`

Industrial Placement
Final Report

Isaac Anderson
Mechanical Engineering with Advanced Design and Innovation
University of Bath

with

Griffon Hoverwork Ltd.
Design Department
SOUTHAMPTON

28th July 2014 to 24th July 2015

Industrial Supervisors:

Christopher Walden-Bevan
Griffon Hoverwork Ltd.
Merlin Quay, Hazel Road
Woolston
SOUTHAMPTON
SO19 7GB

Email:
christopher.walden-bevan@griffonhoverwork.com

Tel: 023 8068 6644

Emma Aikenhead
Griffon Hoverwork Ltd.
Merlin Quay, Hazel Road
Woolston
SOUTHAMPTON
SO19 7GB

Email:
emma.aikenhead@griffonhoverwork.com

Tel: 023 8068 6721

Personal Tutor: Dr. Martin Ansell

Placement Officer: Rachel Pascoe

`

SUMMARY

In the last twelve months within the Design Office at Griffon Hoverwork, I feel that I have greatly expanded my knowledge of the design process, and seen first-hand how a design company works.

Having worked in two of the main departments of the Design Office; Modelling, where detailed design of components and assemblies to go on the craft happens, and Statutory Compliance, the department that makes sure that all designs that are approved meet the standards that the MCA and HSC code state, I've had the opportunity to work on a wide variety of projects, including designing many components for the new 12000TD, as well as producing various schematics for submission to the MCA for approval.

This report summarizes some of the key projects and tasks undertaken within the last twelve months.

`

LIST OF SYMBOLS, ACRONYMS AND TECHNICAL TERMS

12000TD	A twelve tonne payload hovercraft, currently being built, that will operate as a passenger ferry from Southsea, Portsmouth to Ryde, Isle of Wight.
2000TD	The hovercraft of choice for military use, currently used in countries such as Colombia, India and Peru.
995ED	A hovercraft currently being developed with search and rescue operators in mind.
Auditing Dept.	The department responsible for keeping all Griffons internal standards and codes up to date, as well as helping to implement and optimize them.
Bulkhead	An upright wall that acts as a partition to other sections within the craft.
Detail Designer	An engineer in charge of designing and modelling components for all hovercraft.
DraftSight	The 2D CAD software currently used by the company.
ECR	Engineering Change Request – raised when a change is proposed to a craft.
Engine bay bulkhead	The bulkhead that separated the engine room from the service bay area (and ultimately the main cabin).
FTP Code	The International Code for the Application of the Fire Test.
HSC Code	High Speed Craft Code – intended to be a comprehensive set of requirements for high speed craft, including equipment and conditions for operation and maintenance.
Lloyd's Register	These surveyors inspect and provide quality assurance for ships and other vehicles in the marine industry
MCA	Maritime Coastguard Agency, an executive agency sponsored by the Department for Transport.
Modelling Dept.	The department within the Design Office that had responsibility for all modelling.
Production Dept.	The department responsible for building all craft Griffon designed.
Production model	A SolidWorks model that all production drawings was based off, and ultimately showed how much of a craft had been designed.
Production permit	A document filled out when a change has been proposed to a craft but needs to be carried out without an approved ECR.
Reference model	A model thrown together from parts a production model, used as reference while designing parts for craft.
Service bay	The area between the main cabin and the engine room where several pieces of electrical and safety equipment were stored.
Stage 1	Officially called "Module Fabrication", this stage covered the creation of the main hull of the craft.
Stage 2	Officially called "Module Outfitting", this stage covers the creation of cabin parts, such as decks, engine frames and wheelhouses.
Stage 3	Officially called "Hovercraft Integration", this stage covers the installation of several parts designed in Stage 2, as well as electrical, thermal and protective work done on the craft. By the end of this, the hovercraft should be nearly complete.
Stage 4	Officially called "Hovercraft Outfitting", this stage covers the final kitting out of the hovercraft.
Statutory Compliance	The department within the Design Office responsible for making sure the craft keeps to the regulations the MCA set.
Wheelhouse	The area from which the craft is piloted.

`

INTRODUCTION

Griffon Hoverwork Ltd. are a British hovercraft manufacturer based in Merlin Quay, Southampton since the beginning of 2011.[1] Created from the merger of Griffon Hovercraft Ltd. and Hoverwork Ltd. in 2009 by the Bland Group, Griffon are at the forefront of hovercraft development and currently have over 200 craft operating in 40 countries spanning five continents.[2] These craft are used in a variety of applications such as search and rescue, passenger ferries and military operations, as well as other non-standard uses such as cricket pitch covers and crop sprayers.[3]

The year long placement with Griffon involved working in the Design Office, where a new craft (the 12000TD) was being developed from concept to production. Release was initially due in the summer of 2015, but this date was later revised to November 2015. As well as this, opportunities to work on other craft, such as the 2000TD and the 995ED arose during the duration of the placement year.

The role included;

- Developing system level designs into detailed solutions under the supervision of in-house engineers.
- Producing complex 3D models, production level drawings and design instructions.
- Interaction with the production team on live hovercraft builds to provide technical advice and improvements in design.
- Working with compliance to ensure that designs and schematics were in accordance with HSC and FTP codes, as issued by the MCA.

WORK, PROJECTS AND ASSIGNMENTS

Being part of a relatively small design team who were in the beginning of the build of the 12000TD gave a lot of opportunities almost immediately to get stuck in. The following is a breakdown of a selection of some of the assignments completed over the course of the year at Griffon.

GIRDER AND TRANSVERSE BULKHEAD DRAWINGS (12000TD – STAGE 1)

As an introduction to show the way the Design Office created drawings for Production to use, one of the first tasks assigned was to help the Modelling department clear up their backlog of uncompleted work packages. The majority of these work packages consisted of a completed part/assembly model used in the overall craft model, but not a drawing for Production to actually build the part, and hence by creating thee drawings production could continue to the predetermined schedule.

This was seen as an ideal task to begin the placement with, and it was certainly beneficial in seeing what was acceptable to release under Griffons strict quality standards. One of the most useful things learnt during this initial task was the fact that the drawing had to be complex enough for our sub-contractors to be able to make to tight tolerances, but simple enough for production to actually use in assistance with the build. By getting feedback and constructive criticism from both Production and through peer checking, it was crucial in making the rest of the year as productive as possible.

SERVICE BAY BULKHEAD (12000TD – STAGE 2)

`

The first bit of design work of the placement was the service bay bulkhead. A bulkhead that separated the main passenger cabin from the engine room, it was also used to house several vital pieces of electrical equipment, such as distribution panels and battery containers. However, this storage of equipment was tougher by the fact that the servicing area of the craft was only 600mm wide.

Originally, the design was a series of vertical aluminum sheets welded together to form a wall that separated the main passenger cabin from the servicing area of the craft, but it was decided in a design meeting that something that was more aesthetically pleasing was required. As a result framework made out of aluminum channel, in which countersunk holes were drilled into to support the composite covering that was used. This design was constantly tweaked using ECRs as the build progressed, in order to optimize the design for a hypothetical future 12000TD.

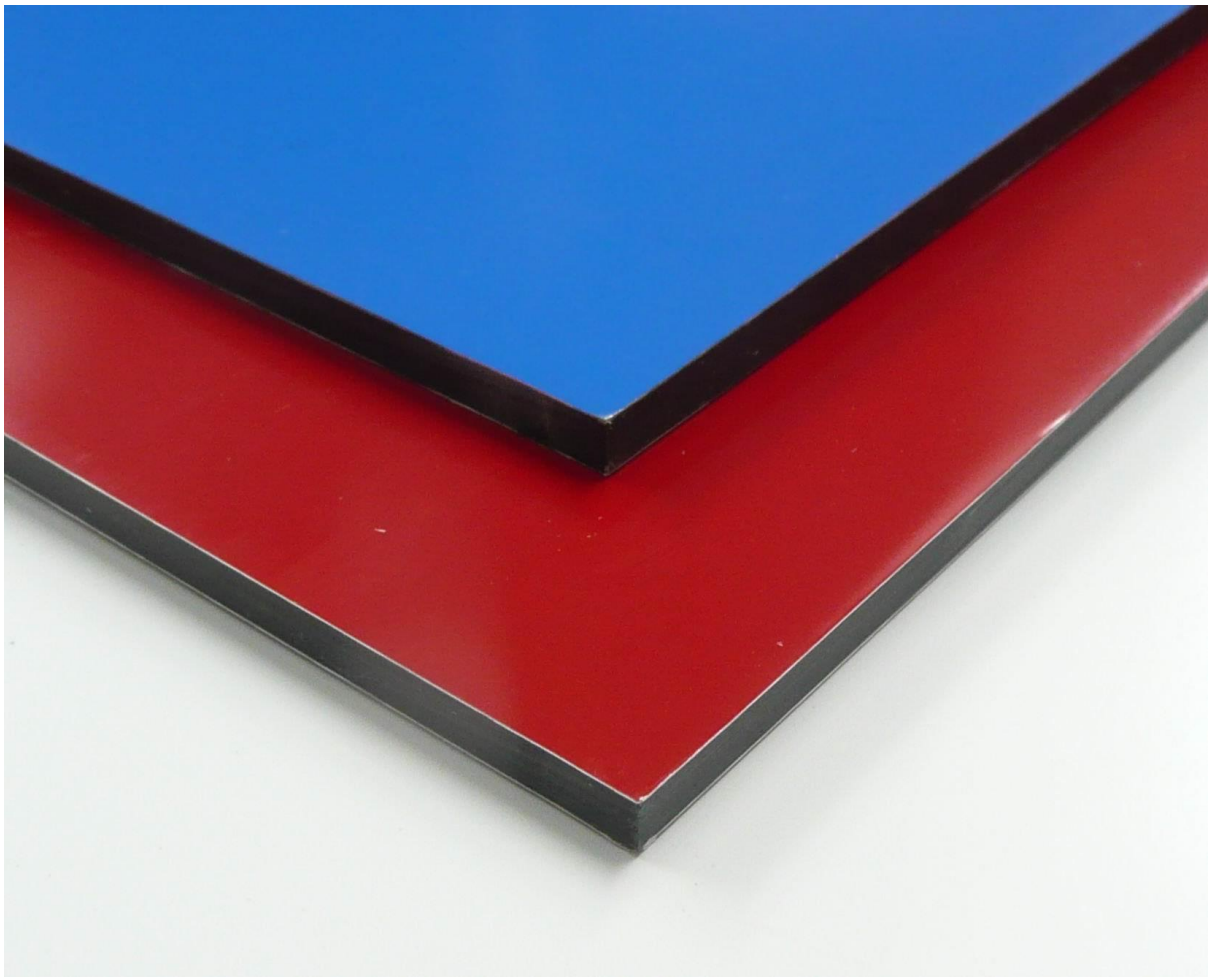

Fig. 1 – Stock photo of the colored Alucobond coverings used on the service bay and courtesy bulkheads. [4]

WHEELHOUSE LADDER (12000TD – STAGE 2)

The 12000TD was designed with the wheelhouse located at the top of the craft, opposed to previous Griffon craft, which traditionally have the wheelhouse at the front of the craft. Because of this, access to the wheelhouse was to be gained by climbing a ladder situated in the main cabin, in front of the majority of passenger seats but in line with the port and starboard exit doors.

`

Normally, a ladder would have been brought from an external supplier, but because the height and angle required were different to any standard part, a specialist design had to be created, which included;

- Not having a slant of more than 5°.
- Being securely attached to the floor without bolting, as access to the underside of the floor was not possible in this region.
- To have filleted edges wherever possible to reduce the risk of injury to a passenger, but not too many as to make manufacturing "in house" impossible.

Later in the build, another bulkhead (the courtesy bulkhead) was created to surround the ladder, in order to separate the main cabin from the ladder. This bulkhead also had spaces for a fire extinguisher, television monitors and cabin crew seats, and was designed in the same way as the service bay bulkhead (a framework that would be covered in Alucobond paneling).

Fig. 2 – The first of two finished wheelhouse ladders, fresh off the production line within Griffon.

ACTUATOR GUARD (CANADIAN COAST GUARD)

All Griffon craft come with a 12 month warranty as standard, during which they offer close support to any customer experiencing issues with their purchase. Even after this initial warranty period, Griffon is still prepared to repair any faults for a small fee. As each craft is unique to the customer in its own individual way, quite often the feedback gained during the warranty period is used to improve the craft design through the use of ECR's.

In this this particular case, salt water was causing actuators in a variety of positions and orientations within fire shutters to rust up, and as such guards needed to be designed for each to stop this. Designing this, as normal within the Modelling department when coming up with new parts, a reference model was required to make sure that everything fitted when manufactured and built. However, as this craft was built before the merger of 2009, a lot of the drawings and models were impossible to find, and hence a brand new reference model had to be created from a series of photos from the craft.

FABRICATE MAST (12000TD – STAGE 2)

The modelling department of Griffon has two types of modelling; reference and production. Only production models are used to generate production drawings, as production models have more detail contained within them, as opposed to reference models, which are generally used when designing a new part. They were used a lot more towards the end of the build, when the main model got too large to load on many computers.

`

A job picked up was to convert a mast model, which was to hold several pieces of important navigation equipment, from a reference model into a production model that complied with Griffon's internal standards. As well as this, an assembly drawing showing how this unique design was meant to be put together had to be produced, which was simple enough for production to understand, but complex enough not for them to miss out any key assembly detail.

WHEELHOUSE JIG (12000TD – STAGE 2)

As mentioned earlier, the wheelhouse was located on top of the main cabin. It was to be supported on four "AV mounts" that were attached to pillars supported in the main cabin, and to aid this, four holes were positioned on the wheelhouse that would then later be used when lifting the wheelhouse onto the hovercraft. The position of these holes was critical – if they were out by a small amount, then the wheelhouse wouldn't fit onto the mounts designed earlier on the hovercraft. The role of the jig therefore, was to maintain the position of these mounts while the mold was being made.

However, in an attempt to cut costs, the jig could only be fabricated using metal that was already in stock, which created a multitude of problems regarding strength, stability and height. It was also meant to be reusable, as well as easily transportable as it was needed in our GRP shop, about 500m down the road from the main Production building, and easy to store, which was becoming a problem as more and more of the free space available within Production was being taken up by new parts, such as engines, ducts and doors arriving and needing space to be kept until they were installed on the craft at a later stage.

STRUCTURAL FIRE PROTECTION (12000TD – STAGE 3)

In approximately February, a job came that mixed required liaising with Statutory Compliance. Modelling of the major mechanical components for the wheelhouse had been completed, and therefore the next part of the job was to start modelling the safety components for the wheelhouse – in this case, the structural fire protection.

Modelling the fire protection was very important as the space in the wheelhouse was at a premium, and failing to do this effectively could have led to a clash in the model, which had occurred previously when modelling the actual components in the wheelhouse. Saying this, there were stringent rules and regulations that had to be met as per the FTP code. The overall modelling job consisted of finding a way to cover the wheelhouse with as little wasted fire protection as possible, specifying what precise brand and thickness of fire protection was to be used as per FTP and Griffons internal fire safety code, and then modelling this in a way that would completely cover any exposed faces of the lower wheelhouse tub, not clash with any pre-existing structures within the region and still be acceptable to the MCA, who needed to approve plans for everything safety related before the craft was able to go on trials.

This was the first of a series of jobs needing the use of external codes (such as the HSC or FTP) to aid with design. Designs and schematics requiring the use of these codes were normally submitted to either Lloyds Register or the MCA for approval prior to them being installed on the hovercraft, as failure to do so would quite often require them to be removed anyway, wasting valuable time, resources and money.

`

Fig. 3 – The Southampton headquarters of the MCA, the executive agency responsible for implementing British and International maritime law and safety.

LIFE SAVING APPLIANCES PLAN (12000TD)

One of the submissions drawings required by the MCA by Statutory Compliance was a lifesaving appliances plan (LSA); this would show the location of all LSA equipment, such as fire extinguishers, smoke detectors and lifejackets. Using DraftSight, this plan was one of the most important documents in the entire craft, as it was to be displayed in the main passenger cabin, and was to be referenced by the crew. It was also to be referenced by the Modelling department wherever possible, as Stage 4 would require a lot of modelling of the OEM parts positioned in this drawing.

This drawing was heavily influenced by the HSC code, as there were chapters dedicated to individual components. The location of these parts was also influenced by the HSC code (for example, the liferafts had to be next to each emergency exit). After using the code, and referencing previous passenger craft to see the position of LSA equipment, a plan was created that was gradually tweaked over the course of a few weeks to fit around the design.

ECR REGISTER

Working closely with the Auditing section of the Design Office, the successful implementation and optimization of the ECR process was another task assigned.

An Engineering Change Request (ECR) is submitted when a change to the design of the craft would be beneficial to either the production process, the procurement process, or if a change has been made to the craft that has not been shown on the model (which drives all production of the craft).This process goes through a change board, which is made up of the chief engineer, the technical and electrical team leaders, and a detail designer. From here, a list of all the new ECR's raised are discussed at a weekly ECR meeting, where the decision is taken to accept or reject them based on production easement, design improvement, cost and a variety of other factors. Accepted ECR's are then carried out at a later date, either by the Modelling or Production whilst rejected ECR's are sent back to the person who originally raised it, with a rejection reason attached.

`

ELECTRICAL EQUIPMENT BRACKET (12000TD)

The final design task set was a bracket that would support some of the electrical equipment contained within the service bay. This bracket had the following constraints;

- It had to be able to support 20kg of electrical equipment
- It couldn't be more than 444mm in height, as this was the size of the gap it had to fit into, but it had to be more than 436mm, as this was the height of the tallest piece of equipment. This was the most
- The bracket had to be supported on six pre-existing studs.
- The equipment had to be secure while the hovercraft was in operation.
- Easy access to each individual electrical equipment piece was needed.

The fact that the bracket had to support 20kg, as well as being able to fit in the small gap earmarked for it while being large enough to fit all of the equipment was the hardest part of the design, as using sheet metal of a safe thickness would have made the bracket too large for the gap. Furthermore, even a small variation in the way that the craft was built would have rendered the design useless.

All of these constraints made coming up with an effective design virtually impossible, and ended up producing a solution that, in hindsight, came in completely the wrong direction. It ended up being rejected for a better solution that involved creating a shelf between the service bay and engine bay bulkheads.

CONCLUSION

Over the course of the year, I have worked in two of the main sub-departments in the Design Office; Detail Design and Statutory Compliance. Working in both has given me a greater appreciation of how a design department works in tandem towards the common goal (in this case, getting the 12000TD ready for trials), as well as getting a deeper understanding of how the overall design process works from concept to manufacturing. I also feel I understand the limitations of certain manufacturing facilities to a greater degree, and the relationship between the manpower, the amount of money possible and the available machinery when coming up with a new design.

Having always had an interest in product development, I feel that in some ways Griffon was the perfect company to work at for a year, as the 12000TD was the epitome of engineering product development. Even though the design and development process was different to standard practices due to manpower and time constraints, being part of a team that managed to get the 12000TD to the stage it was at when I left the company is something that I am proud to have been a part of. The year has also influenced my future degree choice; I've changed from doing Automotive Engineering to Mechanical Engineering with Advanced Design and Innovation, as I feel that I'll have a greater passion for what I am studying during my last two years of study. Also, having been doing a lot of what this degree entails, I'm confident that it is the best degree out of the options offered for my skillset, as well as being respected enough to keep my future job prospects as broad as possible.

Having run the ECR and production permit processes for six months has also shown me how process optimization is used within the development process to save the company money in the future. Even though the product was quite niche, Griffon did have a standard template that all craft followed, and issues from some of the older designs were had created issues in production such as storage and waste problems. By encouraging Production to raise ECR's for build issues

`

they often solved themselves, the Design Office was able to get a greater picture of the production process and make it as streamlined as possible.

Overall, my experience at Griffon over the course of the last year is something I feel was vital for my overall development as an engineer. The skills learned over the course of the year, such as 2D and 3D CAD, will be useful as I continue my degree, and seeing a design develop over the course of the year gives me useful experience to contribute to any future group or individual design projects.

REFERENCES

1. http://en.wikipedia.org/wiki/Griffon_Hoverwork
2. http://www.griffonhoverwork.com/about-us.aspx
3. http://www.shippingandmarine.co.uk/article-page.php?contentid=15908&issueid=454

IMAGES

4. Weiku, 2015. Alucobond panel. Available at: http://img.weiku.com/a/009/863/Alucobond_Panel_6286_1.jpg