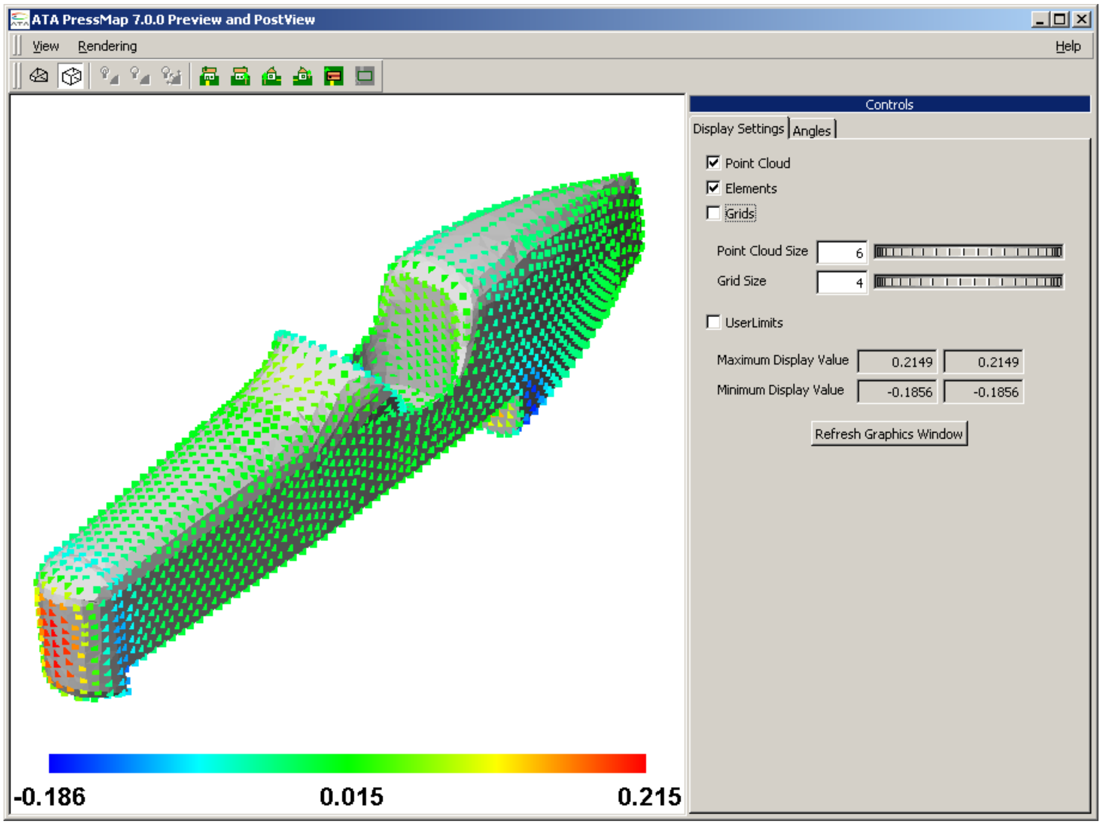

Figure 7. PressMap Preview display.

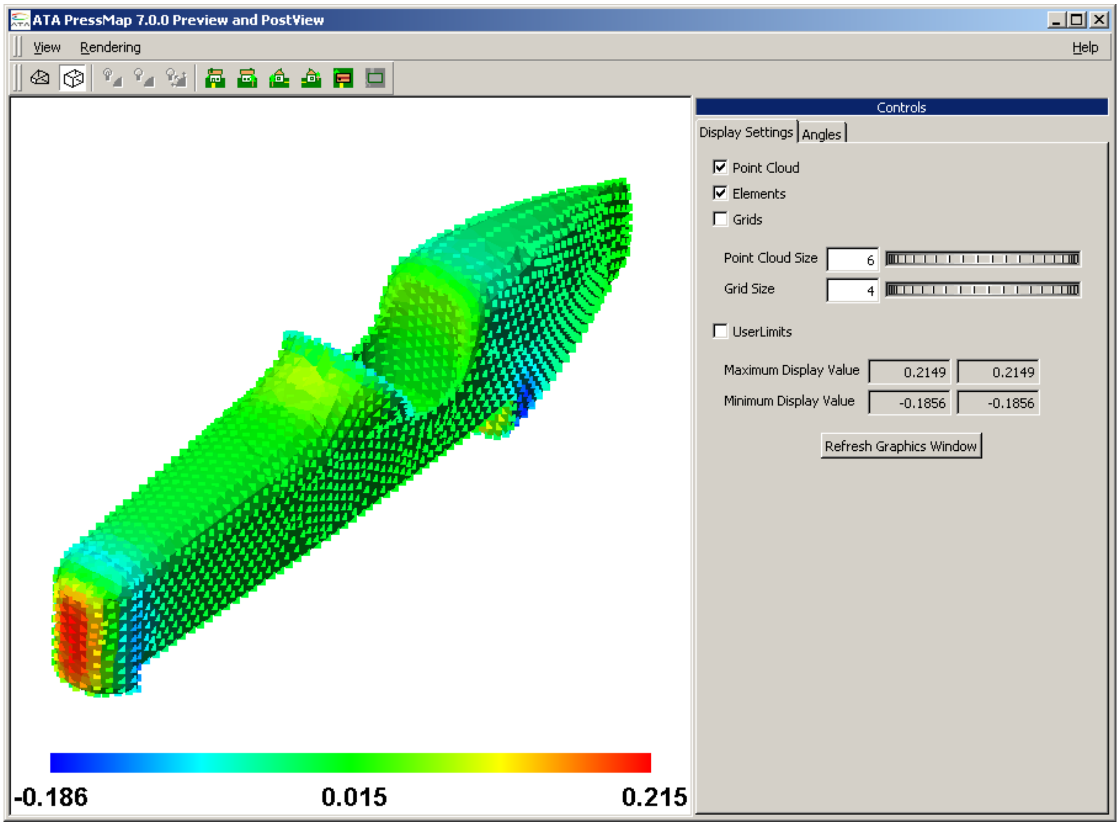

Figure 8. PressMap PostView display.

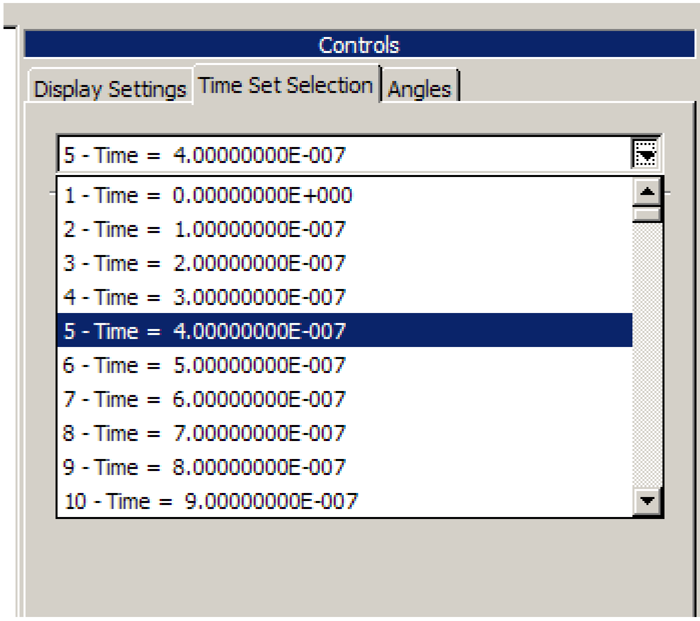

Figure 9. Selection of time set for cases with multiple time sets.

PressMap License

PressMap 5.4 and higher now use the Sentinel RMS server for licensing. This is the current license server for ATA products. For more details on this server, please go to http://www.ata-e.com/software/license-server-ata-software.

PressMap Revision History

Version 7.0.3

- Bug fix for reading Abaqus include files.
- Bug fix for reading abq_types.txt file.

Version 7.0.2

- Added **Use Time as Case IDs** option to advanced options. This option is not available through the command line.

Version 7.0.1

- Added **Compute only at Center** option to advanced options. This option is not available through the command line.

Version 7.0.0

- Added ability to use element thickness to determine if pressure should be used for directional-dependent options.
    - Replaces old method for directional dependence.
    - Affects command-line operation (see Appendix B)
- Added option to allow user to include additional element types for Abaqus
- Improved mapping of data around a cylindrical surface.
- Improved mapping for sparse pressure data
- Improved mapping for quad shapes and near edges
- Added pressure scale option to Preview/PostView.

Version 6.1.0

- Added Preview and PostView capability
- Made minor enhancements and bug fixes

Version 6.0.2

- Added option for PLOAD4 normals to be written to bulk data
    - Affects command-line operation (see Appendix B)

Version 6.0.0

- Added Abaqus support
- Added external modes support for I-deas transient
- Included utility program PressMapMerge for I-deas transient

Version 5.4.0
- Changed licensing to Sentinel RMS server
- Made minor bug fixes

Version 5.3.1
- Re-implemented text mode, which was disabled in Version 4.0

Version 5.3.0
- Added advanced options:
    - Write out loads as forces or pressures
    - Limit the information written to log files
    - Find nearest point based on a radial tolerance multiplier
- Added capability to map transient data to I-deas output

Version 5.2.3
- Added double-field NASTRAN data

Version 5.2.2
- Fixed memory problem for large models

Version 5.2.1
- Fixed NASTRAN bug

Version 5.2.0
- Added cylindrical coordinates

Version 5.1
- Added options for when pressures are on both sides of a shell element

Version 5.0
- Added the ability to remove duplicate pressure points
- Added ability to process multiple pressure sets
    - Static or time-dependent

Version 4.0
- First GUI version of PressMap
- Added NASTRAN support

Appendix A: CFD File Contents and Format

The CFD pressure data file is delimited into blocks of data by keywords. Not all of the keywords are necessary, but if included, the keywords must be in the order shown below:

1. **TITLE**. Optional. If present, must be first record in file.
2. **COORD**. Optional. Defines transformation from CFD coordinate system to FEM coordinate system. If not present, mapping program assumes CFD and FEM coordinate systems are identical.
3. **SYMM**. Optional. Allows the pressure data to be reflected across a symmetry plane.
4. **TIMES**. Optional (*required for multiple times steps*). Allows for pressures at multiple time steps or cases.
5. **OUTTIMES.** Optional. Allows for multiple output time steps.
6. **DYNAMIC.** Optional. Prints out data for a transient analysis. Only the keyword **DYNAMIC** is needed. If the keyword **DYNAMIC** is used with I-deas, the pressures are mapped as nodal forces. For Abaqus, if there is more than one output time, the data are treated as transient data, even if the **DYNAMIC** keyword is not used.
7. **PRESS.** Required. Defines the coordinates of the CFD points and the pressure or coefficient of pressure (Cp) at these points. At least one point is required.
8. **CYL.** Optional. Sets the coordinate system as cylindrical. Otherwise, the data are in Cartesian coordinates. If this card is used, it must be on the first non-comment line following **PRESS**.

The format of the pressure data file is as follows:

1. For comments, use a **$**. Any information after the first **$** will be ignored:
   For example:

```
$  This entire line is a comment
3.4 2.7 4.5 0.1   $ all data after the first "$" are ignored.
```

2. For a title, two lines are necessary. The first line has the keyword **TITLE** as its first 5 characters, and the second line contains the title. For example:

```
TITLE
The next uncommented line is the title for the results
```

3. For a coordinate transformation, 4 lines are necessary. The first line contains the keyword **COORD** as its first 5 characters, and the next 3 lines contain the definition of the coordinate system transformation, as shown below. The data lines are free-format:

```
COORD
X0 Y0 Z0 $ The offset from CFD origin to FEM origin in the FEM CS.
X1 Y1 Z1 $ CFD X-axis vector in FEM coordinate system (FEM CS).
X2 Y2 Z2 $ A vector defining the CFD XZ plane in the FEM CS.
```

The transformation from the CFD to FEM is shown by the following equations:

$$\vec{X}_{FEM} = \begin{bmatrix} \vec{X} \\ \vec{Y} \\ \vec{Z} \end{bmatrix}^T \vec{X}_{CFD} + \overrightarrow{X0}$$

where :

$\vec{X}_{CFD}$ = coordinates in the CFD coordinate system

$\vec{X}_{FEM}$ = coordinates in the FEM coordinate system

$$\vec{X} = \frac{\overrightarrow{X1}}{\left|\overrightarrow{X1}\right|}, \quad \vec{Y} = \frac{(\overrightarrow{X2} \times \overrightarrow{X1})}{\left|\overrightarrow{X2} \times \overrightarrow{X1}\right|}, \quad \vec{Z} = \vec{X} \times \vec{Y}$$

$$\overrightarrow{X0} = (X0, Y0, Z0), \quad \overrightarrow{X1} = (X1, Y1, Z1), \quad \overrightarrow{X2} = (X2, Y2, Z2)$$

4. For the **SYMM** block, 3 lines are necessary. The first line contains the keyword **SYMM** as its first 4 characters, and the next 2 lines contain the definition of a symmetry plane in the FEM coordinate system, as shown below. The data lines are free-format:

```
SYMM
X0 Y0 Z0 $ A point on the symmetry plane in the FEM CS.
X1 Y1 Z1 $ The normal of the symmetry plane in the FEM CS.
```

For each body point not on the symmetry plane, an additional pressure point location is created by the following equations:

$$\vec{X}_{PSYMM} = \vec{X}_P - 2\left[(\vec{X}_P - \overrightarrow{X0}) \bullet \breve{X}1\right]\breve{X}1$$

where :

$\vec{X}_P$ = original pressure point coordinates.

$\vec{X}_{PSYMM}$ = coordinates of symmetric pressure point.

$$\breve{X}1 = \frac{\overrightarrow{X1}}{\left|\overrightarrow{X1}\right|}, \quad \overrightarrow{X0} = (X0, Y0, Z0), \quad \overrightarrow{X1} = (X1, Y1, Z1)$$

5. For the input time data, at least 2 lines are needed. The first line contains the keyword **TIMES** as its first 5 characters, the next line contains the number of time values, and the third line and beyond contains the time values in ascending order, with 4 values per line, except for the last line, which can have 1 to 4 values.

```
TIMES
N           $ Number of times
T1 T2 T3 T4 $ Time values
...
TN-1 TN     $ Final row can have less than 4 values
```

If only 2 lines are input, the time values will default to 1, 2, 3, etc. For instance:

```
TIMES
10
```

will generate times 1 to 10.

6. For the output time data, at least 3 lines are needed. The first line contains the keyword **OUTTIMES** as its first 8 characters, the next line contains the number of time values, and the third line and beyond contain the time values in ascending order, with 4 values per line, except for the last line, which can have 1 to 4 values.

```
OUTTIMES
N            $ Number of times
T1 T2 T3 T4  $ Time values
T5 T6 T7 T8  $ Additional time values
...
TN-1 TN      $ Final row can have less than 4 values
```

If input times are defined but no output times are defined, the output times will be the same as the input times. Also, if output times are between input times, PressMap will interpolate the pressures between two input times. Any output times greater than or less than the input times will be ignored.

7. For the pressure data, at least two lines are needed. The first contains the keyword **PRESS** as its first 5 characters, and each line that follows contains the coordinates of a CFD grid point with the coefficient of pressure at that point. The data lines are free-format. An example is shown below:

```
PRESS
X1 Y1 Z1 CP1 $ Pressure point and coefficient of pressure
X2 Y2 Z2 CP2
X3 Y3 Z3 CP3
```

If the data are in cylindrical coordinates, the pressure data will be as follows:

```
PRESS
CYL
R1 TH1 Z1 CP1 $ Pressure point and coefficient of pressure
R2 TH2 Z2 CP2
R3 TH3 Z3 CP3
```

where THi are theta angles in degrees. The cylindrical coordinates will be read by PressMap, converted to Cartesian coordinates, and stored in memory.

If input times are defined, additional lines are needed for each pressure coefficient, with 4 values per line, except for the last line, which can have 1 to 4 values, as shown below:

```
TIMES
6
T1 T2 T3 T4
T5 T6
PRESS
X1    Y1    Z1    CP1T1 $ Pressure point and coefficient of pressure
CP1T2 CP1T3 CP1T4 CP1T5 $ Additional pressure coefficients
CP1T6                   $ Additional pressure coefficients
X2    Y2    Z2    CP2T1
CP2T2 CP2T3 CP2T4 CP2T5
CP2T6
```

For Cylindrical coordinates:

```
TIMES
6
T1 T2 T3 T4
T5 T6
PRESS
CYL
R1    TH1   Z1    CP1T1 $ Pressure point and coefficient of pressure
CP1T2 CP1T3 CP1T4 CP1T5 $ Additional pressure coefficients
CP1T6                   $ Additional pressure coefficients
R2    TH2   Z2    CP2T1
CP2T2 CP2T3 CP2T4 CP2T5
CP2T6
```

The following are valid CFD files:

```
TITLE
     EXPERIMENTAL RE-ENTRY VEHICLE, MAX Q-ALPHA.
COORD
    9.30000E+01    0.00000E+00    0.00000E+00
    1.00000E+00    0.00000E+00    0.00000E+00
    0.00000E+00    0.00000E+00    1.00000E+00
$
SYMM
    9.30000E+01    0.00000E+00    0.00000E+00
    0.00000E+00    1.00000E+00    0.00000E+00
$
$    X, inch         Y, inch         Z, inch         Cp
$
PRESS
     1.14044E+01    -8.17367E+00    -2.34699E+01     2.41345E-01
     6.42327E+00    -6.33882E+00    -2.34646E+01     1.14598E-01
     1.14044E+01    -1.83098E+00    -3.27500E+01     1.02369E-01
     6.46169E+02    -2.91713E+01    -3.26565E+01    -2.48273E-01
     1.97866E+02    -2.94464E+01    -3.26963E+01    -4.88448E-03
     2.35048E+02    -3.51424E+01    -2.62059E+01    -1.29118E-01
```

and

```
TITLE
     EXPERIMENTAL RE-ENTRY VEHICLE, MULITPLE TIMES.
COORD
    9.30000E+01    0.00000E+00    0.00000E+00
    1.00000E+00    0.00000E+00    0.00000E+00
    0.00000E+00    0.00000E+00    1.00000E+00
SYMM
    9.30000E+01    0.00000E+00    0.00000E+00
    0.00000E+00    1.00000E+00    0.00000E+00
TIMES
3
0.0   1.0   2.0
OUTTIMES
4
0.0 0.5 1.0 1.5
DYNAMIC
$    X, inch         Y, inch         Z, inch         CpT1
$    CpT2            CpT3 ...
PRESS
     1.14044E+01    -8.17367E+00    -2.34699E+01     2.41345E-01
     2.41345E-01     2.41345E-01
     6.42327E+00    -6.33882E+00    -2.34646E+01     1.14598E-01
     1.14598E-01     1.14598E-01
     1.14044E+01    -1.83098E+00    -3.27500E+01     1.02369E-01
     1.02369E-01     1.02369E-01
```

Keep in mind that the records are free-format; the indentations and adherence to columns shown here are used only for legibility, not because they are required.

PressMap also allows the user to include additional files by use of a **#include** statement. If the user has an input file with the following:

```
TITLE
EXAMPLE PRESSURES
COORD
    9.30000E+01    0.00000E+00    0.00000E+00
    1.00000E+00    0.00000E+00    0.00000E+00
    0.00000E+00    0.00000E+00    1.00000E+00
$
SYMM
    9.30000E+01    0.00000E+00    0.00000E+00
    0.00000E+00    1.00000E+00    0.00000E+00
$
#include "file2.dat"
```

and a **file2.dat** that has the lines:

```
$
$    X, inch         Y, inch         Z, inch         T
$
PRESS
     1.14044E+01    -8.17367E+00    -2.34699E+01     2.41345E-01
     6.42327E+00    -6.33882E+00    -2.34646E+01     1.14598E-01
     1.14044E+01    -1.83098E+00    -3.27500E+01     1.02369E-01
     6.46169E+02    -2.91713E+01    -3.26565E+01    -2.48273E-01
     1.97866E+02    -2.94464E+01    -3.26963E+01    -4.88448E-03
     2.35048E+02    -3.51424E+01    -2.62059E+01    -1.29118E-01
```

then PressMap will read both files and concatenate them together.

Appendix B: Command-Line and Batch File Operation

PressMap also has the ability to be run as a command-line program. To activate the command-line option, the user types *pressmap -t* in the **Command Prompt** window. The user will then answer the prompts as they appear on the screen.

This command-line option allows users to run PressMap in batch mode. This can be done by creating an input file **input.txt** that contains the responses to the PressMap queries (see below).

With a properly formatted input file, batch mode can be executed by typing *pressmap -t < input.txt* in the **Command Prompt** window.

The format of the **input.txt** files is:

Line 1. Input file format. **1 = I-deas (default), 2 = NASTRAN, 3 = Abaqus**
Line 2. Output file format. **1 = I-deas (default), 2 = NASTRAN, 3 = Abaqus**
Line 3. Input structural file name.
Line 4. Input pressure file name.
Line 5. Output file name. **blank = accept default**
Line 6. Pressure scale factor. **blank = accept default of 1.0**
Line 7. Pressure offset factor. **blank = accept default of 0.0**
Line 8. CFD load set title. **blank = accept default**
Line 9. Additional options. **0 = no additional options (default), 1 = additional options**

If Line 9 is blank or 0:

Line 10. Input load set. **blank = accept default of lowest numbered load set**
Line 11. Output load set. **blank = accept default of N+1, where N is the highest numbered load set**
Line 12. Additional cases to process? **0 = No (default), 1 = Yes**

If Line 9 is not blank or 0.

Line 10. Load type. **1 = pressure on element faces (default), 2 = forces at nodes**
Line 11. Element edge maximum subdivision. **blank = accept default of 32**
Line 12. Merge tolerance for pressure data. **blank = accept default of 1E-8**
Line 13. Pressure locations option. **1 = pressure on one side (default), 2 = pressure on one side – direction-dependent, 3 = pressure on both sides**
Line 14. Use shell thickness option. **1 = do not use shell thickness (default), 2 = use shell thickness**
Line 15. Radius tolerance multiplier. **blank = accept default of 2**
Line 16. Number of near pressure to use, **blank = accept default of 12**
Line 17. Special options depending on output file format.
I-deas: external modes for I-deas? **0 = No (default), 1 = Yes**
NASTRAN: PLOAD4 includes element normal? **0 = No (default), 1 = Yes**
Abaqus: no special operation; press **Enter** to continue
Line 18. Log file options. **1 = minimum (default), 2 = detailed, 3 = verbose**

Line 19. Input load set. **blank = accept default of lowest numbered load set**
Line 20. Output load set. **blank = accept default of N+1, where N is the highest numbered load set**
Line 21. Additional cases to process? **0 = No (default), 1 = Yes**

If there are additional cases to process, repeat lines 1 to 12 or 1 to 21.

An example **input.txt** file is shown below. It performs two cases. The first case is I-deas to I-deas without advanced options. The second case is NASTRAN to NASTRAN with advanced options.

```
1
1
example1.unv
pressure.txt
pressure.unv
1.0
0.0
Example 1 Pressure Mapping, I-deas to I-deas
0
1
2
1
2
2
example2.blk
pressure.txt
pressure.blk
1.0
0.0
Example 2 Pressure Mapping, NASTRAN to NASTRAN, with advanced options
1
2
32
1E-8
1
1
2.0
12
1
3
1
2
0
```

Appendix C: Using PressMap with I-deas for Transient Pressures

PressMap can be used to perform a transient analysis in the I-deas Response Analysis module. When the user selects I-deas with the transient option, PressMap creates an I-deas program file. The name of the program file is based on the input pressure file name, and is documented in the PressMap log file and output window.

Due to the nature of the way I-deas treats element pressures and nodal forces in Response Analysis, PressMap will always convert the mapped pressures to nodal forces for Response Analysis.

By running the program file, the Response Analysis case will be created to include all of the transient pressures. Before running the program file, the model must meet the following requirements:

- The user must be allowed to create a transient event in I-deas (i.e., the model file must have a modes run completed and stored). If the modes run is external to I-deas, the user needs to set the **I-deas Modes Options** to **External** (see [7] above).
- The .afu file that will be created by the program file must either be new or not contain any records.

In addition, the user should be aware of the following items:

- After the program file is executed, the user will have to edit the transient event to include damping and other non-load-related items.
- The program file uses the full path name for the universal file, so if the user moves the universal file, the user will need to edit the program file to change the filename.
- The afu file and event name will be the same as that of the universal file (less path and .unv extension). The user can edit the program file to change this.

Note:

If the user needs to merge two or more outputs from PressMap to make one transient, the user will need to run the utility program PressMapMerge that is included with PressMap. This is a command-line-only program, and will combine multiple loads on a node.

To run PressMapMerge, the user types *pressmapmerge* in the **Command Prompt**. Then, the user enters the name of the first I-deas universal file created by PressMap, the second PressMap I-deas universal file, the internal or external modes option, and the output universal file name. The program file name will be the same as the output universal file, excluding the extension.

If the user needs to combine more than two files, the user will need to first combine two files, and then use the output from PressMapMerge with the third file, and so on.

An example of PressMapMerge is shown below. The user inputs are in ***red italic bold***.

```
C:\>pressmapmerge

PressMapMerge 1.0.0 - Merge I-deas Dataset 58s from files created by PressMap
Copyright (C) 2009 ATA Engineering, Inc. All rights reserved.

Enter the first input I-deas universal file name: input1.unv

Enter the second input I-deas universal file name: input2.unv

Enter the Modes Option, 1-Internal (default), 2-External : 1

Enter the output I-deas universal file name (input1_out.unv): output.unv

  - Input Structural file 1  : input1.unv
  - Input Structural file 2  : input2.unv
  - Output Structural file   : output.unv
  - Output Program file      : output.prg
  - Log file                 : input1.log

* Scanning universal file ...
  - 2496 Functions found

* Reading dataset 58 from universal file ...
  - 2496 Functions stored
  - Merged functions for Node/DOF 20549 1
    ...
  - Merged functions for Node/DOF 199032 1
  - 120 duplicate Functions merged

* Writing universal file, program file ...
  - 2376 Nodal forces for 1505 times written to output file

* 0 Warnings

* 0 Errors

* PressMapMerge completed successfully
```

Appendix D: Including Additional Abaqus elements to PressMap

Starting with Version 7.0.0, PressMap has the ability to read more than the default elements types by changing the abq_types.txt file stored in the directory with the PressMap executable. The default abq_types.txt file is shown below and describes the file format:

```
#---- WARNING: DO NOT EDIT FILE BETWEEN HERE AND THE NEXT WARNING!
#
#  abq_types.txt allows the user to extend the capabilities of
#  PressMap by associating an Abaqus element type with a code
#  that represents a generic element type.
#
#  This file ignores any characters after a '#' sign
#
#  The file format is:  Abaqus_elem_type code
#
#  The codes are shown below.
#
# Code  Generic element type
# ----  -------------------------
#   0   linear triangle
#   1   linear quadrilateral
#   2   linear tetrahedron
#   3   linear wedge
#   4   linear brick
#   5   parabolic triangle
#   6   parabolic quadrilateral
#   7   parabolic tetrahedron
#   8   parabolic wedge
#   9   parabolic brick
#
# Defaults in PressMap
#
# C3D4      2
# C3D6      3
# C3D8      4
# C3D8R     4
# C3D10     7
# C3D10M    7
# C3D15     8
# C3D20     9
# S3        0
# S3R       0
# S4        1
# S4R       1
# STRI65    5
# S8R       6
#
# Duplicate entries are ignored.
#
#---- WARNING: DO NOT EDIT FILE ABOVE THIS LINE!
#
# NAME     CODE
#--------  ----
SFM3D3        0
SFM3D4        1
R3D3          0
R3D4          1
S3T           0
S4T           1
C3D8I         4
```

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