

# SUMMER INTERNSHIP

## “Design of a Boat for Petroleum Transportation”

Samudra Shipyard (P) Ltd.

Rajkumar Kewat  
Mobility and Vehicle Design  
IDC IIT Bombay

# Contents

1. Brief
2. Research
3. Benefits of Inland waterways
4. limitations/ problems to implement this national waterway project
5. Study of cargo distribution by road transportation
6. Scenarios
7. Brain storming
8. Ideations
9. Concepts
10. Future of the project
11. References

# Brief

Design a cargo Boat to transport LPG, CNG etc. for distribution in Kerala through National Waterways.

## Need of project

- Increased number of accidents of LPG, CNG, Hazardous chemical carrying truck.
- Failure of the LNG Kochi terminal.
- Focus of the government to enhance the Inland water transport through national waterways

# Research

# Problems

NATIONAL > KERALA  
Updated: September 2, 2012 20:04 IST

KANNUR, September 2, 2012

## Chala gas tanker toll rises to 19

A CORRESPONDENT  
COMMENT · PRINT · T T  
Like Share 0 Tweet G+1 0 in Share Pin it Shares



KPGC President Ramesh Chennithala and Minister of State for Power K.C. Venugopal during a visit to the houses of victims of Tanker explosion at Chala in Kannur district on Sunday. Photo: S. K. Mohan. The Hindu

Article 1 - <http://www.thehindu.com/news/national/kerala/chala-gas-tanker-toll-rises-to-19/article3850944.ece>

Home > States > Kerala

## Lessons Not Learnt from Chala Tanker Tragedy

By K R Ranjith - KANNUR | Published: 15th January 2014 09:12 AM Last Updated: 15th January 2014 09:12 AM



The gas tanker which overturned and caught fire at Kalliasseri in Kannur on Tuesday | A Sanesh

Article 2 - <http://www.newindianexpress.com/states/kerala/Lessons-Not-Learnt-from-Chala-Tanker-Tragedy/2014/01/15/article2000544.ece>

## Fire disaster following LPG tanker explosion at Chala in Kannur (Kerala, India): August 27, 2012.

### Abstract

A fire disaster following LPG tanker explosion occurred at Chala bypass, Kannur, Kerala, India on August 27, 2012. The three chambered tanker with total 16tonnes (162.57 quintal) LPG collided with a road divider and exploded thrice. A total of 41 people became victims during first blast; out of which 20 died in various hospitals. Five people remained inside the house after first blast and escaped unhurt from the zone of accident before second blast. All the victims were transferred to various hospitals; of these, six were transferred to the burns unit of the Kasturba Hospital, Manipal

Article 3 - <http://www.ncbi.nlm.nih.gov/pubmed/23639222>

Home > News > One killed, 34 injured as LPG tank...

Tuesday, 28 August 2012 17:09

## One killed, 34 injured as LPG tanker explodes in Kannur

CD Network, Photos by Rajesh Kumar



Kasargod, August 28: A woman was killed when an LPG tanker lorry burst into flames after an accident and set her house nearby on fire near the Chala temple, six km from Kannur, police said on Tuesday. Thirty-four people were injured in the accident.

Article 4 - <http://coastaldigest.com/index.php/news/44254-one-killed-34-injured-as-lpg-tanker-explodes-in-kannur>



Image(article 4) - <http://coastaldigest.com/index.php/news/44254-one-killed-34-injured-as-lpg-tanker-explodes-in-kannur>



# Failure of Kochi LNG Terminal

Home > Cities > Kochi

## LNG Kochi Terminal Not of Any Benefit to Kerala

By Express News Service | Published: 30th January 2016 05:27 AM | Last Updated: 30th January 2016 05:27 AM

Email 0



KOCHI: In January 2014, then Prime Minister Manmohan Singh dedicated the Rs 4,500 crore LNG Terminal at Puthuvype in Kochi to the nation. Even after two years the terminal is not of any benefit to the nation or the state.

Article 5 - <http://www.newindianexpress.com/cities/kochi/LNG-Kochi-Terminal-Not-of-Any-Benefit-to-Kerala/2016/01/30/article3251354.ece>

CITIES - KOCHI ALAPPUZHA, April 9, 2016  
Updated: April 9, 2016 07:13 IST

## Delay in LNG pipeline laying to be poll issue in Alappuzha

R. RAMABHADRAN PILLAI

COMMENT · PRINT · T T

*LDF has held discussion with commerce, industry leaders*

The Left Democratic Front (LDF) is likely to take up issues pertaining to the inordinate delay in the completion of the LNG pipeline project during campaigning in the district.

The LDF leadership has held parleys with commerce and industry leaders who have underlined the need to complete the project. Communist Party of India (Marxist) (CPI(M)) leaders have already gone on record that the project will receive due attention if the LDF assumes power.

### Lack of connectivity

The commissioning of the LNG terminal in Kochi two years ago was considered a milestone in the history of development projects in the State.

But it could not make the desired impact in the industrial scene due to the inability of the authorities to ensure pipeline connectivity to the intended areas.

The pipeline project, envisaged for completion along with the commissioning of the terminal, got delayed mainly due to protests from landowners, backed by political parties, in the districts in north Kerala.

Laying of the pipelines, under the Petroleum & Minerals Pipelines (acquisition of right of user in land) Act, 1962, meant that the ownership of land would rest with the title holders who could take up cultivation, subject to conditions.

While the pipelines could be laid in Ernakulam without much trouble, the work was halted in several other districts.

Political forces

Industry sources said certain political forces were working behind the scenes.

The United Democratic Front (UDF) government, which failed to expedite the project, at a later stage authorised Collectors to take action to ensure completion of the project. The project is in progress, but no date has been set for completion yet.

It is against this background that the LDF is coming forward with a promise to complete the project which is expected to take gas to Kanjirkode and from there to Mangaluru and Bengaluru through separate pipelines.

The original plan to lay an undersea pipeline to Kayamkulam from the LNG terminal at Puthuvype in Kochi has also been neglected.

The government failed to chalk out a strategy to take the fishermen into confidence after the latter opposed the project.

Nor was there any move to lay an alternative pipeline along the Kochi-Alappuzha land route.

*Work delayed due to landowners' protests*

*Plan for undersea pipeline did not materialise*

Article 6 - <http://www.thehindu.com/news/cities/Kochi/delay-in-lng-pipeline-laying-to-be-poll-issue-in-alappuzha/article8453057.ece>

NATIONAL - KERALA  
Updated: September 16, 2015 05:46 IST

KANNUR, September 16, 2015

## Protest delays GAIL pipeline project

SPECIAL CORRESPONDENT

COMMENT · PRINT · T T

The opposition of land owners to the proposed gas pipeline by the Gas Authority of India Ltd. (GAIL) remains a sticking point in the efforts of the district administration to accelerate procedures for making land available in the district for the pipeline project.

The meeting held by District Collector P. Bala Kiran on September 14, to discuss measures to expedite action for getting consent of land owners for laying the pipeline underground was inconclusive. It ended in commotion with the land owners staging a walkout in protest saying that they would not allow the pipeline laying under their plots as they did not want to live in constant fear of disaster for the rest of their lives.

As the efforts of the district administration to speed up the land availability for the natural gas pipeline reached a deadlock following dissent from the residents, Mr. Kiran said that the issue would be discussed at the meeting of District Collectors scheduled on September 17 and 18. The meeting saw political leaders expressing the view that GAIL authorities should ensure safety of the meeting and market rate for the land identified for laying the pipeline. A good compensation package matching the one announced for the Kannur airport and an initiative to make the people aware of the pros and cons of the project were stressed at the meeting.

The efforts of GAIL Chief Manager Tony Mathew to explain the importance of the gas pipeline to be linked as part of the national network were eclipsed in protest. He said that public safety would be ensured.

Article 7 - <http://www.thehindu.com/news/cities/Kochi/delay-in-lng-pipeline-laying-to-be-poll-issue-in-alappuzha/article8453057.ece>

# Opportunity

≡ SECTIONS

 THE FINANCIAL EXPRESS

[Home](#) / [Economy](#) / Growth of waterways key for India's development: Nitin Gadkari

## Growth of waterways key for India's development: Nitin Gadkari

Union Road Transport and Highways and Shipping Minister Nitin Gadkari has pitched for improving waterways as a mode of transportation for the development of the nation.

By: ANI | Published: May 18, 2015 11:32 PM

Article 8 - <http://www.financialexpress.com/article/economy/growth-of-waterways-key-for-indias-development-nitin-gadkari/259094/>

“I dream of making waterways in India, at a level that the National Highways Have been made. Till date, the waterways have never been given importance, But, these **waterways will lead the nation to progress,**” said by Nitin Gadkari.

# Opportunity

## Government expecting Rs 25 lakh crore investment for infra development: Nitin Gadkari

PTI | Apr 30, 2016, 02:17AM IST

Tags: shipping infrastructure | roads | Nitin gadkari | infrastructure | Indo-American Chamber of Commerce

NEW DELHI: The government is expecting investments worth Rs 25 lakh crore over the next 3 years in the roads, railway and shipping infrastructure that includes setting up of 27 industrial clusters at ports at around Rs 8 lakh crore, Union Minister Nitin Gadkari said today.

"We are committed to overhaul country's infrastructure and gradually working towards achieving this. We plan to spend Rs 25 lakh crore in our highways and shipping sector which includes setting up of 27 industrial clusters near ports at an estimated cost of Rs 8 lakh crore," Gadkari said.



Article 9 - [http://articles.economictimes.indiatimes.com/2016-04-30/news/72726800\\_1\\_lakh-crore-highways-projects-union-minister-nitin-gadkari](http://articles.economictimes.indiatimes.com/2016-04-30/news/72726800_1_lakh-crore-highways-projects-union-minister-nitin-gadkari)

## Our Ministry will contribute 2-3% to GDP growth: Nitin Gadkari

By Prema Katiyar, ET Bureau | 22 May, 2016, 04:31AM IST

Post a Comment

### On low share (6%) of waterways in transport compared to China (47%)

I agree that the share of waterways is minuscule in our country; it is 6% now and has risen 2.5% in the last two years. The Congress government never looked to increase the share of coastal traffic and waterways. I have started work on five such projects and DPR (detailed project report) of 18 is ready. Work on the stretch between Pala (in Haryana) and Wazirabad (in Delhi) will be started in three months. Having said that I know that it is a difficult task; it is a new subject but I am trying my best. We can't be sure but we will try to shift 15% of road transport of **BSE -0.56%** fertilizer, cement etc to waterways in five years. I believe it will be done.

Article 10 - <http://economictimes.indiatimes.com/opinion/interviews/our-ministry-will-contribute-2-3-to-gdp-growth-nitin-gadkari/articleshow/52377776.cms>

## Work on Rs 4,200 crore Jal Marg Vikas project takes off

By PTI | 2 Jun, 2015, 06:01PM IST

Post a Comment

READ MORE ON » World Bank | Jal Marg Vikas | IWAJ | Inland Waterways Authority of India

NEW DELHI: The 'Jal Marg Vikas' (National Waterway-1) project, which envisages developing a fairway between 1,620 km Allahabad and Haldia stretch, has taken off with a \$3.5 million funding from the World Bank.

"The Jal Marg Vikas Project on River Ganga has now taken off with the World Bank extending a project preparation fund (PPF) of \$3.5 million ... as advance, which is part of its financial assistance for the project," Inland Waterways Authority of India (IWAJ) has said.



The central government has designated the IWAJ as the implementing agency, with a Project Management Unit (PMU), for the Jal Marg Vikas Project, an IWAJ spokesperson said.

Article 11 - <http://economictimes.indiatimes.com/news/economy/infrastructure/work-on-rs-4200-crore-jal-marg-vikas-project-takes-off/articleshow/47515752.cms>

Massive work is also being done on waterways front and detailed project reports are being worked out for converting all rivers into waterways.

Inland Waterways has become one of the key

leaders in economic development

05 May, 2016

India's economic growth is directly proportional to its logistics sector and now inland waterways where the government has also given the green signal. Many major cities are inseparably linked to the rivers and situated on their banks.

Article 12 - <http://www.merinews.com/article/inland-waterways-has-become-one-of-the-key-leaders-in-economic-development-reports/15915942.shtml>

# Opportunity

## Our Ministry will contribute 2-3% to GDP growth: Nitin Gadkari

By Prema Katyar, ET Bureau | 22 May, 2016, 04:31AM IST

[Post a Comment](#)

### On low share (6%) of waterways in transport compared to China (47%)

I agree that the share of waterways is minuscule in our country; it is 6% now and has risen 2.5% in the last two years. The Congress government never looked to increase the share of coastal traffic and waterways. I have started work on five such projects and DPR (detailed project report) of 18 is ready. Work on the stretch between Pala (in Haryana) and Wazirabad (in Delhi) will be started in three months. Having said that I know that it is a difficult task; it is a new subject but I am trying my best. We can't be sure but we will try to shift 15% of road transport of **BSE -0.56 %** fertilizer, cement etc to waterways in five years. I believe it will be done.

Article 9 -

<http://economictimes.indiatimes.com/opinion/interviews/our-ministry-will-contribute-2-3-to-gdp-growth-nitin-gadkari/articleshow/52377776.cms>

## Work on Rs 4,200 crore Jal Marg Vikas project takes off

By PTI | 2 Jun, 2015, 06:01PM IST

[Post a Comment](#)

READ MORE ON » World Bank | Jal Marg Vikas | IWA | Inland Waterways Authority of India

NEW DELHI: The 'Jal Marg Vikas' (National Waterway-1) project, which envisages developing a fairway between 1,620 km Allahabad and Haldia stretch, has taken off with a \$3.5 million funding from the World Bank.

"The Jal Marg Vikas Project on River Ganga has now taken off with the World Bank extending a project preparation fund (PPF) of \$3.5 million ... as advance, which is part of its financial assistance for the project," Inland Waterways Authority of India (IWA) has said.



The central government has designated the IWA as the implementing agency, with a Project Management Unit (PMU), for the Jal Marg Vikas Project, an IWA spokesperson said.

Article 10 - <http://economictimes.indiatimes.com/news/economy/infrastructure/work-on-rs-4200-crore-jal-marg-vikas-project-takes-off/articleshow/47515752.cms>

## Inland Waterways has become one of the key leaders in economic development: Reports

05 May, 2016

India's economic growth is directly proportional to its logistics sector and now inland waterways where the government has also given the green signal. Many major cities are inseparably linked to the rivers and situated on their banks.

Article 11 -

<http://www.merinews.com/article/inland-waterways-has-become-one-of-the-key-leaders-in-economic-development-reports/15915942.shtml>

We will try to shift **15% of road transport** of fertilizer, cement etc. to waterways in five years.

The **development of NW-1** would result in a viable supplementary mode of transport and huge quantities of bulk cargo can be transported thereby helping in economic development of this region, the spokesperson added.

Inland water transport (IWT) also has **tremendous potential for cargo movement and tourism**. The excellent environment credentials, the high safety standards for shipments and the large carrying capacity of the vessels are just some of the outstanding features of this long standing mode of transport.



## Key points

- National waterways Bill (2015) aims at declaring **106 additional inland waterways** as NW in addition to the five existing national waterways.
- Gov. is developing National Waterway-1 (NW-1) under the **Jal Marg Vikas Project**, with assistance from the World Bank, About NW-1: 1620 km Haldia - Allahabad stretch of River Ganga
- Development of multi-modal terminals, strengthening of open river navigation technique, modern **River Information System (RIS)**, **Digital Global Positioning System (DGPS)** etc.
- River Information System(RIS) launched to facilitate safe, accurate navigation

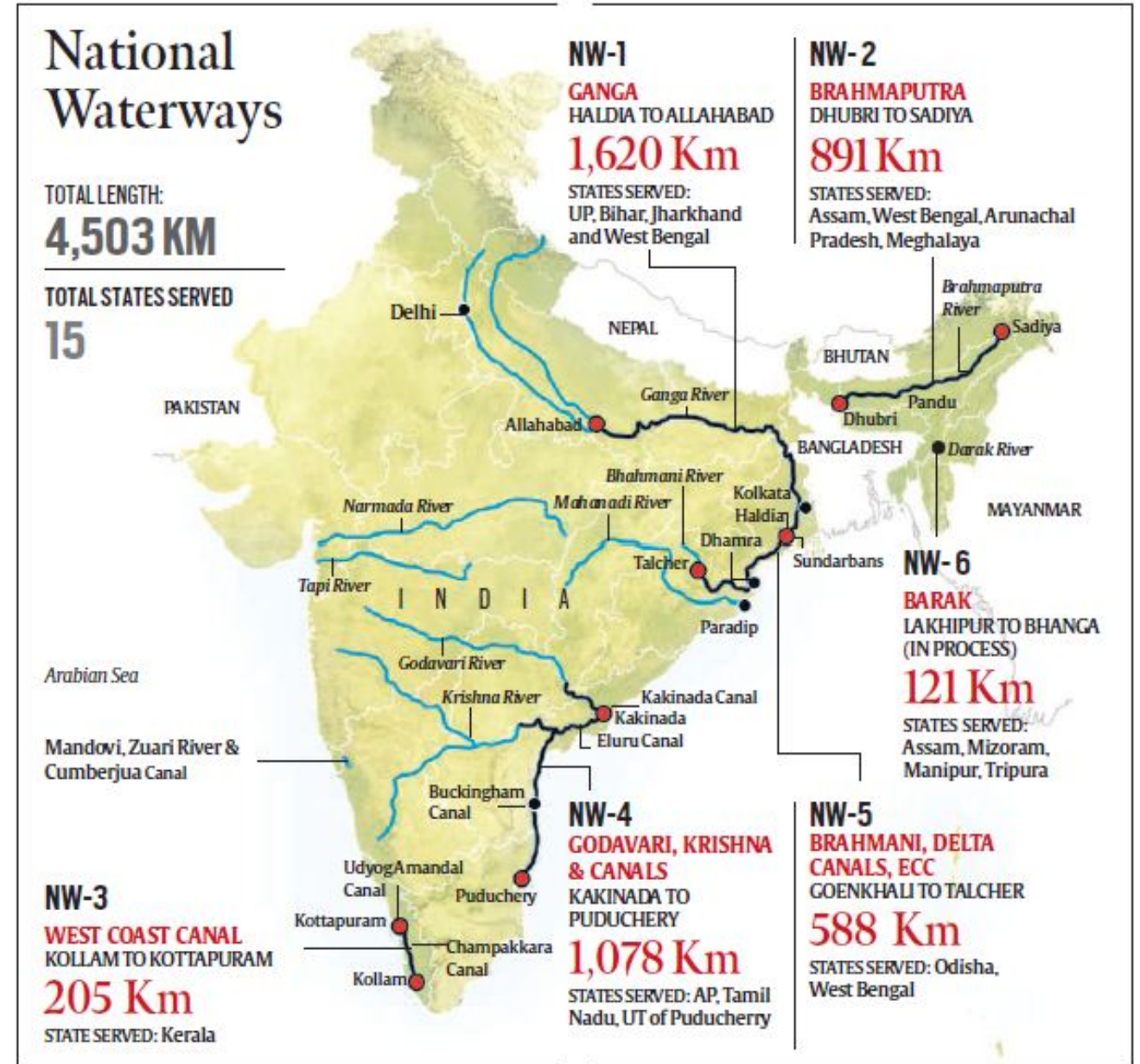





Fig 1 - <http://www.civildaily.com/story/inland-waterways-converting-rivers-to-national-waterways/#post-6080>

## Benefits of Inland waterways

Recognized as **fuel efficient, cost effective and environment friendly** mode of transport, especially for bulk goods, hazardous goods and over dimensional cargos

			
One horsepower can carry	4000 kg	500 kg	150 kg
One liter fuel can move	105 ton-km	85 ton-km	24 ton-km
Cost per kilometer	25-30 paisa	1 rupee	1.5 rupee

**Cost of developing** waterways much lower than rail on road.

**Immense potential for domestic cargo** transportation as well as for cruise, tourism and passenger traffic.

**Systematic development** will open up progressive economic and transport opportunities in the country

**Reduces congestion and accidents** on highways

**Open up considerable investment and business opportunities** in the areas like water-based tourism, construction and operation of terminals, creation of storage accommodation, and provision of other facilities required for smooth water-based navigation and Help to generate **millions of new jobs**

## limitations/ problems to implement this national waterway project

India's water channels will need to have adequate width, depth and air clearance. Many **rivers are seasonal**, with water flows declining sharply after the monsoon

Navigating such rivers in the lean season may, therefore, require **regular and extensive dredging and desilting**.

**Higher water salinity**, especially in the coastal regions and estuaries, and constant inflow of silt in the rivers can also be problematic

Water highways will require **more river ports** with their **support infrastructure** – road and rail connections, warehouses and other services

**Heavy investment** will be needed also to procure equipment, including dredgers, shipping vessels and barges of different sizes



Fig 2(Desilting Process)- <http://budcline.aminus3.com/image/2012-03-12.html>



Fig 3 (Dredging) - <https://sandrp.wordpress.com/2014/11/25/lessons-from-farakka-as-we-plan-more-barrages-on-ganga/>



# Study of cargo distribution by road transportation



Factory



Capacity – 25-20 ton



Capacity 15 ton



Capacity 10 ton



Capacity 1 ton



Capacity 4 ton



Capacity 7 ton

## **Scenarios for distribution of LPG in Kochi through waterways**

### Scenario one

## Scenario one



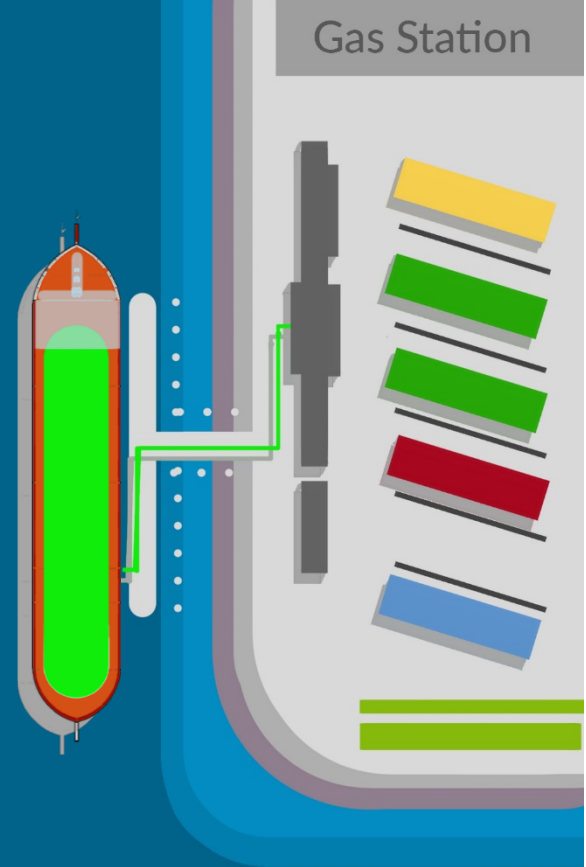
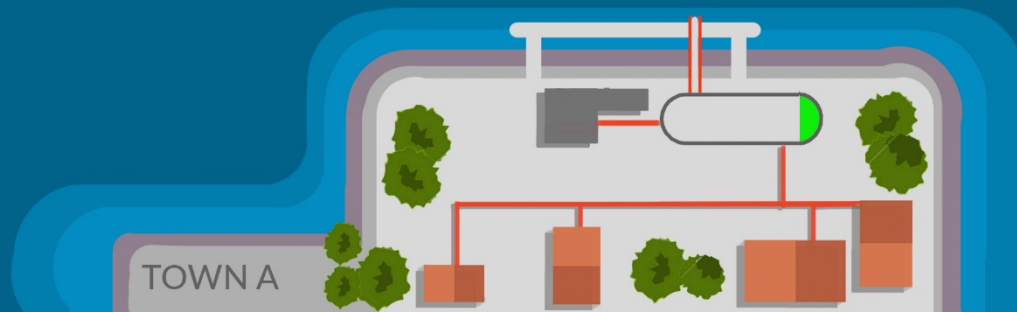
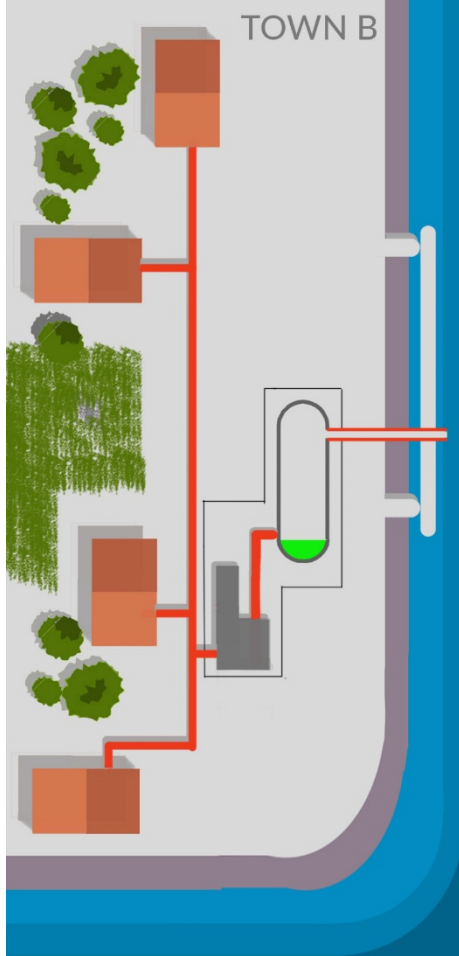
Scenario one





## Scenario Two









## Scenario Three



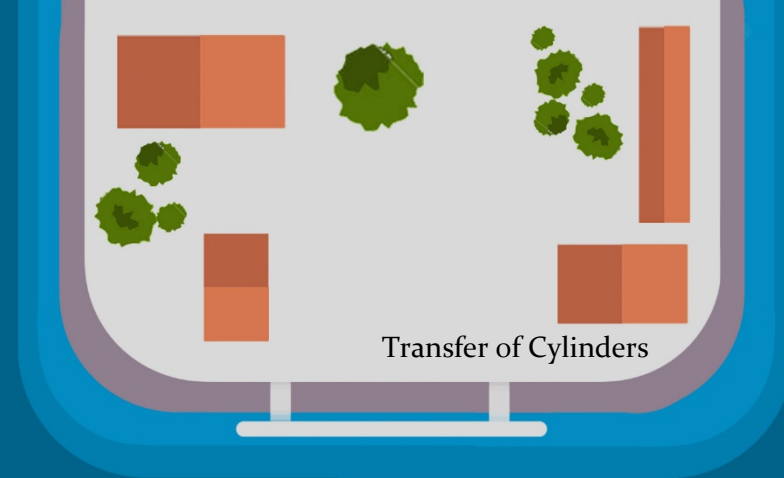
TOWN

Individual storage

For next Town

Gas Station

## Scenario Four

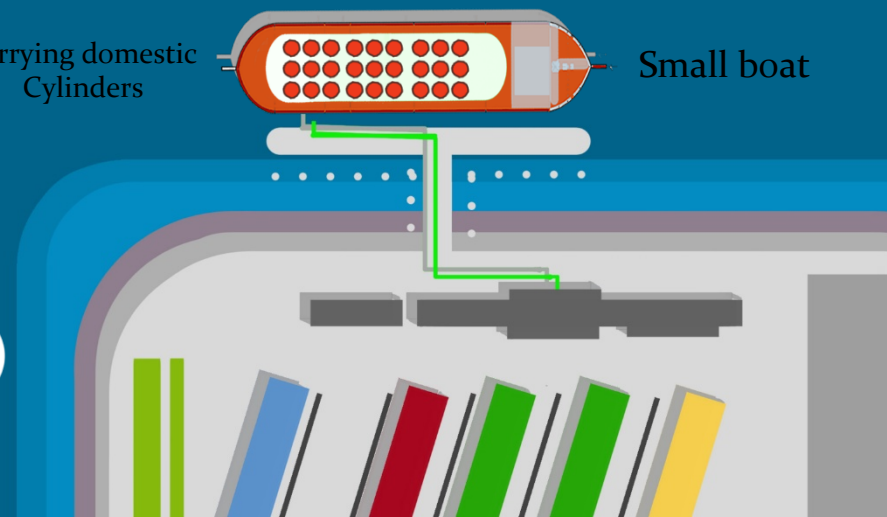


Transfer of Cylinders

For next Town

Carrying domestic  
Cylinders

Small boat



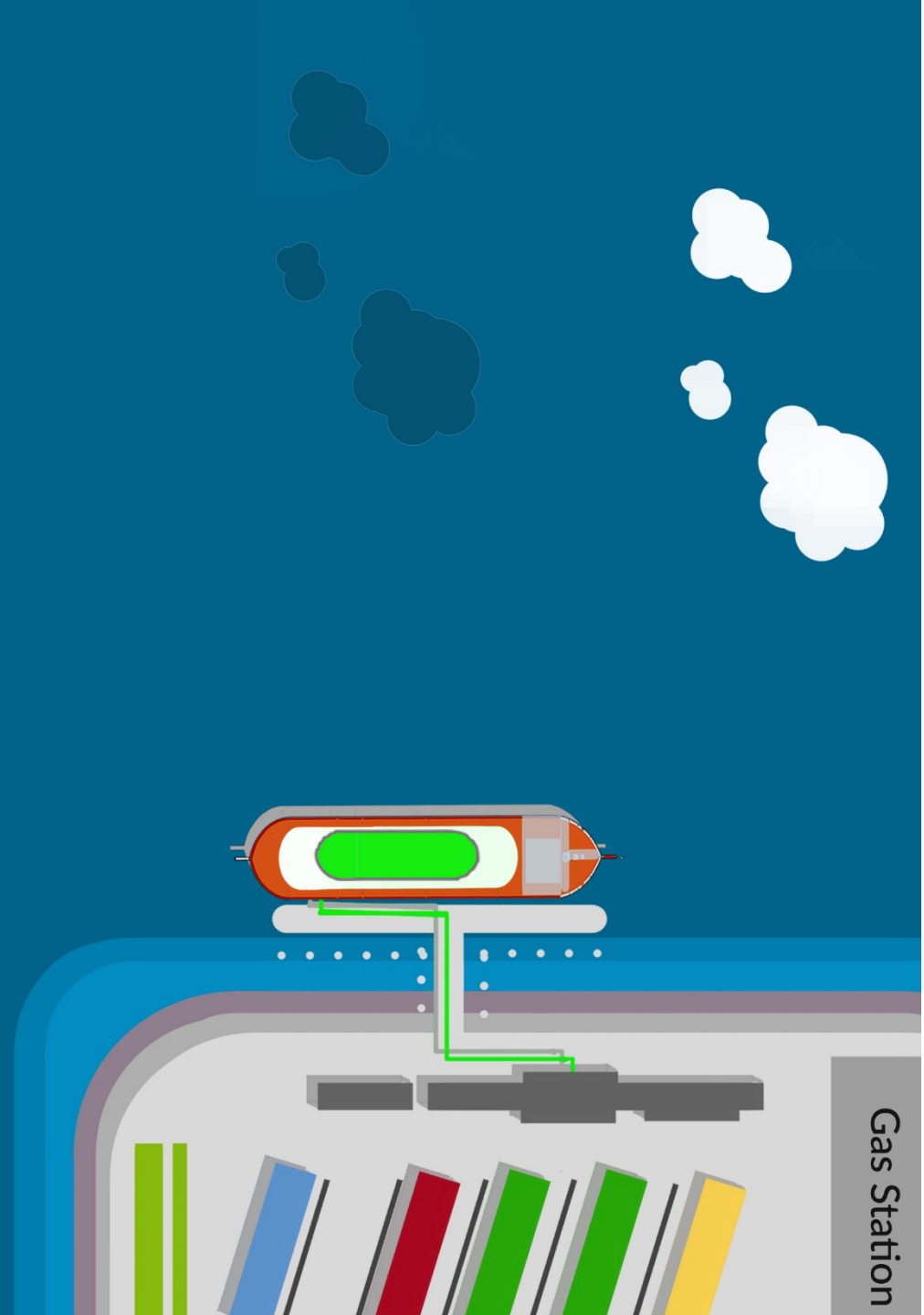
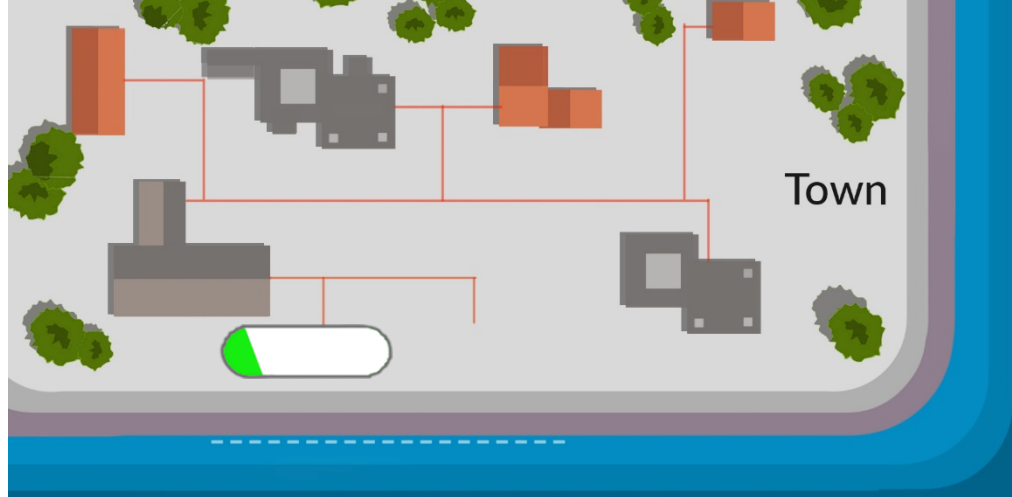




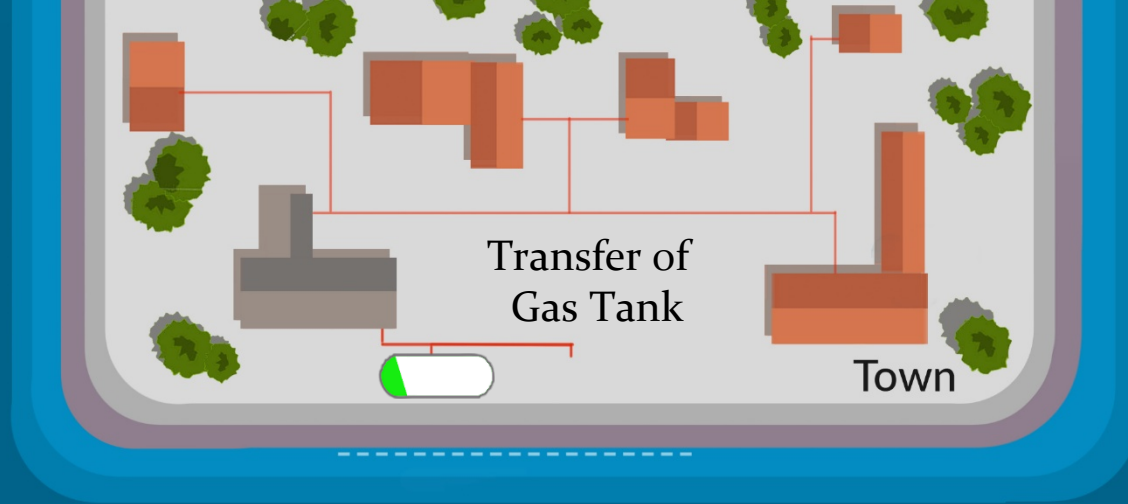


## Scenario Five

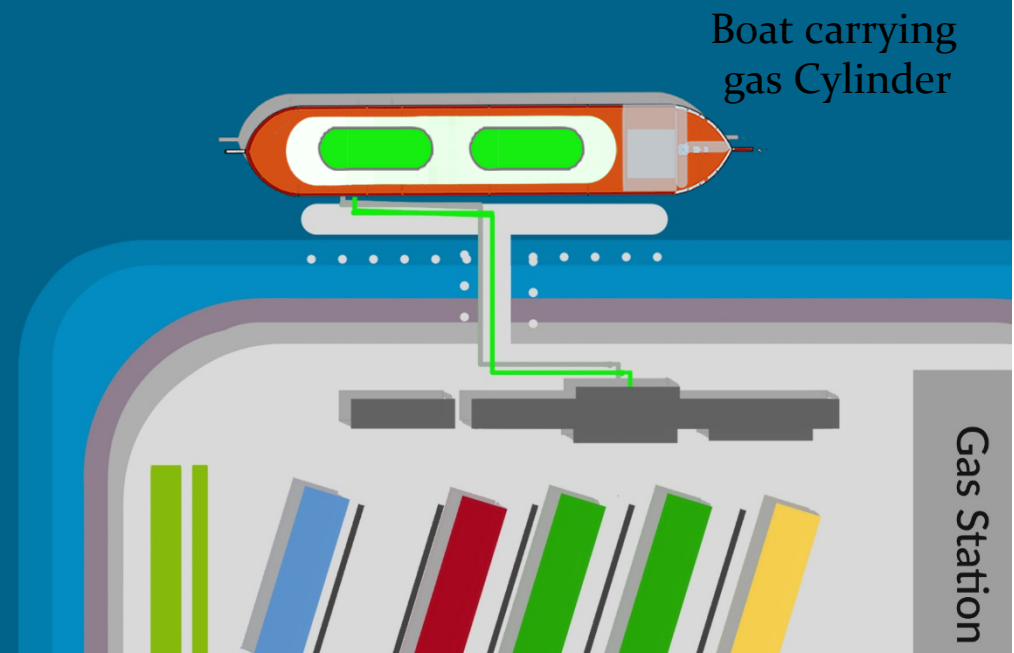




## Scenario Six



To next Island

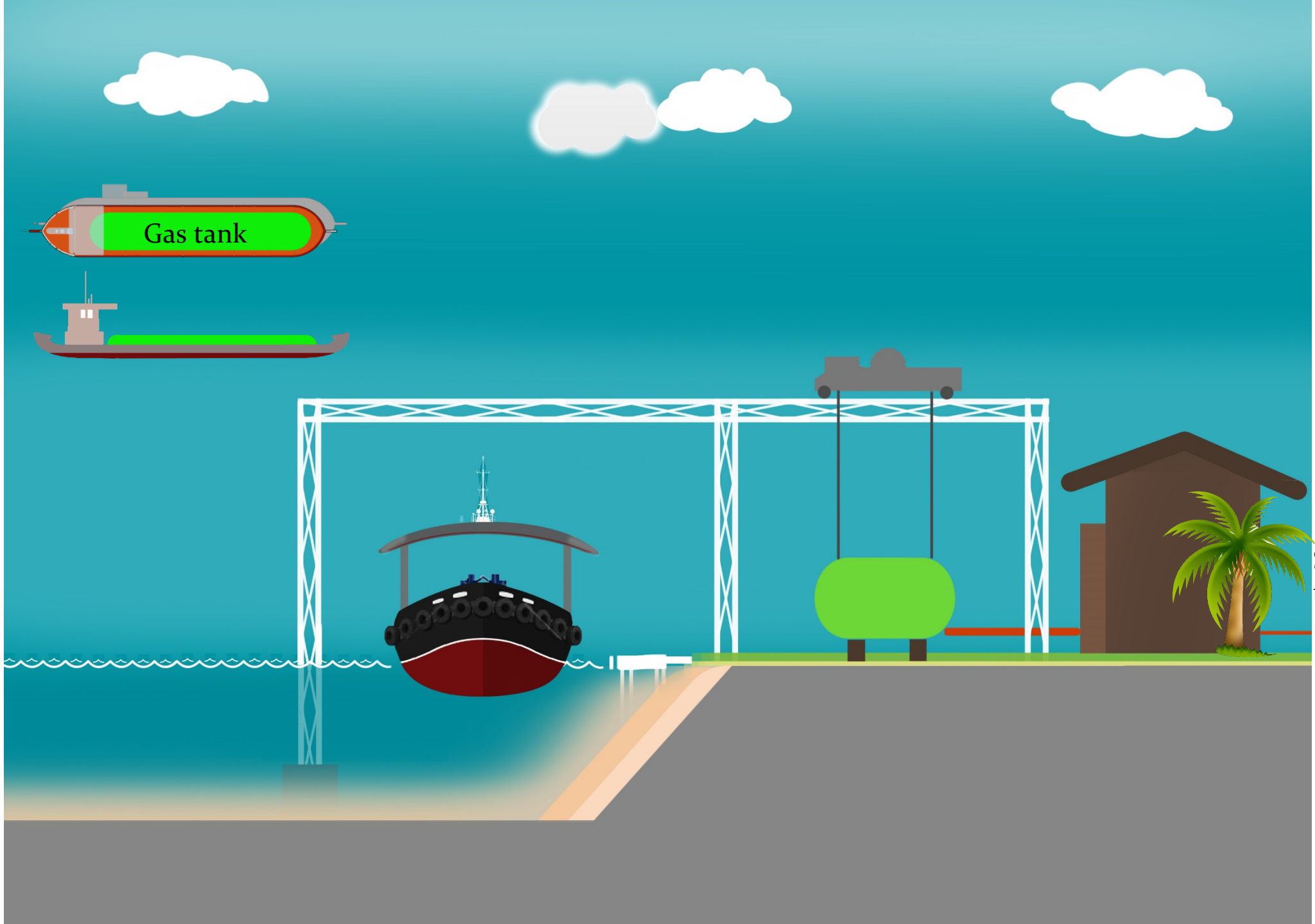




Mechanisms for gas tank transfer

Mechanism one





Gas tank

Supply for  
town



Mechanism second

For small capacity cylinders tanks



## Mechanism Third

For very small gas containers



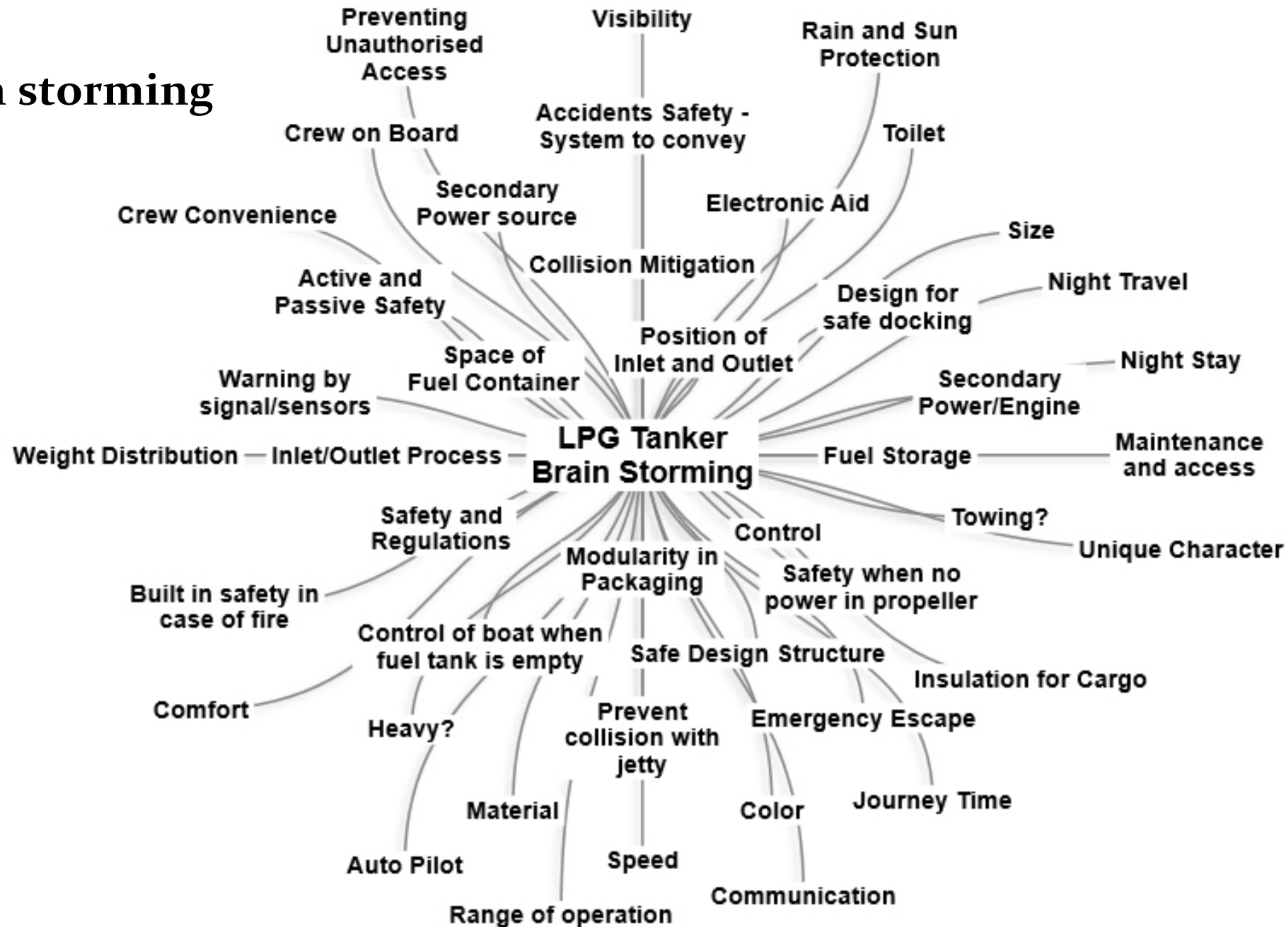


## Mechanism Four

Small cylindrical containers



# Brain storming



## Things to consider

Hull dimensions – (28m \* 4.87m \* 1.4 m , 12m \* 2.5m \* .85m).

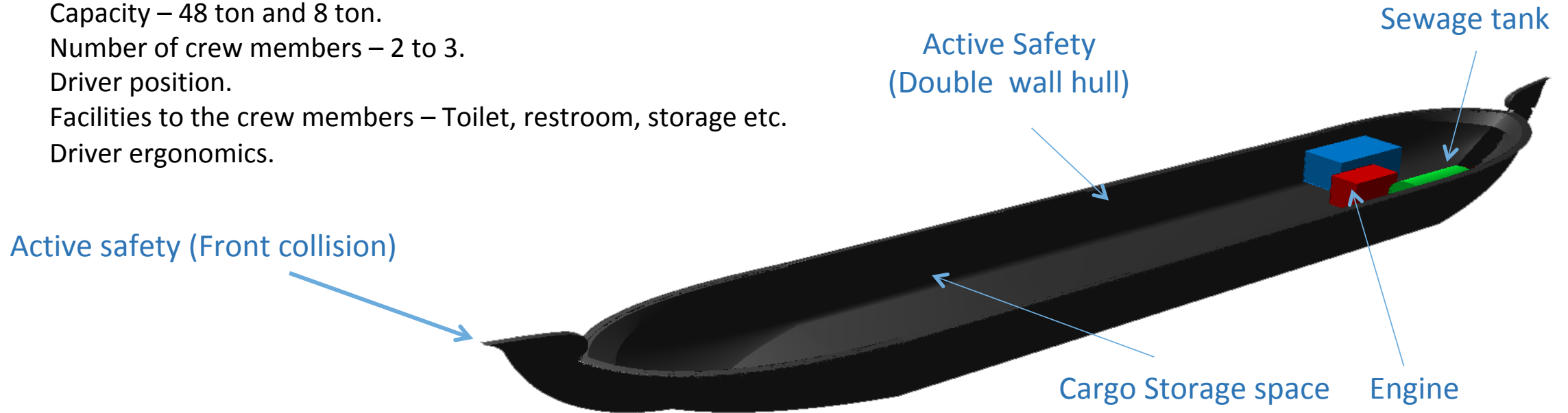
Capacity – 48 ton and 8 ton.

Number of crew members – 2 to 3.

Driver position.

Facilities to the crew members – Toilet, restroom, storage etc.

Driver ergonomics.



### Safety -

Active safety – Double wall hull design for reduce hull failure in crash.

- Gas leak sensors

Passive safety - River Information System (RIS) and

Digital Global Positioning System (DGPS) For guiding in navigation

- Sensor for depth and collision alarm.

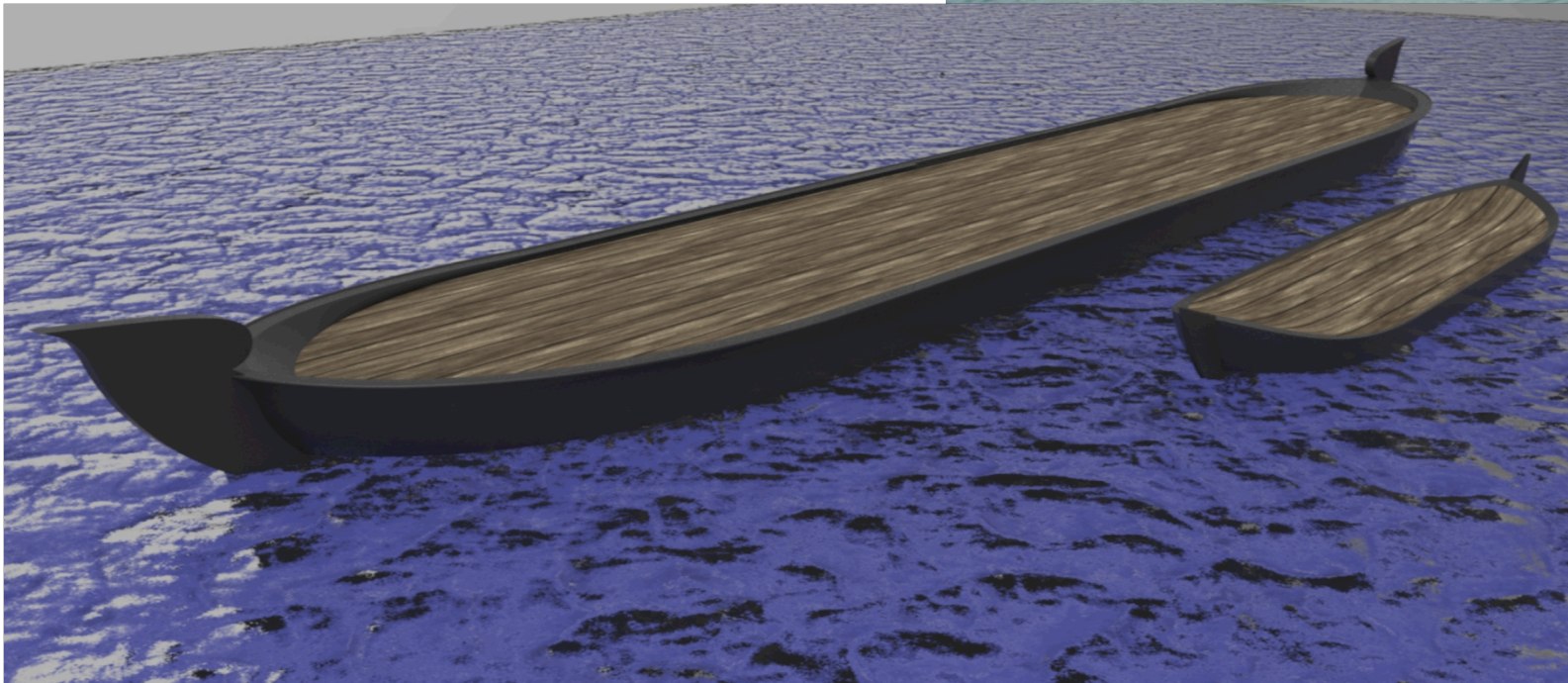
### Engine type and Power

# Ideations

## Hull Consideration

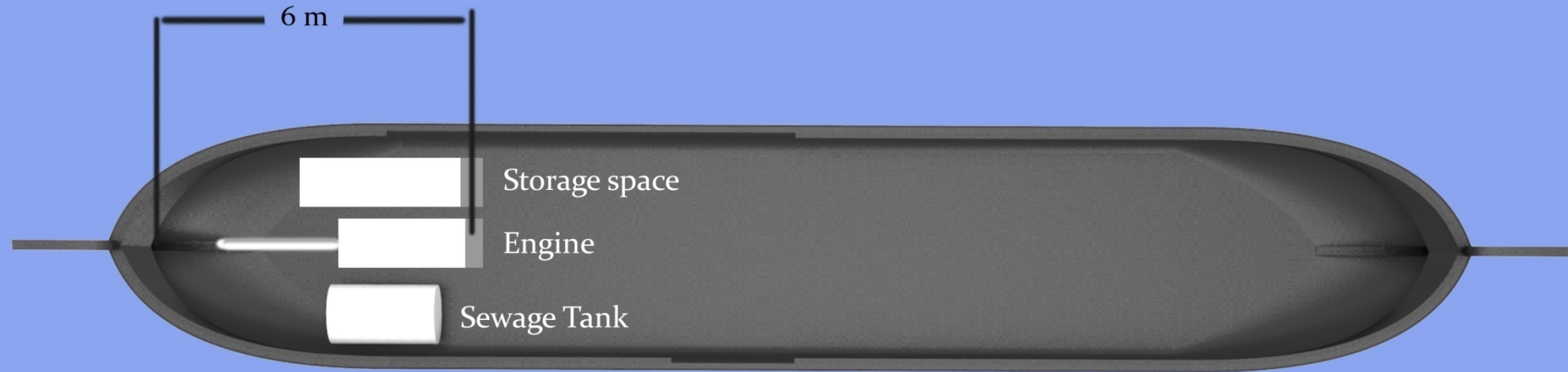
28m (capacity - 48 ton )

12m (Capacity - 8 ton)

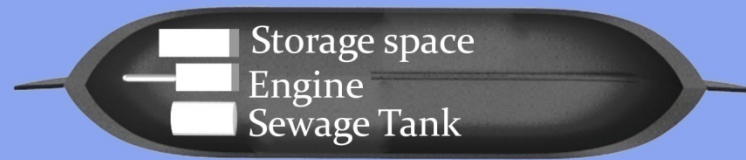




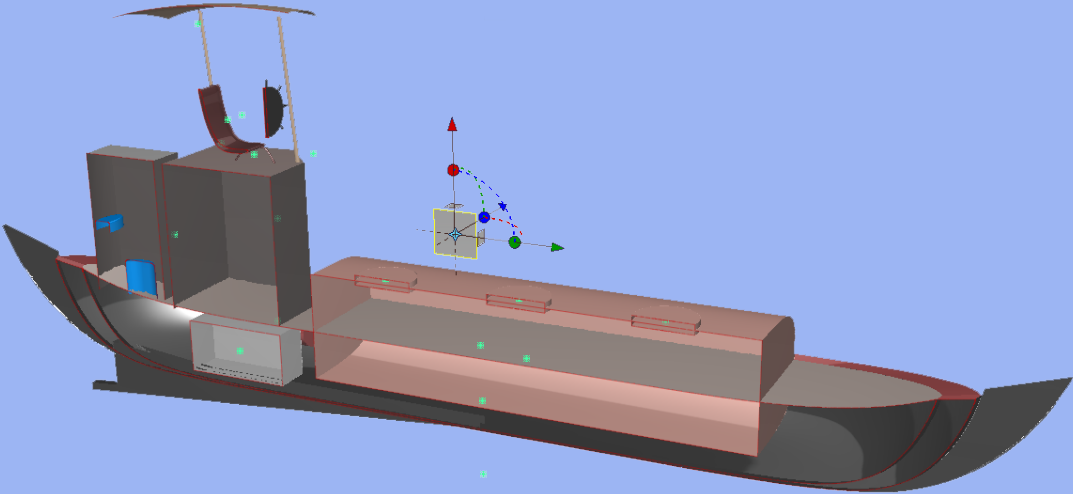
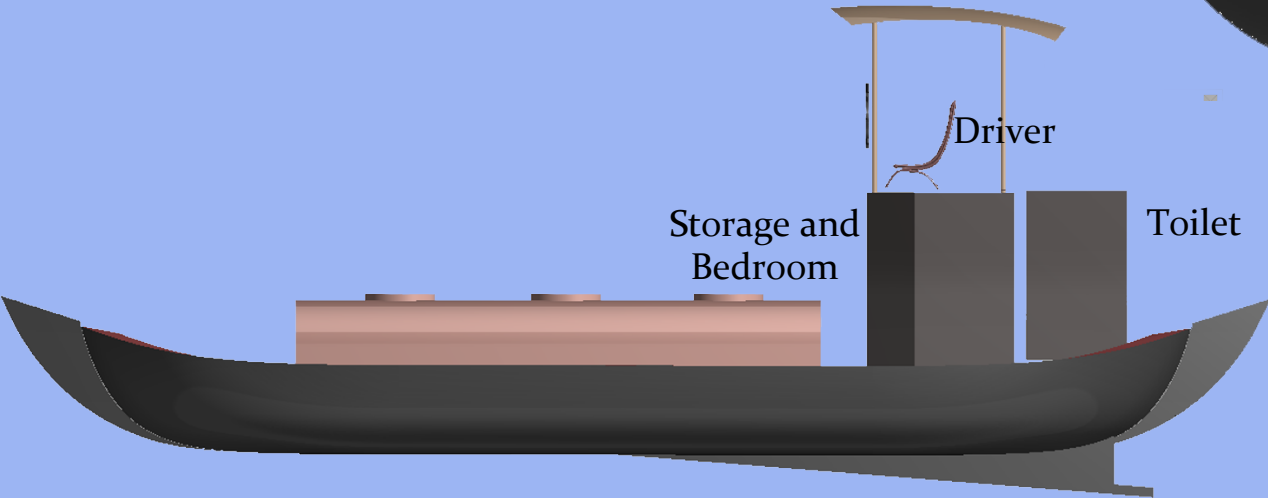
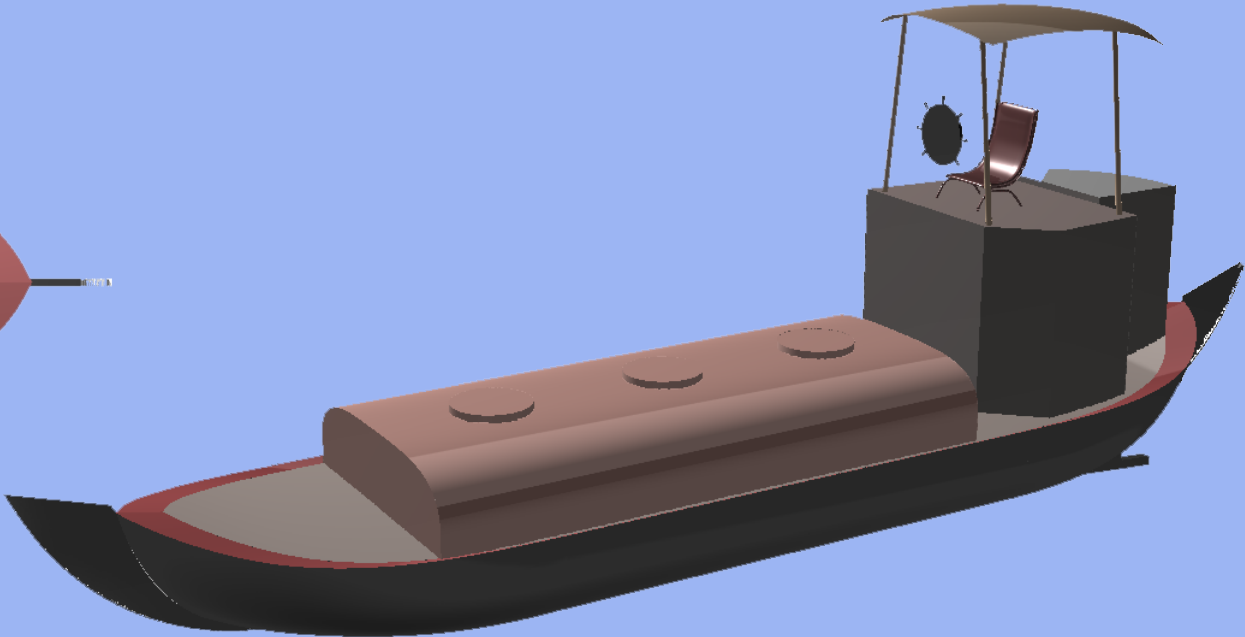
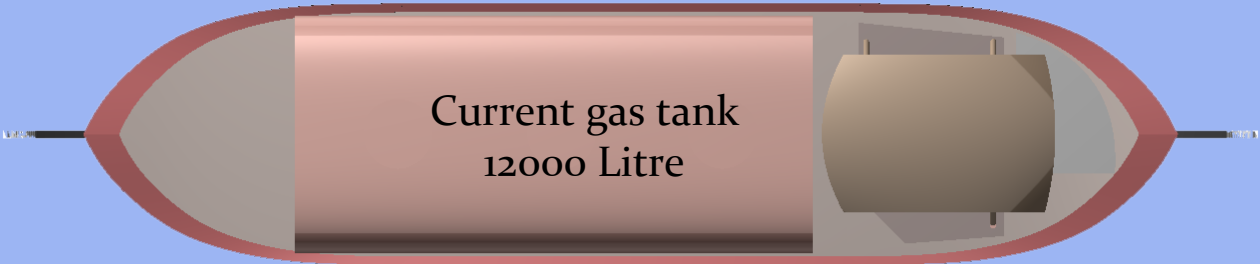
Hull - 28 m, capacity - 48 ton



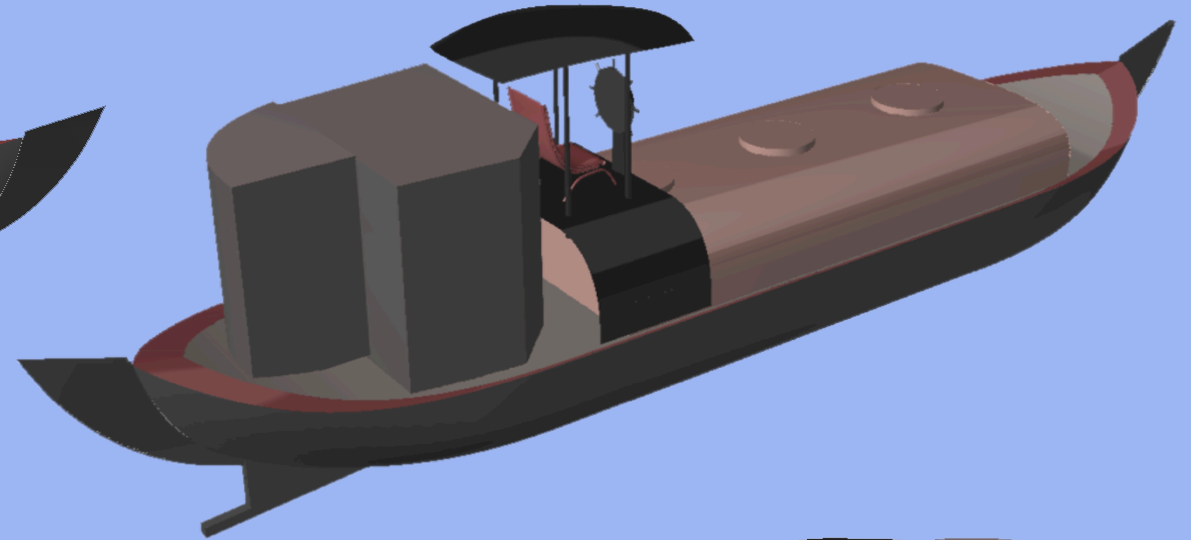
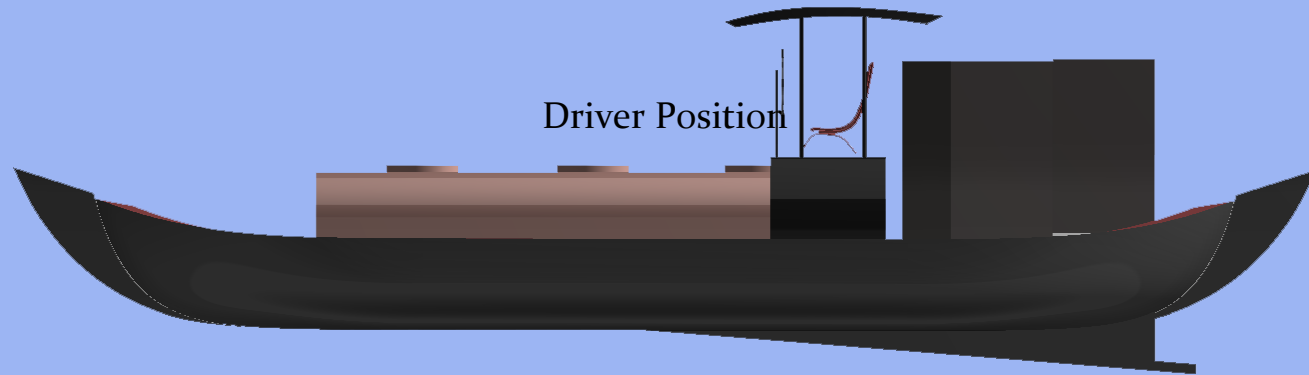
Hull - 12 m , capacity - 8 ton



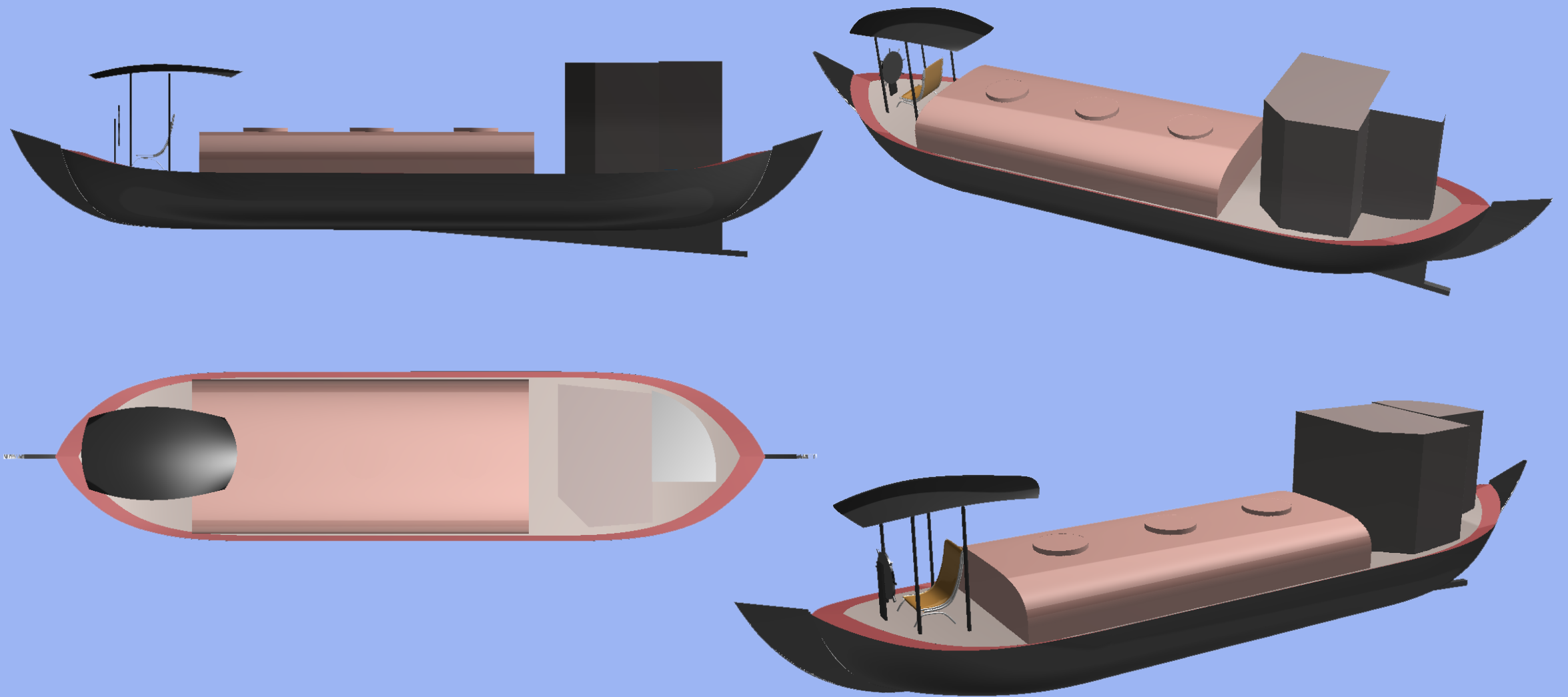
Ideations for small hull – Idea one



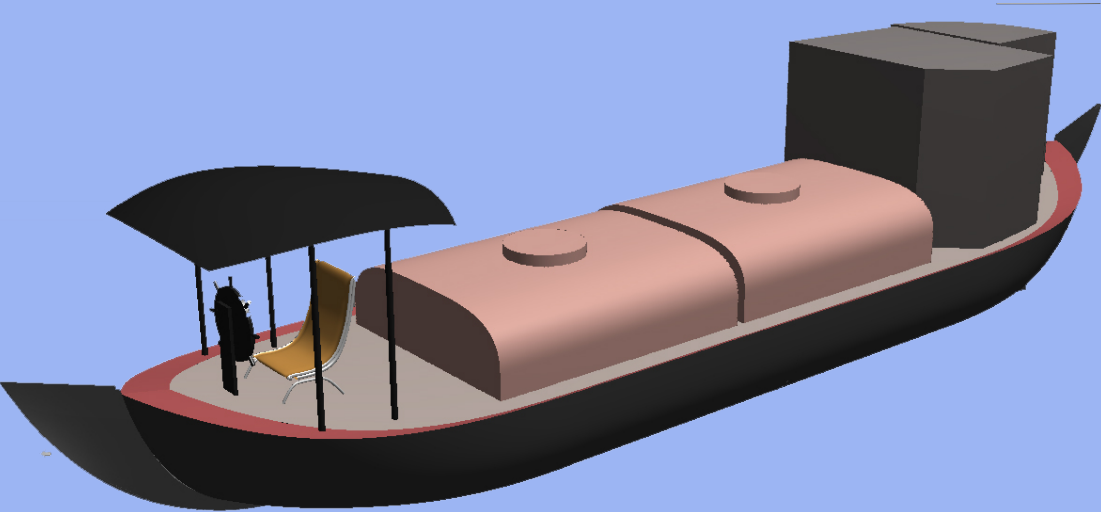
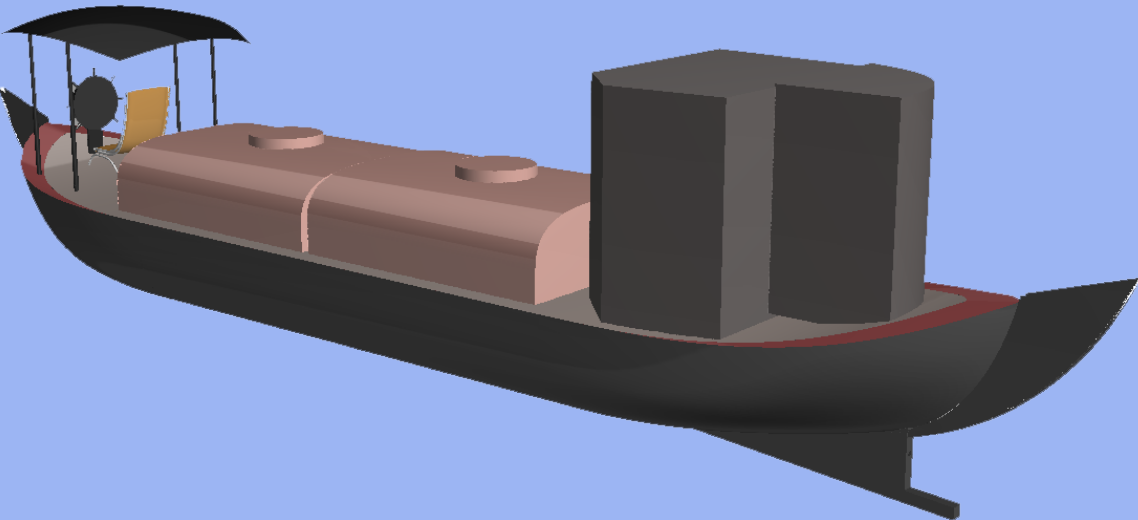
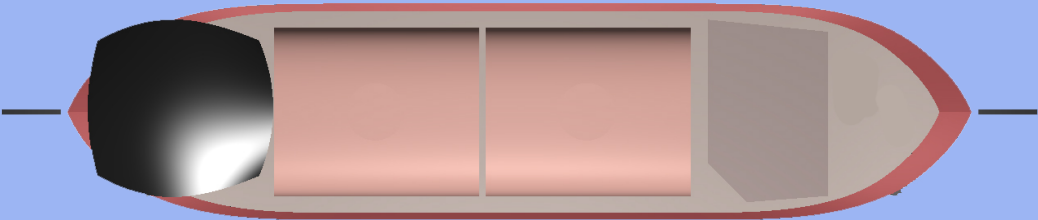
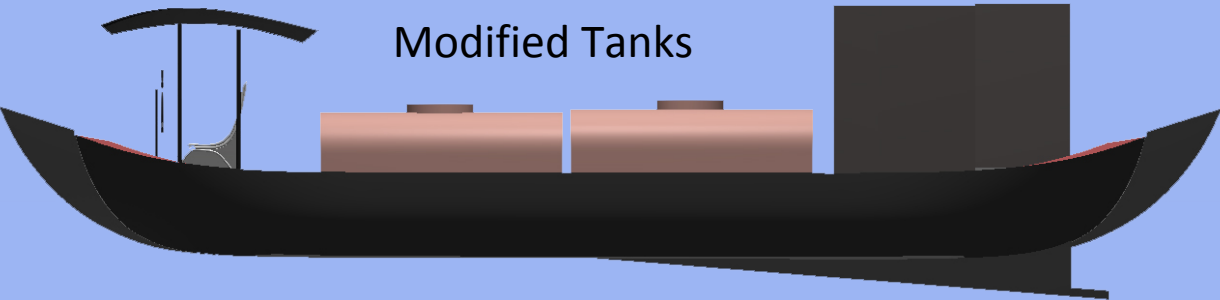
## Idea second



Idea Third



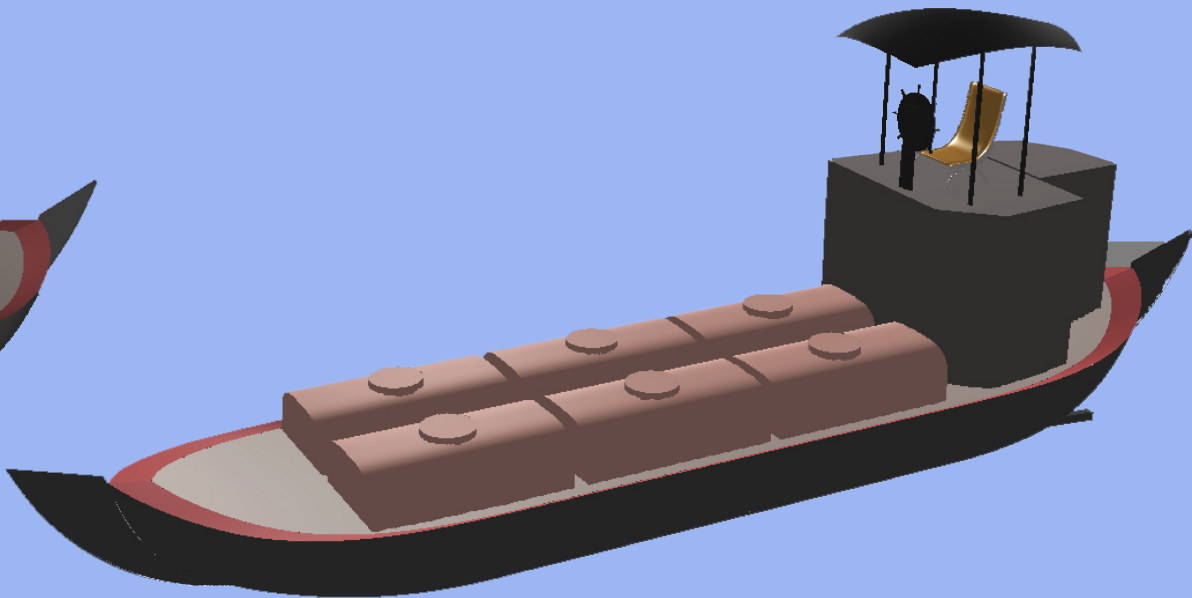
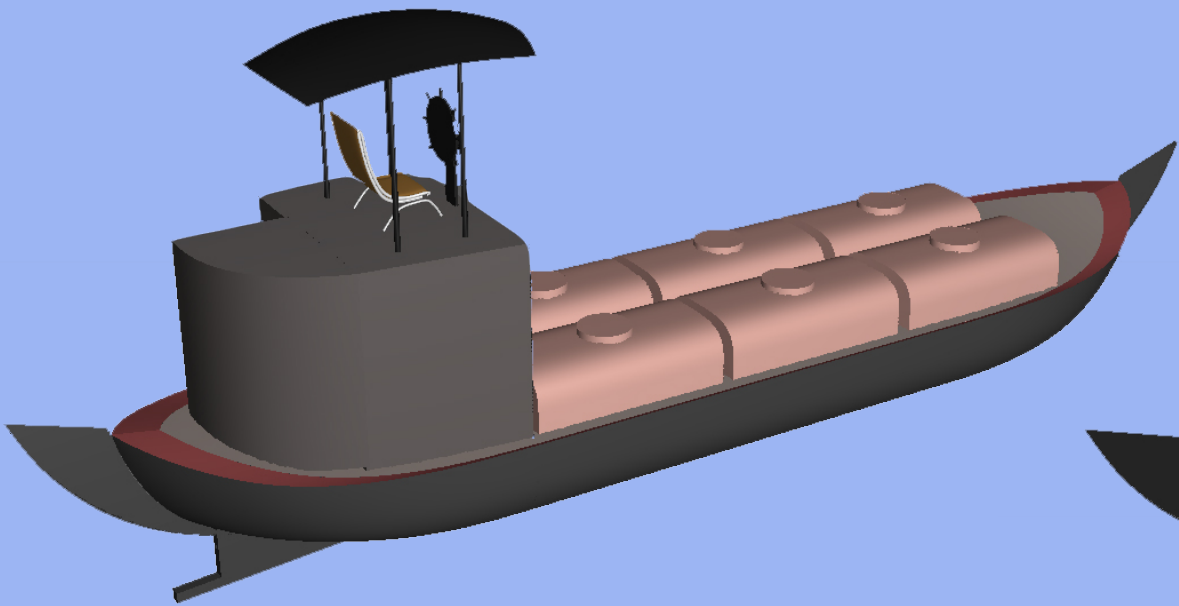
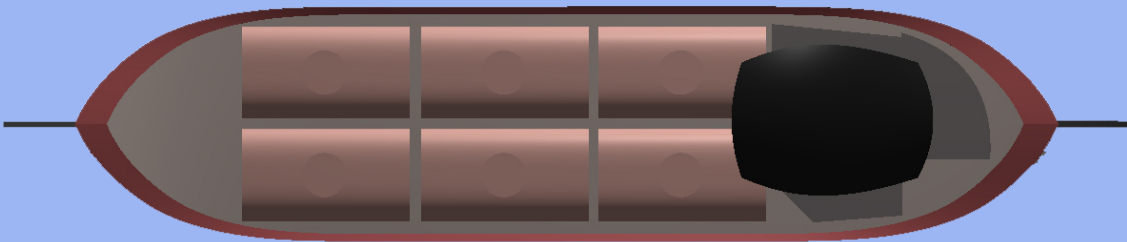
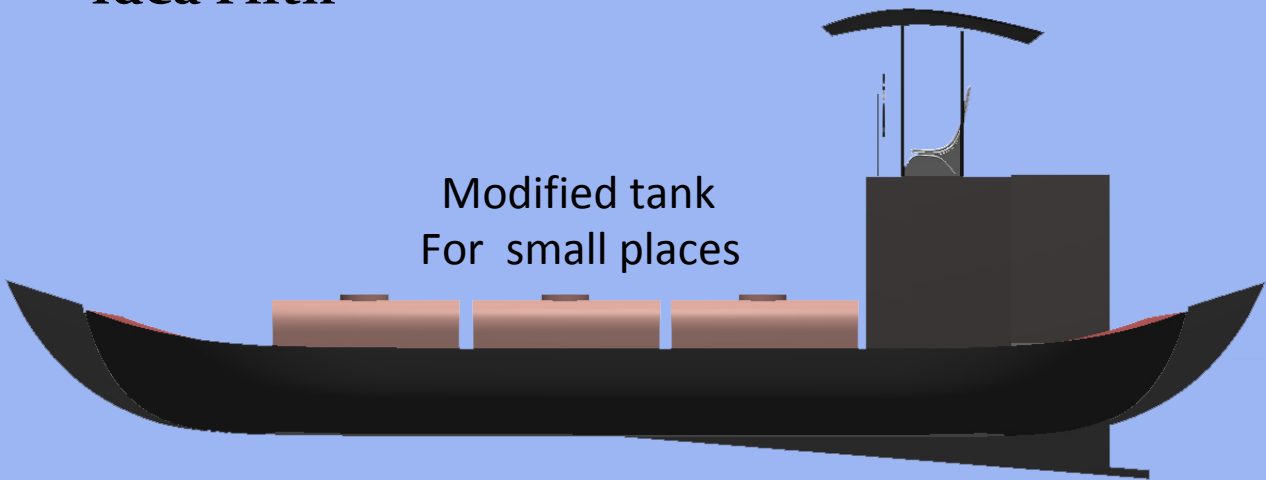
Idea Forth



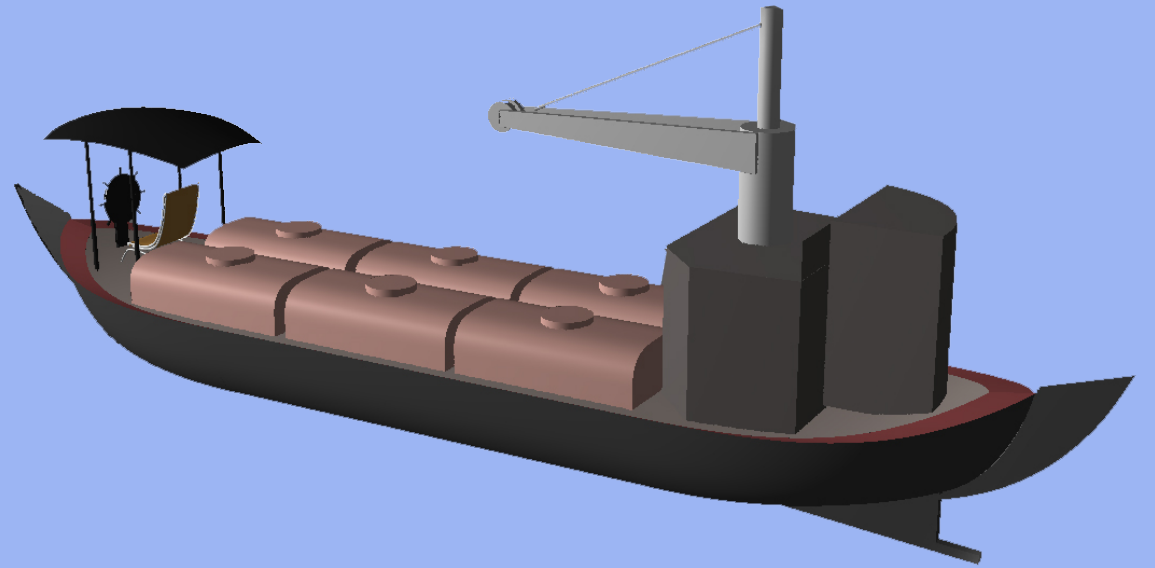
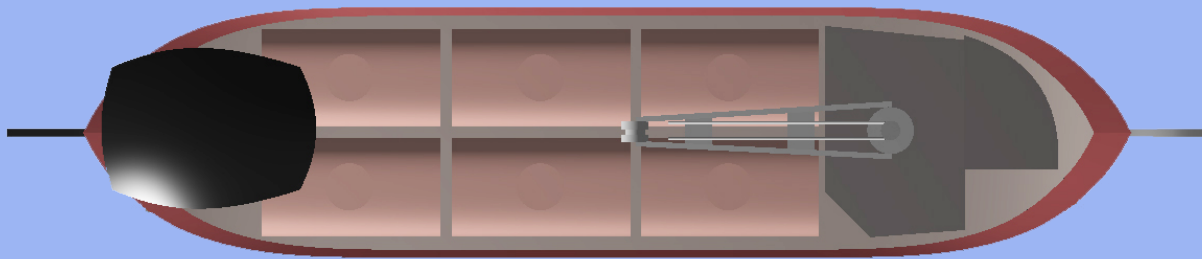
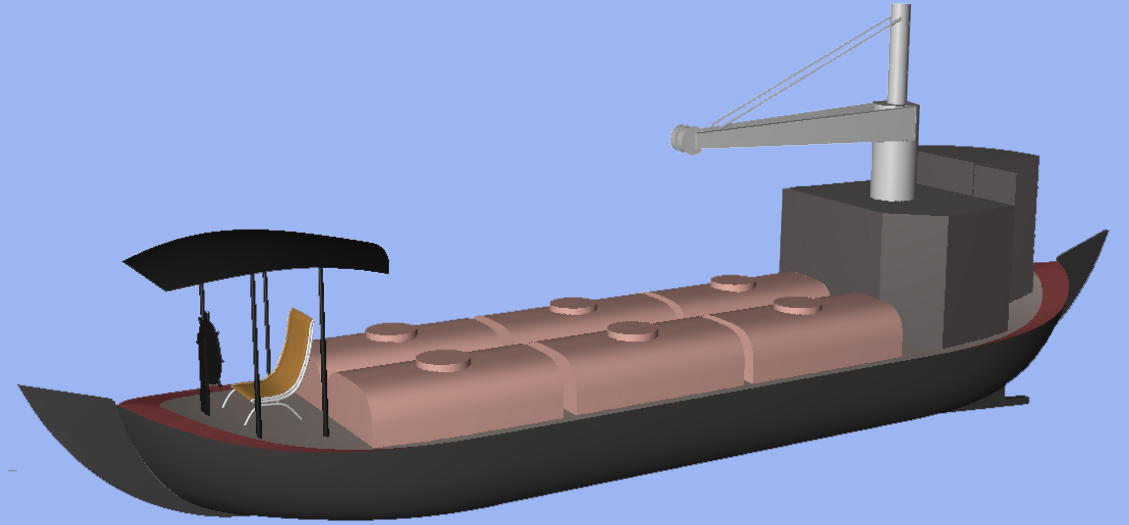
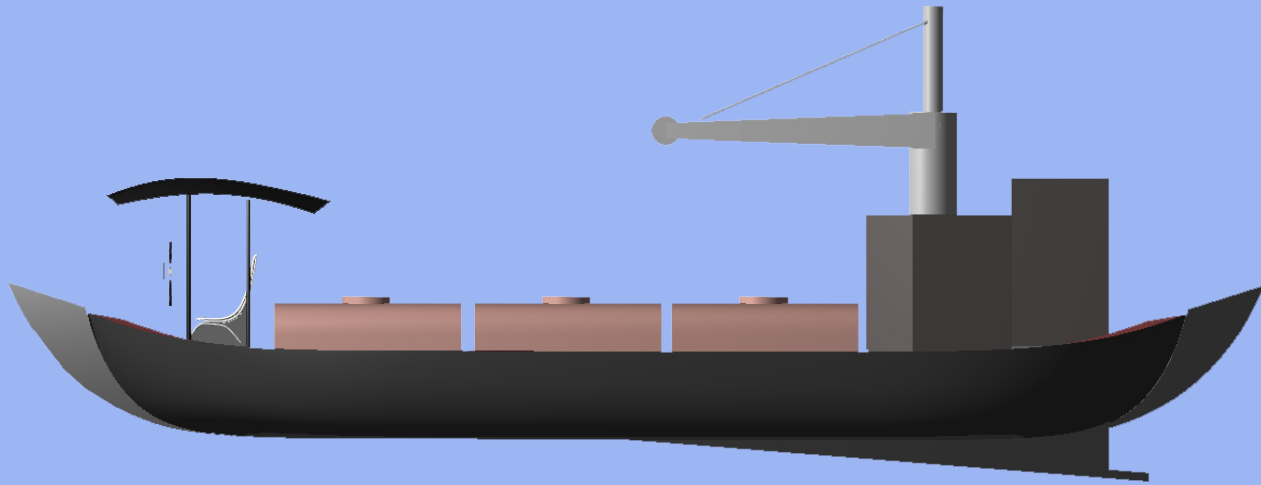


Idea Fifth

Modified tank  
For small places

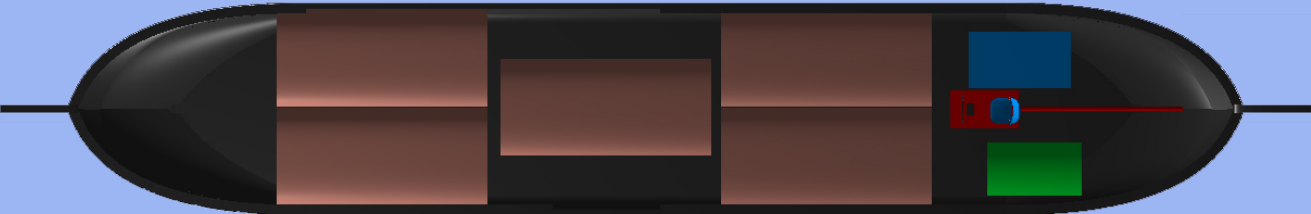


## Idea sixth

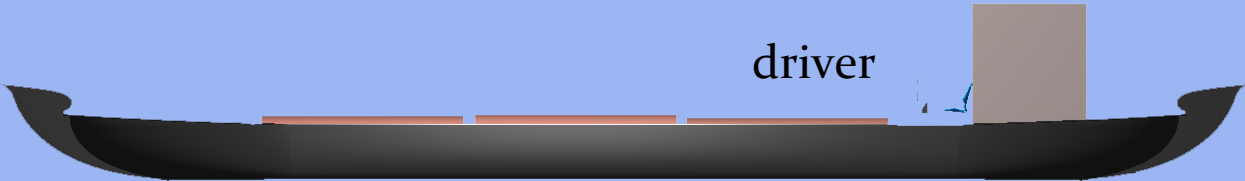


House boat hull – Idea one

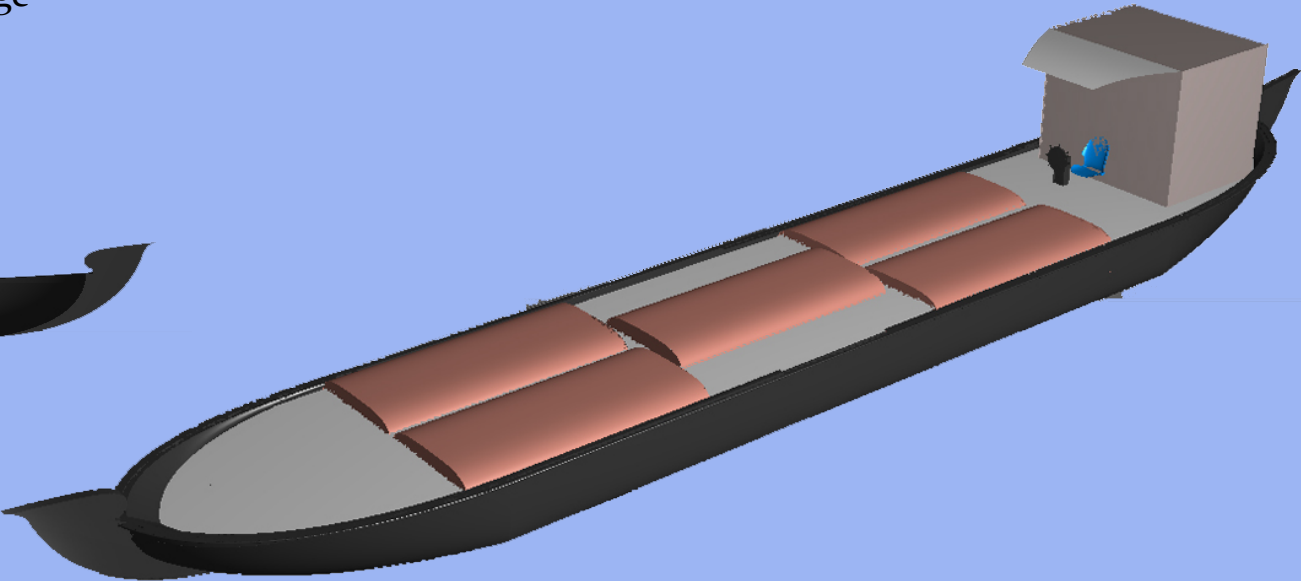
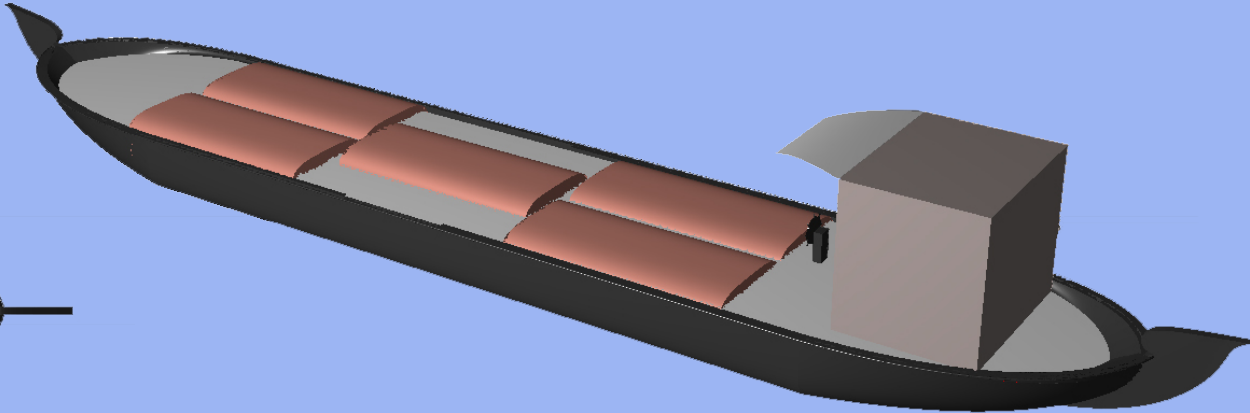
Current gas tanks



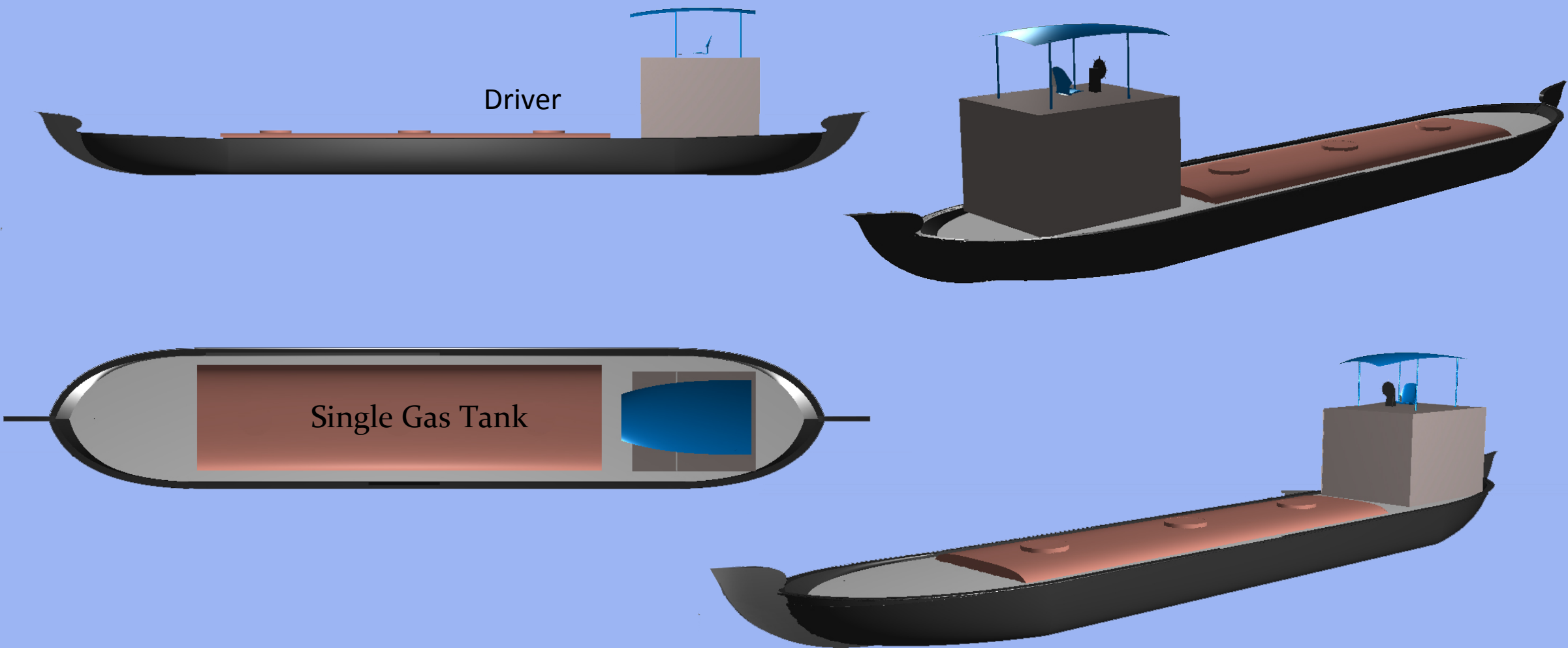
Engine , sewage  
And storage



driver



Idea Second



THANK YOU!