Newsletter on PIAS and LOCOPIAS functionality extensions

As released between January 2017 and November 2018

Introduction

This newsletter summarizes some major enhancements of (LOCO)PIAS since the previous overview from January 2017. Individual release notes are also published on the website and in LinkedIn group SARC BV around the moment of release, however, an additional comprehensive collection from time to time is considered to be appropriate for archiving purposes. Other sources of PIAS news are the SARC user days, the most recent being held at Amstel Boat House of Amsterdam in April 2017. With some 70 attendants this event was well received and valuated.

The subjects of this newsletter more or less indicate the end of PIAS' renewal process which started in 2012. The body of this work was finished some years ago, although still some missing pieces had to be inserted. One important item being the integration of hopper dredger stability into PIAS modules for intact and probabilistic damage stability, on which this newsletter also reports. The final step will be that all PIAS' modules will be using compartments from the *Layout* module directly, without the diversion through the elder *Compart* module, as has been the practice for the past years. A version with the new *modus operandi* is being tested at SARC right now, and will be released in the early days of 2019. That will make *Compart* obsolete, so it will be removed, after 33 years of good services in handling literally multiple millions of compartments.

Obviously, the development of PIAS will not come to an end with this milestone. The list of envisioned enhancements is too long to be elaborated here, however, one feature in particular will be the inclusion of piping and their shape and connectivity in PIAS, which will be used to enhance flooding scenarios in (probabilistic) damage stability computations.

May 18, 2017

Updated PIAS Layout file format

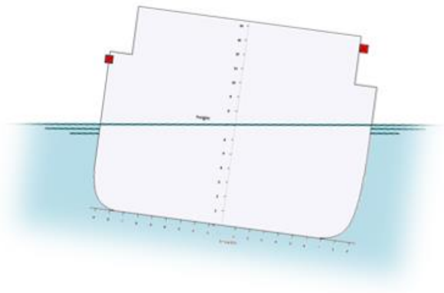
In order to accommodate future program enhancements, PIAS' module *Layout* has been updated as per May 18, 2017. As usual, this format update is upwards compatible, which means that newer PIAS versions can read the old format, but older versions cannot read the new format. So, in order to be prepared to receive PIAS files in the contemporary format, users are advised to update PIAS at a convenient moment.

June 6, 2017

Assessment of intact and damage stability to PS and SB in PIAS

In PIAS, for each particular project of vessel the side of heel for intact and damage stability calculations is user-configurable, where the options are:

- Portside (PS).
- Starboard (SB).
- The side of the statical angle of inclination. With this setting, the side of the worst stability is estimated with this method: if this statical angle is to PS then the calculation is made to that side, otherwise to SB.
- Portside and starboard. With this setting there will be no a priori assumption on the "worst side", instead the stability will be calculated to PS as well as SB, while both sides are fully taken into account in the stability assessment.



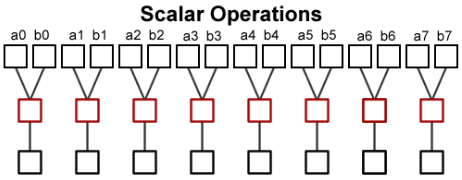
In a separate white paper [Assessment of intact and damage stability to PS and SB in PIAS]() the background of this feature is described into some detail.

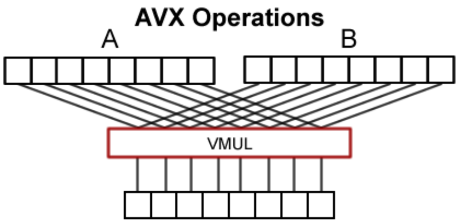
June 27, 2017

Hardware-supported acceleration of PIAS

Some tasks of PIAS can be quite computation-intensive, such as the computation of intact stability (in particular if enhanced features are active, such as the shift of liquid method, and/or stability around the weakest axis) and damage stability, but also the generation of curved surfaces in Fairway. Time was that each new computer generation was faster than its predecessor, mainly thanks to processor clock frequency increase, but that has come to a halt a decade ago. Nowadays, CPU manufacturers try to stimulate performance gains by means of parallelization, so that multiple tasks can be executed simultaneously. In the recent weeks, at SARC, we have been working to optimize (LOCO-)PIAS with these technologies, with the goal to cramp out all possible performance out of modern hardware.

This resulted for some PIAS applications in a speed increase of a factor 3 to 8, depending on the task and the hardware. In a separate white paper [Acceleration of PIAS by hardware support]() the background and results are described into some detail.





June 2017

Redesigned inclining test module

PIAS' inclining test module was conceived in the late '80s. Although it has always served us well, in the course of the years the need for some additional functionality arose, such as:
The possibility to specify separately the test weights and their displacements (instead of everything combined), as well the option to give a heeling moment (instead of weight/displacement combinations).

- The use of tanks as inclination weights.
- Use the ship's draft mark readings.
- Diagram of moments vs. heel angles.

The inclusion of these enhancement has been combined with a redesign and modernization of the structure and content of all menus. As a result the inclination test module is ready for the decades to come. A full discussion of the features and functionality can be found [in the manual]().

July 11, 2017

Stability around the weakest heeling axis

PIAS, as many other stability programs, has from its conceptualization in the 1980s determined the intact and damage stability (or, to be more precise, the GZ) with respect to centreline plane. That is not always correct, in particular with hull shapes which are significant asymmetrical in longitudinal direction the GZ should be determined with respect to a rotated plane (rotated around a vertical axis).
Occasionally, people have inquired for a possible extension of PIAS towards the effects of stability around the axis of weakest stability, and the recurring reply of SARC was that this would certainly be feasible, and could be produced on order. In 2017 that was finally implemented in PIAS.
In a separate white paper [Calculation of stability around the weakest heeling axis with PIAS]() the background of this feature is described into some detail.

September 22, 2017

Modified computation method for ullage & sounding under heel or trim

PIAS' *Layout* module is able to produce tank sounding tables with a variety of parameters and units. Commonly, if the ullage or sounding parameters are included in such a table, those are determined in a user-defined sounding pipe, which can exist of two or more points. The latter to model curved or knuckled pipes. Additional, it is also possible to define just a single point, which is then used as the reference point for ullage or sounding. Conventionally, for such a case the ullage or sounding was computed under the assumption that the measuring tape goes through this reference point in a vertical direction. This mechanism has been changed, and now a direction perpendicular to the water plane (so, including the effect of heel and trim) is applied, which is more realistic.

November 8, 2017

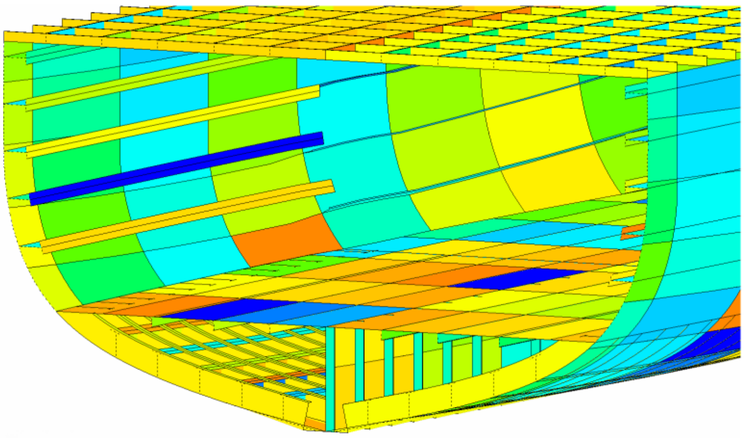
UI extensions to Layout

For clear identification and overview, in PIAS' *Layout* module each compartment, bulkhead or plane can be assigned two user-defined names. During the design and optimization of the internal ship layout, locations of these entities often change. For additional assistance in this process, a feature has been added which automatically generates the second names of these entities, based on their positions. This facility can be switched on or off, according to personal preferences. Furthermore, the definition window for bulkheads and planes has been extended with zoom and pan capabilities.

January 3, 2018

Extension PIAS -> Poseidon interface

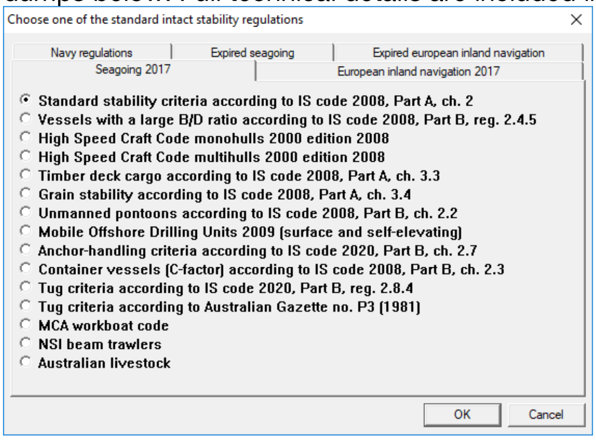
In 2016 an interface from PIAS to the scantling program Poseidon (by DNV•GL) was released. This facilitated the transfer of PIAS' design data, such as general particulars, shape of hull, compartments, bulkheads and decks, envelop of Still Water Bending Moment from all loading conditions etc. In 2018 more entities have been included in this interface, such as local loads, longitudinal and transverse girders, stiffeners and shell plate distribution. Full details are included in PIAS' manual section on this topic. The picture shows an example of hull, internal layout, plates, girders, webs and stiffeners defined in PIAS, converted to Poseidon

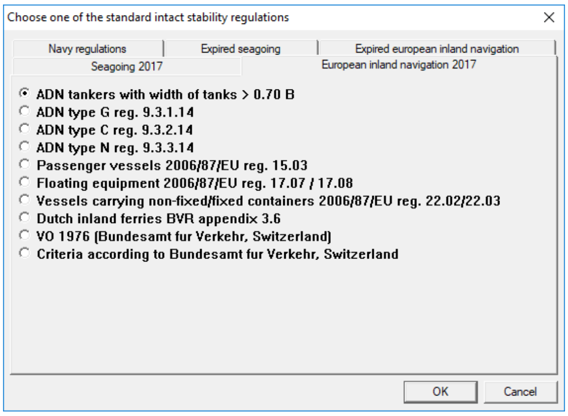


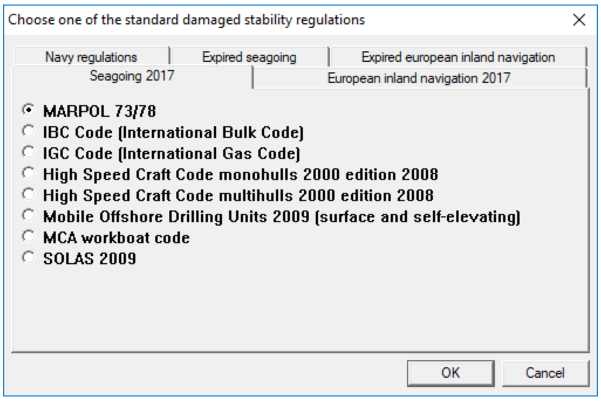
January 8, 2018

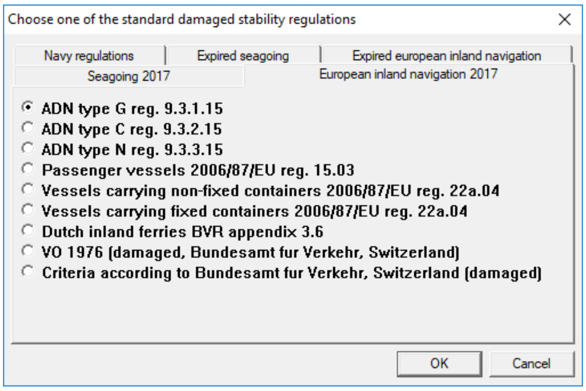
Updated stability criteria

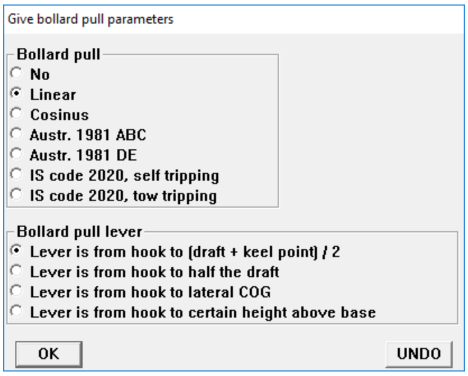
PIAS' set of standard stability criteria has significantly been extended, see an overview in the screen dumps below. Full technical details are included in PIAS' manual.







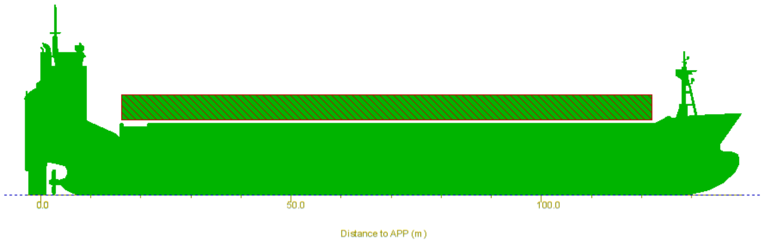




February 27, 2018

Multiple windage areas

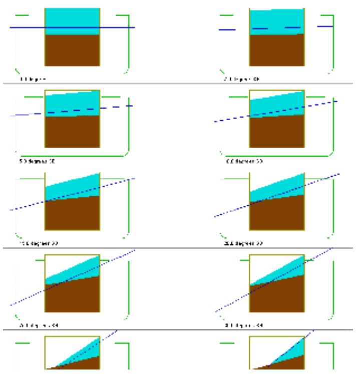
For the computation of wind heeling moments, in PIAS the windage area can be given. That used to be limited to a single contour, with some maximum number of points, which was sufficient for the common use the past 25 years. However, when importing the contour shape from a Cad system that maximum can easily be exceeded. For this reason this PIAS' module Hulldef has been extended to accommodate a wind contour with a number of sub-contours (each with a resistance coefficient), with an unlimited number of points.



February 16, 2018

Hopper stability integrated into PIAS' Loading module

Already for some decades, PIAS has the capability to compute intact and damage stability for open-top hopper vessels, e.g. as required by the dr-67 & dr-68 regulations for hopper dredgers with a reduced freeboard. This function, which was available in a separate PIAS module, has recently been integrated in PIAS' standard stability module *Loading*. With this enhancement the hopper stability computations can now be combined with all *Loading*'s tools and options, and is now also available for the LOCOPIAS on-board loading software. More details of the new *modus operandi* can be found in the manual.



March 12, 2018

Added: function to import damage cases from an XML file

In PIAS damage cases can be defined in text-based menus, or toggling tanks as being damaged in the tank overview plot. This has been extended with a function to import damage cases from an XML file. The XML used for this function is included in the *SARC XML dictionary*, which is available on request.

April 1, 2018

Release PIAS software update distributor

SARC is devoted to enhance PIAS with new functions and features, and to keep it in line with the latest rules and legislation. For that reason it is important to download and install PIAS updates on a regular basis. While updating, PIAS' existing programs will inevitable be replaced by newer ones. Unfortunately the design of MS-Windows prevents programs in use to be overwritten. The larger the organization, the greater the change that some remote user is still using PIAS, and consequently preventing the update from being installed.
Recently, PIAS has been extended with some wizardry to avoid these loopholes, which can be used to distribute a PIAS update from the client's network server to local workstations. This feature is available to all users, at SARC a document describing this feature is available on request.

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April 19, 2018

LOCOPIAS IMDG implementation

From January 2018 the new 38th amendment of the IMDG Code will become mandatory and to invigorate this an IMDG module has been added to LOCOPIAS. IMDG (International Maritime Dangerous Goods) Code is accepted as an international guideline to the safe maritime transportation or shipment of dangerous goods or hazardous materials. This (mandatory) Code has been designed to protect crew members and to prevent marine pollution.
The IMDG code extension in the LOCOPIAS container module assists in the loading of dangerous cargo by real time validation against the IMDG requirements. It presents the operator an overview of conflicts in segregation and stowage requirements. Current implemented version is amendment 38-16 (the most recent version of the code). Features and functions are discussed in a white paper labelled LOCOPIAS IMDG implementation.

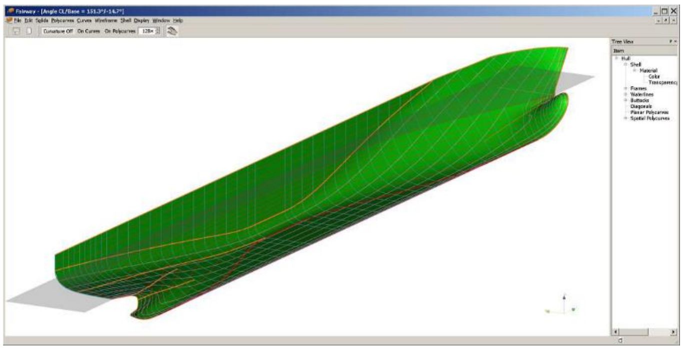
May 15, 2018

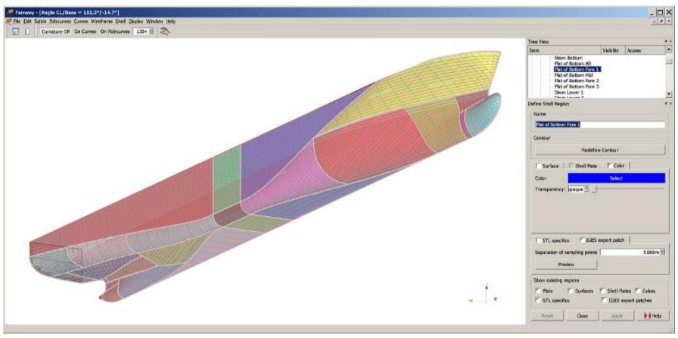
Enhanced surface export from Fairway

Although the NURBS surface method is not very suitable for the hull design process as such, it is widely used for interfacing. So, when a hull design is to be used downstream, e.g. for engineering, CFD analyses or visualization, the Fairway hull form has to be converted to a set of NURBS surfaces. The first step is identifying larger, four-sided areas, which is essential because its four-sidedness is an intrinsic requirement of the NURBS. With some neat mathematical processing, a patchwork of NURBS surface is created with the following properties:

- Guaranteed gap-free along common boundaries between adjacent surfaces.
- The number of vertices of the resulting NURBS surfaces is determined automatically, and is the minimal required to achieve this gap-freeness, as well as accurate representation of the original Fairway surface.

This method is baptized LEANURBS (an acronym for Lowest Effective Amount of NURBS). Its implementation in Fairway is demonstrated by the following sequence of screen dumps, from which the first shows the ship hull in Fairway. The second is a screen dump where the hull is subdivided into four-sided regions and the last one is the IGES file in Rhino.





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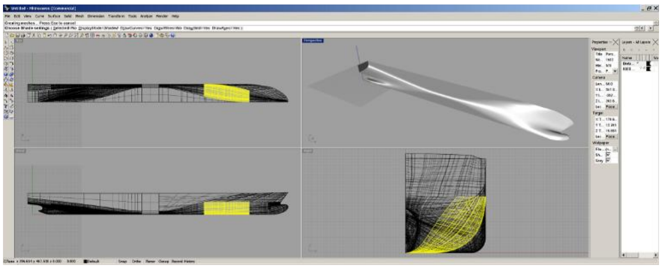
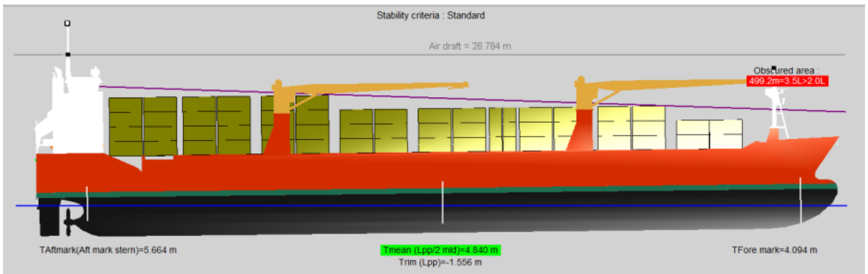


July 17, 2018

Enhanced GUI design in PIAS' module Loading, and LOCOPIAS

The GUI from PIAS' *Loading* module is the place where the most important particulars of a loading condition are summarized in one window. The graphical design of that window has recently been updated, see the screen dump below for an example



July 20, 2018

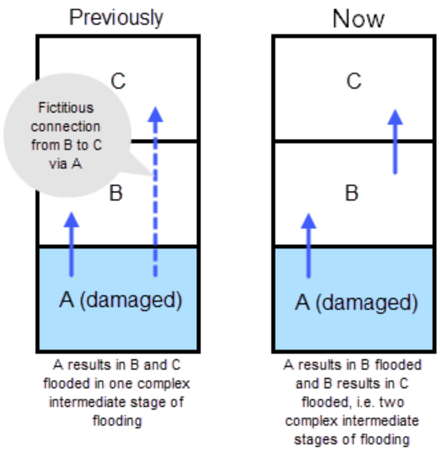
New setting "Righting levers denominator" in damage stability

Righting (and heeling) levers of stability are determined by dividing the righting (or heeling) moment by the ship's displacement. In intact condition, the displacement to choose for that division is unambiguously that of the loading condition under consideration. In damage stability, the choice is not that obvious. However, the standard suggested by the relevant regulations has conventionally been "Constant displacement", so that has always been the standard choice in PIAS. For some time now an alternative choice is also available — as presented in "MSC.1/Circ.1461, guidelines for verification of damage stability requirements for tankers" and "IACS 110 Guideline for Scope of Damage Stability Verification on new oil tankers, chemical tankers and gas carriers" — i.e. "Intact displacement minus liquid cargo loss". The choice between these two alternatives is now available as a setting in PIAS, please consult the manual for more details.

September 24, 2018

New generation method for compartment connections

Already for some twenty years, the Probdam damage case generator has a feature, called compartment connections, for generating complex intermediate stages of flooding. This tool has been improved so that a multitude of complex intermediate stages will be generated, instead of just a single one previously. This results in a more realistic flooding pattern of compartments through the defined compartment connections. As an example, see the picture below which shows the previous mechanism, as well as the present one. In this example compartment A is initially damaged and compartments B and C are being flooded due to the compartment connections with compartment A.



October 8, 2018

Hopper dredger stability integrated into PIAS' Probdam module

Hopper dredger stability (e.g. dr-68 or Bureau Veritas N.I. 144) computation used to be present in PIAS in a separate module *Hopstab*. In February 16 of this year a new version of PIAS' stability module *Loading* was released, where all hopper stability effects have been integrated (and enhanced, compared to *Hopstab*). The dr-78 and dr-68 stability regulations require a hopper dredger also to comply with requirements of probabilistic damage stability. This has been available for some decades in PIAS, based on the hopper particulars as defined in *Hopstab*. Recently, PIAS' probabilistic damage stability module has been updated, so it now applies the hopper and loading data as defined in *Loading*. The new *modus operandi* of probabilistic damage stability for a hopper dredger is discussed in the manual. After this enhancement, module *Hopstab* has become obsolete and has be discarded. This marks the end of the software renewal process around hopper dredger stability in PIAS, and implies that specific hopper-related data files from elder projects cannot be used anymore for computations. Please refer to the specific conversion manual chapter for further discussion.