CENTURY DYNAMICS
Solutions through Software

RELEASE NOTES FOR
AQWA version 5.5F AGS version 5.5F

1. CONTENTS

This intermediate release contains version 5.5F of AQWA and the AGS, together with supporting dlls and resource files.

2. INSTALLATION

Before installing this version you **MUST** already be running version 5.5A or later.

The installation program is called setup_aqwa_55f.exe. When you run this you will be prompted to input the directory where this program is to be installed. This must be alongside the directory where the previous version 5.5A was installed. For example, if you have installed version 5.5A in d:\temp\aqwa\v55a, you should install this version in d:\temp\aqwa\v55f. Previous versions may be uninstalled after this version is installed.

There is no new security setup file.

3. DEVELOPMENTS

The last version that was released as a full installation was version 5.5A. For completeness the major developments since then are summarised below. Details of all developments and bug fixes can be found in the PSR lists on our website; www.century-dynamics.com.

Description	Version
JONSWAP spectrum for cross-swell	5.5B
Maximum number of structures and articulations increased to 50 each	5.5C
PFIX option changed to a card in Deck 2	5.5C
Removal of check on sloping elements near the waterline	5.5D
Use of sum frequency QTFs	5.5E
Print-out of additional mooring results	5.5E
“Lids” for suppression of irregular frequencies and standing waves	5.5E
User-defined multi-directional spectra (“carpet” spectra)	5.5F
Plotting of radiation forces	5.5F

3.1 JONSWAP spectrum for Cross-Swell

It is now possible to define a JONSWAP or Pierson-Moskowitz spectrum for cross-swell, using a modified XSWL card.

3.2 Additional mooring data checks

There are two aspects of mooring stiffness data that cause fairly frequent problems and calls to the support team.

Catenary Line Stiffness

The COMP and ECAT cards for defining a catenary mooring system are intended for situations where catenary behaviour is dominant. That is, where the mooring stiffness is caused by the weight of the line. The maximum tension used in setting up the mooring database is that input by the user on the ECAT card. If this tension is very high the database has to cover situations where the line is virtually straight and the stiffness is determined by the elastic stiffness of the line. This can cause problems.

Sometimes the high maximum tension is correct, but sometimes users put in a high value “just to make sure the whole range is included”. A warning is now output if the maximum tension leads to a strain greater than 0.25%. This will not stop the analysis, but is intended to discourage the use of unnecessarily high values for maximum tension.

POLY Line Stiffness

It appears that users sometimes obtain non-linear line stiffness coefficients by curve-fitting to manufacturers’ data. This can lead to definitions with negative coefficients. If the line is then used in a situation outside the validity of the original data, the overall stiffness may become negative, leading to rapid divergence in the analysis. This most often happens when the extension of the line is greater than in the original data.

A warning is now output if either the first or last coefficients on a POLY card are negative. This will not stop the analysis, but may help users to solve the problem if the analysis fails.

3.3 50 structures and articulations.

It is now possible to analyse problems with up to 50 structures. They can all be diffracting, but there is an additional limit on the number of hydrodynamically interacting structures. Refer to section 4.2.0 in the reference manual for details of the limits.

There can also be up to 50 articulations.

3.4 Removal of PFIX option

The PFIX option for analysis of partially fixed structures has been removed and replaced by a PFIX card in Deck 2. This will facilitate future developments involving external elements and running of analyses from the AGS.

3.5 Sloping elements near the waterline

For many years AQWA has generated a fatal error when a model has sloping diffracting elements near the waterline, because the dG/dn matrix could become nearly singular. The evaluation of the Green's Function has now been improved and this error has been removed for elements where the normal points down, such as highly flared stern sections. For bulbous bows where the normal points up the error is still generated.

3.6 Sum frequency QTFs

AQWA-DRIFT can now use the sum frequency QTFs to calculate drift forces, using a new SQTF option.

Note that the 5th term (2nd order contribution to the potential) in the near field QTF solution in AQWA-LINE is only present in the difference frequency formulation. This is considered small as the formulation for the 5th term is based on the 1st order wave forces which tend to zero for high frequencies.

3.7 Additional mooring results

There are two new cards in deck 18.
The PRMD card will print out the mooring drag forces.
For a composite mooring the PMST card will print out the tensions between individual mooring sections i.e. at intermediate positions.
The additional results are NOT presently copied to the .plt file.

3.8 "Lids" for irregular frequencies and standing waves

In version 5.5E of AQWA two "lids" have been introduced for suppression of irregular frequencies and reduction of the standing wave that may occur in a moonpool or between two hydrodynamically interacting vessels. At present the inclusion of these lids is a manual process, although it is hoped to automate it when some experience has been gained.

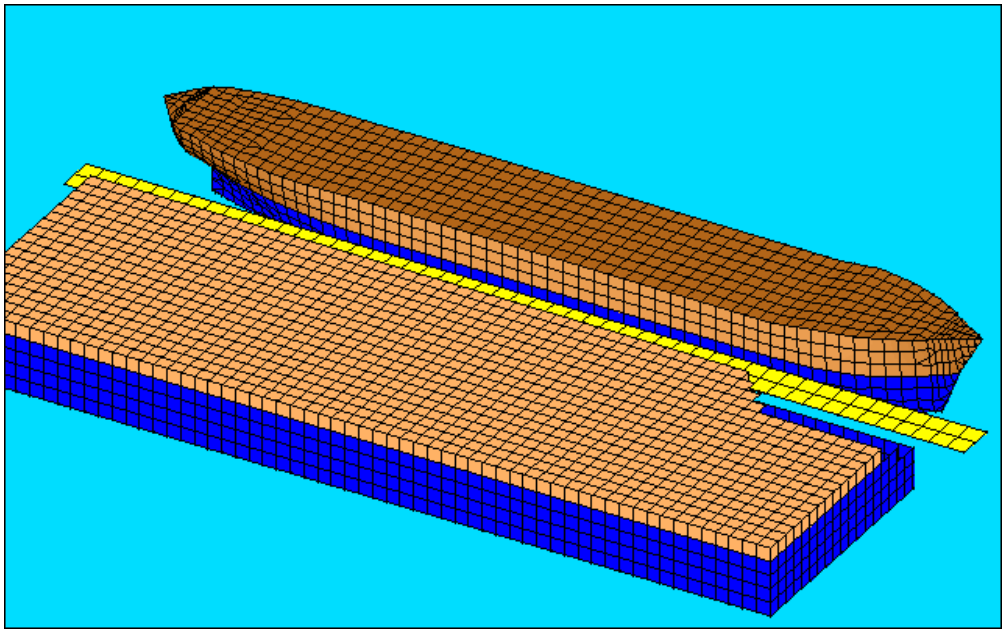
The lids are modelled by horizontal diffracting elements that must be defined in a separate group. The format of the input is similar to the PFIX card in Deck 2.

For suppression of irregular frequencies an ILID card is used in Deck 2, with an integer defining which group the elements are in. The user must then define a number of elements that should:

- be within the vessel
- have their normals pointing upwards (i.e. the nodes must be listed anti-clockwise when looking down on the elements)
- be as close to the surface as possible.

The usual modelling checks are still applied, so the elements must be 0.5 * facet radius below the surface. This may lead to fine meshes on the lid in order that it may be close to the surface. At present no guidance can be given on the required mesh density.

To reduce the amplitude of standing waves a VLID card is used, with an integer defining the element group and a factor that must be between 0 and 1. 0 will give no effect, 1 will result in zero vertical velocity at the elements. The elements should be between the vessels and have their normals pointing upwards. However, these elements appear to be successful when further from the surface, so larger elements can be used. They do not need to follow the vessel outline closely so a simple mesh should be adequate, as illustrated in the figure below. (The corner of the pier was removed with the new "Select Elements, Omit" facility in the AGS).

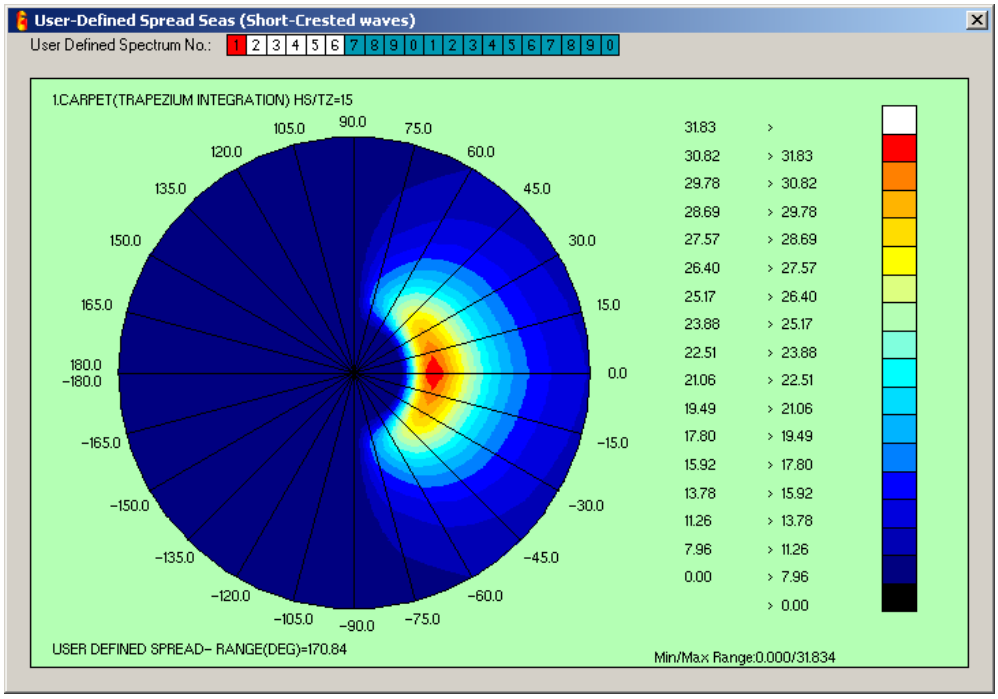


3.9 "Carpet" spectra

It is now possible to define a multi-directional spectrum for use in AQWA-LIBRIUM and FER. The input is similar to the present user-defined spectrum except that the spectrum can vary with direction as well as frequency. This allows the user to define, for example:

his own spreading function;
a wind driven sea with two separate cross-swells.

A typical plot is shown below.



3.10 Plotting of radiation forces

In the AGS under Function/Processing > Data Processing > Added Mass/Damping Convolution it has been possible to plot the added mass and damping curves for each structure. This facility has been extended to include the curves related to interaction between structures, so now the whole of the added mass and damping matrices can be output graphically.

4. BUG FIXES

Fixes to Grade 4 and 5 bugs are summarised below. These are bugs that produce incorrect answers: Grade 4 bugs give obviously incorrect results while Grade 5 bugs give errors that are not obvious to the user. Details of all the bug fixes can be found on our web-site.

Description	**Fixed in version**
Coincident nodes generated by AGS	5.5B
Incorrect transfer function printing in AQWA-FER	5.5C
Incorrect import of damping values for interacting structures	5.5C
Incorrect calculation of interacting added mass in AQWA-NAUT/DRIFT	5.5E
Number of cable elements not increased when NCEL card used	5.5E
Flexible moorings inaccurate with intermediate buoys	5.5F
Mooring stiffness inaccurate with cable dynamics	5.5F

Spectrum incorrect when using IWHT with AQWA-NAUT	5.5F
Database incorrect when imported from .HYD file	5.5F

4.1 Coincident nodes generated by AGS

Although not a Grade 4 or 5 bug (the program stops with an error message), users will no doubt be pleased that the irritating tendency of the AGS model generator to produce models with coincident nodes has been corrected.

4.2 Incorrect transfer function printing in AQWA-FER

The transfer functions written to the .LIS file and the .PLT file by AQWA-FER were incorrect. This was only an output error; other results were not affected.

4.3 Incorrect import of damping values for interacting structures

When the WDMP card is used in Deck 7 to import radiation damping for interacting structures, the values were read incorrectly.

4.4 Incorrect calculation of interacting added mass terms

The added mass calculation for interacting structures was incomplete in AQWA-NAUT and DRIFT. This problem was discovered in an analysis where the wave frequency coincided with a structure resonant frequency, leading to a high degree of coupling. At other wave frequencies the effect was not significant.

4.5 Number of Cable Elements

When the NCEL card was used to increase the number of elements in the cable dynamics calculation, it had no effect and the solution still used 50 elements. The 50 element solution was correct, and a simple check of the results would have shown that they were unchanged.

4.6 Flexible moorings inaccurate with intermediate buoys

Mooring flexibility was not handled correctly with intermediate buoys. This could lead to inaccurate results when a mooring system had long flexible lines, intermediate buoys and relatively high tension.

4.7 Mooring stiffness inaccurate with cable dynamics

The mooring stiffness matrix was inaccurate for structure-structure lines with cable dynamics. This only affected AQWA-FER and LIBRIUM.

4.8 Spectrum incorrect when using IWHT with AQWA-NAUT

When using the IWHT card in NAUT to import a wave height time history, the program did not use the equivalent user-defined spectrum as printed in the .LIS file.
Note. Only AQWA-DRIFT will reproduce an imported wave height time-history accurately. Other programs use an equivalent spectrum that gives similar statistical results but NOT an identical wave profile.

4.9 Database incorrect when read from .HYD file

When the hydrodynamic database is imported using the FILE/CSTR/CPDB cards in Deck 6, the database was inaccurate for interacting structures. The original calculation of the database in AQWA-LINE was correct.