

# MODIFICATION OF DREDGERS, A CRAZY IDEA OR NOT?

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**Abstract:** There can be multiple reasons for modification or conversion of dredgers and all related equipment. Today we see a shortage of dredging material. Due to the large dredging works in the Persian Gulf and other areas, the demand for special equipment is high and not all existing equipment has sufficient capacity or quality to fit the bill.

In addition most yards are fully booked for the coming years, so modification is sometimes the only alternative.

Modifying equipment might cause problems:

- How is the technical condition?
- Which drawings are available?
- Did new rules become effective?
- How about efficiency and economical status?

For most types of equipment there are a lot of possible modifications.

For trailing suction hopper dredgers the hopper capacity can be increased as well as the dredging depth. The loading and unloading process can be improved, etc.

For cutter suction dredgers the cutter power and all relevant items can be upgraded, the cutter depth can be increased or just minimized. The swing length and dredging process can be improved by installing a spud carrier system, etc.

Existing equipment can be converted into other systems like modifying a split barge into a split hopper dredger, a bucket dredger into slope trimmer, a cutter dredger into deep suction dredger, a tug into a bed leveller etc.

Also merchant vessels can be converted into dredging vessels like a naval supply vessel into an aggregate dredger, a module carrier into deep stone dumper/deep dredger, a work vessel into a water injection dredger, etc.

In this paper a number of projects will be presented, realized in the last ten years.

It can be concluded from these examples that there are very often new possibilities for existing equipment, even when they are of older age.

**Keywords:** flexibility, new possibilities, lifetime extension, increases of capabilities, upgrading.

## INTRODUCTION

The following projects will be discussed. We have tried to indicate different types of equipment. Some dredgers have been converted in such a way that they can hardly be recognized. Especially for the older vessels it is difficult to find all the relevant information. Sometimes the drawings are not even at as built level, so you might understand the problems after a technical life of 15-20 years.

1. A block laying vessel modified into a side stone dumper.
2. A tugboat into a bed leveller with jets.
3. A multipurpose vessel into a water injection dredger.
4. The conversion of a bucket dredger into a spreader pontoon.
5. A split barge into a split hopper dredger
6. A split hopper dredger into a split barge.
7. A naval supply vessel into an aggregate dredger.
8. Reducing the cutter depth for a heavy cutter dredger.
9. Increasing the hopper capacity of a hopper dredger, at this moment the largest hopper dredger in the world.

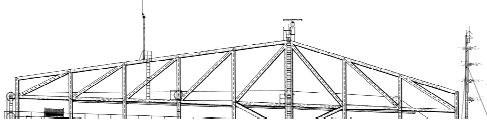
(These are a few examples, also due to limit of time).

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## CONVERSIONS/MODIFICATIONS

### **Block laying vessel into side stone dumper**

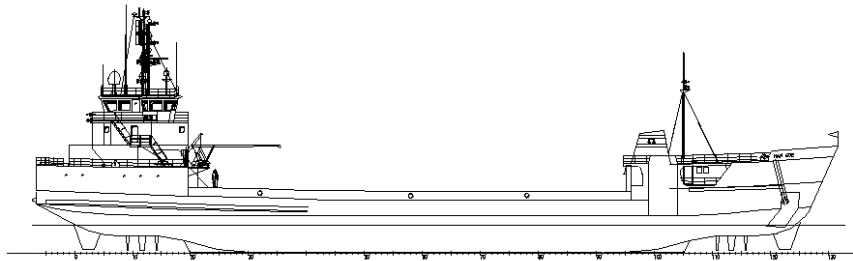
The block laying vessels named 'Norma' and 'Libra' were originally built in 1968 for building the piers at the harbour entrance of Rotterdam. (fig.1 and 2).





**Fig. 3 'Norma' as floating shearlegs**

In 1985 the 'HAM 602' was converted into a multipurpose vessel (MPV) with a very large working deck with enough space for cranes, cable laying equipment, etc. Also extra accommodation has been added.(fig. 4 and 5).



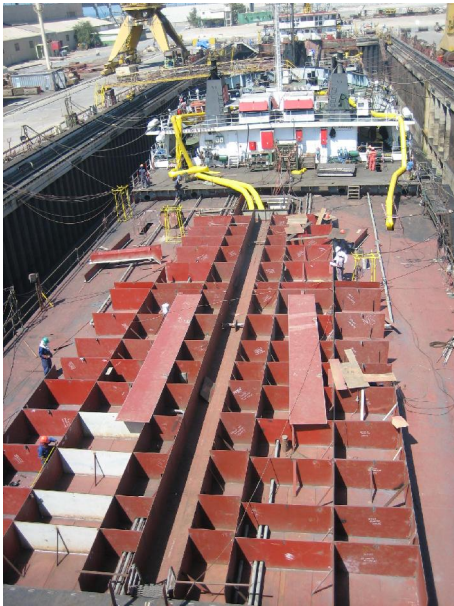
**Fig. 4 side view MPV**



**Fig. 5 'HAM 602' during trials**

With all the big projects in the Persian Gulf area and a lack of material available, it was decided to modify the MPV into a side stone dumper. With an already renewed engine room, accommodation and good manoeuvrability this vessel was very suitable for this conversion.

A shipyard in Dubai executed all the necessary work and so a new chapter has been added to the life of HAM 602. (fig. 6, 7 and 8).



**Fig. 6 'HAM 602' during last conversion**



**Fig. 7 'HAM 602' on trials**



**Fig. 8 'Ham 602' in action**

### Conversion of a tugboat into a bed leveller

On its own a conversion of a tugboat into a bed leveller is not a very complicated job. However, when jet water supply also has to be provided and the only available tug is of age (built in 1954) with a very slender body, a few problems arise which have to be solved.

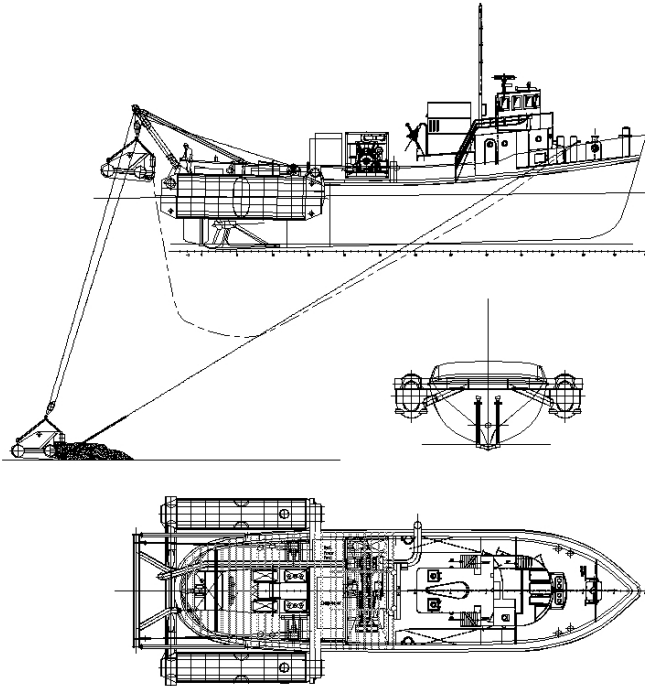
How to get sufficient information about drawings and stability?

How to cope with a riveted steel construction.?

What about class?

Fortunately there was a sister ship in Holland and some pictures were sent from Africa, where the tug was sailing. Also several drawings were found in files.

To create extra displacement at the stern side where it was most needed, two pipeline floaters were connected to the aft ship structure (*fig. 9*).



**Fig. 9 G.A. Plan 'Geer' with bed leveller**

The jet water pump set was placed on the aft deck and also the hoisting gantry and the winch (*fig. 10 and 11*).



**Fig. 10 and fig. 11 Tug 'Geer' as bed leveller**

The vessel did perform well and is acting today again as a normal tug.

## Conversion of a multipurpose vessel (MPV) into a water injection dredger (WID)



**Fig. 12** artist impression of a project soon to be realised.

It concerns a multi purpose vessel, today working as bed leveller, so gantries and winches are already available. Conversion into a water injection dredger is not too complicated.

Two pump sets are placed at the fore deck with suction inlet to the bottom. One elbow gantry is placed at each shell side and a U-shaped frame for delivery of jet water to the nozzles. The position of the nozzles is adjustable to existing water depth.

### **Bucket dredger into a spreader pontoon**

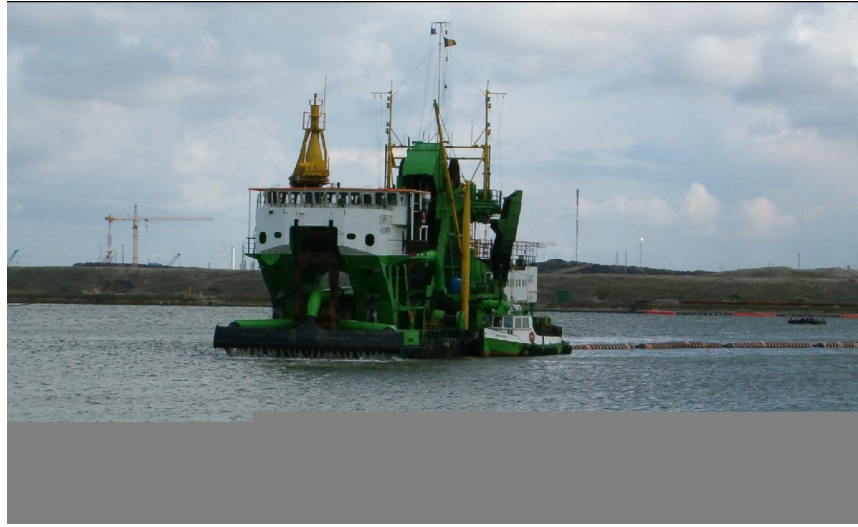
A bucket dredger is a nice piece of equipment for a conversion. Mostly strong constructed, with a lot of winches and a big gantry, it can be used for a lot of executions.

This dredger was modified into a spreader pontoon. The lower part of the ladder was replaced by a T-shaped pipe over almost the total width of the pontoon (*fig. 13*) and a mixture supply pipe was mounted on the original bucket ladder.



**Fig. 13** T-shaped pipe on the ladder

The pontoon was connected via a floating pipeline to a dredger (*fig. 14*).



**Fig. 14 'Adriatico' connected to a dredger via floating pipe line**

And then its temporary life as a spreader pontoon could begin; for instance producing the layers on the sea bottom for dyke construction, with assistance of course from the necessary tools and instruments. The pontoon can also be used for water injection dredging.

#### **Conversion of a split barge into a split hopper dredger**

The dredger 'Dravo Costa Blanca' is owned by Dravosa, a joint venture of Van Oord and Dragados based in Spain (*fig. 15*).



**Fig. 15 'Louisiana'**

The vessel, ex split hopper barge 'Louisiana', was converted at the yard Astilleros de Huelva in Spain into a split trailing suction hopper dredger in 1994. During the conversion existing equipment was over-hauled or renewed. The dredging equipment installed consists of a submersible dredge pump, driven by an electro motor. For pumping

ashore a self-discharge system with a separate, diesel driven pump has been installed at PS aft. The delivery connection is located on the bow, where a floating shore-linked pipe can be hooked on.



**Fig. 16 'Dravo Costa Blanca'**



**Fig. 17 'Dravo Costa Blanca' side view**

**PRINCIPAL DIMENSIONS:**

Length overall	73.00 m
Breadth	13.00 m
Depth	4.90 m
Hopper capacity	1,450 m <sup>3</sup>
Dredging depth	23/35 m
Trail pipe diameter	0.55 m
Total installed power	3,100 kW

New propulsion engines and gearboxes were installed with as consequence more powerful generator sets. Also the trailing pipe has been lengthened with new position of aft gantry.

**Conversion of split hopper dredger into split barge**

The split hopper dredger 'Pantagruelle' was built in 1979 for an Italian contractor. At a later stage it joined the fleet of DEME (fig. 18).



**Fig. 18 'Pantagruelle'**

But for the last few years it was more often laid up than in working condition.



Then DEME took delivery of their new seagoing cutter dredger 'd' Artagnan', equipped with barge loading facilities. It was necessary to have seagoing split barges of quite big capacity. With its 2 000 m<sup>3</sup> hopper the 'Pantagruelle' could fulfill this demand.

For the conversion the complete dredging installation and accommodation were removed. A new accommodation for a reduced crew was fitted at the aft ship with new funnels and repositioned overflows (fig. 19).



**Fig. 19 split barge 'Pantagruelle'**

As split barge she is living a new life, together with the split barge 'Krankeloon', who was also converted from split dredger into split barge.



**Fig. 20 'Pantagruelle' and 'D'Artagnan'**

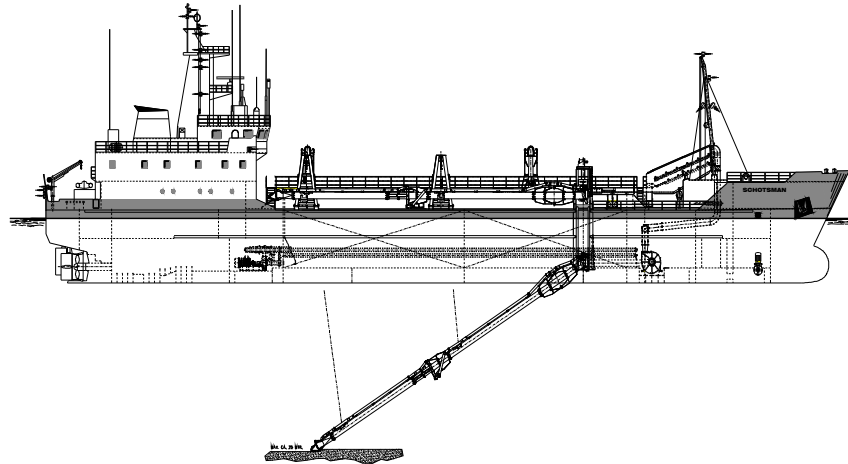
#### **Conversion of a supply vessel via a general cargo vessel into an aggregate dredger**

Originally the vessel, which was built in 1982, was a supply vessel for the navy. In 1998 it was lengthened and converted into a general cargo vessel (fig. 21)



**Fig. 21 dry cargo ship**

In 2002 the vessel was purchased by the Dutch company Schotsman at Terneuzen and converted into an aggregated dredger at Shipyard Boer, named 'Schotsman' (fig. 22).



**Fig. 22 side view**

The dredging equipment installed consists of a single trailing suction pipe arrangement at starboard side at main deck level, a static sieve mounted on the foredeck connected to a closed launder with four hydraulic operated doors to load the hopper during trailing and two barge loading pipes mounted on main deck level at port side. The vessel is equipped with four hydraulically operated bottom doors and a drainage system for dewatering the load of sand in case of unloading by shore based grab cranes (fig. 23 and 24).



**Fig. 23 Aggregate dredger**



**Fig. 24 'Schotsman' at sea**

### Widening cutter suction dredger 'Al Mahaar'

The cutter suction dredger 'Al Mahaar' (formerly 'Amazone') is the most powerful dredger in the fleet of the Qatar Dredging Company. QDC is a joint venture of the Belgian DEME, the Qatari UDC and the Government of Qatar (fig. 25).



**Fig. 25 'Al Mahaar' before widening**

To deploy the dredger 'Al Mahaar' on several projects in the Gulf Area, it was necessary that the dredger could perform in very shallow waters at minimum draft and dredging depth.

The draft had to be reduced to 3.5 meters to be able to work in a water depth of 5 meters.

After studying several possible solutions, it was decided to widen the dredger with side pontoons welded to the original dredger instead of a dismantlable arrangement.

To allow dredging at the original depth, ballast provisions and cofferdams were provided between the dredger and the new side pontoons. These side pontoons were built as a single pontoon in India, towed to the yard in the Gulf where they were separated into two pieces and welded to the original dredger (fig 26 and 27).



**Fig. 26 one pontoon**



**Fig. 27 pontoon separated into two parts**

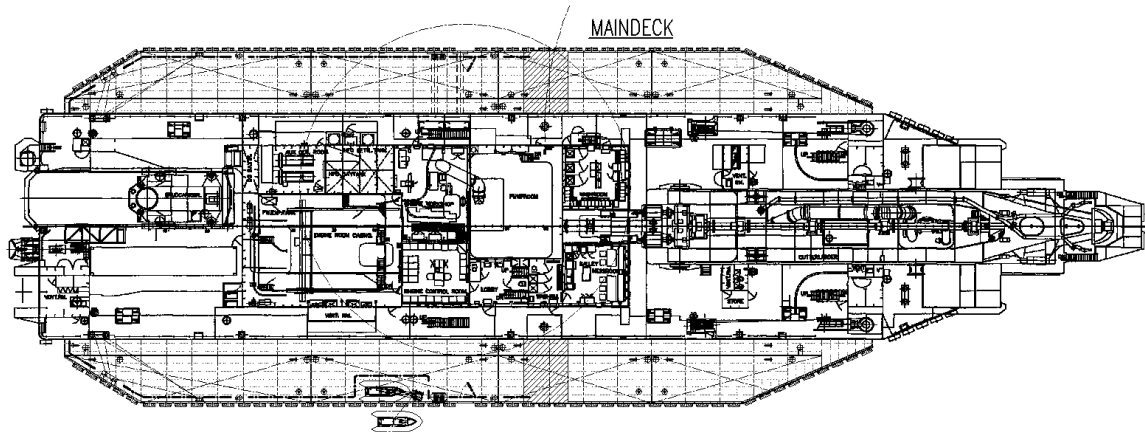


**Fig. 28 side pontoon to be welded**

The total breadth has been upgraded from 19 meters up to 29.44 meters. Together with other modifications this conversion took place in March/April 2006 (Fig 29.). VER has been involved in the engineering of the total widening.



**Fig. 29 'Al Mahaar' after widening**



**Fig. 30 Deck layout 'Al Mahaar'**

### Jumboizing TSHD 'W.D. Fairway'

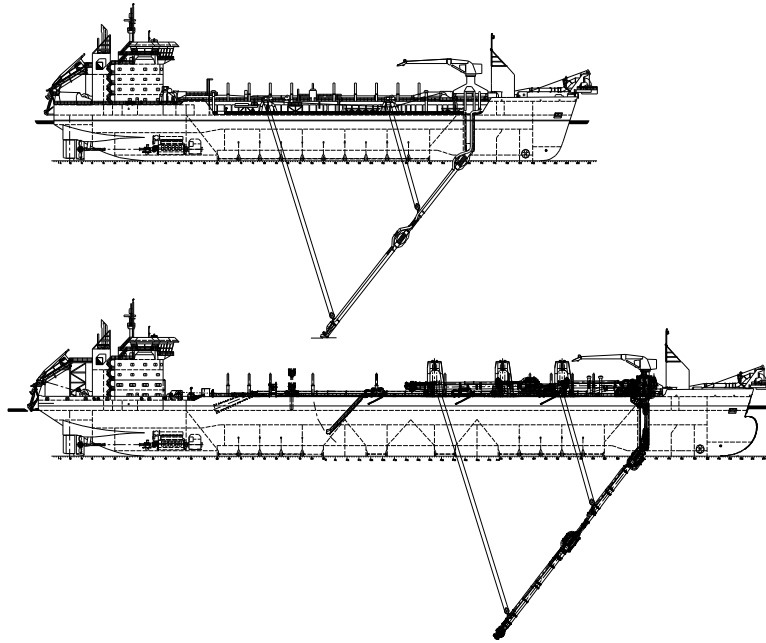


Fig. 31 side view before and after conversion

Principal Dimensions	Original	Modified	
Length over all	173.15	230.71	m
Breadth moulded	32.00	32.00	m
Depth moulded	13.10	16.85	m
Dredging draught	11.49	13.68	m
Hopper capacity	23347	35508	m <sup>3</sup>
Trial speed	17.10	16.40	kn

To achieve these new dimensions and capacities, the dredger was 'rebuilt' as follows:

- building-in midship section of about 54 meters,
- increase of main deck height with approx. 4 meters.
- addition of a bulbous bow,
- addition of a ducktail of about 5 meters,
- replacement bow thruster,
- modification of hopper loading and discharge system.

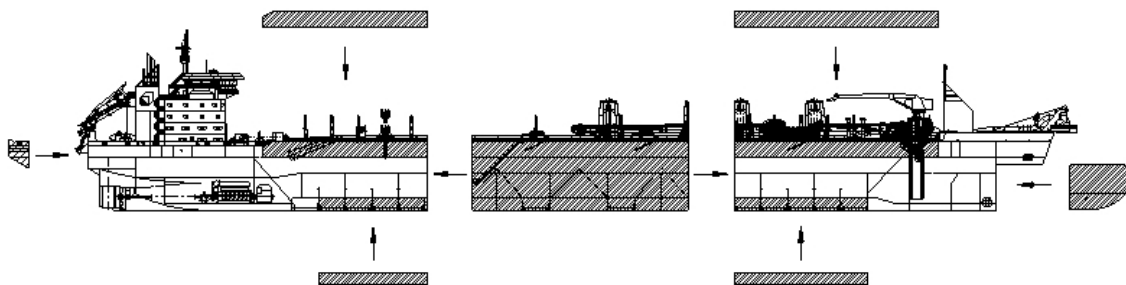


Fig. 32 side view lengthening section

Removal and replacement of suction pipes.

The engineering of the modification wasn't an easy job. Due to the lengthening with 54 meters of the vessel, in combination with the increased draft the engineers faced several difficulties in local and global strength and stability. The lengthening section was prefabricated and fully equipped with bottom doors, cylinders and piping. On completion, the section was towed to a shipyard in Singapore.



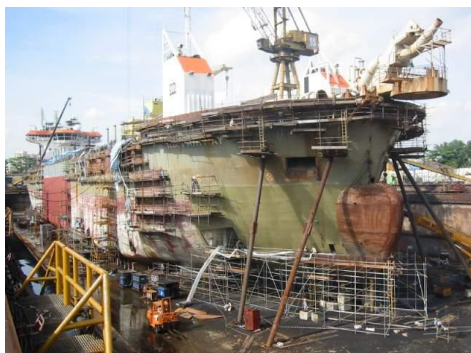
**Fig. 33 Section in progress**

Before arrival of the original 'W.D. Fairway', all prefabrication and preparations were finalized. The ship was then brought into dry dock and cut into two pieces. After this, the fore ship was floated out and the aft ship remained in the dry dock. Then, the lengthening section and the fore ship were floated back sequentially.



**Fig. 34 separation in dry dock**

After pumping dry the dock and settlement on the dock blocks, both sections were skidded to the right position, aligned and welded to the aft ship. In the meantime, deck sections, other steel sections and additional equipment were fitted. A series of extensive tests completed the job.



**Fig. 35 lengthening with new section**



**Fig. 36 new bulbous bow**

The engineering and preparation of this job took over more than a year. The entire actual conversion took four months, certainly a major achievement completing this enormous job in such a short time.



**Fig. 37 'WD Fairway' in refloating condition**



**Fig. 38 'WD Fairway' after conversion**



**Fig. 39 'WD Fairway' in operation**

## CONCLUSION

From the presented projects it will be clear that there are many possibilities to give new life to old dredgers. Also for quite young equipment it is sometimes useful to convert, making the dredger suitable for a specific job or giving new opportunities for the rest of its lifetime.

One cannot say: "Old dredgers never die", but small modifications, big conversions and even complete makeovers are possible so you can extend the lifespan.

It's not always cheaper, but it's certainly faster than new building.

