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The New Ship's Hoist Niederfinow

Operationelles Programm Verkehr EFRE Bund 2007-2013

EUROPÄISCHE UNION
Investition in Ihre Zukunft
Europäischer Fonds für
regionale Entwicklung

Bundesministerium
für Verkehr, Bau
und Stadtentwicklung

Foreword

In 2007, the existing ship's hoist at Niederfinow was distinguished by the Federal Chamber of Engineers as a "historical symbol of the art of engineering in Germany". This fascinating structure has only had 71 non-scheduled days of stoppage since it was commissioned in 1934 and is therefore the epitome of reliability. However, after 75 years of operation, the signs of wear and material aging are increasing. The provision of 1934-type replacement parts for the drive and safety systems is often possible only at considerable expense. After decades of work, the old supporting framework is beginning to become brittle. Modern types of cargo ships no longer fit through the old ship's hoist, resulting in a significant bottleneck in the trans-European network of inland waterways.
So it's high time for a new, next-generation structure!

The "New Niederfinow Ship's Hoist" will meet the parameters of Class V European waterways and thus conform to the European standard that has been in force for over 30 years. In future, large motor barges with up to 104 TEU containers of cargo will be able to pass through the "New Niederfinow Ship's Hoist". Thus the new structure will create not only the conditions for maintaining the functionality of the Havel-Oder waterway, connecting the conurbations of Berlin and Szczecin, but will also create the economic conditions for the shifting of goods transport to waterways: the environmentally-friendly traffic carrier. Outstanding relocation successes in industrial and commercial locations along the Havel-Oder waterway are additional impressive proof of the great role played by a high-quality waterway connection in the creation of jobs in the region.

As the result of an iterative planning process over several years between engineers, architects, and planners of landscapes and green spaces, there is now a new landmark in Niederfinow. What is remarkable is that the decision-makers of today again decided on a structural type that largely corresponds to that of the old one. Of course, the architecture and constructive design of the new structure will differ markedly from the technology of 1934. However, the former drive and safety concepts are still formative today, and are again being used but with contemporary components and control elements.

Each year, over 150,000 tourists visit this impressive technological monument. We expect up to 300,000 tourists per year during the construction of the new structure. The public can access a new information centre. After commissioning the new hoist, four generations of descent structures can then be viewed in Niederfinow – the Liepe barrage weir with lock on the Finow canal (in operation since 1743), the old chain of locks (in operation 1914-1972), the "Old Niederfinow Ship's Hoist" (commissioned in 1934) and the "New Niederfinow Ship's Hoist" (commissioning planned for 2014).

I wish the people on site great success and work free of accidents.

Thomas Menzel
President of Waterways and Shipping Directorate, East

1 The “Old Niederfinow Ship’s Hoist” (2005) – An imposing monument to the art of engineering
2 2005 – Basic restoration of the old ship’s hoist, lantern pinion
3 As models: the old and new ship’s hoists juxtaposed; below right: the new information centre

An additional tourist attraction

150,000 plus

Even the existing ship's hoist is one of Brandenburg's tourist attractions, to be found in any tourist guide. Each year, it has 150,000 visitors. It is expected that the "New Niederfinow Ship's Hoist" will also receive attention from the public during the construction phase and after its commissioning.

Please enter!

Visitors to Niederfinow should not only be amazed by the new ship's hoist but should also experience it directly. This is why it has been made accessible using lifts, stairs, pathways, footbridges and bridges – including access for the disabled. The ambulatory areas for visitors are at 49.95 m above mean sea level in the interior of the structure, directly above the trough alongside the pulley support, as well as on the outside between the pylons behind the truss girder. Three bridges cross the trough area between the opposing pylons and at the east end. This means that visitors are brought close to the technology of the ship's hoist and can additionally enjoy far-reaching views over the Barnimer Land from several locations. At the end of construction work, it will also be possible to visit the aqueduct, the upper outer harbour and the old chain of locks using newly laid visitor paths.[1]

Whilst the "New Niederfinow Ship's Hoist" is still under construction, we recommend the view from the old ship's hoist, which lies directly adjacent to the construction site, or a guided tour with an expert. [2]

[1] Explanations of technical terms from page 8

[2] More information at: www.wna-berlin.de

1/2 Numerous paths take visitors close up to the technology
3 The information centre shortly before its opening in spring 2009

The information centre

An information centre was opened in the spring of 2009 to the south of the two ship's hoists. It will accompany the construction of the "New Niederfinow Ship's Hoist" through current images and descriptions, technical data and different scale models.
An exhibition addresses the significance and function of the "New Niederfinow Ship's Hoist" and gives an insight into the merits of Germany's waterways as efficient, safe and ecological traffic carriers which are very economical.

The architectural design

A new symbol arises

Committed to prominence. As is the tradition in Niederfinow, the "New Ship's Hoist Niederfinow" will attract not only ships but also visitors. So it must be both functional and beautiful. But how much design can a work of engineering take?

In-house architects and engineers

The Department of Constructive Design at the Federal Waterways Engineering and Research Institute (Bundesanstalt für Wasserbau - BAW) was substantially responsible for the architecture of the new ship's hoist. This meant that in-house architects took on the design. They focussed on two principles: that the design of the structure should follow its function, and that in spite of its size, the new ship's hoist should integrate into the surrounding countryside.

Less mass, more transparency

A structure that is 133 m long and over 50 m high does not integrate by itself, especially as it is principally executed in concrete and steel due to structural considerations, and because these materials are also required due to their economical nature in investment, maintenance and operation. But the designers also wanted to achieve the greatest possible transparency by minimizing the mass of the construction. Here, less is more.

The colour concept will incorporate the ship's hoist into its surroundings using different grey and blue tones. An additional yellow tone only appears where visual accents are placed or for the guidance of visitors. This colour design, the shape and the material used in the construction of the "New Niederfinow Ship's Hoist" can also be found in all of the adjacent new buildings such as the information centre, thus forming a corresponding ensemble of buildings.

Self-confident and contemporary

Even if a comparison with the adjacent old ship's hoist is inevitable, the new structure must come out of the shadow of its predecessor and show itself to be self-confident and contemporary.

"The 'New Niederfinow Ship's Hoist' must say that it is a product of the 21st century. Echoing the construction of its predecessor, the truss girder between the towers is a reminder of the builders of the ship's hoist in 1934. After the encroachment by planners in this landscape, the view from the platform is a gesture of reconciliation and the view over the beautiful Barnimer Land is a particular experience for visitors to the ship's hoist."

Udo Beuke, Head of Architectural Design' Section, BAW

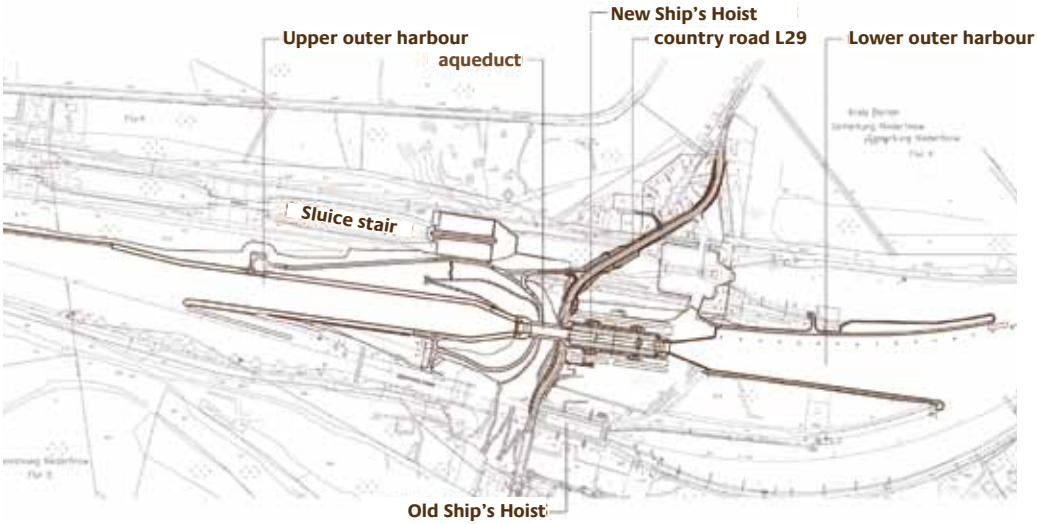
The "New Ship's Hoist Niederfinow"

How it will work in the next generation

In 1992, the Federal Waterways Constraction Office Berlin received a commission to draw up plans for a new descent structure at the Niederfinow site. This was an enormous challenge, which equally inspired engineers in the field and visitors with no previous knowledge, as the ship's hoist from 1934 had set standards in both form and function. The new structure would be measured against this. Furthermore, in addition to form, function and appeal, the design also had to be economically and environmentally convincing.

Preliminary examinations and basic principles

At the start, a great deal remained open. A preliminary study clarified fundamental questions such as the ideal location, the best technical concept and suitable dimensions for the new structure.
For the route of the new descent alone, four variants were examined by the WNA and assessed regarding their nautical suitability, economy and eco-friendliness. The function of the structure was examined in a further step: how could the 36 m fall in the land height be best overcome?



With a chamber lock? A chain of locks? A water slope? Inclined or longitudinal haulage? Or – as in the previous structure – using a vertical elevator? All of the variants were gone through by planners with reference to traffic forecasts and the fleet structure, and checked using operating concepts, structural versions, operating and maintenance costs.

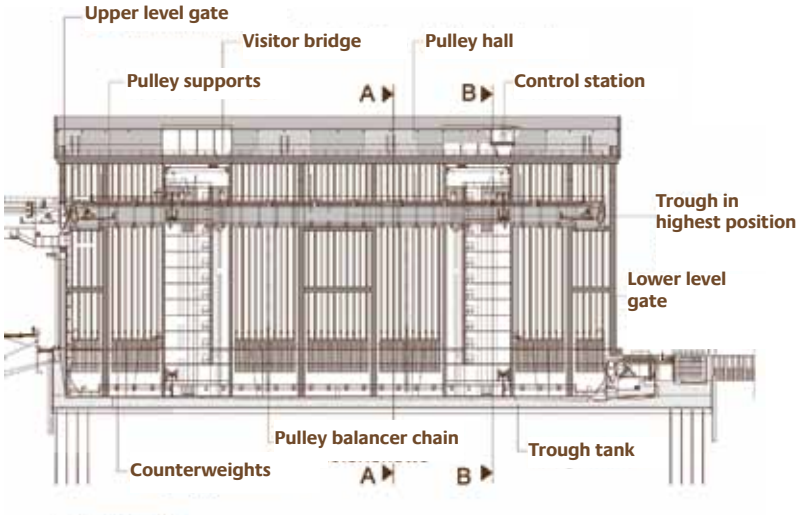
The decision was made in favour of a new vertical elevator with a counterweight. Its trough was to be designed for ships up to 115 m in length, 11.45 m beam and 2.80 m draught. An ideal route was now determined: it placed the new ship's hoist between its predecessor and the disused chain of locks, which could thus be retained as an historic monument.

Overall technical solution

The new descent structure in Niederfinow is more than just a ship's hoist. The extensive installation at the foot of a 36 m-high fall in the land was broken down into

- The actual ship's hoist with its supporting framework, trough (including counterweights), trough security system, trough tank and lower level closure
- The aqueduct with abutment, safety gate and upper level closure
- The upper outer harbour, which branches off from the summit level (i.e. from the highest canal section) of the Havel-Oder waterway and
- The lower outer harbour, which opens into the Oder level of the Havel-Oder waterway.

The "New Niederfinow Ship's Hoist" – like the old one – is designed as a vertical elevator with a counterweight. This solution was successful in 1934 and is again a winner in the 21st century. The principle is well known but the dimensions have changed:

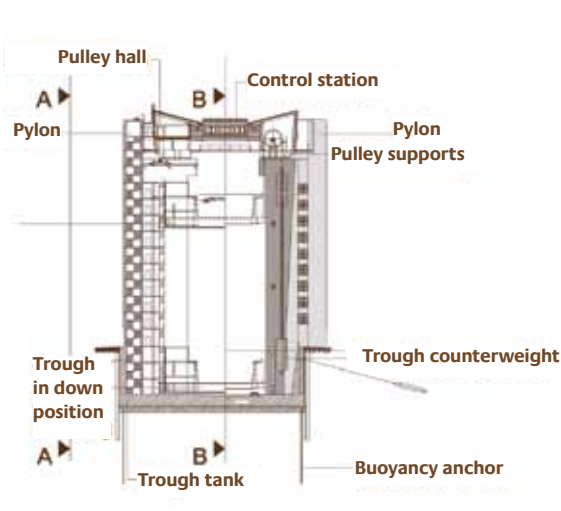


Longitudinal section

Just the water-filled trough of the new hoist weighs over 9,000 tonnes. It is suspended using 224 cables, which run over a total of 112 double pulleys in the pulley hall, using 220 counterweights and four cable weight balancer chains suspended from two pulley supports. The trough weight is almost balanced using this counterweight construction.
The new ship's hoist in Niederfinow (like its predecessor) thus works using minimal motive force and simply has to overcome friction, starting resistance, mass inertia and slight differences in water levels.

Control station between the eastern pylons

The ship's hoist is controlled from a control station, which is located over the trough between the pylons at the east end.



Cross section

Pulley hall on the left next to the control station

The cable weight balancer chains

When the cables run over the pulleys, the weight of the cables shifts. This upsets the balance between the trough and the counterweights. The four cable weight balancer chains remedy this imbalance.

The supporting framework

The supporting framework guarantees the stability of the whole ship's hoist. It consists of the trough tank, which is embedded in the ground, four reinforced concrete towers (pylons) based in it, as well as two pulley supports and 12 pulley support stanchions. Using this whole static system, the enormous loads from the trough and counterweights can be transferred over the pulleys on the pulley supports and from there on each side over two pylons and six pulley support stanchions through the trough tank into the foundation.
But the supporting framework also takes on further loads: the pulley hall, the control station, the visitor bridges between the aqueduct and the western pylons, the truss girders between the western and eastern pylons and the eastern support for the aqueduct. The outer western pulley support stanchions are connected with each other through a concrete beam to support the aqueduct.

The trough tank

The trough tank is a white tank which rests flat on the underwater concrete base of the foundation ditch. Its base is 2.40 m thick, the side walls have a thickness that varies between 1.50 m (top) and 3.00 m (bottom). The trough tank, pulley supports, pulley support stanchions and pylons are interconnected so as to be deflection-resistant. As a complete system, they form a half frame with strongly counterarched legs of differing rigidities. In the east, the trough tank enters the lower level closure.

The pylons

The pylons stand 6.40 m above mean sea level on the trough tank and are thus part of the trough tank in the lower area of their outer walls. They extend 11 m below ground and 52.30 m above it. The cross section of a pylon is determined by the trough drive space in its interior, as well as by the dimensions of the stairs, the connecting passages and the crane for maintenance work on the 15th floor.

The pulley supports and their stanchions

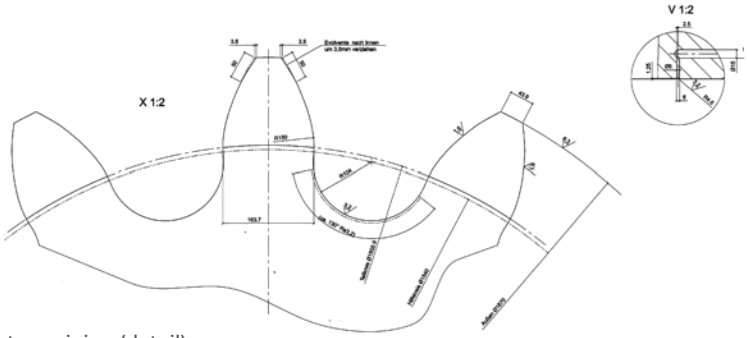
The two pulley supports run along the ship's hoist over the pylons and pulley support stanchions. They take the load of the pulleys, the pulley hall, the visitor ambulatory areas, visitor bridges and the control station. The pulley support stanchions, connected with the pulley supports and the trough tank so as to be deflection-resistant, transfer vertical loads from the pulley supports into the trough tank, and also incorporate the guides for the counterweights.

Figure left:
To create the underwater concrete base of the new ship's hoist, 8,318 m^3 of special concrete was produced and processed in 80 hours of uninterrupted concreting work in March 2010.

The trough

The ship's trough is the movable part of the hoist. Ships float in it whilst being raised or lowered. A trough 125.50 m in length and 27.90 m in width (in the area of the drive houses) will be fitted in the "New Niederfinow Ship's Hoist". It is thus at least twice as long and about as wide as an Olympic swimming pool. The usable dimensions turn out to be somewhat smaller, but with a length of 115 m and a width of 12.50 still allow the passage of modern motor barges and even 114 m-long triple-compartment boat trains.

Once the trough has completed its journey, it is locked into place in the anchorage, also called the dock, using a trough holding device. The gap between the trough and the level is now closed using the gap seal and filled with water from the adjacent level. Only then are the gates opened, allowing the ship to leave the hoist. The ships can enter from the outer harbour, and again the gates close the trough. After the gates are closed, the water in the trough is brought up to the nominal water level using a



Lantern pinion (detail)

Lantern gear toothing – pinion:

Number of teeth = 13
Spacing = 376 mm
Spacing tolerance +/- 0.25
Reference diameter – 1555.9 mm
Width of tooth face = 460 mm

Material: 30CrNiMo8
Quality +QT
d_{Flim} = 230 N/mm²
d_{Hlim} = 700 N/mm²

Tooth quality 10

Alignment correction
Length of end relief 46 mm
End relief 0.9 mm

reversing facility (used to balance the water levels between the trough and the level). The gap is emptied, the gap seal opened and the trough holding device released. Then the trough moves the ship to the opposite anchorage.

The radial lock gates

Radial lock gates close the trough. They are moved in ground recesses in their open position and turned up out of the water in their inspection position. Their upper edge lies 5.00 m above the base of the trough; their freeboard is thus 1.00 m. The gates are moved by two electronic lift cylinders, each of 650 kN propulsion force. A cable impact protection installation protects the gates from ship impact.

The enormous trough is driven at four points. Each drive point has two engines and a 320 kW capacity. Due to the high total output, the hoist operation can still be maintained even if one of the propulsion forces fails.

The trough drive

The four drives are located on both sides of the trough (one in each trough quarter) and are designed as rack drives with lantern gear toothing. Each drive point consists of the drive motors with three-phase induction motors, electrohydraulically ventilated independent service and stop brakes, and the main gearboxes. The two main gearboxes of a driving point operate both sides of the pinion (driving gear wheel) taken to the lantern gear ladder using roller carriages. The lantern gear ladder is anchored in the concrete of the respective pylon. The pinion engaged in the lantern gear ladder is carried on a spring anti-vibration system. An electronic synchronisation monitor and controller, as well as continuously running synchronisation shafts synchronise the four drive units. The mechanical shaft system has the task of ensuring synchronism in all drive points in the case of faults in the electronic control, and guaranteeing continued operation of the ship's hoist in the case of one of the drive points failing.

Trough safety

On its journey over about 36 m in height, the trough is protected by a trough safety device. This means that is can be held safely in any position even in the case of an uncontrolled loss of water which would upset the balanced construction of weight and counterweight.

This trough safety device is located at each on the four drive points and consists of four enormous split internally-threaded columns on the supporting framework. A 10-tonne turning bolt (which can be imagined as a giant headless screw), fastened to the trough, moves along in each split internally-threaded column. In normal operation the turning bolt and the split internally-threaded column do not touch. The safety device is only employed when there is an imbalance of over 200 kN between the trough and the counterweights: the drives switch off, the pinion compresses and triggers the fall of the turning bolt onto the threads of the split internally-threaded columns. This patented system, which was also responsible for safety in the old hoist, can easily lock the heavy trough in place.

Split internally-threaded columns with turning bolt
The split internally threaded columns are about 42 m long, with a split inner thread, comprising of several parts. The turning bolts, connected to the trough through pendulum supports, correspond to screws with four threads. They are 3 m tall and have an external diameter of 1.08 m. Each weighs about 10 tonnes. The four axes of the split internally-threaded columns are spaced about 30 m from each other across the trough and about 70 m from each other along its length.

The controls

The control of the ship's hoist consists of an automated system as well as an operating and monitoring system.
The drives of the hoist are automated using stored program controls (SPC) and sensors that determine the state of the

installation. Each drive unit, such as a trough gate, has its own SPC. The controls are interconnected and connected to the master SPC. Should the bus system fail (a safety-oriented communication connection between the automated system and the operating and monitoring system), the installation groups will continue to be able to be operated.

In order to check during planning whether the intended controls were suited to the planned machine installation, a virtual control model was created for the ship's hoist. The drives (actuators) as well as the limit switches, the measuring devices and monitoring devices (sensors) were reproduced in this model. In this way, the planned sequence of the locking procedure as well as any failure or malfunction of the controls or sensors could be simulated.

The virtual control program

The virtual control program can simulate malfunctions and analyse consequent reactions. If an intolerable state is revealed, the machines either have to be controlled differently, equipped with other control elements and sensors, or have other safety measures provided. In order to improve the understanding between the control technicians, the construction planners and the operators of the installation, the controlled locking procedure is shown in moving images in perspective. In these images, the procedures and reactions run over time, so that even "non-control technicians" can better recognise sequences and intolerances.

This planning model will be further developed into a model for the testing of the ship's hoist. In this way, the control programs will already have been tested before the actual installation is produced without any faults leading to real damage. On completion of the hoist, the model will be retained. On the one hand, it can be continued for the training of operating and maintenance personnel, and on the

other it can be used to estimate the effects of changes to the controls or sensors.

The aqueduct

The 65.50 m long aqueduct connects the ship's hoist to the upper outer harbour. Like the hoist trough, it offers a usable water level width of 12.50 m and is also closed off from the hoist using a radial lock gate.

The gate thus forms the eastern end of the summit level of the Havel-Oder waterway. The gap drainage and reversing installation is located in the eastern head area of the aqueduct, in addition to the drives for the gate.
The aqueduct will be given side routes on the left and right, which can be used by maintenance vehicles. This means that it is possible to use a truck crane to lift the heavy slide gates of the trough drainage installation through openings in the aqueduct and to drive them away for repair work.
The western abutment supports the aqueduct as well as the safety gate with its gate drive houses. The gate

View from the north-west over the new ship's hoist and the aqueduct

can be closed for planned drainage of the aqueduct or if an unforeseen emptying of the summit level is threatened via the aqueduct or hoist. In this type of accident, the abutment must take additional loads. It is based therefore on 28 piles (each with a diameter of 1.20 m), drilled up to 30 m deep into the solid boulder clay of the ground.

The bridge connections

On the head water side, the clay seal of the upper outer harbour and the safety sheet piling with its inspection walkway are connected to the abutment so that any movement from there can be absorbed. The canal seal is connected using a 3 m thick clay block. The cross connection of the safety sheet piling to the abutment can be observed from the inspection walkway, which crosses the canal under the abutment to the east. The vertical connections are monitored using water level indicators.

The two outer harbours

Ships reach the "New Ship's Hoist Niederfinow" – from whichever direction of approach – across a spacious outer harbour.
Both new outer harbours branch off from the old outer harbours of the adjacent earlier hoist structure.
The new upper outer harbour will be 440 m long and have a width of level water of 46.50 m and a depth of 4 m. A 40 cm-thick clay seal, filter mats and a 60 cm-thick fence of fascines form the base and protect the canal from water losses. The banks will be fortified on the north and south sides using pile planking and equipped on both sides asa waiting area for ships. A breakwater around 110 m long and 9 m wide separates the new upper outer harbour from the old one.

The dikes of the upper outer harbour

The normal banked-up water level of the upper outer harbour lies about 32 m above the terrain of the Oder lowlands. To the Hohensaaten level, the dike height reaches about 36.50 m. The dike bottoming in the north reaches as far as the disused chain of locks, whose 3rd lock is filled in to produce a stable dike.

Like its predecessor, the lower outer harbour of the new ship's hoist opens into the Hohensaaten level. It is curved and therefore extends like a funnel from 55 m to 90 m. Both banks are designed as waiting areas: the northern one is 440 m long, and the southern one 360 m long. The northern bank is fortified using a fascine fence.
So that ships can lay-to here, there are pile moorings at 30 m spacings. The southern side will be retained by anchored sheet piling.

The emergency and fire concept

Should a fire break out on a ship or in the drive room of the ship's hoist during raising or lowering, the trough will continue to the end position for docking – this will take no longer than three minutes – as the upper and lower end positions provide the best conditions for action for the fire service, which can arrive here within 13 minutes of the alarm being sounded.

So that emitted heat and aggressive fumes do not endanger the supporting cables of the trough in the interim period, the trough has a sprinkler system.With the aid of a pump system in each of the four trough drive rooms, water is sent from the trough through a pipe network with open spray nozzles. In this way the cables supporting the trough can be coated with a mist of water and cooled up to a height of about 6 to 8 m above the trough. This sprinkler installation can be operated from the control station.

However, if the trough comes to a standstill on the way to an end position due to a power failure or other technical defect, those fleeing must overcome the height difference between the trough and one of the ten floor levels in the pylons. This is done using variable-height stairs with self-adjusting steps, which are carried by the trough. In this way, the stairs in the pylons can be reached from any intermediate position of the trough.

Nature protection and caring for the landscape

The advance of the southern wood ant

The landscape and habitats of plants and animals, created over centuries, is changed through extensive building projects such as the "New Niederfinow Ship's Hoist". Iris Wegener – from the WNA Berlin – is responsible for environmental planning during the construction of the ship's hoist. How does a responsible planner deal with this, Ms Wegener?

Iris Wegener
"First of all, we had all the possible disturbances shown to us and a balance sheet drawn up. For this, extensive investigations were carried out in the project area and its close surroundings by scientists from the Federal Institute for Hydrology (BfG) in Koblenz and specialists from the state of Brandenburg. In close collaboration with authorities and associations working for the protection of nature, the environment and monuments, over 20 measures were then determined, through which the WNA Berlin can compensate for encroachments caused by the construction and its operation."

What sort of measures are they?

Iris Wegener
"In Niederfinow, for example, we protected and secured existing biotopes, planted coppices, planted new banks and removed any barriers that were present. So in future otters will be able to cross under the new L29 and the northern access to the hoist using species-appropriate passageways. These measures are located within the


1

1 Habitats for otters will be maintained
2 Incorporating the new ship's hoist in a mature landscape
3/4 Replacement planting for cleared woodland

construction site, at the site of the actual encroachment. But we are also active in the adjacent countryside:
Together with national and local forestry management, we have found suitable areas to the north and south of the Oder-Havel canal as replacement land for the woodland cleared for the construction site. Since 2008, we have been gradually converting a total of 37.5 hectares of commercial forest – that is to say monoculture pine or poplar – into natural mixed woodland with wide woodland margins. And, on a 6.5-hectare former military area at Senftenhütte, we will create a locally-appropriate deciduous wood.

Compensation for constructional changes at the Oder-Havel canal also occurred through involvement in the ecological river renovation in the Barnim nature park. The natural control mechanisms were restored there through the closure of artificial diversions, the dismantling of dilapidated weirs and the closure of drains. The flows of the Nonnenfließ and the Schwärze rivers will be dynamically strengthened, adjacent bogs rehydrated and, in particular, passage for fish and micro-organisms will be created in the streams."

And when will these compensatory measures take effect?

Iris Wegener
"We started to take compensatory measures before the first work began on the building of the ship's hoist.
At this time, a few measures, such as securing the existing vegetation on the banks using calmus reed-beds, was already complete. For this, reed-bed root bales were replanted in a newly-created shallow water zone in the lower outer harbour of the old chain of locks. That was the first measure.
During the course of construction, we will implement further measures for minimization, replacement, compensation and creation, all of which have been agreed with the MLUV, the state ministry responsible. Construction and compensation go hand in hand with us."

What compensation measures are particularly close to your heart?

Iris Wegener
"In the planning associated with caring for the landscape and in the ecological accompaniment of the construction work, special attention is being paid to species protection:
– In close collaboration with the Eberswalde state institute of forestry, so far three nests of the specially protected small southern wood ant have been relocated to adjacent woodland.

1 Small southern wood ants
2 The kingfisher
3 A member of the beaver family

Together with a local ornithologist of the NABU, a good solution was also found for broody kingfishers.

– A beaver family which had settled in what was to be the lower outer harbour was a great challenge for us. Many beavers of the same species living in the environment showed us how successful the strict protection status of this animal has been in recent years. After advice from Mr Peter Ibe from the beaver protection department of the Mittelelbe biosphere reserve, a contractual scenario was developed for resettling our beavers on the opposite bank, and this was agreed with the relevant authorities. I am sure that all the animals and plants involved will be happy, even around the new ship's hoist."

Outlook

Connection to the future

In the summer of 2008, construction work started on the "New Niederfinow Ship's Hoist". It should enter operation in 2014. Then motor barges with beams of up to 11.45 m will be able to pass along the whole stretch from Berlin to Szczecin without certificates of exemption.

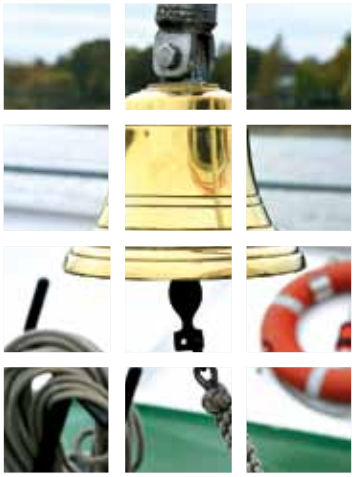
The old ship's hoist will initially remain in operation. As long as this is economically justifiable, it will continue to work for a few years next to and in parallel with its successor to transport smaller barges and sport boats, to provide a buffer during peak times, and to cushion any possible start-up difficulties in the new ship's hoist. But then it will be closed down and retained as an outstanding monument to technology, to vividly document a further epoch in the history of technology at the Niederfinow site.

In 75 years of operation, 765,500 trough journeys have been registered by the old ship's hoist (as at December 2008). The quantity of goods moved amounts to 160 million tonnes. The total number of reference tonnes, which is the tonnage that is theoretically possible, was 317 million tonnes for this period.

The "New Niederfinow Ship's Hoist" is designed for a passage of 4,400,000 tonnes of goods per year. Its commissioning will thus create the basis for managing increasing amounts of transport in an environmentally-friendly yet economical manner, even into the future.

1 The “New Niederfinow Ship’s Hoist” building site, 2009

2 At 2,225,590 tonnes of goods, the passage of goods through the old ship’s hoist in 2008 was about 15% higher than in the previous year.



Technical data – old and new – A comparison

Technical details	Old Ship's Hoist	New Ship's Hoist
Dimensions		
Height (above ground)	52.00 m	54.55 m
Length	94.00 m	133.00 m
Width	27.00 m	46.40 m
Depth (trough chamber/tank)	8.00 m	11.00 m
Construction material (including aqueduct)		
Steel	18,000 t	8,900 t *
Concrete and reinforced concrete	72,000 m^3	65,000 m^3
Usable dimensions of trough		
Length	82.50 m	115.00 m
Width	11.94 m	12.50 m
Permitted beam	9.50 m	11.45 m
Overhead clearance	4.10 m	5.25 m
Depth of water	2.50 m	4.00 m
Max. loaded draught of ships	1.90 m	2.80 m
Trough weight		
Weight of empty trough (inc. equipment)	1,600 t	2,785 t
Weight of trough filled with water	4,290 t	9,800 t
Trough journey		
Height of lift	36 m	36 m
Travel time	5 min	3 min
Speed	12 cm/s	25 cm/s
Duration of lock procedure Ø	20 min	16.5 min

*Reinforcing steel

Technical details	Old Ship's Hoist	New Ship's Hoist
Drive		
Ward-Leonard set, direct current,	1 item	–
Ward-Leonard generator	277 kW	–
Exciter generator	15 kW	–
Drive motor	4	8
Drive motor speed	1,500 rpm	1,500 rpm
Total drive power	220 kW	1,280 kW
Cable pulleys and cables		
Number of cables	256	224
Cable diameter	52 mm	60 mm
Cable length	56.70 m	58.00 m
Double-groove sheaves/pulleys	128	112
Cable sheave/pulley diameter	3.50 m	4.00 m
Cable sheave/pulley weight	4,000 kg	6,000 kg
Cable balancer chains	4	4
Weight of chains	4 x 22.5 t	4 x 40.0 t
Counterweights		
Number	192	220
Weight	20.87 t[1]	41.00 t[2]
Upper outer harbour		
Length	1,200.00 m	900.00 m
Width	48.00 m	46.50 m
Depth of water	2.80 m	4.00 m

[1] Weight of three pieces [2] Weight of single piece

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Technical details	Old Ship's Hoist	New Ship's Hoist
Lower outer harbour		
Length	140.00 m	510.00 m
Width	18.00 – 56.60 m	55.00 – 90.00 m
Depth of water	3.40 m	4.00 m
The aqueduct		
Length	157.00 m	65.50 m
Width	28.00 m	21.70 m
Depth	3.90 m	4.00 m
Safety gate		
Distance from Ship's Hoist	289.00 m	80.00 m
Width	30.00 m	12.50 m *

*clearance

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