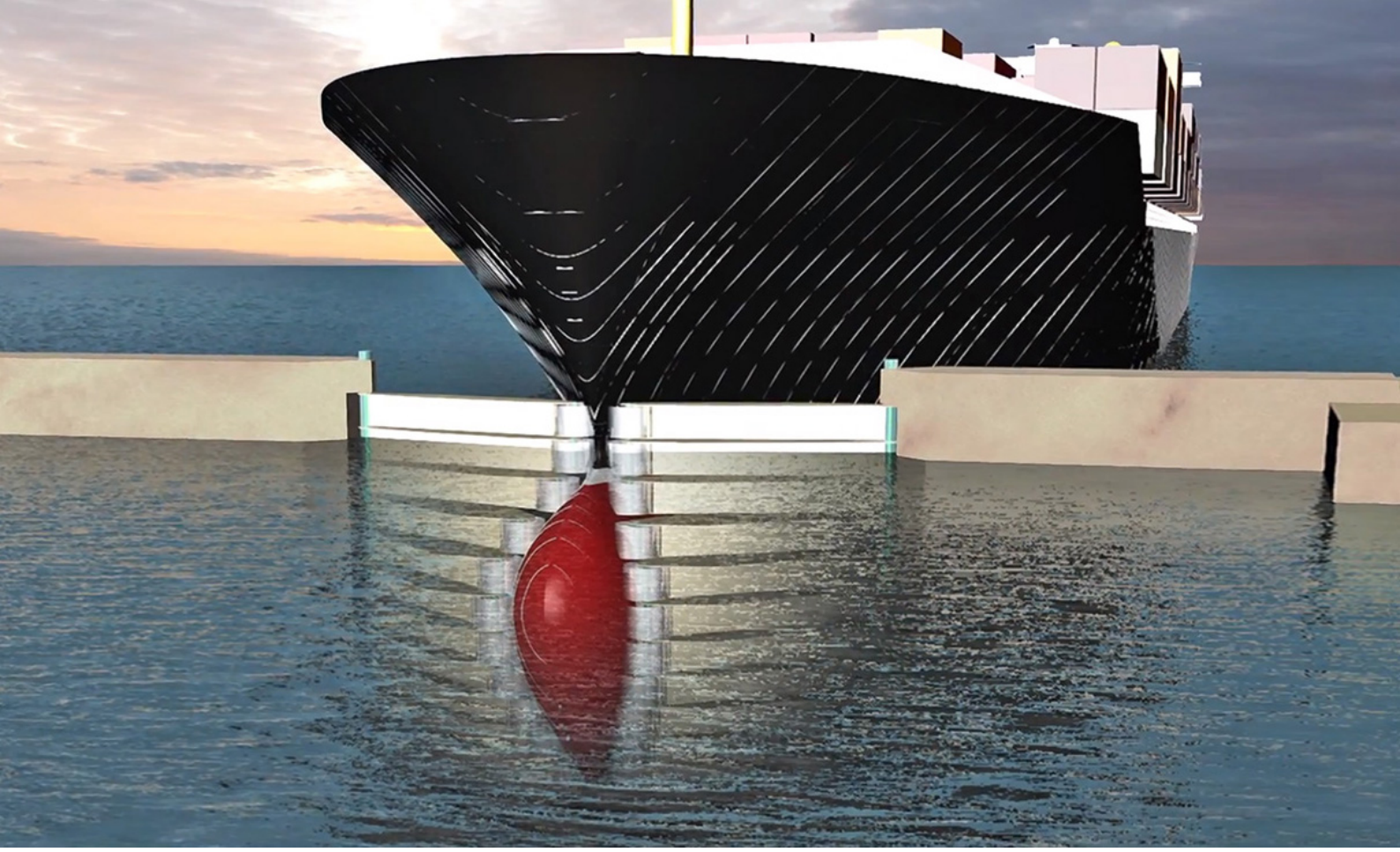


Artist Impression Locky Sirens lock. The bulbous bow of a ship sails effortlessly between the sealing louvers Watergate

THE MAKING OF
LOCKY SIRENS
a revolutionary sea lock

Robert C. Smit, Dutch designer and inventor unfolds details of Locky Sirens

English Translation: Rob den Heijer

How is Locky Sirens different from conventional locks?
What is involved in the engineering of Locky Sirens?
What benefits does provide Locky Sirens to the nautical world?
FAQ, publications, resources, and ...

HOW DOES THE AIR FIZZ SYSTEM WORK

• The PCT patent (global intellectual property protection) allows showing more technical information in this brochure than in previous publications •

This is the logo of Unlocking Amsterdam, the project of which Locky Sirens is a part.
The video shows the creation of the logo.

Locky Sirens, a Revolution!

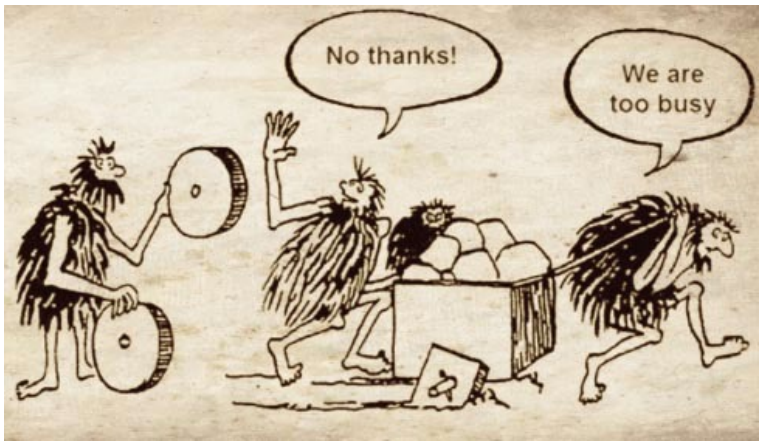
Locky Sirens sinks ships
Causes collisions
And is nevertheless a revolutionary sea-lock

Locky Sirens replaces the operation of the lock chamber and second door set, which are part of the conventional lock, with the application of air. Air in the form of air fizz is blown into the floodwater, and elegantly replaces the expensive, slow-acting and salinization causing lock chamber and second door set.
This brochure provides information about all unique aspects of Locky Sirens.

Conventional locks have been built for the last 11 centuries, following one and the same principle. Chiao Wei-yo, the inventor, designed the first sluice in the 10th century for the Great Chinese canal system. In this canal system, two lock gates were built at some distance from each other, with the lock chamber situated in between. In this lock chamber, the water could rise to high water level or drop to low water level. A ship floating in this water was raised or lowered so that it could travel from low to high water, or vice versa, to continue its journey.

This is still how it works: the world of sluices applies sound, ancient systems. Safety and reliability are of great importance. In the last decades, the century-long reign of conservatism gave way to a more scientific approach, while engineering received a boost from advanced 2D/3D CAD (Computer Aided Design) capabilities and sophisticated computer programs.

The world of water engineering reacted with curiosity to Robert C. Smit's revolutionary invention. Engineers were impressed by the concept of Locky Sirens, but they also expressed skepticism toward the system. Skepticism is understandable when one realizes that in Locky Sirens both lock chamber and a second door set are removed. Every hydraulic engineer will frown upon the sight of such a mutilation of a sluice. After all, the functioning of sluices always required two gates and the lock chamber, as determined by the inventor Chiao Wei-yo.



Humor shows how 'old' is not always 'best'

Robert C. Smit, Inventor

Robert is an inventor and designer of technical illustrations commissioned by companies like Tata Steel

'And then there was the vision of a broom'

Robert C. Smit

True innovation comes from seeing through new eyes, by thinking 'out of the box', and by paying attention when wondrous things are showing up. When Robert strolled along the large sluice of IJmuiden, space and atmosphere of the landscape around him seemed to change. He mentally experienced an immense broom*, without the handle, lying upside down on the bottom of the North Sea Canal and, emerging from the water, the waterway closed across its entire width. Water could no longer flow from one side of the brush to the other side. Right through that brush, a large ship was navigating ...

Locky Sirens was born!

Robert discovered how the new North Sea Lock at IJmuiden could be built according to a cheaper, faster and more efficient concept, a concept that also prevents salinization.

He developed his revolutionary sea-lock invention, had the design protected by a patent, and established contact with CEO's and engineers at Rijkswaterstaat and large water-engineering companies. Meanwhile, he invited NRC Handelsblad, an important newspaper in the Netherlands, and other media to publish his discovery. Recently, one of the major Dutch companies offered to build a **scale model** of Locky Sirens.

* See further down in this brochure

Index

* Anyone who is considering supporting the project can ask for the Investment Flyer by email.
Investors receive a multiple of their deposits returned upon successful completion of the project (see information in flyer)

1-Publications

This page and the following pages show publications as they appeared in the national press

ZATERDAG 22 MAART 2014 WATER

Noord-Holland

Alternatieve opening voor Amsterdam

Al meer dan 25 jaar wordt er gesproken over de komst van een nieuwe zeesluis in de monding van het Noordzeekanaal. De discussie is in een stroomversnelling geraakt: 2019 moet-ie er liggen. Te duur, teveel overlast voor het milieu en te onpraktisch, meent Heemskerker Robert C. Smit. De industrieel ontwerper komt met een alternatief, het Locky Sirens sluissysteem.

Pieter van Hove

Umuiden ✱ De mogelijke komst van de tweede grote zeesluis in de monding van het Noordzeekanaal leidt tot discussies tussen voor- en tegenstanders van dit miljoenenproject. Ontwerper Robert C. Smit uit Heemskerk heeft een revolutionair alternatief ontwikkeld: een sluis die goed is voor het milieu, veel effectiever werkt en bovendien veel goedkoper is. En veel fraaier oogt dan de huidige.

Sluiskolk

„Al vijfhonderd jaar gaat het schutten van schepen in sluizen op dezelfde manier. Aan de ene kant komt het schip via een sluisdeur binnen in de sluiskolk, een enorme bak die het hart vormt van de sluis. Door het water in de kolk op het niveau te brengen van de zee of van het binnenwater, kunnen schepen naar de zee varen, of naar het binnenwater." Maar daarin ziet Robert C. Smit de nodige problemen. „Het grootste bezwaar van de traditionele sluis is de lange schuttijd en de gigantische zoutlozing op het binnenwater", zegt de grafisch ontwerper die technische illustraties levert voor onder andere Tata Steel en ingenieursbureau Danieli Corus. Dat schutten moet dus anders kunnen, stelde hij enige tijd geleden vast. Maar hoe?

Revolutionair

„Vanouds liggen de twee sluisdeuren achter elkaar in de sluis. Daartussen zit een afstand van honderden meters. Je hebt tienduizenden kubieke meters water nodig om die kolk te vullen en vervolgens weer te legen."

Een revolutionair concept bracht de oplossing. Waarom komen die twee deuren niet naast elkaar te liggen in de vaarweg? Zoiets als klapdeurtjes die langzaam wijken bij het passeren van het schip. De afgelopen negen maanden is de Heemskerker intensief met de werking van sluizen en het uitwerken van een eigen ontwerp – met de naam Locky Sirens – aan de slag geweest.

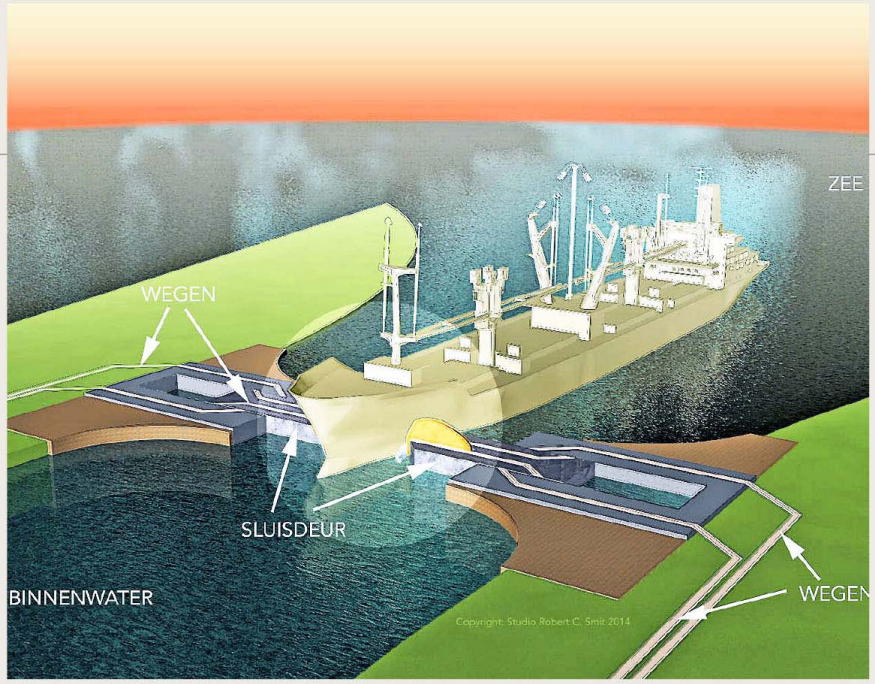
Robert trekt een vergelijking: „Het wassen van een auto in de wasstraat bij voorbeeld. Denk aan de lenigheid en gedecideerde aansturing van een autowasserij-rolborstel die de zijkant van de auto reinigt. Het behendig 'aftasten' van het silhouet van de auto gebeurt in het nieuwe sluissysteem met het silhouet van het schip, door de deuren die nauw aansluiten op de wand van dat passerende schip. Op deze wijze wordt tijdens de doorvaart het schip op zich deel van de sluisdeur.

Want op de plaats waar de deur zich opent om toegang te verlenen aan het schip, sluit het vaartuig zélf het hoge buitenwater af van het lage binnenwater."

Octrooi

De Heemskerkse ontwerper heeft inmiddels octrooi verkregen op zijn Locky Sirens. Daarnaast heeft een gerenommeerd ingenieursbureau veel interesse in het ontwerp van Robert C. Smit. Deze week heeft hij hierover een gesprek.

Site:www.studiorobertcsmit.com



Van schutten zou in het ontwerp van Robert Smit geen sprake meer zijn.

AFBEELDINGEN: STUDIO ROBERT C. SMIT

WATER ZATERDAG 22 MAART 2014

Noord-Holland

'Dubbel zoveel zout bij nieuwe grote Zeesluis'

Umuiden ✱ De nieuwe sluis zou 500 meter lang zijn bij een breedte van 65 meter. De diepgang bedraagt 18 meter. Het geheel krijgt rechte roldeuren en de exacte locatie is tussen de Noordersluis en de Middensluis, iets zuidelijker dus.

Maar bij de aanbesteding voor de sluis zullen bouwers worden uitgedaagd een vijf meter bredere sluis aan te leggen dan de sluis van 65 meter waar tot dusver op werd gerekend. Voorwaarde is wel dat ze binnen het budget van 848 miljoen euro blijven.

Gevolgen

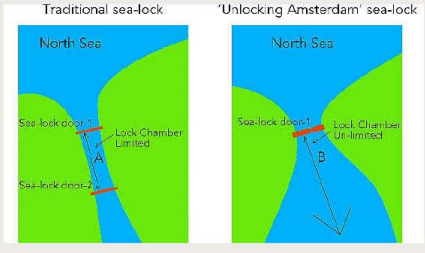
Uit de milieueffectrapportage (MER) is volgens Rijkswaterstaat gebleken dat de gevolgen van de sluis op de omgeving minimaal zijn. Smit is het daar niet mee eens. „Ook bij een gelijkblijvend aantal schuttingen zal het Noordzeekanaalgebied een bijna dubbele hoeveelheid zout te verstouwen krijgen. Mijn 'Locky Sirens'-systeem kan een perfect antwoord bieden op de bijna verdubbeling van zoutinstroom, waardoor er niet bij elk schip dat passeert de lading van 40 vrachtwagens volgeladen met zout het binnenland instroomt, maar slechts die van maximaal een halve vrachtwagen!

Fijnstoffen

Daarbij is er een enorme uitstoot aan CO_2 en fijnstoffen. De Locky Sirens verkort de schuttijd tot slechts een paar minuten. Een ander voordeel is dat het Locky Sirens systeem slechts een diepte van 15 meter behoeft, terwijl de traditionele nieuwbouw 18 meter nodig heeft bij gelijke effectiviteit, stelt Smit.

'Ontwerp veel goedkoper dan huidige sluis'

Robert C. Smit verwacht dat zijn ontwerp veel goedkoper is (minimaal 180 miljoen) dan de huidige sluiswerken. „In mijn initiatief is de sluiskolk overbodig. Die bestaat ondergronds uit een ingewikkeld buizenstelsel voor het in- en weg laten lopen van het water. De kosten hiervan bedragen 20% derde deel van de totale bouwkosten. Dat geld bespaar je dus. Daarnaast is de bouwtijd veel korter. Een groot bezwaar van de traditionele sluis is de lange schuttijd en de gigantische zoutlozing op het binnenwater. Het schutten van een zeeschip duurt gemiddeld 53 minuten. Bovendien is een aanzienlijke hoeveelheid brandstof nodig om een schip weer op gang te brengen.



De bestaande sluis (l) en de variant.

De Ertshaven van Tata Steel bij het Noordzeekanaal.

Ook kleinste scheepjes kunnen door sluis

Sleepboten kunnen in het alternatief van Robert C. Smit de sluis niet doorvaren. Dat kan alleen wanneer het doodtij is. „In het Panamakanaal is dat ook het geval, en daar worden de schepen met treintjes door het sluizencomplex geloodsd.

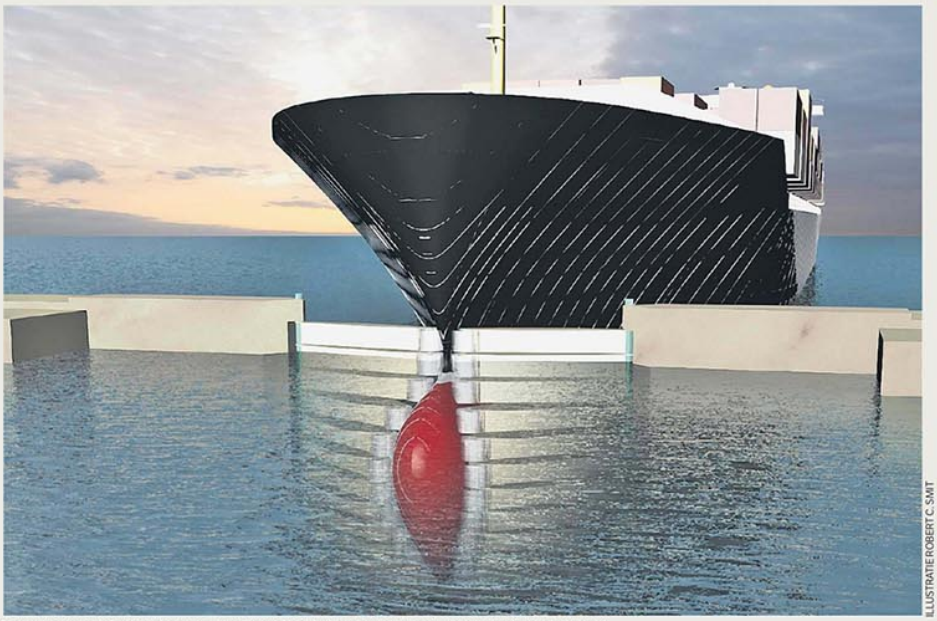
In een variant van mijn vinding kunnen echter ook de kleinste sloepjes een snelle doorvaart in de sluis hebben." De variant maakt onderdeel uit van het octrooi, en daar kan en wil de Heemskerker op dit moment nog niet verder op het item ingaan. Zeesluizen zijn een manier om schepen van hoog zeewater naar lager binnenwater te begeleiden en omgekeerd.

Maar zij vervullen ook de functie van zeewering. Daarom moet er volgens Smit om veiligheidsredenen altijd een tweede deur bestaan die de functie van de eerste deur overneemt als daar iets mis mee zou gaan.

Om dezelfde veiligheidseisen moet het functioneren en aansturen van Locky Sirens drievoudig beveiligd zijn uitgevoerd, zoals dit bij verkeersvliegtuigen ook het geval is, meent Heemskerker Smit.

Publication Noordhollands Dagblad
Double tabloid, 4 editions (out of 7), Saturday, March 22, 2014

NRC WEEKEND ZATERDAG 7 JUNI & ZONDAG 8 JUNI 2014 W7



ILLUSTRATIE ROBERT C. SMIT

Lamellen in de sluisdeur van het ontwerp van de Locky Sirens volgen de contouren van de scheepswand.

Met een vaart door de sluis

Techniek
Sluizen betekenen tijdsverlies voor de commerciële scheepvaart. Voor pleziervaarders zijn het vaak bedreigingen van het huwelijksgeluk. Op zoek naar de doorvaarbare sluis.

Door **Joost van Kasteren**

Het gebeurt honderden, misschien wel duizenden keren per dag: een schip komt aangevaren en moet afmeren omdat de sluisdeuren gesloten zijn; eerst wachten tot het water in de sluiskolk op niveau is en de sluisdeuren opengaan; dan naar binnen varen en aanleggen, vaak met meerdere schepen; dan weer wachten tot de sluisdeuren dicht zijn en het water in de kolk is gestegen of gedaald, en tenslotte geduldig wachten tot de andere sluisdeuren open zijn en je weg kunt varen. Zeker als er meerdere schepen tegelijkertijd worden geschut ben je al gauw een uur kwijt.

Dat kan beter, dacht Robert C. Smit, beeldend kunstenaar te Heemskerk en gespecialiseerd in 'artist views' en video's van technische installaties en processen. Met sluizen had hij niks, behalve dat hij als jongen regelmatig zat te vissen bij de kleine sluis in IJmuiden, maar de discussie over de nieuwe zeesluis bij IJmuiden in de monding van het Noordzeekanaal zette hem aan het denken. „Ik kreeg een beeld in mijn hoofd van een schip dat door een serie borstels heen vaart, zoals een auto door de wasstraat. Als je de kier tussen de sluisdeuren continu aanpast aan de vorm van het schip dat er doorheen vaart, sluit het schip het hoge, zoute buitenwater af van het lage, zoete binnenwater. Als de kier tussen het uiteinde van de deur en de wand van schip maar klein genoeg blijft, komt er nauwelijks water doorheen en heb je genoeg aan één set sluisdeuren in plaats van twee."

Het beeld liet hem niet meer los en al tekenend kreeg het steeds meer vorm en detaillering. Schepen hebben bijvoorbeeld niet allemaal dezelfde dwarsdoorsnede, dus om de contouren van het schip te volgen, bedacht Smit een oplossing waarbij sensoren een reeks horizontale lamellen aan het uiteinde van de deur laten in- en uitschuiven zodat ze steeds op een vaste afstand van tien centimeter van de scheepswand blijven terwijl het schip door de sluis vaart. Een variant werkt met rollers aan het uiteinde van de lamellen.

Bellenbed

Om te voorkomen dat het schip een 'sprong' moet maken (bij vloed is het niveauverschil tussen de ene en de andere kant van de deur een kleine twee meter) bedacht Smit het bellenbed, waarbij luchtbellen van onder af in de watermassa voor de sluis worden geblazen. Daardoor daalt de dichtheid van het water en komt het schip dieper in het water te liggen. Het hoogteverschil aan beide zijden van de sluis blijft, maar het schip hoeft nu niet bergop of bergaf te varen.

Smits heeft zijn concept Locky Sirens gedoopt - de Sirenen van de Sluis gedoopt. Hij ziet legio voordelen: „De doorvaartijd wordt met negentig procent verminderd tot vijf minuten. Omdat er geen sluiskolk hoeft te worden gebouwd - de bak waarin de schepen worden geschut - kun je een sluis bouwen voor een derde van de prijs. In geval van de nieuwe zeesluis bij IJmuiden, waarvoor de aanbesteding inmiddels van start is gegaan, zou dat betekenen dat die geen 900 miljoen euro hoeft te kosten maar slechts 300 miljoen. Ook komt er veel minder zout water het Noordzeekanaal binnen, geen 60.000 kubieke meter zoals bij de nieuwe sluis, maar slechts een fractie daarvan, 1 procent. Daardoor heb je veel minder last van verzilting."

Via vrienden en familie kreeg Smit voldoende geld bijeen om een octrooi aan te vragen. Bovendien wist hij enkele grote bouwbedrijven en adviesbureaus te interesseren. Die vertelden hem dat de kans dat nieuwe zeesluis bij IJmuiden gebouwd zal worden op basis van zijn Locky Sirens-concept vrijwel nihil is.

De procedure voor aanbesteding is begonnen en een van de voorwaarden is dat de aannemer niet alleen de sluis ontwerpt, bouwt en laat financieren, maar dat hij de sluis ook moet onderhouden. „Geen aannemer haalt het in zijn hoofd om onder zulke condities te komen met een concept dat nog niet eens in het laboratorium is beproefd", reageerde een van de bouwbedrijven.

Toch blijft Smit volharden: „Met Locky Sirens is de bouwtijd zoveel korter dat je nog wel een jaar of anderhalf hebt voor het uitvoeren van de noodzakelijke proeven. Bovendien zet zo'n uniek concept Nederland nog een keer extra op de wereldkaart als waterbouwkundig land. Die Deltawerken zijn immers alweer een hele tijd geleden."

Flitssluis

De Locky Sirens hebben wel wat weg van de Flitssluis die tot het jaar 1400 gangbaar was. Al in de Oudheid probeerde men rivieren beter bevaarbaar te maken door het aanleggen van dammen. Om schepen door te laten, werd in zo'n dam een schuif aangebracht waardoor het schip óf met het stromende water mee wordt gezogen óf tegen de stroom in omhoog moest worden getrokken. Erg bedrijfszeker was het niet; veel schepen en ladingen gingen verloren.

Vandaar dat schepen vaak niet werden geschut, maar dat de lading werd overgeladen. Omdat die tegelijkertijd werd verhandeld werd op die dammen de kiem gelegd voor veel van onze steden. Duizend jaar geleden werd in China de huidige sluis met een dubbele set deuren en een sluiskolk ontwikkeld. Via Italië kwam het concept bij ons terecht en in 1373 werd de oudst bekende sluis van dit type aangelegd bij Vreeswijk (nu gemeente Nieuwegein).

De vraag is of moderne varianten van de flitssluis, zoals de puddingsluis (zie kader) en de Locky Sirens, ooit de huidige, tijdrovende sluizen kunnen vervangen? **Otto Weiler**, expert/adviseur kustwerken bij Deltares, het kennisinstituut voor water, ondergrond en infrastructuur heeft er een hard hoofd in. „Schepen worden als het ware gedragen door water", zegt hij. „Omdat het water in het algemeen redelijk vlak is kun je met weinig kracht een groot gewicht verplaatsen. Schepen zijn dan ook steeds groter geworden om meer lading te kunnen vervoeren. Bij een sluis moet een schip echter een hoogteverschil overbruggen. Omlaag gaat nog wel. Maar om het schip naar een hoger niveau te krijgen, heb je een grote trekkracht nodig. Bij een hoogteverschil van een meter, red je dat niet, zelfs niet met behulp van sleepboten, laat staan met het eigen motorvermogen van het schip."

Sluizen, zeker zeesluizen, fungeren ook altijd als primaire waterkering en dat vraagt om een zeer robuuste constructie. Weiler: „Tijdens stormcondities moeten de gesloten sluisdeuren bij IJmuiden een waterhoogte tot ruim vijf meter kunnen weerstaan. Dat vraagt om buitengewoon sterke, hoge deuren en dat laat zich moeilijk rijmen met subtiliteiten, zoals door sensoren gestuurde lamellen. Afgezien daarvan wil je ook zo min mogelijk bewegende onderdelen, omdat in een zout milieu alles de neiging heeft om weg te roesten, waardoor onderhoudskosten hoog zijn. Je kunt er natuurlijk nog een beweegbare kering of sluisdeur achter leggen, maar dan ben je je kostenvoordeel weer kwijt."

Han Vrijling, emeritus hoogleraar Waterbouwkunde aan de TU Delft vindt de Locky Sirens „een interessant concept", maar ook hij ziet bezwaren. Het 'bellenbed' dat kunstenaar Robert Smit bedacht om het hoogteverschil te overbruggen leidt er niet alleen toe dat het schip lager komt te liggen, waardoor diepliggende schepen in problemen kunnen komen, maar heeft ook tot gevolg dat de waterstand wordt opgestuwd door de geringere dichtheid. Vrijling: „Ik vermoed dat beide effecten elkaar opheffen, waardoor de afstand tot de bodem, en daarmee het hoogteverschil nagenoeg even groot blijft als zonder bellenbed."

Vrijling ziet ook nog wel wat nautische bezwaren. Zo zal het niet eenvoudig zijn om het schip op koers te houden op zijn tocht door de sluisdeuren. Zeker niet als de dichtheid van het water lager is, want dat heeft ook effect op het functioneren van het roer en de schroeven. Dat kan leiden tot een verhoogd risico op aanvaringen. Toch zou Vrijling wel een keer een experiment willen doen: „Altijd de moeite waard en misschien kom je op nieuwe ideeën."

Robert Smit laat zich niet zo gauw overtuigen. Hij stuurt nog een video waaruit moet blijken dat het door het bellenbed opgestuwde water zo snel wegstroomt dat het schip daadwerkelijk lager komt te liggen. Volgens hem zou dat de bezwaren van Weiler en Vrijling goeddeels ondervangen. „Ik hoop nog steeds dat de Locky Sirens de poort naar Amsterdam gaan bewaken", zegt Smit. „Ik heb dat beeld in mijn hoofd, en dat gaat er voorlopig niet meer uit."

INNOVATIEF ONTWERP

Geen sluisdeur, maar een puddingbult

Studenten van de Hogeschool Rotterdam ontwikkelden in 2011 samen met het ingenieursbureau van dezelfde gemeente, de gel- of puddingsluis, **een sluis die zelfs helemaal geen deuren heeft**. In plaats daarvan wordt over een lengte van 3,5 kilometer het water vervangen door een bult van gel, een mengsel van gelatine en het mineraal bariet.

De gel is voldoende vloeibaar om schepen doorheen te trekken, maar tegelijk stevig genoeg om in het midden boven het waterniveau te kunnen blijven uitsteken. Aanvankelijk was er veel belangstelling voor de puddingsluis – de studenten wonnen er zelfs de Innovatieprijs mee – maar toch ligt het onderzoek nu stil, omdat er geen geld voor is.

SLUIS

Slimme vinding

GROTERE ZEESCHEPEN VRAGEN OM grotere zeesluizen. Bij IJmuiden zou een nieuw sluizencomplex 850 miljoen euro moeten kosten. Kan dit systeem van schutten niet eenvoudiger en goedkoper?

T. Toepoel, e-mail

MARK VELDKAMP
WETENSCHAP

Ingenieus schutten: schepen varen tegen een flexibele deur die de vorm van de boeg volgt.

Niet alle uitvindingen komen van wetenschappers. Soms nemen de grote Nederlandse bouwbedrijven de vinding van een leek zo serieus dat ze een schaalmodel willen bouwen. Bijvoorbeeld de zeesluis van Robert C. Smit uit Heemskerk.

Deze industrieel ontwerper heeft een revolutionair idee voor een sluissysteem met een enkelvoudige deur.

Bij 'Locky Sirens' varen zeeschepen tegen een flexibele deur die de vorm van de boeg volgt. Hierdoor vormen huid en deuren min of meer één geheel.

Overbrugging van het verschil in waterhoogte dat soms meerdere meters bedraagt, was de grootste uitdaging.

Ook daar heeft de uitvinder een bijzondere oplossing voor gevonden: een 'bellenveld'. De dichtheid van een vloeistof neemt af – en daarmee ook de opwaartse kracht – als er zich luchtbellen in bevinden. Door deze natuurkundige wet zal een schip dieper in het water komen te liggen als een veld van bellen onder de romp opstijgt. Door de juiste hoeveelheid lucht aan het water toe te voegen, kan het schip tot op de centimeter nauwkeurig op diepte worden gebracht tijdens de doorvaart door de sluisdeur.

Als het schip het verschil van 'laag' naar 'hoog' water moet overbruggen, zal een bellenveld vóór de sluisdeur worden gebruikt. Het schip vaart weliswaar tegen een 'muur' van water op, maar door de geringe dichtheid zal het nauwelijks tegendruk ondervinden. Volgens Smit zijn er grote voordelen aan zijn systeem: „De sluis is veel goedkoper te bouwen, neemt veel minder plaats in en er is nauwelijks schuttijd. Dat betekent en passant minder milieubelasting voor de omgeving die in de IJmond al zo zwaar wordt belast door Tata Steel. Bovendien is de hoeveelheid zout water dat het binnenland in stroomt, verwaarloosbaar."

De ontwerper verwacht binnenkort met een schaalmodel de praktische werking aan te tonen, waarna het concept rijp voor de markt zal zijn.

Voor een videoclip over de vinding: ga naar youtube.com en tik in 'locky sirens'.

Leek ontwerpt schutsysteem

Publication The Telegraph
1/3 Tabloid - Saturday, November 29th, 2014

Revolutionair concept van Heemskerkse ontwerper

Alternatief sluis uitvinding

Pieter van Hove
p.van.hove@hollandmedia.combinatie.nl

Heemskerk * De alternatieve grote zeesluis van industrieel ontwerper Robert C. Smit uit Heemskerk wordt nu wereldwijd beschouwd als een nieuwe uitvinding. De Heemskerker heeft dat onlangs van het octrooibureau te horen gekregen.

„Het officieel verplicht gestelde internationale nieuwheidonderzoek kwam met een positieve beoordeling!

Dat is natuurlijk een aangenaam feit. Het octrooibureau had al direct bij aanvraag een eigen onderzoek ingesteld naar de nieuwheid van mijn concept, en dat was positief uitgevallen. Maar voor het daadwerkelijke octrooi is bevestiging van nieuwheid door een officieel en internationaal onderzoek nodig."

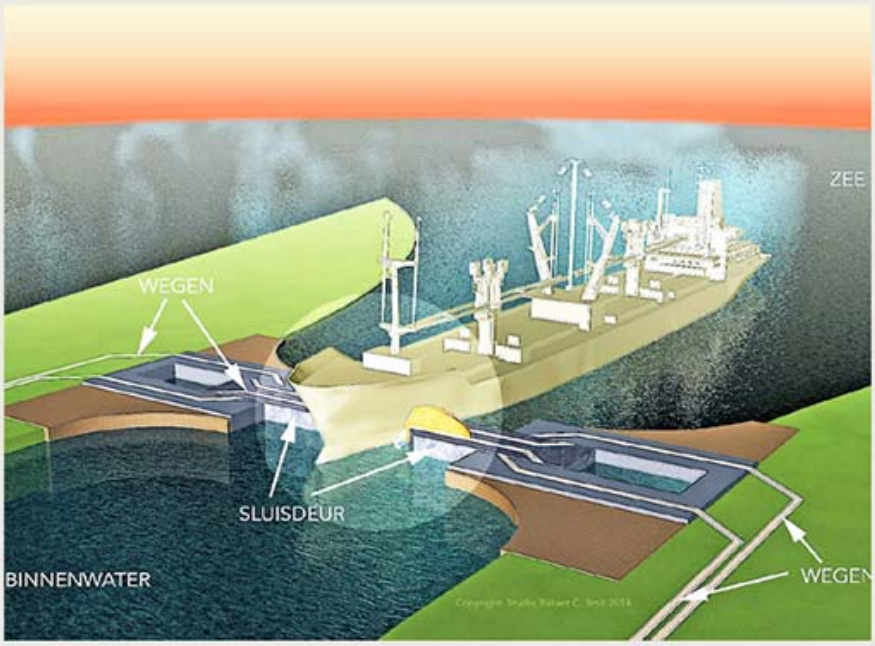
Schutten

Al achthonderd jaar gaat het schutten van schepen in sluizen op dezelfde manier. Aan de ene kant komt het schip via een sluisdeur binnen in de sluiskolk, een enorme bak die het hart vormt van de sluis. Door het water in de kolk op het niveau te brengen van de zee of van het binnenwater, kunnen schepen naar de zee varen, of naar het binnenwater. Een bezwaar van de traditionele sluis is de lange schuttijd en de gigantische zoutlozing op het binnenwater.

Kubieke meters

Vanouds liggen de twee sluisdeuren achter elkaar in de sluis. Daartussen zit een afstand van honderden meters. Er zijn tienduizenden kubieke meters water nodig om die kolk te vullen en vervolgens weer te legen. Een revolutionair concept bracht de oplossing. Waarom komen die twee deuren niet naast elkaar te liggen in de vaarweg? Zoiets als klapdeurtjes die langzaam wijken bij het passeren van het schip.

De afgelopen twee jaar is de Heemskerker intensief met de werking van sluizen en het uitwerken van een eigen ontwerp - met de naam Locky Sirens - aan de slag geweest. Te vergelijken met het wassen van een auto in de wasstraat. De inspanningen van de Heemskerker hebben tot succes geleid.



De werking van de alternatieve sluis.

FOTO STUDIO ROBERT C. SMIT

Eén van de grote bouwmaatschappijen van Nederland heeft aangeboden het schaalmodel van de Locky Sirens sluis te bouwen. Smit: „Dit gebeurt in nauwe samenwerking met mij. We zijn nu toe aan het opstellen van een gedegen overeenkomst, waarin helder beschreven staat welke materiële, financiële en juridische aspecten er spelen."

Luchtbellen

Het schaalmodel heeft niet als hoofddoel om uit te vinden óf het revolutionaire systeem werkt, maar hóe het werkt; het systeem is het samenspel van 'het-schip-omsluitende deuren' en een geavanceerd luchtbellen systeem. En nog meer goed nieuws: iemand heeft zich gemeld met een 'substantiële investering'.

Smit kan overigens nog niet vertellen wat de naam is van deze privépersoon. Ook over de naam van de bouwmaatschappij mag en kan hij voorlopig nog geen mededelingen doen.

Publication IJmuider Courant
1/2 Tabloid - Thursday, February 5, 2015

2- Video Animations

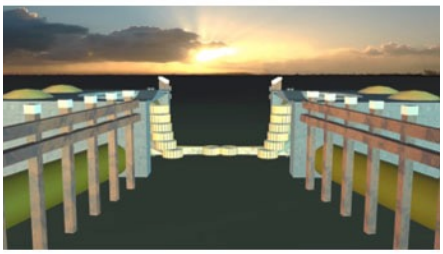
Produced and published Video Animations

Introduction *Locky Sirens*

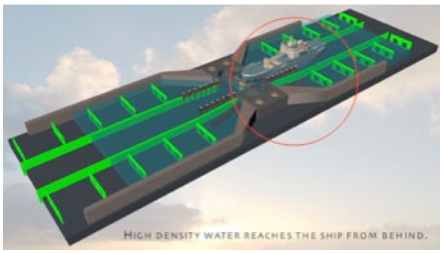
Poetry *Locky Sirens*

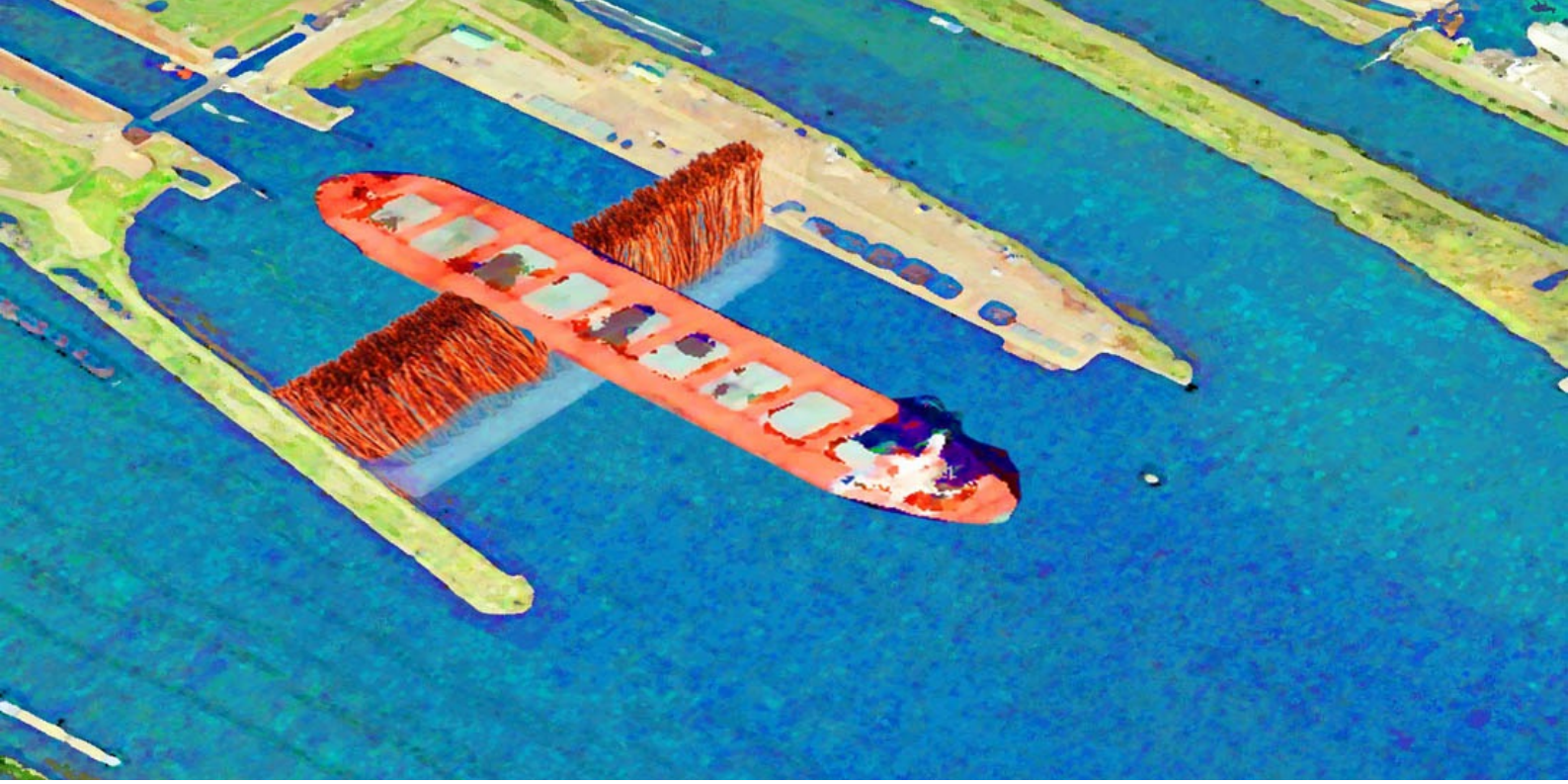
Lock Chamber *vs. Locky Sirens*

Technique *Locky Sirens*



Water & Air *in Locky Sirens*





The vision that revealed Locky Sirens: an upside down broom in the North Sea Canal

3- The Invention

Discovery, construction and operation of Locky Sirens

Albert Einstein:
To know what is possible tomorrow,
you must step outside of what is possible today

Discovery

After Robert had followed Einstein's advice, and after having seen his vision, he spared no effort to shape his revolutionary concept and introduce it into the maritime and nautical world.

Improvements

When compared to a conventional lock, Locky Sirens offers important advantages. For one, it comes at only a third of the price, it takes 4 times less construction time, needs 20 times less building materials such as reinforced concrete, and in actual operation Locky Sirens is capable of transferring even the biggest ships to the required level 15 times faster. A conventional sea-lock causes salinization of the hinterland, **Locky Sirens puts a definitive stop to salinization** (page 18 2.7 Water).
An additional advantage is that Locky Sirens makes sure that ships do not have to wait, greatly reducing the harmful emissions of their idling engines. This is a great advantage for public health.

The elimination of the Lock Chamber

The qualities of the revolutionary lock are shown in various video animations Robert has produced. One of these videos clearly shows the differences between conventional locks and Locky Sirens.

Locky Sirens brings the ship from high to low tide and vice versa in a cleaner and faster way, by means of air fizz.
Air fizz? Yes, bubbles! Air in water is able to raise or lower even the largest container ship by a meter... This is the only function of the lock chamber of a conventional lock system: to raise or lower the ship! Locky Sirens does not need the lock chamber, therefore a second door kit is unnecessary.
What remains as a functional lock is a single set of doors and an air fizz system, together called Locky Sirens. The air fizz system is active at the high water end.

The big question

How is air fizz able to take over the function of the conventional lock chamber? How is it possible that millions of air fizz bubbles can perform the same task as millions of pounds of reinforced concrete?

The secret lies in the density of water. Air fizz is able to reduce the density of the high water in which a ship floats. This also reduces buoyancy capacity of the water, lowering the ship exactly as much as is needed to bring it to the level of the low tide water. Locky Sirens fixes this 3 times cheaper, 15 times faster, and 50 times cleaner than the conventional lock chamber.

Efficiency

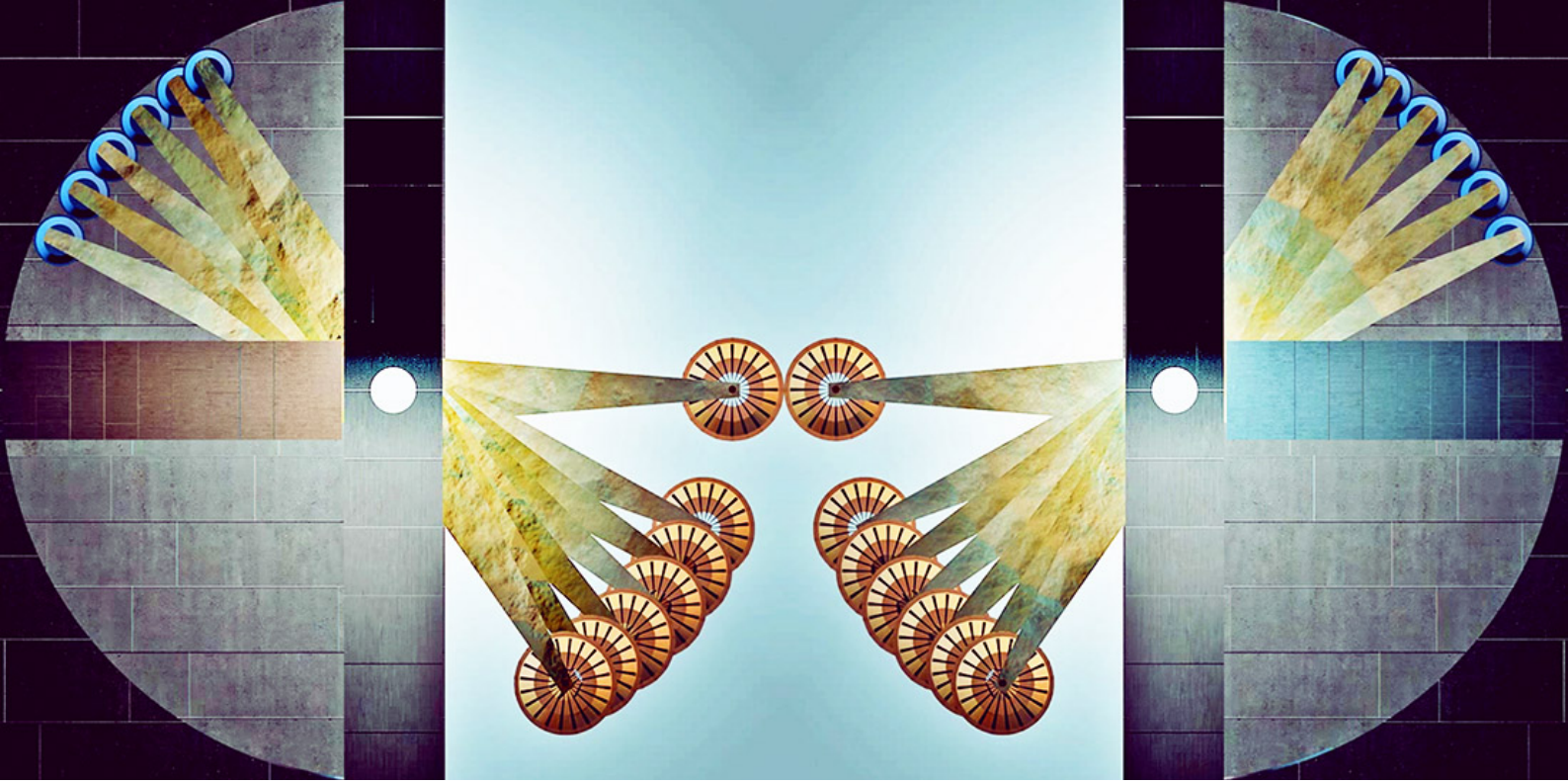
Having to wait for hours: once to get into a port and one to leave, burning fuel to bring the ship to a full stop in the lock, and then burning even more fuel to bring the ship back up to speed, costs a lot of money to a ship-owner.
Only 4 minutes are needed to move a ship through Locky Sirens. 4 minutes, without any deceleration or acceleration. Construction costs and construction time are also much less in Locky Sirens. For a comprehensive price idea of the construction costs, see page 15.

Endless Lock Chamber

The length of the lock chamber of a conventional lock determines the maximum length of a ship. This is a disadvantage of the conventional lock. Locky Sirens has no length limitation because of the lack of a lock chamber. Ships of any length can pass.

Global Implementation- Building into existing lock sites

Locky Sirens can be implemented in any existing lock worldwide, which makes it commercially interesting for companies to build. The new system of the faster and more efficient Locky Sirens takes over the task of the old lock, while both conventional doors remain open, so as not to be an impediment to navigation and transport.



The above illustration shows the top view of an inland water Locky Sirens
Until the year 2035, the Netherlands needs fifty floodgate replacements
This video animation (start watching at 2m 12s) shows how this lock system works

4. Engineering

Locky Sirens is Beauty & Simplicity

In recent years, much research has been done into the phenomenon of 'lock'. There are the concepts of Falkirk sluice, Gel sluice, Tilt sluice and Foldable floodgate.

Locky Sirens is a concept that excels in simplicity and elegance. While the architectural footprint of Locky Sirens measures 20x155 meters, the footprint of the new sea-lock in IJmuiden measures 580x155 meters. The construction time of Locky Sirens is one year, that of the conventional lock is four years. The cost difference amounts up to hundreds of millions of euros.

Parts List of Locky Sirens

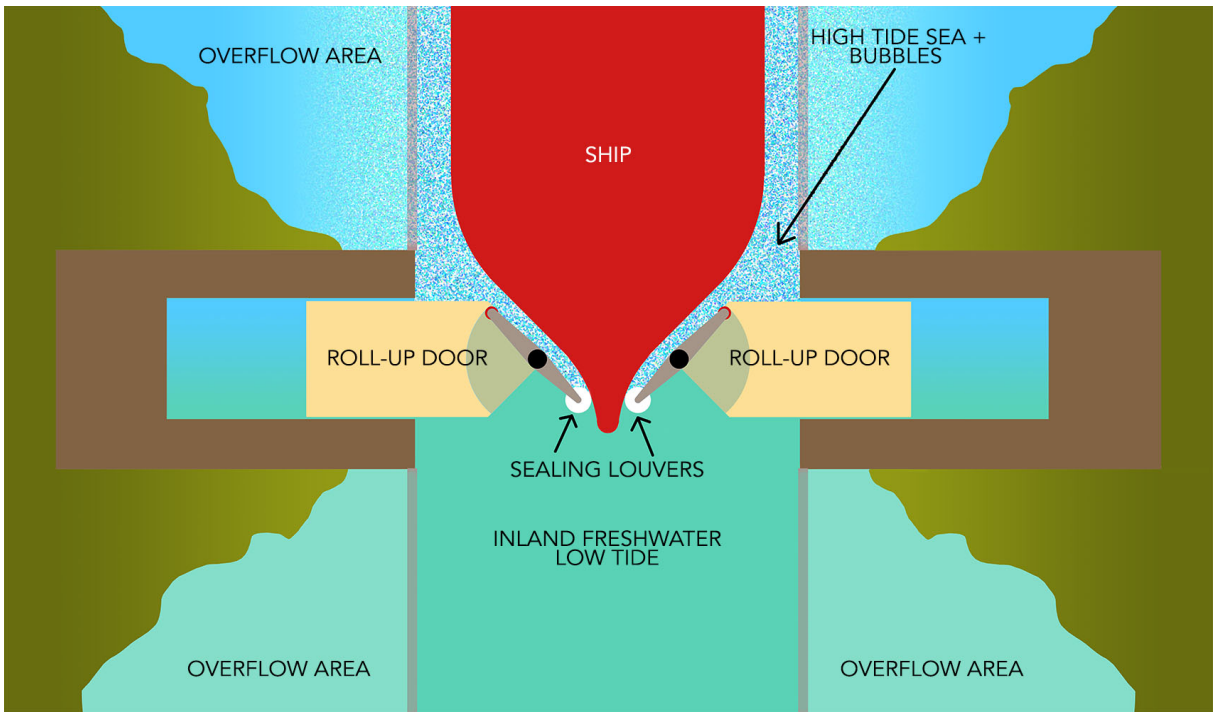
Locky Sirens consists of a door-set with hinged door sealing louvers, air fizz system, air compressors, a door moving control system and sheet pilings on both sides of the waterway. An advanced fender allows ships to pass Locky Sirens safely and quickly.

Sea Lock and Inland water Lock

There is a distinction between sea locks and Locky Sirens inland water locks, as shown in this video animation, and on the images above and below.
The inland water sluice has a simpler structure than the sea-lock. **The sealing louvers of the inland water sluice are attached to a rigid pivot point, while the sealing louvers of the sea-lock are attached to a moving lock-door set.** The function of a sea-lock is to regulate greater high/low tide differences between salt water and fresh inland waters, while the inland sluice deals with fresh inland water on both sides, and usually takes care of a smaller difference in high and low tide. In some river delta areas with low tide differences, Locky Sirens could function even without the air fizz system.

Water Flow Layout

Ships that pass through Locky Sirens approach the lock via a waterway that is lined with sheet-piling, several hundreds of meters long. The water inside this waterway will be supplied with air fizz during the passage of a ship. Situated on both sides of the waterway are overflow areas, into which the excess water - filled with air fizz - will flow (see diagram below).



Schematic representation of a sea lock rolling shutters fitted blinds; see this video and the next

The sheet pilings keep the air fizz around the vessel stable by preventing undesirable swirls in the body of water. In addition, they ensure the water flows back into the waterway only after some time, using of a long detour.
This ensures the air fizz around the vessel remains there for 4 minutes; this is the time a ship needs to pass Locky Sirens. This watermanagement functions most efficiently when mass/inertia of the slowly moving body of water is substantial. (See illustration of mosquito and elephant on page 18)

The lowering of a Ship

The air-filled body of air fizzed water lowers the ship as far as is necessary, to the low water level. This will prevent the ship to fall from a waterfall.
Conversely, when a ship sails from the low water level to the high water level, the floodwater is already equipped with air fizz before the ship sails into it, so that the ship meets a high water that feels equal in mass and density to the water the ship is already in.
This way, air fizz realizes in 4 minutes, where the conventional lock chamber takes a full hour!

Concept

This brochure describes the basics of Locky Sirens, and the concept of its operation. It discusses the sailing trajectory, lined with sheet piling, which amount of air is needed, and the size and shape of the rollers that are attached to the sealing louvers.

New Technology

A new concept as Locky Sirens requires new technology. Our modern technology has produced new materials which by their strength, lightness and resistance to corrosion are excellent for Locky Sirens floodgates and her sealing louvers. Joints that could be implemented in these sealing louvers are already being designed by key engineers in the Netherlands. **Research of the air fizz system is essential** because never before air has been used in this way to replace the lock chamber.

Diffuse Watergate

A detailed description with illustrations of the air fizz system can be found in the chapter titled 'Bubbles Bubbles Bubbles ..." (page 18). The phenomenon of the '**Diffuse Air Fizz Watergate**' is also discussed in this chapter. **The 'Diffuse Air Fiz Watergate' is a body of water, filled with air fizz, that prevents the canal water from flowing into the direction of the water where it would disturb the air fizz effect of sinking the ship partially.**

Watergates

The doors of Locky Sirens are half roll-up doors, touching in the middle of the fairway, and closing the waterway when they do. The doors are made wider than the conventional roll-up door, as they also open and close when there is a water level difference.
The conventional sea-lock roll-up door can only be opened when the water at both ends of the door is at an equal level. The door of Locky Sirens has a broader base, which is additionally weighted with ballast placed on rollers. The rollers ensure that the inertia of the ballast does not stop the smooth movement of the watergate.

Moving Along

At the high water end, the doors are designed slightly askew downwards, preventing head-on collisions of waves. In heavy weather, vertical hinged sealing louvers also act as a shock absorber; **the sealing louvers dampen any abrupt water motion**, the way reed bends with strong winds. Bending prevents breaking or malfunction.

Floodgate Control System

The movement of the sealing louvers may be, in terms of control, self-controlling because the bow of a ship gently pushes against the rubber sealing rollers. **Especially when the stern of a ship passes with its propeller and rudder, doors and sealing louvers are driven by engines**. In this way, contact between the doors provided with sealing louvers, and propeller and rudder, is prevented.

Locky Sirens Price Structure

See next page.

Locky Sirens Price Structure

Price indication of a Locky Sirens sea lock.

Lock Width: 70.0 meters
Depth lock: 18.0 meters
Length: not applicable xx.0 meters (in practice: unlimited)
Biggest Drop: 04.8 meters, at springtide/storm

A version provided with 12 sealing louvers per floodgate, 1.9 m height and 13.5 m length from rash pivot in the floodgate (27 m total length).
This type of Locky Sirens is capable of transporting largest ships, and any future length of ships, for Locky Sirens isn't limited by lock chambers.

The initial costs for research and development will be a fraction of the construction cost of a conventional sea lock.

Amounts in millions:

Watergate Main	€ 30.0	x 02 pieces	€ 60
Watergate excl. sealing louvers	€ 25.0	x 02 pieces	€ 50
Louvers excl. sealing roller	€ 01.0	x 24 pieces	€ 24
Sealing roller 1.9 m x 3 m diam.	€ 00.5	x 24 pieces	€ 12
Control sealing louvers	€ 00.5	x 24 pieces	€ 12
Control floodgates	€ 12.0	x 02 pieces	€ 24
Compressors	€ 00.5	x 10 pieces	€ 05
Air fizz pipes etc.	€ 25.0	x 02 pieces	€ 50
Excavation			€ 33
Other costs (fenders etc.)			€ 25
Total cost (watch from 0m44s) Locky Sirens			€ 295

Costs for an inland water lock (watch from 2m12s), with a 24 meters broad waterway, will be a quarter of the sea-lock version.

Ship approaching the lock at IJmuiden; frame from the video animation

5- Nautical Aspects

Will a ship navigate sufficiently stable in Locky Sirens air fizzed water?

Stable Air Fizz Water

Navigating a ship in Locky Sirens air fizzed water is completely stable. Actually this is what happens: **Ships do not float in air fizzed water, but in water surrounded by air fizzed water.**
The air fizzed water is located in a strip around the ship, not under it! In Locky Sirens, the body of water beneath a ship is very stable and contains no air fizz. The water flows away under the ship in a controlled way, **causing the ship be lowered gently**.
In a conventional lock, draining of water will also take place, but with this great disadvantage that the water flows through a limited number of ports and sewers, which results in swirling and unintentional water movements, upon which the ship reacts by moving itself.

Pleasant Water management

An important aspect of Locky Sirens for the maritime world is that she very efficiently handles the water, in contrast to the conventional lock, where water is passed back and forth in a time-consuming way, and with a lot of turbulence.
Air fizz ensures water around the ship gets a lower density, and according to the laws of physics, is gradually pushed away by the water from below the ship. Locky Sirens transports water only where the operation of a lock makes it necessary: **beneath the ship**!
That water can drain away very gradually and equally, on both sides of the ship, without disturbing the ship or producing swirls.

Smooth Flow

In Locky Sirens draining and inflow of water takes place evenly and very efficiently, across the entire length of the ship. **No turbulence** arises, nor any delay in discharging water, as is the case with the conventional lock chamber.
In the lock chamber of a conventional lock, the water level changes by draining the water through long sewers or floodgate ports. The water makes this long detour, or is only entering on one side of the lock chamber, increasing charge or discharge time, and making swirls in the water in which the ship floats inevitable.

Confidence

Application of Locky Sirens requires a different approach by the lock-managers. Perhaps this brochure may be a first step in providing a sufficiently convincing insight and confidence in the sector, by clearly demonstrating **how Locky Sirens is at least as safe and effective as conventional locks**.

Unmanageable?

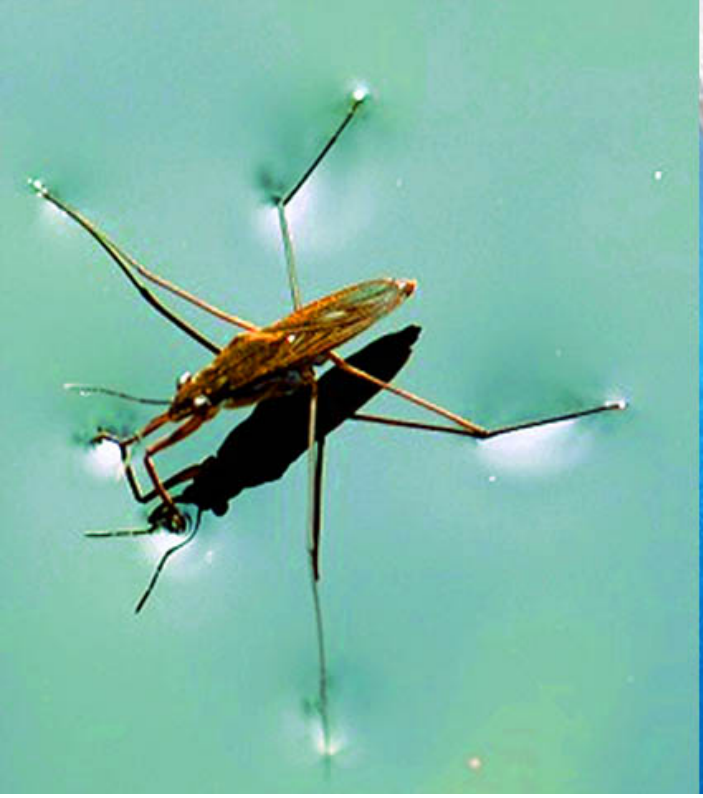
Passing through Locky Sirens has no adverse effect on the navigational capabilities of a ship. Both propeller and the ship's rudder are in plain water, because the air fizz is generated only on the side of the ship. This makes navigating equally safe as navigating in a conventional lock.

Air in Cooling System

How is entering of air from the air fizz system into the cooling systems of engines prevented? The inlet of cooling water of ships is located where air fizzed water does not flow. This makes false air in ship's cooling systems a non-issue.

Keeling over

Will a large vessel keel over, or even capsize, when for example a failure of one of the air compressors creates an unbalanced air fizz supply?
Assuming a vessel experiences a reduced upward pressure by the effect of the air fizzed water of less than 10 percent in comparison with ordinary water, and an air fizz system is constructed in such a way that only a very slight inequality will be possible between port and starboard, **a ship will only tilt up to 0.2 of arc degrees**. Just to get an idea of 15 arc degrees, watch this video (2m50s)...
This means that a large ship of 50 meters width will be 3 inches deeper in the water on the starboard side, and 3 inches higher on the port side. However, thanks to an ingenious system, the air fizz on both sides of the fairway will always be completely identical in its effect.



A toy boat does not sink by air fizz, an ore carrier does, as mosquito and elephant above show the same reaction

6- Bubbles Bubbles Bubbles...

Details of the air fizz system
Actually, can enough air fizz be generated?

Deep Breathing

How much air, in the form of air fizz, is needed to transport a 300 meter long ship in Locky Sirens at high tide, when the difference in the tide measures 1.50 meters? (the difference between high and low tide in the sea lock at IJmuiden). A calculation follows below.

Rise Speed Bubbles

The Flemish Marine Institute (VLIZ) drew up a table (see in the docx file, downloadable from the link on page 5) which shows that the average rising speed of air fizz is 27 cm per second.
If we want to provide sufficient air fizz in the waterway during 240 seconds - the time a ship needs to pass Locky Sirens - we will need a water column of air fizz which is equal to the amount the air fizz travels in 240 seconds. In 240 seconds, air fizz travels a distance of 64.8 meters (27cm x 240 s).

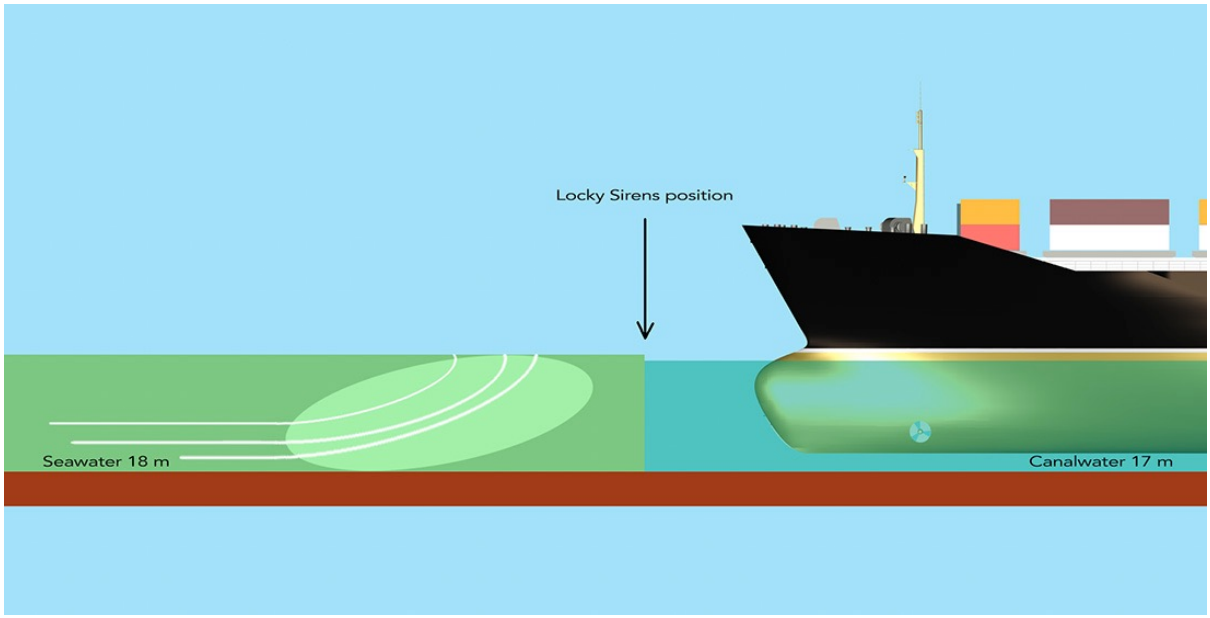
Air fizz 10 Percent

To calculate how many cubic meters of air we need in total during the passage of one ship, we imagine a column of water of 64.8 meters filled with 10 volume percent of air. So we need a quantity of air of 6.48 meters high, with a width and length yet to be determined. **With this percentage, a ship sinks 10 percent, which for a ship with 14 meters of water depth means lowering the ship by about 1.40 meters, which is the height difference with which we need to lower the ship** to prevent a ship an undesirable waterfall-like jump at high tide. We will discuss the amount of air fizz in more detail at a later stage. Right now we will discuss the water zones that Locky Sirens needs to transport vessels efficiently.

Three Air fizz Zones

Locky Sirens works with three separate air fizz zones, as shown in the illustration on this page and the next.

The largest air fizz zone covers the full width of the waterway, with a length of 30 meters, a width of 70 meters and a depth of 18 meters. **It acts as a 'Diffuse Air Fizz Watergate'** (see below) as well as effervescent water with a reduced density and hydrostatic pressure. In the illustration, the air fizz zone is shown as a light green oval. The way through the water is the trajectory as shown in this video animation.



This picture shows what the 'Diffuse Air Fizz Watergate' looks like (the light green oval)

Two elongated air fizz zones are located between sheet-pile wall and ship, running along the full length of the ship, as shown in the schematic cross-sectional representation on the following page.

Mighty Air (Mighty Air, title of the scene in the video animation)

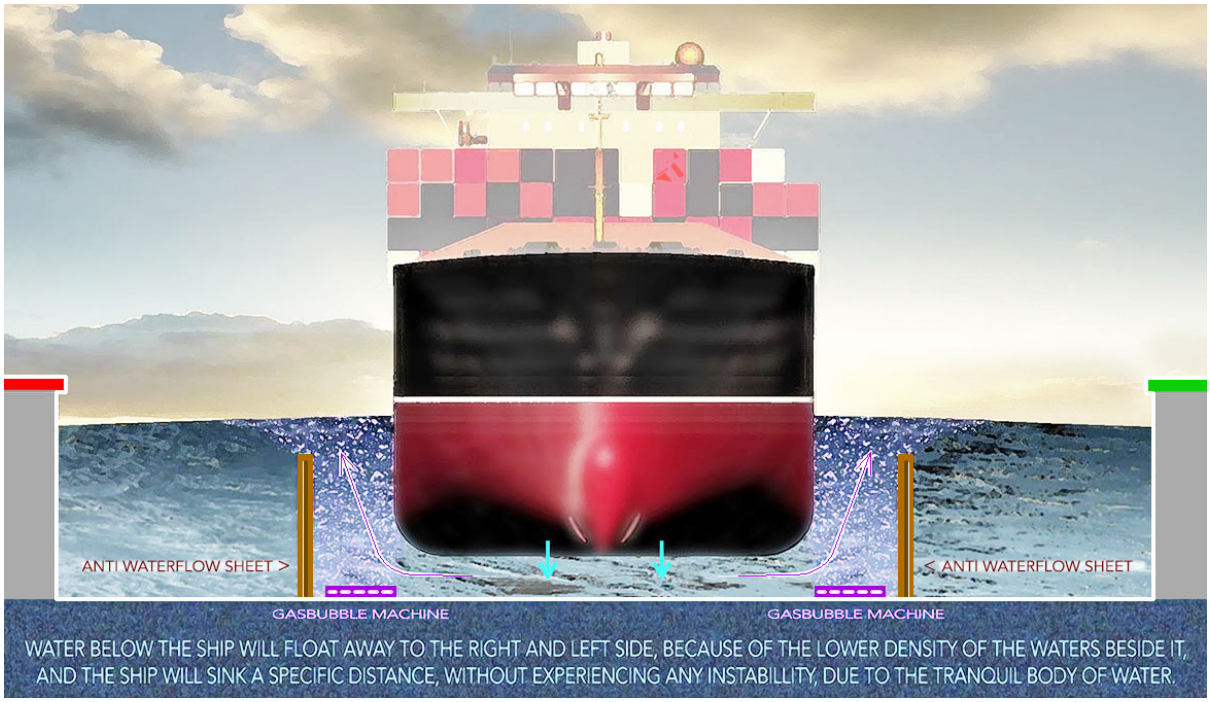
The air fizz of the first zone, that of the so-called '**Diffuse Air Fizz Watergate**', is blown in from the bottom of the waterway. The air fizz on both sides of the ship is blown from a few meters below the surface. Only the top few meters of this water need a reduced density, in order to achieve the desired negative buoyancy.

The water under the boat is not supplied with air fizz. This water indeed carries the ship, but will naturally flow out along the sides of the ship and waterway, when thanks to air fizz, the hydrostatic pressure of the surrounding water is reduced.

The surrounding air fizzed water, forced by the law of communicating vessels, has no power to stay where it is, because it is displaced by the ordinary water that moves into the overflow areas on both sides of the fairway. This ordinary water includes water that is pushed away from under the ship, causing the ship to be lowered.

Moving Air-bubble Zone

To keep the momentum going, an air fizzed water body is needed that moves along with the ship, and keeps its position relative to the stern or the bow of the ship for a few minutes, depending on the direction of the ship: towards high tide or low tide water. The function of this air fizzed zone is twofold:



(1) When the ship sails from low tide into the high tide water, it will refuse to sail against a massive wall of water at the position where the ship's bow meets the high water, but will not resist water which is of a lighter density, which presents characteristics equal to low tide water, in which the ship is sailing.

(2) The function of the air fizz zone is to form a barrier, a kind of diffuse floodgate, which prevents the fizzed water at the high tide side to be replaced by the water of the fairway. Actually, this body of air fizzed water, which has a length of 30 meters and a width of 70 meters, acts as a second floodgate. Not a floodgate of steel, wood or modern concrete, but consisting of water, which is moved upward by the air fizz.
The water in the fairway which, moving in the direction of the lighter combination of water and air, in accordance with the law of communicating vessels (because this lighter water will give way to heavier fairway water), will be only partially succeed in displacing the lighter water and set aside to drive away. By the time the water from the waterway has replaced the fizzy water completely, this water itself will have been transformed into fizzy water by the constant supply of air fizz from the waterway bottom, and will itself be forced upwards and then sidewards into the water-overflow area along the fairway!

Diffuse Floodgate

The principle of the '**Diffuse Air Fizz Watergate**', is that canal water will continuously try to take over the position of the diffuse floodgate, but while doing so it is itself transformed into air fizzed water. Water, flowing across an area in which air fizz is blowing in from the bottom, will inevitably be filled with air fizz, and thus is no longer capable of pushing away air fizzed water which is at a short distance, because of its decrease in density. The 'lighter bodies of water' that are created in this way will also lower the ship lightly.
The principle through which the air fizzed water is not pushed away by the canal-water, is also founded in the inertia of the water system. The essential '**Diffuse Air Fizz Watergate**' function - preventing the canal water from reaching the air fizzed water in which the ship is lowered - finds itself in the transformation of lateral pressure to an upward pressure movement. The final upward pressure is based on the powerful insufflation of sufficient air fizz.

For a visualization of the organic combination of forces, let's do a thought experiment:
Imagine, the air fizz would be blown in from the bottom into the water with such power that this 'storm' blows away the water completely; what would the system do? The canal-water would constantly flow into the air fizz hole with its much lower density, but it will immediately be blown away by the stormy air fizz. The core functioning of the Diffuse Floodgate is the blowing away of the approaching flow of canal-water. When we reduce the exaggerated proportions of the thought experiment down to the real life situation, we see that the constant insufflation of air fizz from the bottom of the waterway moves oncoming canal-water upwards, and makes it flow away into the sides of the water-overflow area. The hydrostatic pressure of the water against the lighter air fizzed water is, as it were, bent upwards, and then disappears in a constant progression alongside the waterway. The air fizzed water in which the ship goes to a somewhat lower depth is capable, by this '**Diffuse Air Fizz Watergate**', to perpetuate the lowering effect for at least **4 minutes, the time a big ship needs for a transition in Locky Sirens**.

Pressure

As mentioned above, the Locky Sirens '**Diffuse Air Fizz Watergate**' actually exists in the form of a steady upward air fizz-provided water body, which moves away laterally. The content of this body of water is 37,800 cubic meters, of which 10 percent must be air fizz. This equates to a total air fizz volume of 3,780 cubic meters.
This air fizz must be active for 240 seconds, ensuring a ship to be lowered by 1.40 meters because of the reduced density, during its 4-minute passage. **Because air fizz in water rises at a velocity of about 27 cm per second, and the water level in the fairway at IJmuiden is 18 meters, the air fizz will reach the water surface and disappear in the air after 67 seconds. To achieve the required percentage of air fizz in the water during 240 seconds, the air fizz quantity has to be blown in about 3.6 times (240/67)**. This represents a total volume of air fizz of 13.745 cubic meters for a transition of a large ship in 4 minutes.
The pressure at 18 meters water depth is 1.8 bar. An air bubble entered at a depth of 18 meters will have twice its original volume when it has traveled half of the distance upward. At a depth of 9 meters, only 0.9 bar of pressure remains. In this calculation we can therefore assume an average air fizz pressure of 0.9 bar. A calculation shows that this is equivalent to 952 cubic meters of air compressed at 13 bar. The air fizz needed to start-up the air fizzed field is disregarded here. However, the energy to start up the air fizzed field must be increased by a quarter.

Compressor

A compressor with an output of 125 hp/90 kW delivers 12 cubic meters of air fizz per minute at 13 bar. This compressor will need 80 minutes to provide sufficient air fizz for a ship which needs to be lowered by 1.50 meters.
When using storage tanks, enough air fizz could be stored by one compressor. When Locky Sirens should have to transport three ships every hour, 4 or 5 compressors must be used. The current number of daily ships transitions is for the large sea-lock in IJmuiden only 15. Multiple compressors will ensure continuity of the air fizz system.

Reliability

So, one compressor can transport a ship in Locky Sirens in 80 minutes at a low/high tide difference of 1.50 meters, which is the average maximum flood height at IJmuiden. For reasons of operational reliability, several compressors must be installed. Assuming the installation of 10 units, Locky Sirens can transport a ship every 8 minutes (even if the high tide would constantly be 1.5 meters!), which would mean 65,700 large ships annually. The current large sea-lock at IJmuiden yearly has 5310 ships

transitions (page 73). The planned new conventional type of sluice has a maximum annual capacity of 8,760 ships. Locky Sirens can therefore handle the growth of shipping in the future with great ease.
If Locky Sirens would be used in the newly built version of the Panama Canal, in Nicaragua, this would greatly facilitate the flow of maritime traffic. It would also be very beneficial to the drinking water facilities in this country.

Energy Costs

The above calculations are based on a low/high tide difference of 150 cm, but on average the high/low tide difference is only about 60 centimeters. See the chart below. The power consumption of the air fizz system may be lowered accordingly.

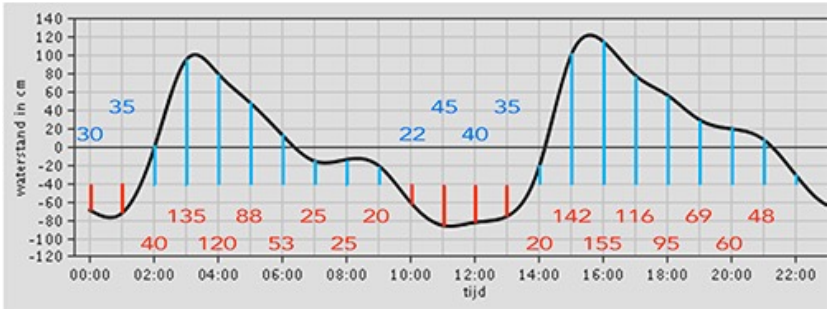
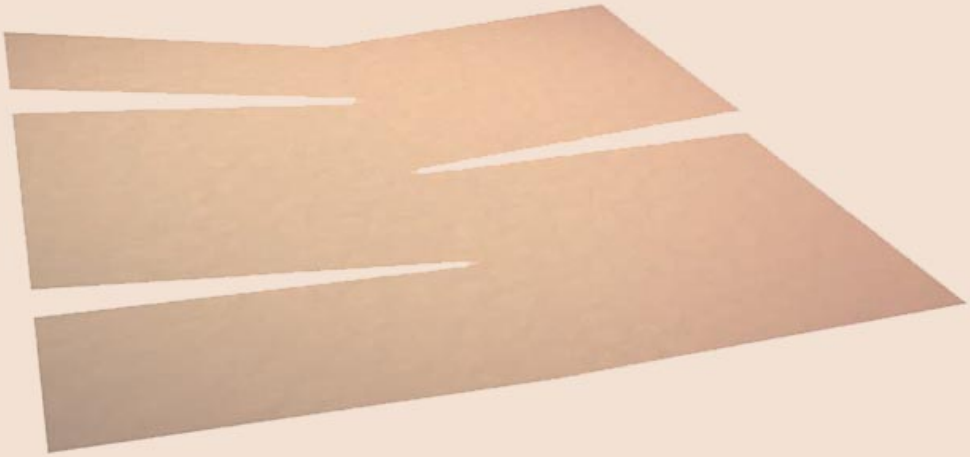


Diagram of water levels at the lock of IJmuiden

The energy costs at the highest low/high tide difference will be € 27,- per ships transition, and € 10.75 at an average low/high tide difference.
The energy costs involved in the air fizz generation in the lateral zones over the entire length of a ship will amount to approximately € 5.80, because of the lesser pressure requirements. The total cost for generating an average ship transition will be € 16.55. (+ one-quarter start-up costs)

These costs will be lower if ships are transported at a small low/high tide difference, without using the air fizz system! If bubbles rise more slowly in salt water than in freshwater, the energy consumption could turn out to be even less. Furthermore it is most probably that the bubbles, in such an immense field of billions of them, will slow each other down, resulting in an overall slower rising of them, thus lowering the energy costs.



CURIOUS 'HOW IT'S MADE'?

Scale model of a folded paper house, as seen in the introduction video animation on Beauty & Simplicity

7- FAQ

Frequently Asked Questions and their Answers

Besides inspiring questions that Robert was asked about the functioning of Locky Sirens, a dose of healthy skepticism towards the concept was expressed.

In the publication in NRC Handelsblad, June 7, 2014 (see page 6 of this brochure) on Locky Sirens, where Prof. Han Vrijling, emeritus professor of engineering at TU Delft, and Otto Weiler, an expert/ Advisor coastal works at Deltares, the research institute for water, soil and infrastructure, expresses clear skepticism about aspects of the Locky Sirens concept:

'A ship in a Locky Sirens lock will not be able to sail stably, because the swirl of the air fizzed water will make the ship drift off and makes navigating impossible; cooling systems of the ships engines will sustain damage at the air penetrating the air effervescence system, and actually, the air effervescence system will not work at all, because the air fizz in the water in which the ship floats will flow more upward, nullifying the sinking effect the water with less density would have on the ship. '

The following pages contain a detailed description which, among other things, explains how ships in Locky Sirens can navigate perfectly, how effervescent air does nót get into the cooling system of ships engines, and why the air fizz system dóes work!

Additionally, a list of frequently asked questions (FAQs) and expressed skepticism about the revolutionary lock system, and of course answers and explanations. Some answers to questions have already been (partly) provided elsewhere in this brochure.

1- EIA Results

Question: What does the the EIA (Environmental Impact Assessment) say about the effects on the environment that the projected large sea-lock in IJmuiden will have? The chapter *'Accountability to the environment'* reports that *"The current IJmond environment already takes a relatively heavy*

environmental toll, and air quality is moderate. Through the use of the new sea-lock, the environmental impact will increase. An important conclusion in the EIA is that with the construction and use of the sea-lock, all legal requirements will continue to be met, provided that we take measures for the so-called Natura 2000 areas and the water quality of the North Sea Canal *(p. 9, 10).*'
Answer: It is hoped that modern engines of larger ships sailing through the locks of IJmuiden will cause less emission of pollutants in the near future. For the present, however, it seems realistic to assume that larger engines will expel larger amounts of COx, SOx, NOx, hydrocarbons, PAKs and other micro-pollutants into the environment. Around IJmuiden, the environment is already polluted by production emissions of Tata Steel.
In addition, the newly planned lock causes almost twice as much salt to flow into the hinterland (in a flood transition at the current large lock at IJmuiden, 50x400x1,5 meter = 30,000 cubic meters of seawater flow into the North Sea Canal, whereas the planned new large lock will increase this to 70x545x1,5 meters = 57,225 cubic meters of salted water. The amount of sea salt carried by the water that flows into the North Sea Canal equals 50 truckloads of 30 tons , for every ships passage!

2- Prevention rather than Remedy

Question: What would the situation look like when Locky Sirens was built instead of the planned conventional large sea-lock at IJmuiden?
Answer: Locky Sirens allows even the largest vessels to pass the lock within 4 minutes. The emissions from ships engines would be greatly reduced because ships wouldn't stay for more than an hour with engines running while waiting.
Through the application of Locky Sirens, the salt inflow would only be 2 to 3 percent, compared to the salinization the current sea-lock at IJmuiden causes. The new larger sea-lock will even increase the salinization up to 190 percent of the current amount! Another emission reduction results from the fact that Locky Sirens requires millions of kilos less of concrete and rebar. The reduction in the production of these materials elsewhere in the world will lead to a major reduction of emissions. This means substantial savings on the environment, as well as material and finances.

3- Proven Techniques

Question: Why is there so much striving for a healthier environment by, for example, 'IJmond Environment Dialogue' (but no real answers or solutions are forthcoming), if the problems they want to solve will be completely solved by building Locky Sirens?
Answer: Locky Sirens is still in its development stage, and needs further development and research. If thorough R&D would be committed to the techniques used by Locky Sirens over the next two years, the construction of Locky Sirens would still start at a relatively early date. Because of the short construction period of the concept, **this revolutionary sea-lock would be ready at an earlier date than the planned conventional lock at IJmuiden**!

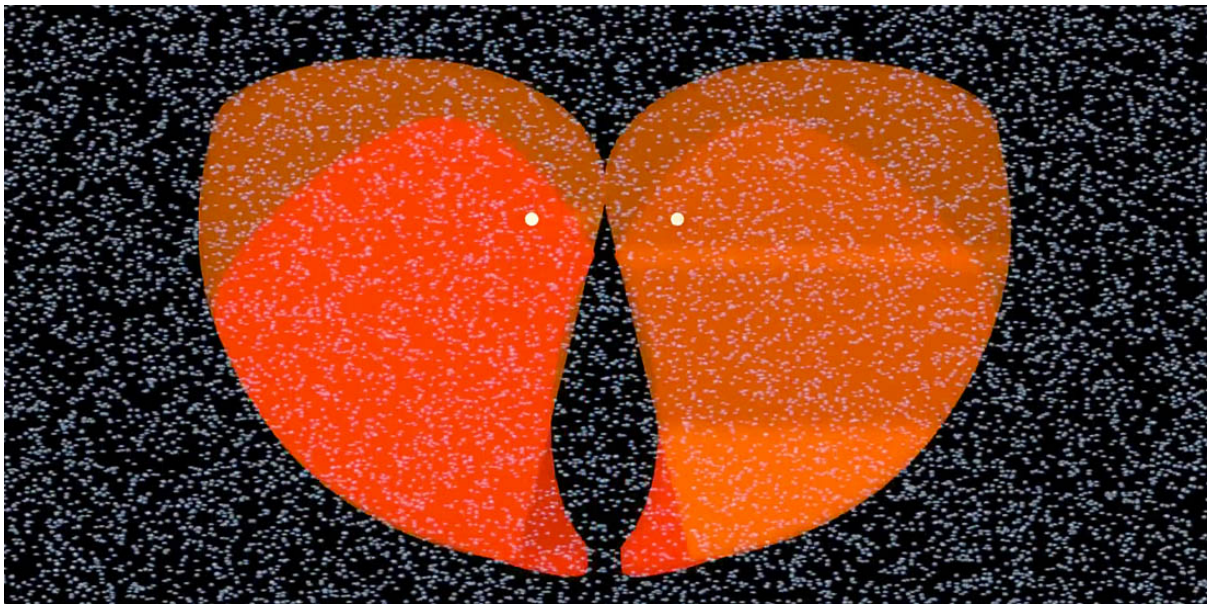
4- Collision

Question: A collision of a ship with a floodgate, especially one of sea-lock and a large container ship, can be disastrous. The damage is enormous and the repair-time unacceptable. The lock could be out of order for weeks or even for months. During repair time, ships that are dependent on the waterway are unable to reach their destinations. Locky Sirens seems an extremely sensitive system in case of collisions because of her fragile sealing louvers.
Answer: **Locky Sirens is immune to such disasters and is flexible in collisions!** When a large ship is accidentally bumping into Locky Sirens, the sealing louvers of the doors will easily move along on the moment of first impact, and next the doors, in which the sealing louvers are located, will immediately give way to the incoming ship. The damage to ship and floodgate will therefore be close to zero, not affecting shipping and their destinations in the hinterland in any negative way.

5- Spring Tide combined with Storm

Question: Are the sealing louver doors of lock Locky Sirens not extremely vulnerable during spring tide and stormy weather?

Answer: At spring tide, and at any time when flood water is pounding against the floodgate, Locky Sirens has the ability to dampen the high waves with the sealing louvers, by moving along with turbulent water. Moreover, the flood water side of the floodgate is constructed (tilted, like a seawall) in such a way that the kinetic energy of the crashing water goes upwards instead of straight against the floodgate, and the door will be pushed firmly into its foundation.



Variant (watch from 5m37s) of Locky Sirens sealing louvers in the form of a heart or lungs

6- Cheap Breeze

Question: Doesn't it take a huge amount of energy to generate enough air fizz water, and maintaining this throughout the passage of a large ship?

Answer: A calculation showing that the energy required to generate the required air fizz is limited to € 16.55 per average transition is shown on another page in this brochure. Among other things, this has to do with the ingenious form of the air fizz water bodies.

7- Sturdy Couple

Question: Can an existing conventional lock easily be merged with the Locky Sirens system?

Answer: **Yes, Locky Sirens can be implemented virtually in every lock, worldwide**. By this update the conventional lock will then function as a real Locky Sirens, with all the benefits that flow from it!

8- Straight Ahead

Question: Do the normative ships have the required power to sail in from the low tide at time of flood?

Answer: The high tide reaches one and a half meter above the low tide, leading one to think that a ship will experience problems entering the high water. However, the density of this high water is - by the insufflation of air fizz - reduced exactly to the extent that a ship sailing into this water experiences the same pressure, the same buoyancy, and a the same resistance as it experiences in the low tide in which the ship is actually navigating. After the command "steady as she goes" the ship will actually sail forward, and not be held back by the differences in tide.

9- Flood Defense

Question: A sea lock has two functions: (1) providing passages to ships, and (2) to protect the country against the sea. How will Locky Sirens perform these important tasks?
Answer: How Locky Sirens takes care of a ships passage has been explained extensively in this brochure. Legally, Locky Sirens is bound to have a backup system in the form of a second door. This door is in use when Locky Sirens is temporarily out of commission, for maintenance and repairs. The additional door should be there in case of a heavy storm. In situations where Locky Sirens will be dealing with very large differences in high and low tide, a second Locky Sirens could be installed in the waterway, working in tandem with the first one. As Locky Sirens is cheap, when compared to a conventional lock, the financial consequences will be small enough in comparison.

10- Unsalted Water

Question: How does Locky Sirens prevent salinization of inland waters?
Answer: An important aspect of a sea wall is the separation of salt and fresh water. When a salt-tongue is reaching too far into the hinterland, it has a major impact on agriculture and drinking water. **Especially farmers who grow crops and need water in the dry season, cannot use salted water to irrigate their crops.** Locky Sirens functions with floodgates that form an almost watertight seal, even when transporting vessels, preventing the salty sea water to flow into the fresh inland water.

11- Aggressive salt and maintenance

Question: Seawater is an aggressive medium, in which you want no hinged sealing louvers (see skepticism NRC Handelsblad of 7 June 2014 - copy in this brochure on page 6.) "During storm conditions, the closed floodgates at IJmuiden have to resist a high tide of up to five meters (1). This requires extremely strong, high doors where niceties such as sensor-controlled sealing louvers cannot be a practical solution (2). Apart from that, you also want to minimize moving parts (3), because in a salty environment all things tend to rust away, so maintenance costs are high. You could, of course, install a movable barrier or lock door (4), sacrificing your cost advantage."
Answer: (1) In the case of water heights reaching 5 meters, the storm barrier must be in position. No lock, not even a conventional lock, will transports ships at such water heights. Locky Sirens does have a floodgate construction that will divert waves, and the sealing louvers will still dampen the waves by moving with sizeable waves. Still, as stated above, water levels of five meters high always require a storm barrier.

(2) As noted, at times of 5 meter high tides, all types of floodgates should remain closed, including conventional locks. This invalidates the argument that in extreme water conditions, movable sealing louvers would not satisfy. Moreover, the Locky Sirens sealing louvers are no subtleties, but intelligent and strong engineering constructions, that stand up to turbulent flood water in the way fragile reeds are braving a storm. They bend but do not break.

(3) Saltwater is a fierce and aggressive medium. It is not friendly to materials that are exposed to it. Our modern technology, however, is able to create materials and structures that are resistant to a salty environment. If old-fashioned wheels of conventional roll-up doors are already capable to carry out their heavy duties for many years on end, for the hinged Locky Sirens sealing louvers it will be quite easy to pivot on the bottom of a conventional lock for a long period of time without any problem. Moreover, we could introduce a new way of maintenance of the sealing louvers of Locky Sirens, by building a completely removable sealing louvers cartridge, a kind of cassette which could be reduce the maintenance operation to a few hours.

(4) The additional floodgate or storm barrier does not take away the cost advantage benefit. Locky Sirens costs only 30 percent of the conventional lock, and an additional storm barrier takes 15 percent, and so the cost advantage is still more than half of the cost of a conventional lock. **In practice, this means that an amount of 300 to 400 million euros could be saved when building the new sea-lock at IJmuiden!**

12- Won't ships break?

Question: Isn't there a risk that a large ship will break in two when it is halfway through the lock?
Answer: As seen in this video of a ship in high seas, a ship is capable of withstanding very high bending forces, such as those caused by ten meters high waves. Compared to the high seas that long ore carriers often experience on the oceans, the maximum decline of 1.5 meters in Locky Sirens is in no way a problem.

13- Sucking Waters

Question: When navigating close to an object, there will be a suction effect between the object and the ship's hull. This is similar to holding a lid just over the hole in the sink with your hand. The lid will be sucked into the drain. Will this effect not occur at the sideboards and at the bottom of a vessel when it passes Locky Sirens? Will this effect not adversely affect the stability of the sailing direction of the vessel?
Answer: This effect will not occur, because in Locky Sirens there will be no substantial flow of water along the ship's hull or bottom. Moreover, the effect of the sink stopper can be discarded, because the hydrostatic pressure in both waters, high tide and low tide water, is more or less equal, especially near to the bottom of the water. This is because the water is provided with a high percentage of air fizz, which determines the density and thus reduces the weight of the water column, and hence reduces the hydrostatic pressure. Therefore, course obstructing aspects are of no relevance, as already indicated in the chapter on bubbles.

14- Other applications of Locky Sirens

Question: How many different applications does Locky Sirens have in the area of locks and efficient waterway management?
Answer: The concept can be used in sea-locks and in freshwater locks. The air fizz system is used in both applications. But the concept can also be used in low tide level differences, as in the many river deltas worldwide. When there is only a slight tidal difference, Locky Sirens can function without air fizz system. Locky Sirens can be implemented in existing conventional locks. **Locky Sirens can also be used in areas where locks threaten the reserves of freshwater and drinking water supplies.** In these areas, Locky Sirens prevents precious drinking water from flowing into the oceans. For example, the planned locks in Nicaragua, or those in Panama, which may lead to substantial

ecological problems in both regions. Finally, Locky Sirens can be used in situations where a lock will offer a small adjustable passage for migrating fish. A six week measurement showed that about 50 tonnes of fish from the North Sea migrated into the North Sea Canal.

15- Stormy Transitions

Question: Does Locky Sirens dispose of additional techniques to transport a ship as safely as possible, even in stormy weather?
Answer: Locky Sirens can be equipped with large swivel rubber wheels in the fender, making it easy for a ship to maintain its track while passing Locky Sirens. These guides are like guardrails along the highway. Locky Sirens floodgates adjust themselves automatically to the position of passing ships in the waterway. When a ship is moving sideways, so it would leave the middle of the water, the sonar sensors will register this and send signals to move the doors exactly in position, exactly at the middle of the doors.

16- Safe, even in a storm

Question: When a ship passes Locky Sirens during heavy storms, will it not tilt over due to the air fizz system?
Answer: Not at all, on the contrary! In heavy storms, Locky Sirens will transport a ship more safely than a conventional lock can do. By blowing extra air fizz to the ship's side where the storm exerts pressure, Locky Sirens is able to compensate any tilt by reducing the buoyancy of the water on the storm side, keeping the ship perfectly leveled.

17- Proven Techniques

Question: Is Locky Sirens capable yet to build a sea-lock?
Answer: Sea-locks may only be built with techniques and materials that have proven their reliability and performance in the past. **As soon as Locky Sirens has acquired this status, she can safely operate worldwide as sea-lock.**

18- Liability and security

Question: Is there an extra security risk during a ship's transition in Locky Sirens?
Answer: **When compared to conventional locks, Locky Sirens is just as safe, if not even safer**. A conventional lock has the disadvantages of the long after-effects of swirling masses of water in the lock chamber, the waiting time of an hour, the necessity to dock at a hardwood decking, and the time-consuming masting and unmasting procedure. One would rather avoid these actions and interventions altogether.
In these respects, Locky Sirens is friendly towards ships and their owners. A ship passes in perfectly still water, there is no tendency to drift or change course, as it is led by rubber wheel guides, almost massaging the ship into the right direction. There is no fastening and undoing of anchor ropes, because the ship passes Locky Sirens without the need of mooring.

19- Unstable because of "false" air?

Question: Will the air fizz system make the ship unstable or cause disruptions in the cooling system of the engines?
Answer: No, the air fizz system is not operating directly underneath the ship, but only at the front or stern, and on both sides of the hull. This will not cause any instability of the vessel at all. Compared to conventional locks, the ship sails in the exact same water conditions. The reason that no "false air" will penetrate into the cooling systems of the engines is that there is no air at the side of the ship which can be sucked into the cooling system. Moreover, marine engines are now cooled through a heat exchanger system.

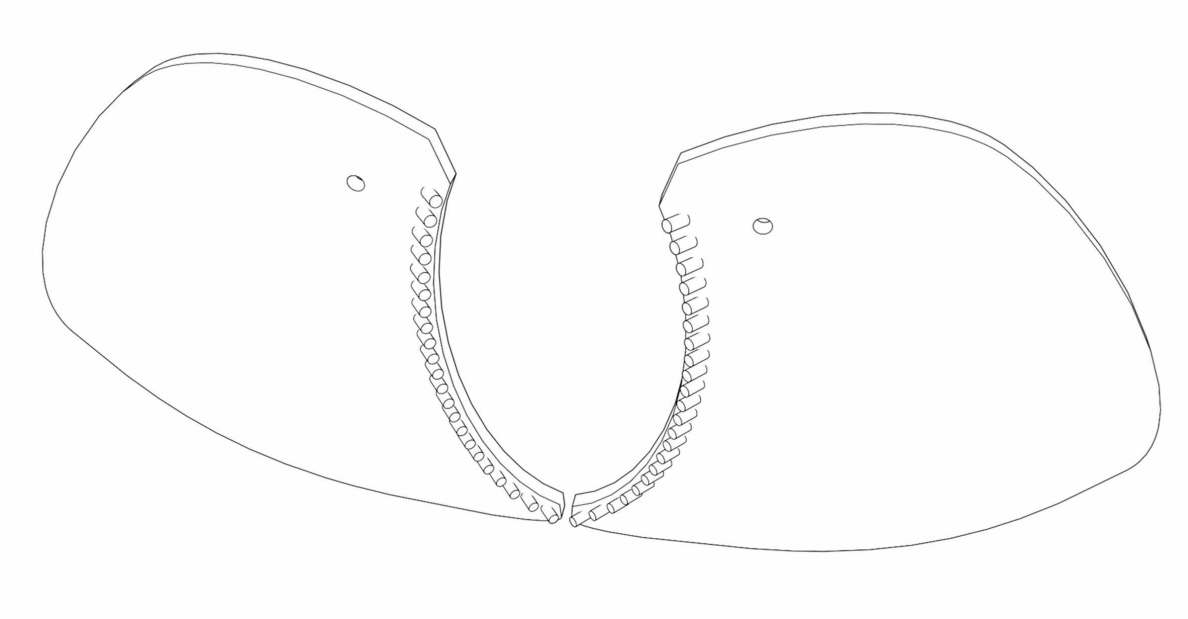
20- Water Cannons

Question: What if the hinged sealing louvers are caught in a propeller, would there not be huge damage to the ship and the sealing louvers?

Answer: Locky Sirens floodgates and sealing louvers are triple protected with sonar sensors that ensure a collision with a propeller or other protrusions on the ship, such as a stability-fin, will never happen. Most ships are sailing with their propellers and rudder deep below the water surface, where there is no height difference and no water flowing, so that propeller and rudder will not be in contact with the door.

Because of the lower density of the high water (caused by the air fizz system), water will hardly be flowing from the high level to the low level, except for the upper half of the high water. Therefore, there is no need to completely shut down the sealing louvers from 3 to 4 meters deep. In the upper part of the water, the sealing louvers can already be closed as much as the proximity of the ship's propellers permit, so that water will not start flowing at a height difference of one and a half meters between both tides.

An additional barrier to stop water streams may consist of powerful water cannons which are installed on the sealing louvers. The water cannons will slow down the falling water.



Sealing louvers concept includes water cannons surrounding the passage opening

21- Is the air fizz system always necessary?

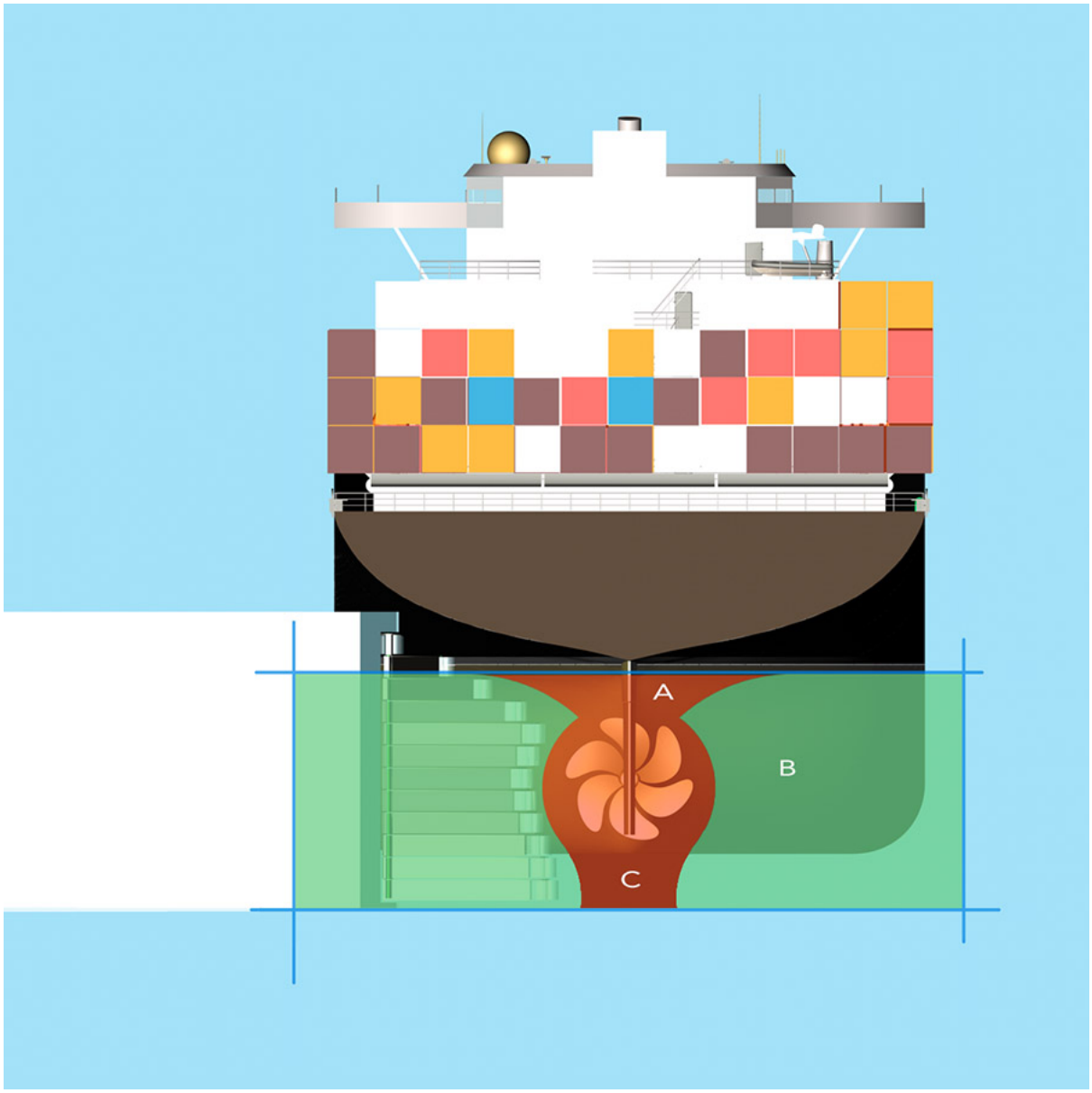
Question: Will Locky Sirens only function with an air fizz system activated, or is it also possible to transport ships without the action of this system?

Answer: **In small tidal differences ships are able to navigate from high to low tide**, says Otto Weiler, Deltares (publication NRC Handelsblad – see also page 6 in this brochure.) Conversely, navigating from low tide to high tide is limited in its possibilities. Especially with larger differences in water height the air fizz system is indispensable. Moving from high water to low water without using the air fizz system will save energy.

22- Stern Backlash

Question: When the stern of a large vessel passes Locky Sirens, there is a temporary situation in which no complete sealing takes place by means of the sealing louvers. How is a strong flow of water prevented in this situation?

Answer: The illustration shows that only a small portion of the waterway is not closed at the place where the propeller and the rudder of the ship are passing (orange-colored part).
The orange area at 'A' is the position where Locky Sirens sealing louvers do not completely close the waterway. At this position, it may be useful to install water cannons when the tidal difference measures about a meter, reducing the waterfall effect.
At position 'C' in the orange area, the waterway is not completely closed, but at this area perfect sealing is not very important. There is a more or less equal hydrostatic pressure of high and low tide waters at this position: high water has a minimized density by air fizz, making both water bodies approximately equal in terms of hydrostatic pressure at the position at 'C'. This means that even with an aperture, no water will start to flow.
The green area marked with 'B' shows the breadth and depth of the waterway. This area is completely sealed off by Locky Sirens sealing louvers and floodgates.

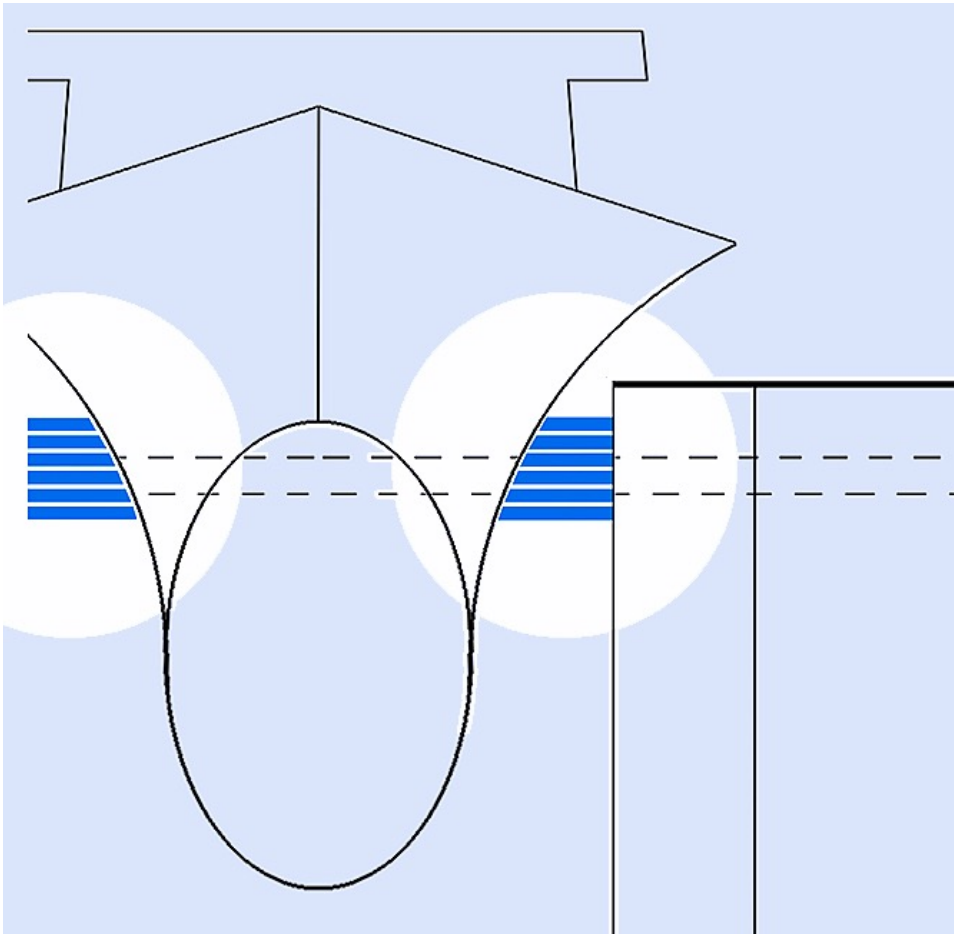


Sealing louvers in the green area keep away (watch from 1m18s) of ship's propeller and rudder

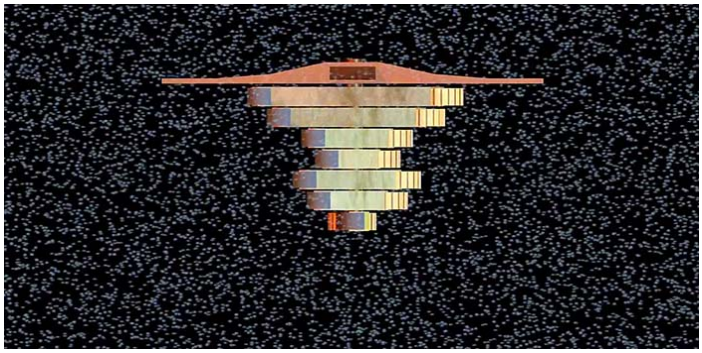
When a ship is carrying no cargo, it floats at a higher level in the water, and the propeller will rise above the water level. Driven by triple-installed sonar sensors, the sealing louvers will be

kept at a safe distance and water cannons will take over the sealing off-task. In such cases, the gap in the closure is about 4 to 6 percent.

Another concept of sealing louvers is depicted in the figure below. Sliding sealing louvers (in blue) are used in order to seal off the space between the ship's hull and Locky Sirens. Sliding sealing louvers have the advantage that they hardly need water to move away when they change position. They are, literally, easy to move. Of course, these sealing louvers may also be fitted with sealing rollers, as shown on the rotating sealing louvers.



Sealing louvers variant. This design displaces just a small amount of water, benefitting the manoeuverability



8- Resources

Consulted Resources

Bulbous bow
North Sea study
Sea entrances Gent Terneuzen study
Study Sea Lock Variants Terneuzen/Gent
Nautical News Scheldt area no July 20, 2012
Salinization aspects
Blue Energy
Deltares study about Blue Energy - osmosis pressure principle
First Inventor Sea Lock
Deltares Lock Fill Course
Bootjesgek
Waterways Summary
New sea-lock IJmuiden
NRC Handelsblad
Yearview Locky Sirens
PCT Patent Status
Albert Einstein
Report Salinization
Environmental Impact Assessment
How Clean is the Nautical world
Biggest Container Ship
Capacity Analysis Inland Schelde area
Sea Lock Terneuzen
Foldable Watergate
Falkirk Sluice
Gel Sluice
Tilt Sluice
Vertical Hinge
Concrete Floodgates and Composite Lock gates
Flemish Institute for the Sea
Ascent rate Bubbles
Air Compressor
Environment Sea Entrance IJmond
EIA
Natura 2000 Areas
Environment Dialogue IJmond
View In The Netherlands
Green Light New Big sea lock IJmuiden
North Sea Canal Area
Sonar
Shipwreck
Unlocking Amsterdam Flyer

9- WDR / West Deutscher Rundfunk Cologne

Heiner Wember (WDR) interviewed Robert

Heiner Wember, "Hörfunkjournalist 'at the West Deutscher Rundfunk Cologne, interviewed Robert twice about Locky Sirens. The first interview is part of a program on the history of the North Sea. This was broadcast on April 29th, 2015. The second interview will be a full Locky Sirens broadcast. In particular, the technical and scientific aspects of Locky Sirens will get extensive coverage. The broadcast date follows later in 2015.

Both programs also can be heard over the internet.

Heiner Wember is:

- 55 years, married, with adult daughters
- A banker
- PhD in history, author of the standard work "re-education camp"
- Radio journalist - WDR time characters, WDR 2 date, WDR depth look DOK 5, Peace Counts, Culture Counts
- Longtime TV journalist - WDR Current hour, NDR Panorama, ZDF Contemporary History, ARD Exclusiv, historical documentaries
- Lecturer - Academy of cooperatives, Konrad Adenauer Foundation
- Media trainer - Zeitenspiegel Reportageschule Günter Dahl Reutlingen, WDR-history time
- Awarded the Ernst Schneider Prize of the German economy in 2008
- Member of the network "The Congress dances"
- author

10-Information Robert C. Smit

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Locky Sirens is a PCT patent protected invention
initiated and designed by (Studio) Robert C. Smit

* Content from external sources excluded