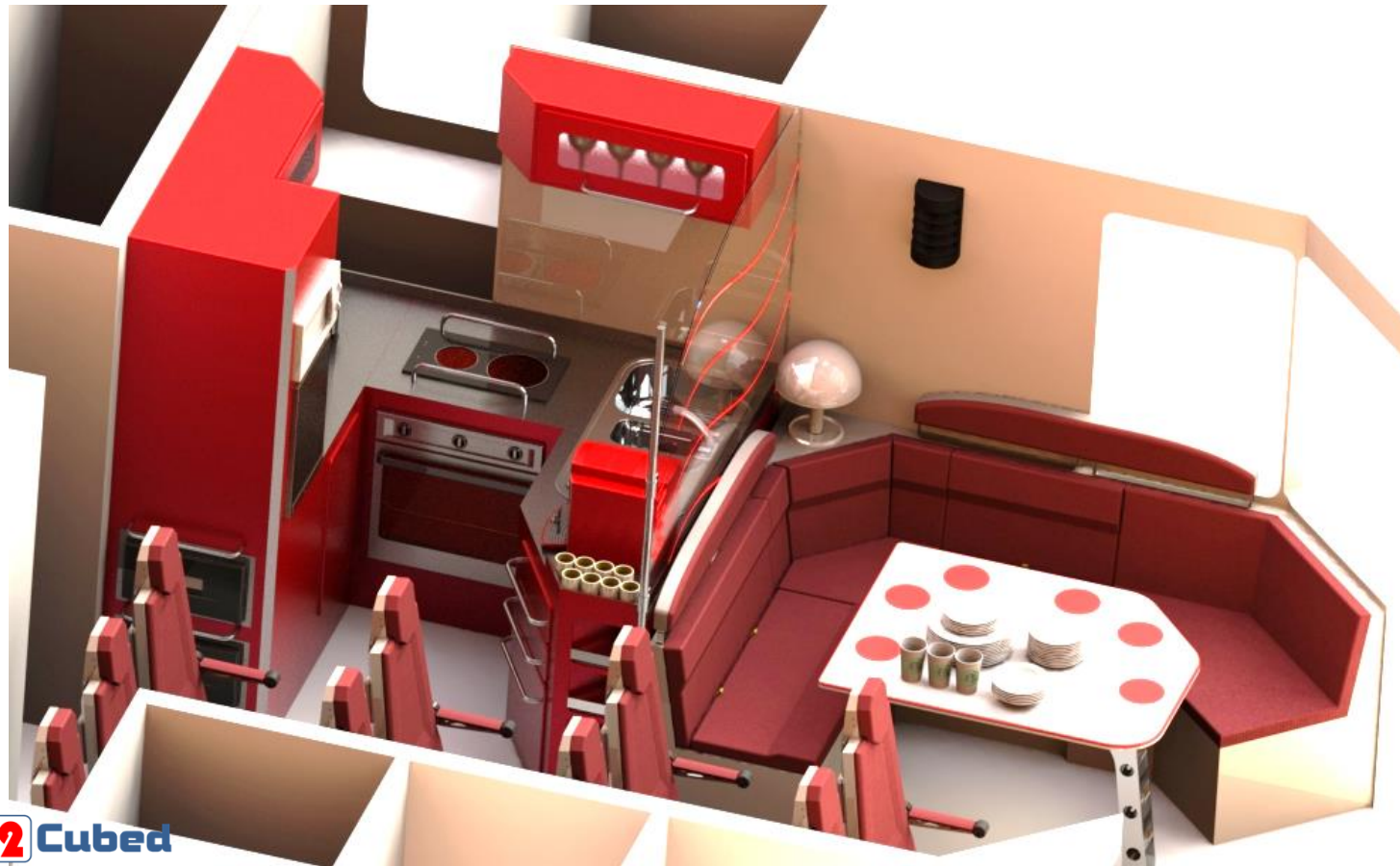


# Modular design and manufacturing for reducing cost and lead times of vessels



# ABOUT US

## PACE and product Manufacturing consultants

- Jules Morgan
- John Key
- Mike Van hysteen
- Tony Harnik



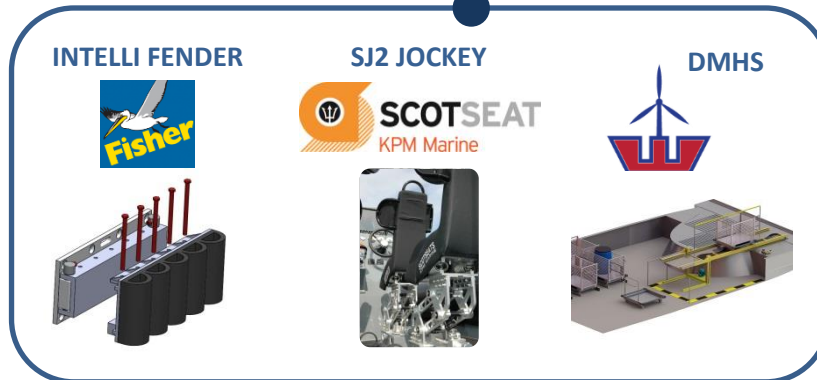
# KPM-MARINE

## Product divisions



# KPM-MARINE

## JOINT DEVELOPMENTS



## Research partners

# Understanding the Stakeholder proposition For Round 3 vessels.



## TYPICAL QUESTIONS

- What if I only get a 4 year contract. Follow on??
- What if the vessel cost requires a 10 year finance deal?
- What if the day rate drops ?
- What if new technology displaces my vessel in 4 years?
- What if the politics change?
- What do i do with the vessel if the above happen?

## • Design For Manufacture tools

- Concurrent engineering
- Design for manufacturability
- Design for lean
- Design for quality
- Design for overhead cost reduction
  - Inventory
  - Critical mass procurement
  - Rationalized products and sub systems

## • Design standardization

- Economies of scale
- Total cost measurements
- Supply chain simplification
- Purchasing leverage
- Establish vendor partnerships

- Total cost measurement to support reduction activities

## • Design For Flexibility

- Quick fit Modularity
- Last point configuration

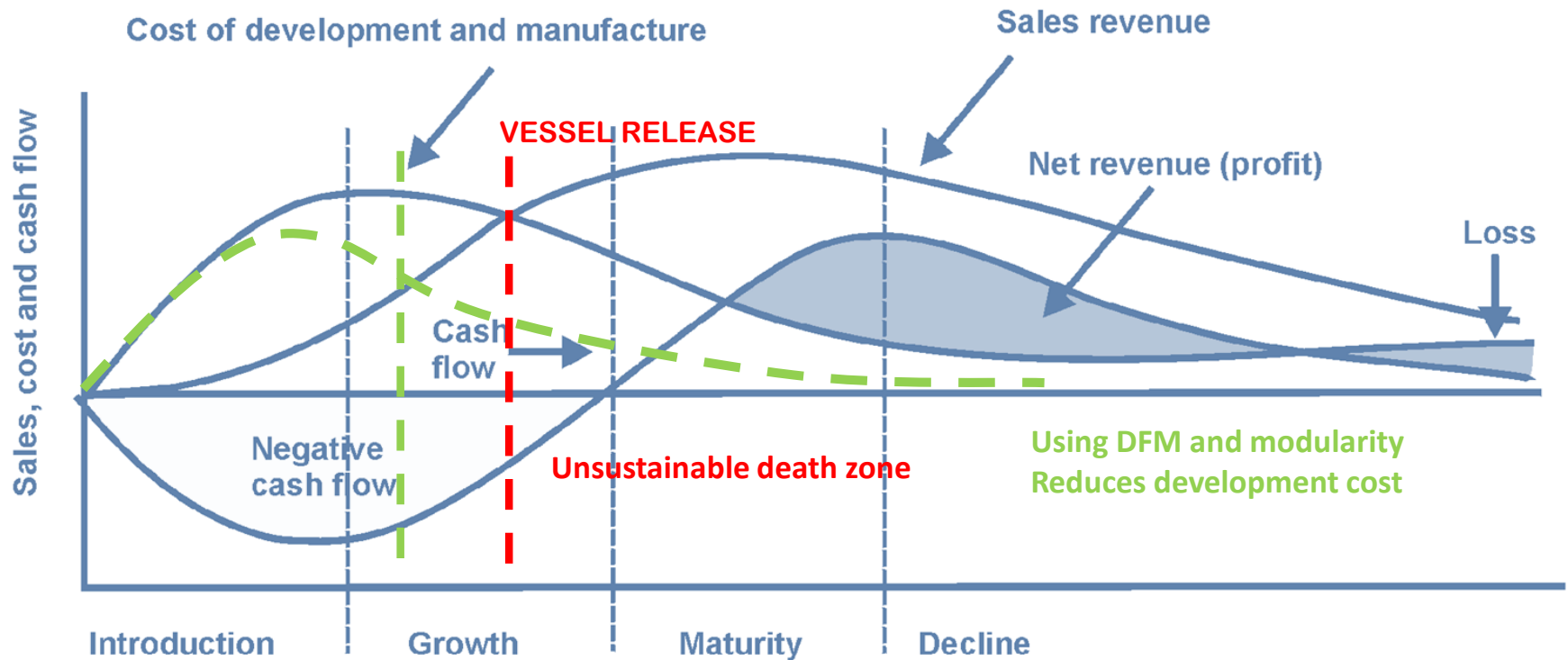
## • Design for Performance

- Weight reduction

## • Design For Life time cost

# Current market position

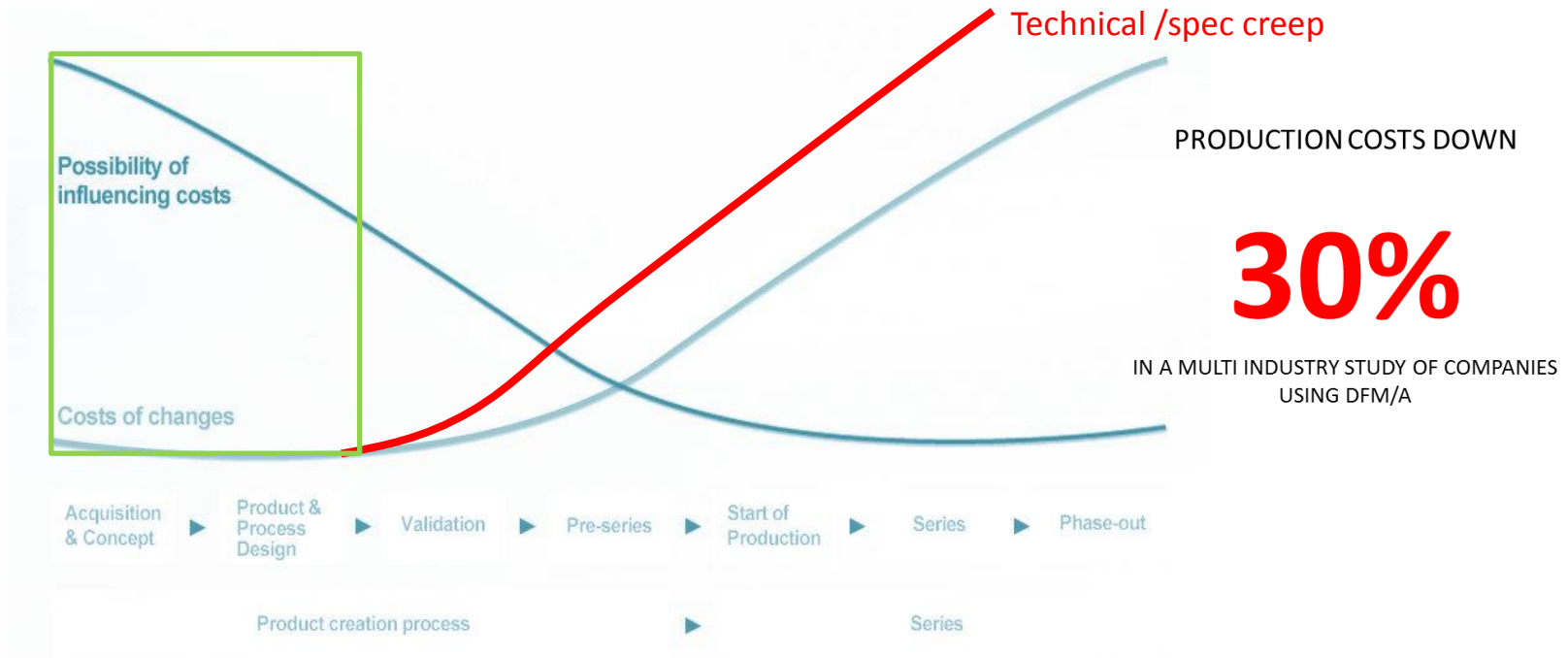
- Boat builders are going bust with increasing competition from the far east.
- Huge variation of designs with risk of vessels not meeting the operational requirements.
- Market and demands changing quickly as experience grows putting pressure boat builders, owners.
- Increased regulation and costs.
- Most vessels are prototypes, hence yards going bust with no follow on to make profit or recover initial investment
- Technical obsolescence and vessels tied up with no revenue to repay loans. (FLOATEL, WALK TO WORK?)
- As vessels become larger the risks to the stakeholders becomes greater and reticence to invest by stakeholders Owners, Funders, Boat yards unless vessels are designed for multi role. (uncertainty)



Uncertain Boat builders and Operators are consolidating with potential reduction in capacity and supply of vessels forcing prices up due to supply and demand.

# Vessel cost reduction

- 80% (Ford,PRTM) of product cost is fixed at design stage and cannot be influenced at build.
- Design generations are moving so fast there is little or virtually no DFM activities
- Most vessels are made in small numbers not allowing production learning.
- Most boat yards suffer technical / specification creep incurring unforeseen costs.
- Making vessels in low cost countries is only hiding the vessel cost problem. ie 20%
- In theory class approval costs should drop with modularity standardisation?.



**Make the mistakes on the cad system and not during the vessel build**



# Determine strategic

The vessel build model is changing

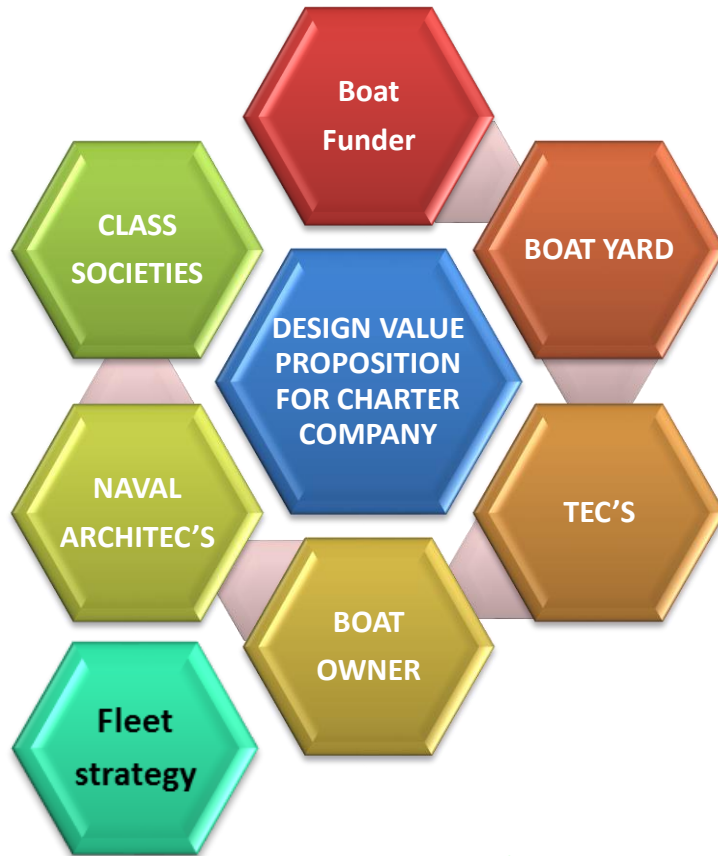
- Old model operator would go to boat builder for product offering
- New. Operators are co-ordinating and managing vessel build with NA's ,int design ,oem's etc relegating boat builders to subcontractors



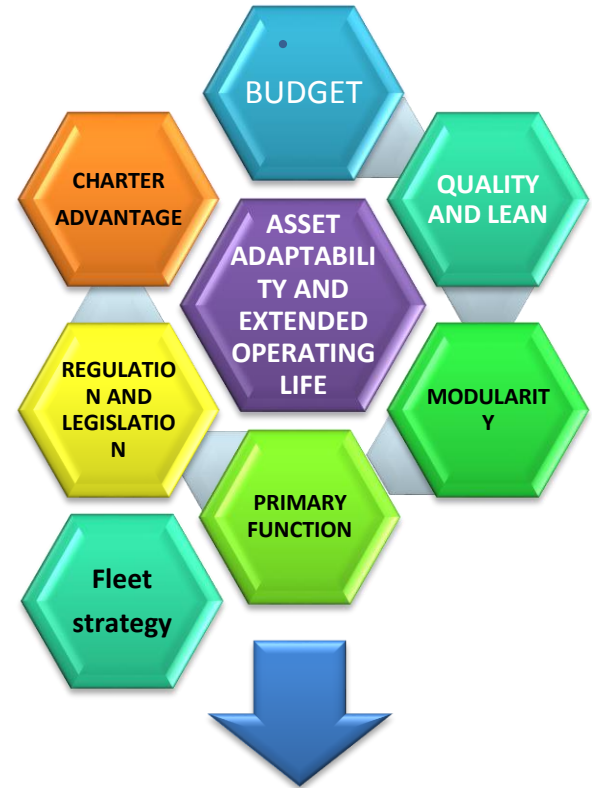
The winners will be those that manage stake holders and vessel specification with lower cost

# Design cue and specification.

- Stake holder expectations



- Vessel Scope and Design Brief



## Cost reduction by design summary



**END OF LIFE AND RECYCLE**



The screenshot displays a software interface with a table titled "KPM-MARINE". The table has multiple columns, including "No.", "Description", "Unit", "Quantity", "Cost", and "Total". The data is organized into several rows, likely representing different components or systems of a vessel.



# EXAMPLE

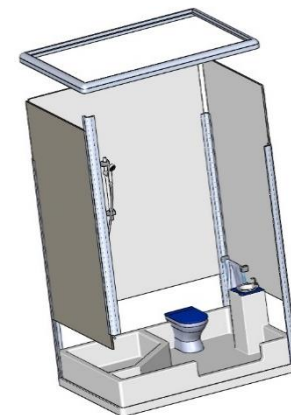
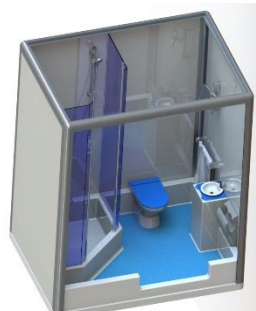
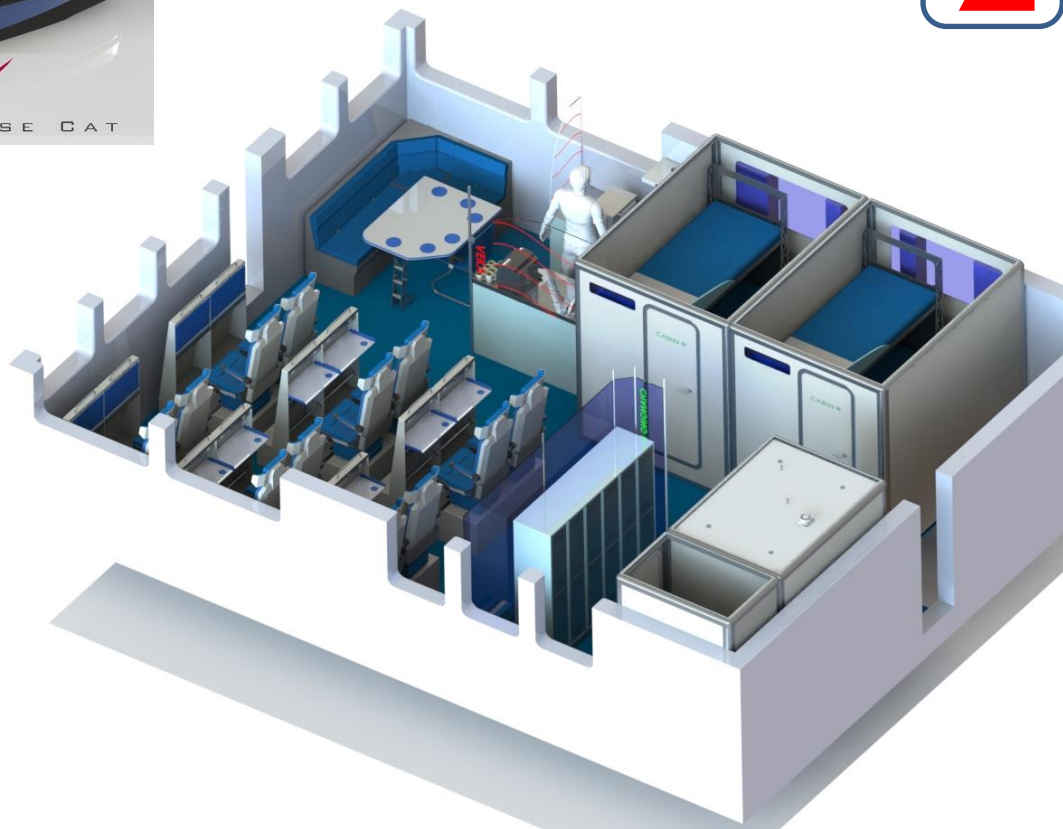
KPM-MARINE



# Cubed

2<sup>3</sup>

2 days  
2 people  
2 tools



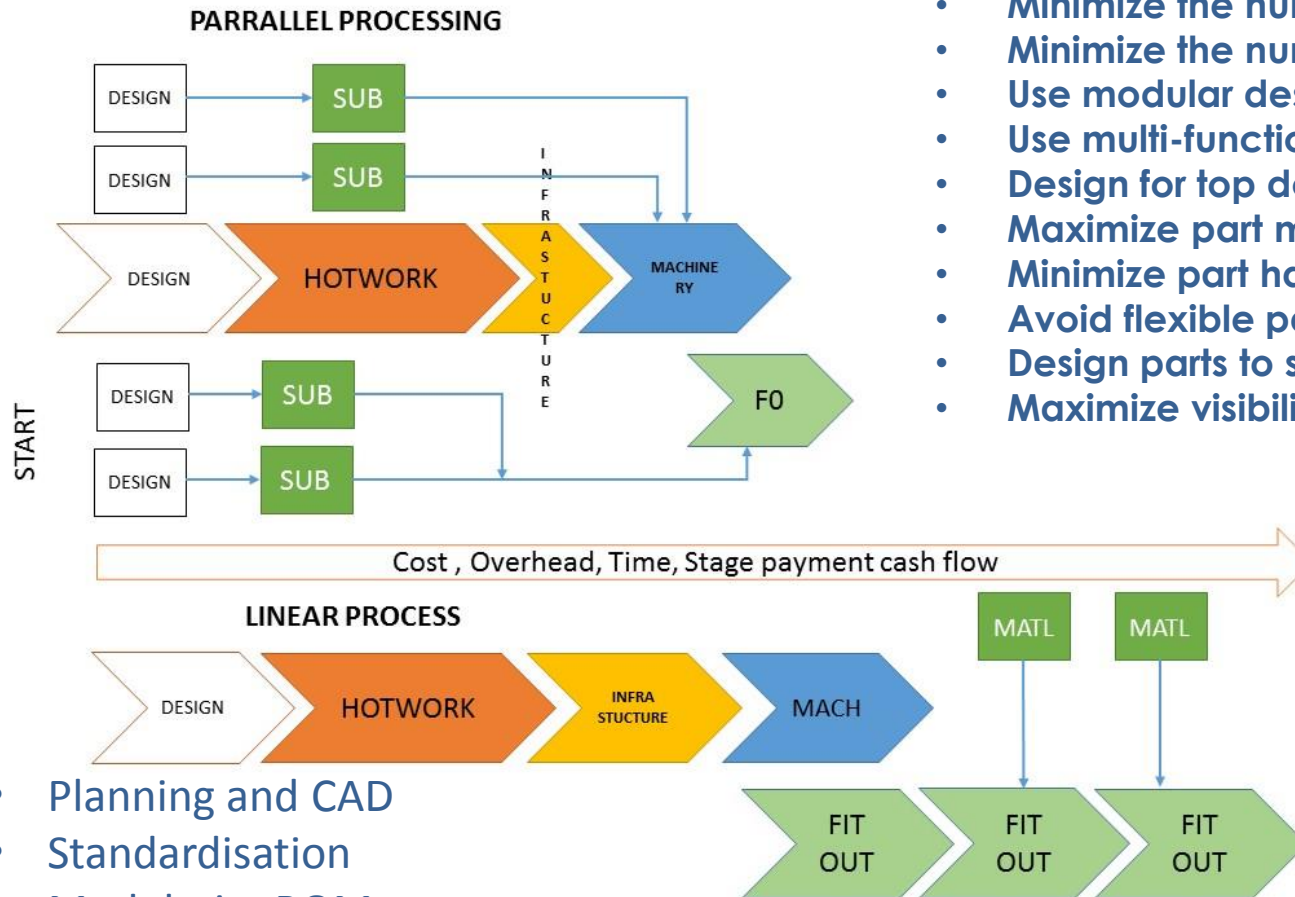


# How to do it

A 17m vessel from bunks, heads ,galley heating to bridge takes 3 people 2 ½ weeks to fit from empty shell

## DFM/A Axioms

- Minimize the number of parts
- Minimize the number of part variations
- Use modular design
- Use multi-functional parts
- Design for top down assembly
- Maximize part mating or compliance
- Minimize part handling and presentation
- Avoid flexible parts
- Design parts to self-fixture
- Maximize visibility of assembled area

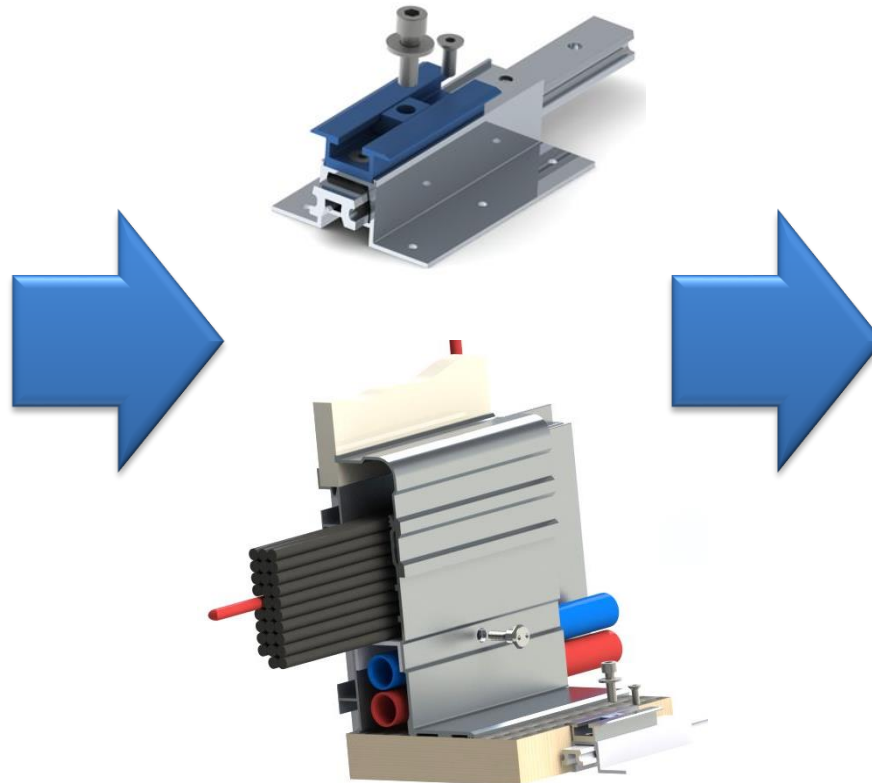


- Planning and CAD
- Standardisation
- Modularity BOM
- Factory fitted units just bolted down
- Access to all services.

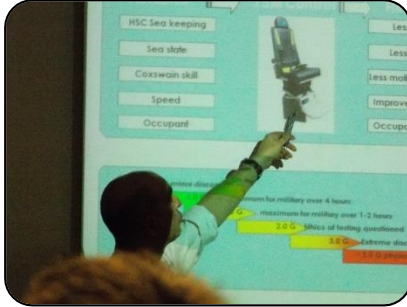
# Modularity Infrastructure and safety

## All modular mass transit vehicles

- Using standardised infrastructure it is repeatable , predictable and accessible .
- The infrastructure can be fully tested to FAA-ECE-annex10 or similar specifications ensuring repeatable safety to one unified standard. ie HSC
- Electrical and service routings can be designed into the infrastructure to allow cost saving in access and fitting.

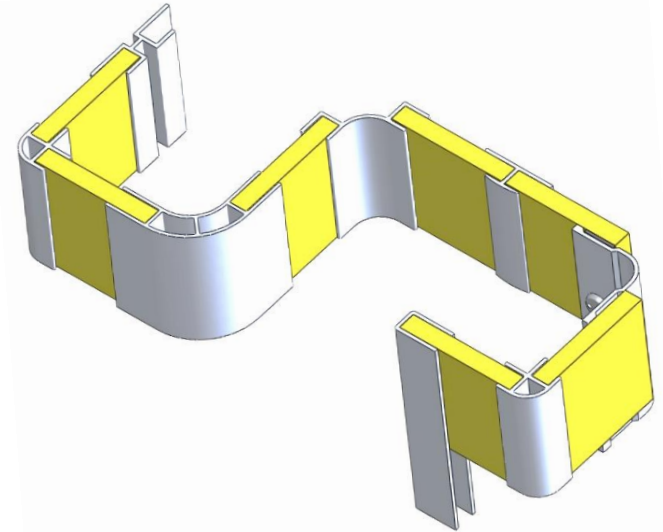
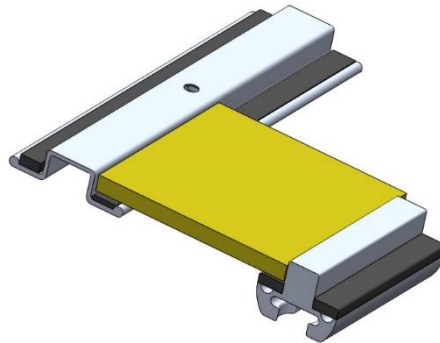
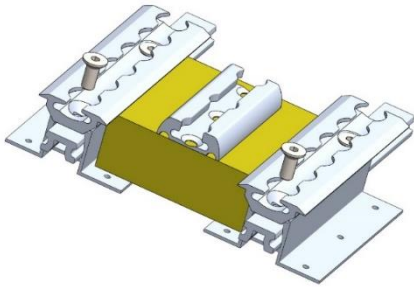


# EX CUBED Training School

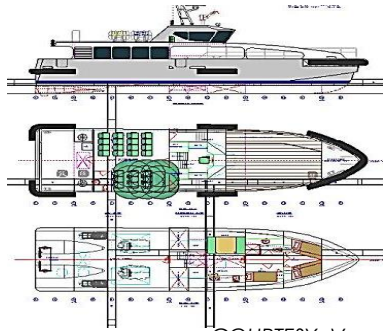


To get the most out of your Ex Cubed and 2 Cubed KPM run a Training programme for customer personnel on all the techniques required to assemble the vessel interiors. The course covers aspects of LEAN, total quality ,safety, tools and project planning.

This training allows the customer to increase productivity . KPM also have a facility for the customers personnel to try all the techniques and methods for them selves. KPM do not fit but can recommend an authorised fitter and supervise quality.



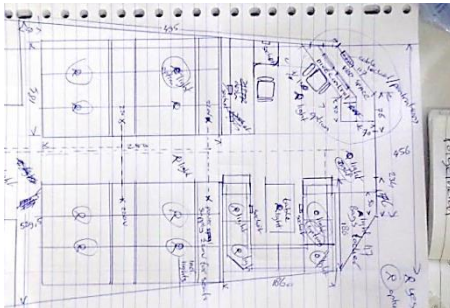
# Step1 Vessel GA- Model



COURTESY Vee craft SA

## ➤ 2D DRAWING

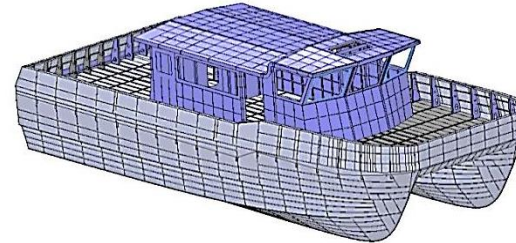
Most customers will have a drawing and KPM can accept most known formats. A 2D drawing will allow KPM to create a detailed quote but it may be required to have detail of the structure



COURTESY WORKSIHIPS NL

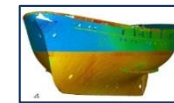
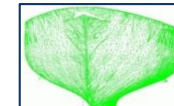
## ➤ SKETCH

A sketch is not uncommon especially for Re-Fit contracts where there generally are no drawings. KPM can work with this information but it will require a KPM engineer to do a detailed survey before detail design can happen



## ➤ 3D MODEL

A 3D CAD model is the ideal and can speed up the whole design process and reduce CAD design time further in the project, which will be reflected in the cost. KPM can process most known formats.



## ➤ 3D Long Range Laser Scan

Depending on the size and complexity of the project KPM can do a 3D laser scan with a tolerance of around 4mm. This will give a very high level of detail that can be used to generate a CAD model..



# Sub System Standardisation , Modularity and simplification

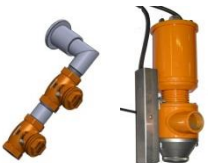
## Modular sub systems



Air systems



Galley etc



pump kits etc



Machinery



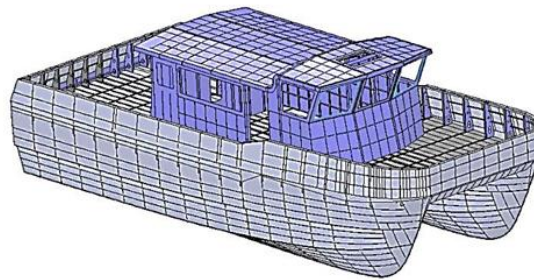
Bridge and nav



Seating

## Last point configure

The hull .



### Benefits

- Predictable cost
- Predictable fitting time and labour cost
- Addresses skill level shortages and reduces labour cost
- Reduced procurement overhead and activity
- Lean and quality control lower quality costs
- Supply kits line side JIT saving inventory and working capital requirement
- Lower fleet operating cost and maintenance
- Lower refit costs
- Lower classification costs.?

## In field change

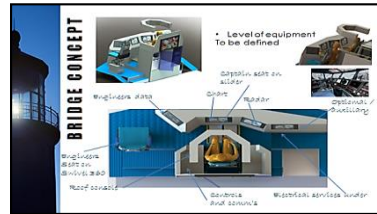
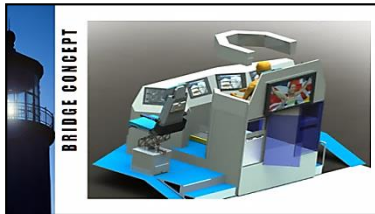
- Survey vessel
- Dive vessel
- Sleeper unit
- Workshop
- Medi center
- Other markets
- etc



## Step3 visualising your ideas



## Step 4 Detail concept and Frozen BOM



KPM-MARINE									
Item	Description	Quantity	Unit	Material	Notes	Item	Description	Quantity	Unit
1	Bridge console	1	Set	Aluminum	Bridge console	2	Bridge console	1	Set
3	Bridge console	1	Set	Aluminum	Bridge console	4	Bridge console	1	Set
5	Bridge console	1	Set	Aluminum	Bridge console	6	Bridge console	1	Set
7	Bridge console	1	Set	Aluminum	Bridge console	8	Bridge console	1	Set
9	Bridge console	1	Set	Aluminum	Bridge console	10	Bridge console	1	Set
11	Bridge console	1	Set	Aluminum	Bridge console	12	Bridge console	1	Set
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37	Bridge console	1	Set	Aluminum	Bridge console	38	Bridge console	1	Set
39	Bridge console	1	Set	Aluminum	Bridge console	40	Bridge console	1	Set
41	Bridge console	1	Set	Aluminum	Bridge console	42	Bridge console	1	Set
43	Bridge console	1	Set	Aluminum	Bridge console	44	Bridge console	1	Set
45	Bridge console	1	Set	Aluminum	Bridge console	46	Bridge console	1	Set
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63	Bridge console	1	Set	Aluminum	Bridge console	64	Bridge console	1	Set
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91	Bridge console	1	Set	Aluminum	Bridge console	92	Bridge console	1	Set
93	Bridge console	1	Set	Aluminum	Bridge console	94	Bridge console	1	Set
95	Bridge console	1	Set	Aluminum	Bridge console	96	Bridge console	1	Set
97	Bridge console	1	Set	Aluminum	Bridge console	98	Bridge console	1	Set
99	Bridge console	1	Set	Aluminum	Bridge console	100	Bridge console	1	Set

### ➤ 1ST CUT DESIGN CONCEPT

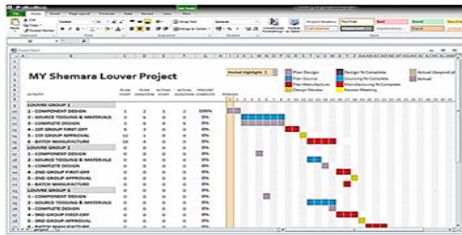
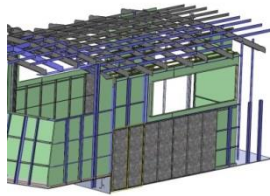
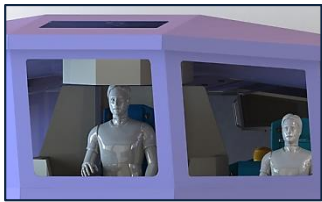
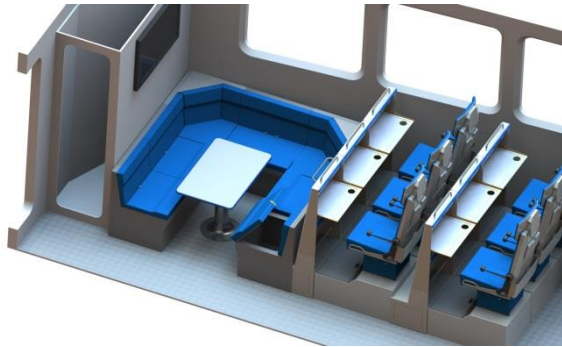
This is the first stage that work becomes chargeable and cost will depend on the size and scope of the project. A quote will be given for the concepts.

Once the concepts have been approved by the customer work can begin on the detailed layout. In all the concepts ergonomics and latest habitation regulations will be included in the designs

- **Modular Detail concept**
- **Fittings and fixtures**
- **Materials and finishes**
- **Colours**
- **Modular Seating**
- **Modular Window details**
- **Modular Bridge layout**
- **Crew areas**
- **Modular Bunks/cabins**
- **Modular Heads**
- **Modular HVAC**
- **Electrical equipment**
- **Lighting**
- **KPM modular units**
- **Modular Galley fittings**
- **Power points**
- **Modular Electrical routing**
- **Escape measures and safety**
- **Personalizing the interior to make your design unique**
- **Grab handles and bracing points**
- **Fire extinguishers**
- **Safety signs**
- **Entertainment systems.**

Every time a change is made on the CAD design  
The BOM and cost model updates.

## Step 5 detail design modelling

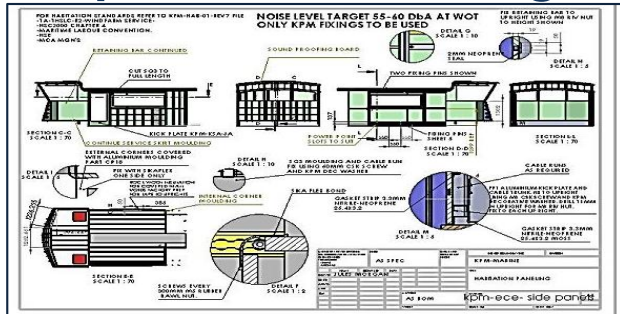


- **Detail design modelling**
- Detail design modelling is the stage at which the engineering detail is produced. As a general rule this accounts for about 50% of the design time. But 80% of the final build cost of the vessel. The design should cover
  - the following;
    - **Full ergonomic analysis and simulation** including access ,seasickness. Ergonomic simulations using percentile dummies that account for differences in racial sizes and weights.
    - **A full HVAC analysis** with air flow and recirculation calculations for northern ;southern and tropical conditions.
    - **Acoustics** and residual noise elimination or suppression. Analysis of attenuation points.
    - **Design for manufacture** and efficient use of materials
    - **Assembly time based** upon time and motion and assembly database.
    - **Build and BOM reduction**
    - **Electrical services** and routing and the speed and accessibility of fit
    - simulation of stress points fatigue and general wear points in high traffic areas
    - **Integrity of all fittings in crash** as per level 3 requirements of HSC
    - **Line of sight calculations** to ensure that all human size ranges have clear vision.
    - Outputs to the customers will be in previous formats mentioned.

### ➤ Budget and cost confirmation

The budgets and any design changes requested by the customer will be assessed against the budget to ensure cost control and build time accuracy. Customer will be kept in formed of any changes.. Also a project plan will be developed against the customers requirements.

## Step 6 detail drawings and instruction for build

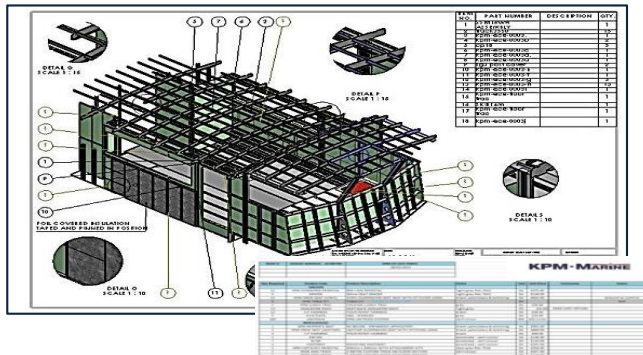


### • Detailed drawings

one of the major delays in most boat yards is caused when fitters are working of drawing. Detailed drawings are produced for each stage of the fit. This will cover vessel structure , dimensions and fixing methods , mouldings, panel numbers seal positions and adhesives to name a few. The detail level has been designed so that customers own Fitters can install the Sea-Ka-No system quickly and efficiently.

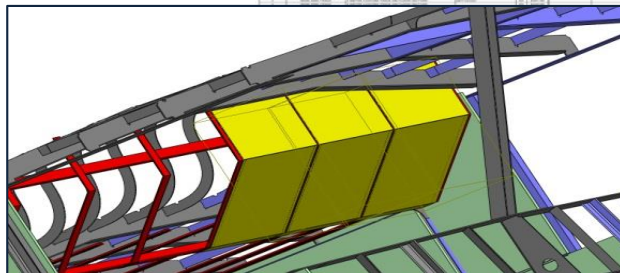
### • Detailed BOM and exploded view

One of the most useful documents is the detailed BOM and exploded view which allows the fitter to manifest all parts ,which if missing would cause delays. All this information will also help in Class submissions, all material specs and certification will also be logged with the document.



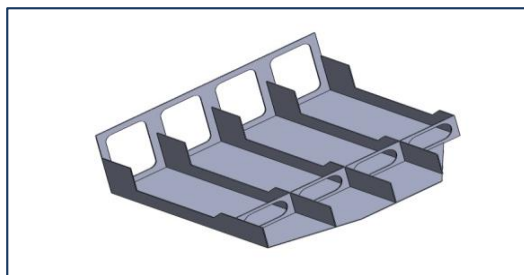
### • Build sequence comic strip

All drawing packs have a comic strip of build sequence showing the part number and its position. colour code the fit sequence. Red shows what has been fitted last and yellow is the part currently being fitted. This simple but effective technique allows fast and efficient fit without the need for reading and interpreting drawings. It also eliminates language barriers .



### • Customer make or buy

KPM can supply all the components and structures in the fit out, but this may not always be practical due to shipping costs. We are aware that customers may want to maintain a manufacturing value for their own staff. In these cases KPM can issue the drawings to you for manufacture. .





- The purpose of this stage is to ensure that costs are being met and identify costly delays. Areas that might need to be addressed for improvement are,
- Supply chain delays
- Technical problems not foreseen
- Customer changes specification.
- Lack of skilled labour / training.

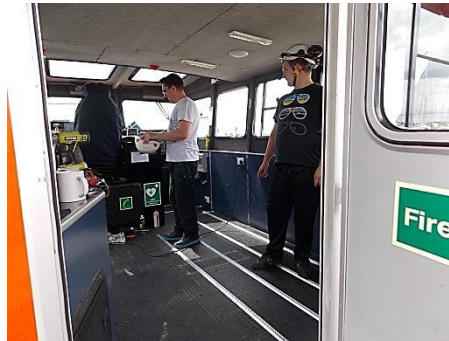
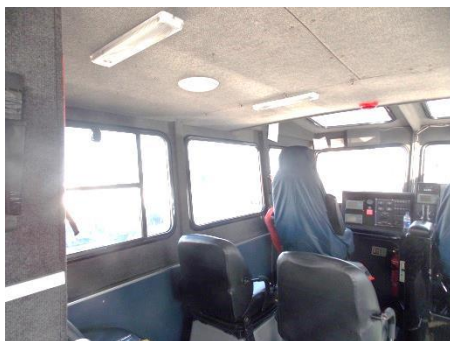
Manifest the complete Bill of materials ready to drop ship . All parts will be identified and counted so that there will be no delays.

Once there is access to the vessel with no other work being done then the fit out can begin to the project control plan. When the customer fit begins then a KPM engineer will assume the role of trainer and supervisor. Once your team have been taught then they will be good to go.



PHOTO COURTESY WORKSHIPS

Strip out-lay track-replace floor- modular galley – modular seats- electrics  
Time taken 2 people 6.5 hours whilst along side. Vessel on call at 17:30 hrs



# Step 8 Customer Support



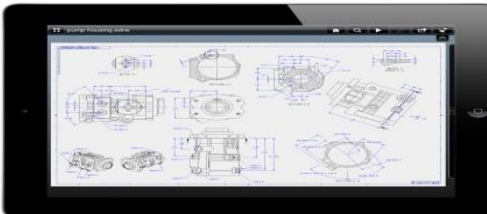
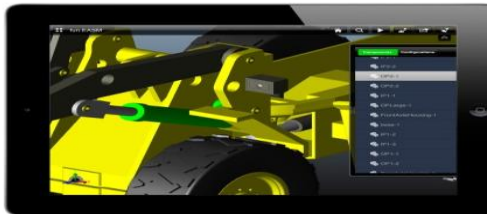
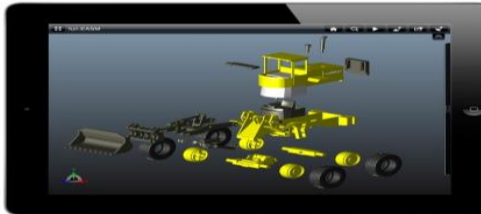
### • Fit Information

All KPM Drawings and models can be put on Ipad using the e viewer application. This allows your whole vessel build to be in one device without having to refer to main computer. Ideal when on site for quick reference.

Features that are available are;

- General assembly
- Dimension check
- BOM check
- Exploded view
- Section view
- Rotatable 3D viewing
- Detail drawings
- Assembly drawings
- Build sequence.

There are numerous features that will allow the project leader to ensure fast communication. As they say "a picture is worth a thousand words"



### • Skype Us

If you have a problem use the skype on the I pad to contact our design team for support. Its free and very effective. We can talk to you any were in the world. If you have a signal that is.



**Thank you**