SUMMARY

Jem DUAL is a smoke machine system that covers all smoke needs in medium to larger clubs. It consist of both haze and fog functionality, and a fluid base makes a convenient refilling scenario.

Jem DUAL is a result of a redesign of the current Martin Magnum Club Smoke system. The design process has been focused on user needs, production optimization, visual expression and storytelling.

The solution incorporates both smoke machine, carrying handle, cable clip and intuitive interface making a complete product solution for the club environment, where performance and convenience is of main importance.

INTRODUCTION

This project is created as a part of 4th semester MA Industrial Design of the Architecture & Design at Aalborg University. The project is conducted in collaboration with Martin Professional ApS in the period 3rd of February to 28th of May 2014. Martin Manufacturing UK have continuously been involved in the development and detailing phases.

The documentation of the proposed solution consists of two parts, a process report, which emphasizes the process behind the product including research, development and detailing, and a product report presenting the final solution and functions.
The process report is written with an intension of showing the reader the process in a manageable manner. In the end of the process report, there is a visual overview of the development process to show the iterations and where the information is gathered. Appendix is to be found in the back of the process report.
During the process report, there are ongoing sum ups. The small sum ups are going to be read as a conclusion of which parts of the sections is taking to the further process. The big sum ups at the end of the sections, are to give the reader a short brief on the essences of the previous section.
The product report is made to give Martin Professional some great sale points according to the new product. In addition to that it shows the production and economy benefits for the company.
Further more there is a product folder for the Jem DUAL.

The enclosed CD contains a digital version of the reports, technical drawings and appendix.

Sources are marked when used during the process report. All referrals are by the Harvard method.
Besides sources, the great knowledge and experience of the connected partners has been used extensively to gain the essential knowledge.

GRATITUDE

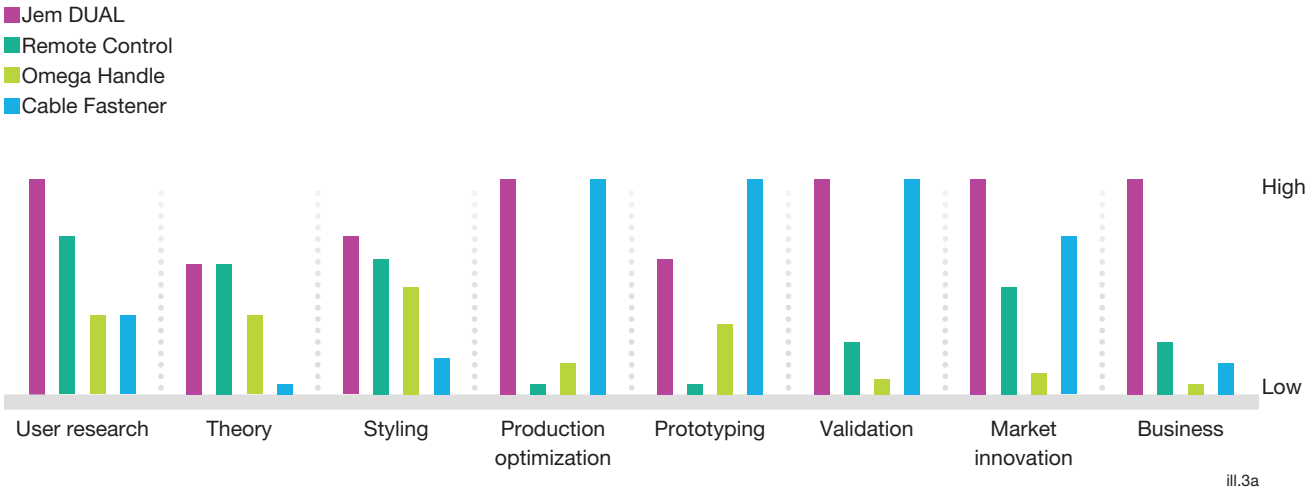
A huge thanks to Nick Scully, Martin Manufacturing UK, for his great help in explaining the workings of Club Smoke, testing fluid and answering a great bunch of questions! Also thanks for shipping all needed components to the prototyping.
Thanks to Jason Andrews for providing an understanding of the whole MMUK system and sale points, and for feedback on the conducted business case.
Thanks to the whole MMUK for taking time to explain and show the factory.

Also a great thanks to Henrik Sørensen, Martin Professional, for passing on some of his huge knowledge of the smoke department, both at the technical parts and the business point of view.
Thanks to the research and development department at Martin Professional for helping when most needed.

PRIORITISATION

In order to achieve a satisfactory level of the including components of this process, there is established a priority diagram. The diagram visualizes a greater priority to the development of some parts, according to the given time and the personal resources.

Initially it is chosen to try out the fact of developing a product that is beneficial and gives additional value to a company. Thus the purpose is to develop a product that is realizable and this have during the process been a method of selection and deselection.



ill.3a

The focus of the development of the Jem DUAL has been on developing a product based on user research that is optimized for the current production at Martin Manufacturing. It is chosen to go into depth with the technicalities of this product in order to produce a functioning and visual prototype, which can be used for further validation. During the user research it is evident that there is a need for a market innovation to reach the goals. In order to emphasize the news value of the product a brand new visual identity that differs from the competitors is incorporated, which can form the basis for the future generation of Jem smoke machines.

The need for a new Remote Control is derived from the user-based research and the development of the Jem DUAL and UI theories are used to design an intuitive interface. The aesthetics of the Remote Control is based on the same principles as the Jem DUAL and acts as an essential accessory. It is chosen to keep the Remote Control on a conceptual level due to time limitations.

The Omega handle idea is originated from the user-based research and acts as an accessory for all Omega quarter turn mountings and is styled for this purpose. Rapid prototyping and theories are used to validate a feasible concept.

The design process of the cable fastener is based on using rapid prototyping to validate the concept in terms of applicability in order to design a well-functioning product. Multiple concepts are used to optimize the production, and market research suggests that the product is quite unique.

PARTNERS

Throughout the process there have been two different partners involved. These are used to obtain and gather all useful knowledge in the various areas they are experts in.

ill.4a

Martin Professional ApS is the overall company. For Martin a redesign of the Club Smoke have a huge interest since it is a part of their product line. Thus it is a part of the overall revenue. For Martin, it is important that the product gives some great sales point to raise the market share.

For Martin Manufacturing (MMUK), which is the smoke sub-division of Martin Professional, they have interest with a redesign, since it is in the UK it will be manufactured. MMUK have a great interest to increase the manufacturing process by using stock parts since the orders are kind of sporadic in the niche market of smoke.

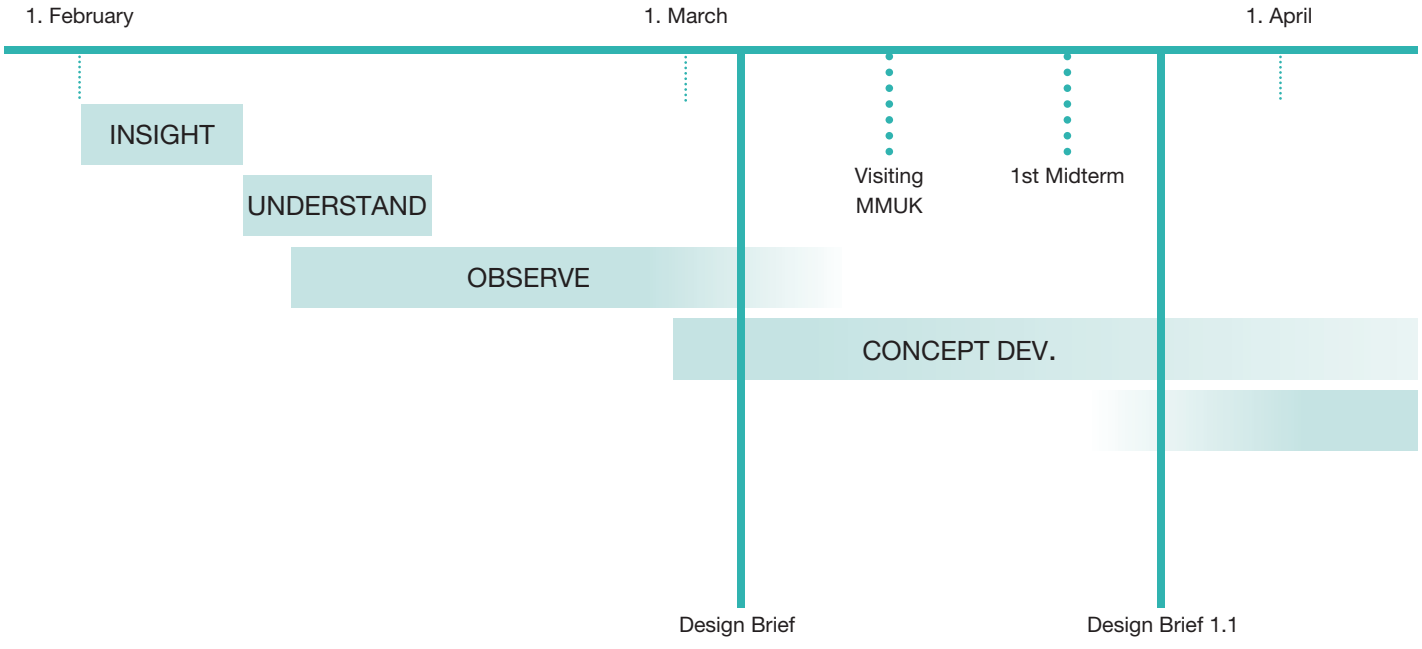
PROJECT TITLE	Jem DUAL
PROJECT GROUP	MSc04-ID11 Camilla Dahl Hansen Thue Kristensen
PROJECT PERIOD	03.02.2014- 28.05.2014
PARTNERS	Martin Professional ApS Martin Manufacturing UK
MAIN SUPERVISOR	Finn Kehlet Schou Department of Architecture, Design and Media Technology
TECHNICAL SUPERVISOR	Benny Ørtoft Endelt Department of Production
NUMBER OF PAGES	187 including appendix
COPIES	7

Camilla Dahl Hansen

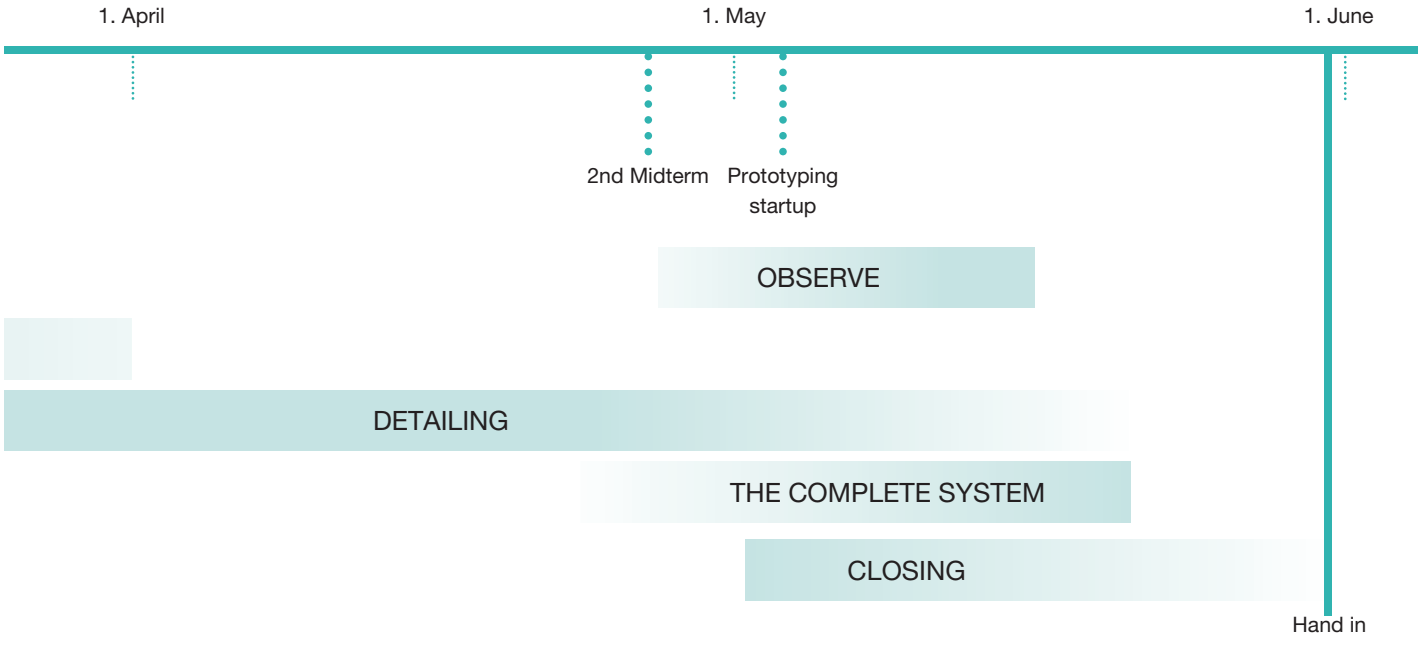
Thue Kristensen

PROJECT MANAGEMENT

The project is divided into 7 phases. A roadmap shows the phases in regards to time consumption, methods and output. The model is used to schedule milestones and deadlines in preparation to keep an overview through the whole process.



	INSIGHT	UNDERSTAND	OBSERVE
TOOLS	Initial design brief Background knowledge Project management	Company analysis Porters Five Forces SWOT Analysis Solution space exploration Product analysis Market analysis Product benchmarking	Product journey Use cases Use scenario Technical research Interviews
OUTCOME	Assignment understanding Project description	Company understanding Technical understanding Market possibilities Market gab	Stakeholders Use understanding Inside understanding Design criteria Design brief



CONCEPT DEV.	DETAILING	COMPLETE SYSTEM	CLOSING
Styleboard Sketching Production visit Testing Technical validation Company feedback Brainstorming	Mock ups 3D modeling Finite Element analysis Thermal analysis	Use scenario Desktop research Survey Q&A Functionality mapping Field research Theory Ideation 3D printing	Process tracking Prototyping User evaluation Benchmarking Break-even Business model canvas
Production understanding Feasible concept Bill of material	System understanding 3D model Jem DUAL system	Concept evaluation Pros. and cons. Theoretical knowledge 3D testing Accesories	Evaluation Reflection on process Product handover

ill. 7a Project management

INSIGHT

Initial design brief
Background knowledge

11

INITIAL DESIGN BRIEF

Martin Professional is a world-leading brand creating dynamic lighting solutions for entertainment, architectural and commercial sectors and a line of smoke machines as a compliment to the intelligent lighting. Martin was founded in 1987 and is based in Aarhus, Denmark and operates with local partners in nearly 100 countries. Since 2012 Martin have been a division of the global infotainment and audio company HARMAN International Industries.

INITIAL ASSIGNMENT

Magnum Club Smoke is a fog machine for the professional market, which was designed and launched in the 1990s. Since the sale have gradually leveled off, Martin wants a development of this product. The task is therefore roughly a redesign of an older but once popular product.
The task is openly set from Martin, but the company is focused on that Magnum Club Smoke is the professional choice for clubs in regards to use and branding, and wish to maintain this market position. There are basically no production constraints to the development and design, but at initial conversation with Henrik Sørensen, CEO of Marin Professional Smoke division it is evident that the wish is a user based approach to the design process.

LINE-UP

The current line-up of Martin's smoke products consists of Martin Magnum and Jem [appendix A]. It is Martin's intension to exclude the Magnum Smoke line, and put the focus on Jem and the new Rush brand. Rush being the cheaper and high volume product line manufactured in China, while Jem being the more exclusive product line for professional use manufactured in UK. Martin sees the Club Smoke as a product in the high end of the Rush product line to avoid conflicting with the Jem Hydra smoke machine that address larger venues and applications in the Jem product line. There are no smoke products in the Rush product line yet, but the majority of the Martin Magnum products will be renamed as Rush products.

CURRENT LINE-UP

- with Magnum and Jem products.

Magnum
- Magnum 650
- Magnum 850
- Magnum 1200
- Magnum 1800
- Magnum 2000
- Magnum Club Smoke

Jem
- Jem ZR44 Hi-Mass
- Jem Roadie Compact
- Jem Roadie X-Stream
- Jem Hydra

FUTURE LINE-UP

- with Jem and the new Rush products.

Rush
- Rush 650
- Rush 850
- Rush 1200
- Rush 1800
- Rush Club Smoke

Jem
- Jem 2000
- Jem ZR44 Hi-Mass
- Jem Roadie Compact
- Jem Roadie X-Stream
- Jem Hydra

DESIGN POSSIBILITIES

After the initial assignment from Martin about redesign of the Club Smoke, the focus is on giving the product a kick, in order to optimize the sales.
Initially, there is seen potential in incorporating new features in the Club Smoke, while optimizing the use situation – including user experience and user interface. It is seen as an essential part of creating an integrated design that contains the visual, the technical and the user's point of view.
Martin needs some good sale points to reach a higher sale level. This can be given in a great storytelling according to a new design.

To reach the optimal process and product, it is important to achieve a technical understanding and insight into what Club Smoke contains and how the product works technically.
This product exist in a small niche market, that have high expectations and demands to the product, and the use of it – therefore it is important to think "out of the box" in order to get the optimum redesign for this niche market.
The product must live up to the high quality, that characterize Martin products.
It is chosen to be open to the product line possibilities of Rush or Jem, and not be limited by the initial design brief, but let the market- and product research and possibilities determine the market position.

ill.13a The Martin Magnum Club Smoke

BACKGROUND KNOWLEDGE

USE OF SMOKE

Smoke form the basis of light experience since light without smoke is only visible on the surfaces that it hits. Besides making light beams visible in mid-air, and thus enhancing the visual effect from lights and lasers, smoke can be used as an effect on its own. Blowing out a beam of dense white smoke can reduce the visibility and be a dramatic effect.

Smoke is the general term used to describe a vapour that appears similar to smoke. This artificial smoke is commonly used within professional entertainment as well as training industrial and military applications. In the professional market smoke is divided into three categories; fog, haze and heavy fog [web 1].

ill.14a Fog effect

FOG

Fog is the most known type of artificial smoke. Fog is a white dense vapour similar to smoke, which gradually dissipates into the surrounding air.

ill.14b Haze effect

HAZE

Haze is used to create a homogeneous and subtle mist effect, which is close to invisible when not lit by light. Haze is used to make light beams visible and has a longer persistence than fog.

ill.14c Heavy fog effect

HEAVY FOG

Heavy fog simulates the heavy fog that can be found in nature, which covers the floor in a dense white fog.

!

Due to a minority use of heavy fog in the club environment, the further insight and research will be limited to fog and haze.

SMOKE FLUID

All smoke machines operate on a carefully mixed fluid and the most widespread fluid type is made of glycol and demineralised water, called "water-based" fluid. This liquid can be mixed for different use situations which require different dispersion times. Another way is to use an oil based fluid, which is known for producing a more dense fog and a great haze, but leave oil residues in the areas used [H. Sørensen, 2014].
An in-depth description on smoke fluid requires great expertise and experience, why this episode covers the basics.

DEMINERALIZED WATER

A large percentage of smoke fluid is demineralised water which is water that has the minerals removed, in order to purify it. Martin smoke fluid uses water that is purified by reversed osmosis.

GLYCOL

The glycol consists of two types of glycol, monoethyleneglycol and triethyleneglycol, which have different useful characteristics when used to produce smoke fluid.

MONOETHYLENEGLYCOL

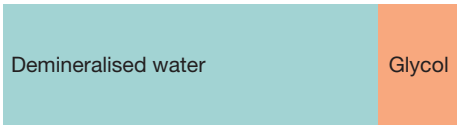
The amount of monoethylenglycol in the smoke fluid affects the density of the smoke; the more monoethyleneglycol a denser and whiter smoke can be achieved.

TRIETHYLENEGLYCOL

The percentage of triethyleneglycol affects the hang-time of the smoke. The more triethyleneglycol the longer the smoke will stay in the air.

The range of Martin smoke fluid consists only of water based fluids and the future Club Smoke is to function on water-based fluid as well. Broadly speaking smoke fluid can be divided into two different types; haze and fog [web 3].

HAZE FLUID



Haze fluid consists of a large percentage of deionized water to provide a thin fluid for a see-through haze effect.

FOG FLUID

Fog fluid consists of more glycol than haze fluid to be able to produce a denser white fog effect.

The percentages of glycol and water affect the production price as demineralised water is cheap in comparison to glycol. Therefore haze fluids are usually cheaper than fog fluids, since it have a higher content of water.

The boiling point of water is 100°C, while monoethyleneglycol and triethyleneglycol have boiling points of respectively 197°C and 288°C, why it is of great importance that the fluid temperature reaches a temperature of around 300°C before it exits through the nozzle as vapour [web 2].


HARMAN
Martin

UNDERSTAND

Martin Professional analysis
Club Smoke
Product DNA
Market analysis
Sum up on analysis

17

MARTIN PROFESSIONAL ANALYSIS

To gain a greater understanding of how Martin sees themselves and their company development, a desktop research is created. This illustrates what Martin stands for and their future goals with the company

In 1987 Martin was founded, primarily as a producer of disco lights and fog machines. Martin offers dynamic lighting solutions for entertainment and architectural markets, lighting controllers and media servers and a complete line-up of smoke machines. Martin has a wide range of customers, from theatres, concerts, cruise ships, DJ's and local partners in nearly 100 countries. The line-up of smoke machines is assembled at Martin Manufacturing in Louth, UK (MMUK) and the light fixtures are produced in Frederikshaven, Denmark [web 4].

Martin creates value through fresh ideas and a large range of dynamic lighting and smoke solutions, based on a solid foundation of experience and knowledge. The goal is to manufacture the highest possible quality, and offer unparalleled after-sales service in order to provide a marked leading return on investment [web 5].

Martin® by HARMAN

ill.19a

MISSION

"... understand, inspire and enable the customers to develop attractive environments and create excitement through the use of dynamic light and visual effects." [web 6].

VISION

"... strives to be the obvious choice for the global professional lighting market. They add value through superior quality, industry-leading competences, full accountability and die-hard dedication to the customers." [web 6].

TIMELINE

2012: Harman International Industries acquires the company
2009: The online Martin eShop, MyMartin, opens for business.
2007: Turnover hits a record DKK 1.2 billion.
2006: Revenue exceeds DKK 1 billion. Martin moves into LED lighting.
2005: Christian Engsted begins as new President and CEO.
2001: Martin becomes the world's leading producer of intelligent lighting.
2000: Revenue exceeds DKK 700 million. Danish firm Schouw & Co. acquires the company.
1998: Kristian Kolding become CEO. Martin enters the exterior architectural lighting market.
1993: Revenue exceeds DKK 100 million
1987: Founded by Peter Johansen
[web 7] [web 8]

PORTERS FIVE FORCES

Porters Five Forces is a framework for business analysis and strategy development [web 9]. By looking at five elements that influence the balance of power in the market it is possible to point out the powers and weaknesses of a company. The model is used to achieve an understanding of the current market situation at Martin. It can establish a basis for which strategy to use when developing a new product. The following Porters Five Forces analysis is made with basis on the general smoke business at Martin. The factors that are found most important are highlighted.

! It is important to justify the price level of a new product with a premium quality product.
It is a possibility to be a part of the market of haze machines.

INDUSTRY

Martin have few huge competitors on the smoke market
- Antari
- Ottec
  - Look
  - Smoke Factory
- American DJ

- Customer loyalty

BUYERS

- Low switching cost to use other products/ brands
  - **Ability to substitute**
- Price difference from other products/brands
- Price sensitivity

NEW ENTRANTS

- Chinese industries
  - Economy of scale
- Niche market
  - Not many new entrants
- No technology protection

SUPPLIERS

- Very depended on suppliers
  - Electronic
  - Raw material
- Switching costs to other suppliers
- **Quality level**
- Number and size of suppliers
- Importance of volume to supplier

SUBSTITUTES

- Other effect machines
- **Haze take over fog machines**
- Niche market dominated by older technology
- Slowly evolving technology

ill.20a Porters five forces

SWOT ANALYSIS

To gain insight on the company's competitive position and strategic options a SWOT analysis is made [web 9]. This provides an overview of the internal strengths, weaknesses, opportunities and threats. The aim of the SWOT is to take advantage of the strengths and minimize the weaknesses by making them into opportunities. This SWOT analysis is made with the company point of view according to the general smoke business, and the strongest parameters are highlighted.

S

- **Strong brand and a loyal customer base**
- Long experience with smoke
- Efficient, experienced and flexible factory capable of rapid reaction to orders
- **Efficient fluid plant**
- Manufacture of the highest quality fluids
- Service department @ MMUK
- Strong financial background
- High staff retention
- Distributors/subsidiaries operate in more than 100 countries
- Patents

W

- General opinion against smoke and haze
- Competition overtakes market share
- **Lack of focus in the sales organization**
- Spare Parts pricing
- Slow delivery of spares from DK

O

- **Revitalize sales through Martin**
- **Introduce products filling the portfolio gaps**
- Develop products based on new technology
- Sales through new channels
- New OEM partners
- **Acquisitions in the haze segment**
- 80 % market share to go after
- Purchasing and sourcing the right price
- Long term fluid contracts
- Service contracts on high end equipment
- Higher margin in UK by supplying directly from MMUK
- US fluid plants, save transportation, revitalized US sales

T

- Organization is split and has no clear strategy
- Only one sales channel - Martin
- R&D is based on few people
- Have never really cracked the haze marked
- Lost continuity over the last years
- **Lack of new products**
- Administration in the R&D process
- **Sales team has a lack of product knowledge, especially the higher end**
- **Marketing weak compared to competitors**
- Poor credit rating
- MMUK staff reduced to critical size

ill.21a SWOT analysis

!

There is an importance of maintaining the strong brand of Martin.
There are seen possibilities to expand the haze segment.
It is seen as a great potential to do better sales channels.
Knowledge within the sales team on a new products allows for revitalized sales.
Continuous sale of smoke fluid is a chance of long-term profit.

CLUB SMOKE

The Club Smoke, on which this project is based, was designed and launched in 1998. The first years the Club Smoke had good sales, but the later years the sales have leveled off and faded out [H. Sørensen, 2014].

The Club Smoke is a pump fluid fog system, consisting of a 10 litre ground-based fluid supply and individual fog heads [appendix B]. It is possible to connect up to four heads in inaccessible areas such as high trussing, club ceilings or under floors. The ground based fluid supply can be positioned in a convenient location, that guarantees no high wire, mid-show refills.

The Club Smoke is specifically designed for permanent club installations and comes with a multi-functional remote control and is DMX compatible [Appendix F].

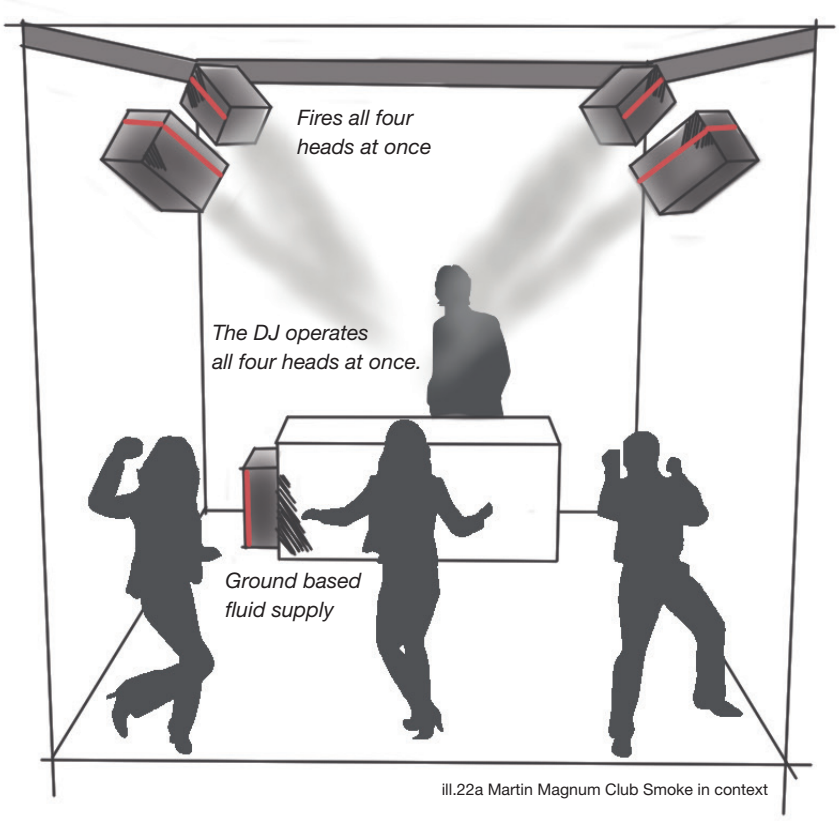
PHYSICAL DIMENSIONS
Base unit: 410 x 290 x 480. 12 kg.
Head: 330 x 310 x 165. 10 kg.

PRICE
Base: 1096 EUR
4 heads: 2319 EUR
Complete 4-head system: 3415 EUR [web 10]

MAX SYSTEM FOG OUTPUT
2000 m^3/min
(500 m^3/min pr head)

OUTPUT CONTROL LEVEL
1 - 99 %
1 % steps

LIQUID CAPACITY
10 litre



ill.22a Martin Magnum Club Smoke in context

PRODUCT ARCHITECTURE

In order to develop a redesign, it is important to have an insight into how the current product function and which elements it consists of. On this basic it can be considered on where to do changes or which functions to keep in a new product.

The two fog fluid pumps pumps the fog fluid to the fog heads. Inside the head the fluid is lead into a copper coil which goes through an aluminum heat exchanger which can reach a temperature of 300°. This heating vaporizes the liquid, after which the fog exits through a nozzle.

REMOTE CONTROL

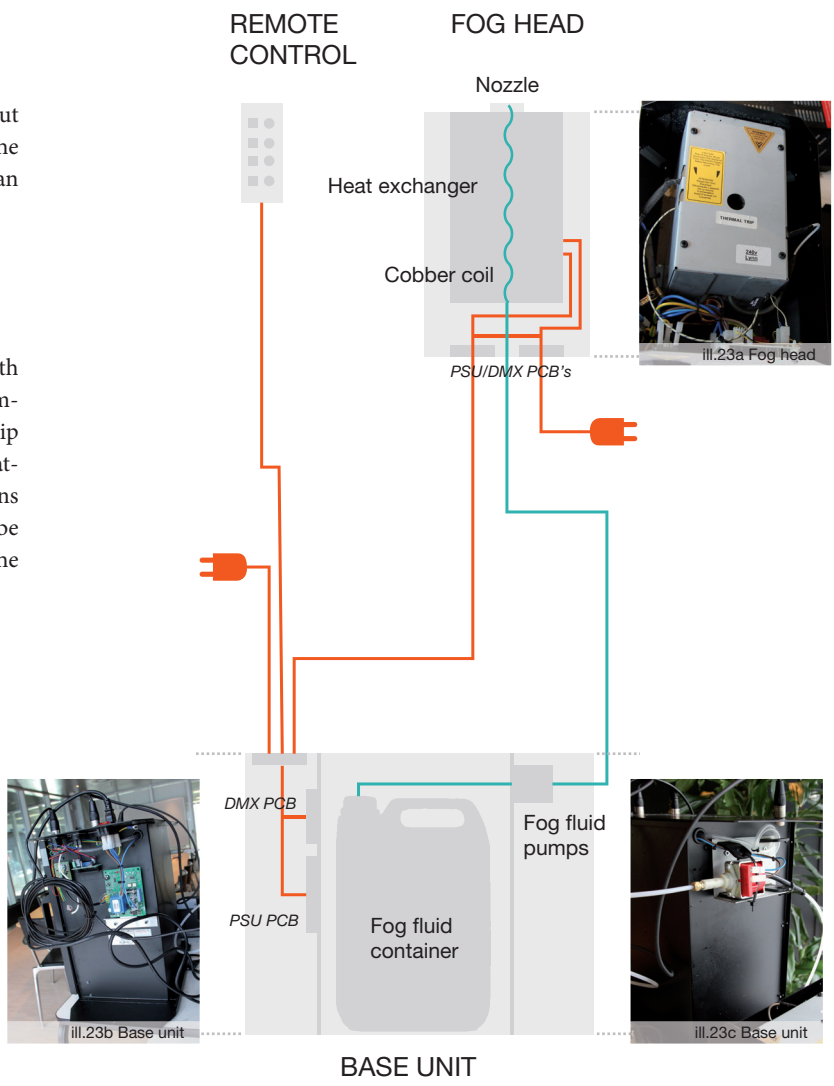
The remote control controls the smoke output as well as the duration of discharge and the pauses between discharges. The machine can also be controlled by a DMX controller.

FOG HEAD

The heat exchanger in the fog head is fitted with a thermostat which ensures the correct temperature. Furthermore there is a thermal trip which measures the temperature on the heating element. In case the heat exchanger runs hot, the machine is switched off, and must be activated manually by pushing a button on the actual heat exchanger.

BASE UNIT

The base unit consists of a 10 litre fog fluid container to supply the four heads with fog fluid, as well as a PSU and a DMX interface PCB that receives information from a DMX controller or the supplied remote control and communicates to the fog heads.
Furthermore two fog fluid pumps, one pair of heads pr. pump, are placed to provide the required fog fluid to the fog heads.



PRODUCT DNA

MARTIN

The Martin pedigree is investigated, in order to clarify if there is a particular design style or characteristics within the Martin products. The research is conducted on both light and smoke equipment.

ill.24a Late 80s

LATE 1980s

The Martin Junior 700 and Magnum 1600 was made using bent black painted sheet metal and had no significant design to make it stand out from the crowd - besides the dominant Martin logo on the side.

In 1999 Martin made the Jem FX-2 fog machine with a plastic casing instead of a metal casing. This was the first plastic cased fog machine. Martin MX and CX lighting series shared the plastic casing. This was quickly taken off the market due to fire hazard.


ill. 24c Jem FX-2

ill.24b Late 90s

1990s

The Martin products from the 90´s were divided in two series; the Martin series and the DJ series. Both series has a long coloured line on the side; red on the Martin series and yellow on the DJ series.

The DJ series was made using bent sheet metal for cost-optimized product which has no distinct appearance, except the yellow line.

The Martin series has grooved extruded aluminium edges, which recurred in all products in the Martin series.

The grooved curved edges are also visible on the still-existing Martin Magnum 2000 fog machine.

Martin®

ill. 24d


ill. 24d The 00s

00s

The most prominent Martin products of the 00´s are the moving heads where the casing is made from black plastic with continuous surfaces with gills for ventilation.

2006

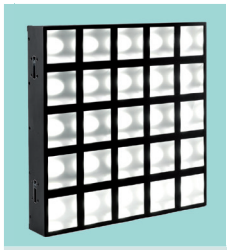
In 2006 Designit designed the new look of the Magnum smoke machines. They incorporated gills with a visible perforated silver steel plate and a silver circular detail around the nozzle in a black painted steel casing with large radius bends.

ill. 24e The new look

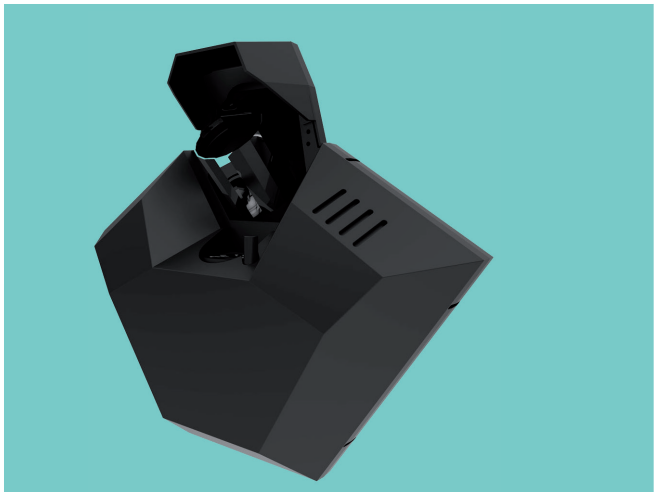
RUSH BY MARTIN

Since Martin has expressed a wish on Club Smoke to be included in the Rush product line, with an opportunity to fill a gap in the missing smoke Rush market, the Rush design DNA is studied in order to determine whether it is the wish to follow this design expression.

ill. 25a



ill. 25e RUSH Strobe 1 5x5



ill. 25h RUSH Wizard

ill. 25b RUSH MH 2 Wash

ill. 25f RUSH MH 1 Profile

ill. 25g RUSH Pin 1 CW

ill. 25c RUSH multibeam 2

ill. 25d RUSH Par 1 RGBW

The Rush Pin 1 CW is dominated by a simple bent steel casing. The MH products look similar to the Martin Mac moving head range, and are made in a thermoplastic casing. The Multibeam 2 could come from any manufacturer, as well could the Strobe 1 5x5 and the PAR products. The upcoming product Wizard is the only products that stand out from the crowd, with its geometric shaped casing, made from thermoplastic, evokes associations of a military stealth aircraft. This geometric casing is reminiscent to the Rush by Martin logo which uses a very angular font, which is in line with the geometric lines of the Wizard.

!

When looking at the Rush series, there are no significant visual expression that have been carried out throughout the product range.

MARKET ANALYSIS

To get an insight into the market there is made a quick desktop research on various effect equipment. Likewise it is needed to get an overview and a larger understanding of the market and the competition, therefore a market analysis is made of competing fog machines. Some general information about the machines is listed for comparison. It is chosen to focus on competitors with comparable flow as the Club Smoke (500 – 2000 m3/min.) available on the Danish market. See appendix C for the complete market research.

ill.26a

Smoke Factory Enterprise TC4 [web 11]
Physical dimensions: 455 x 320 x 465. 23 kg.
Price: 1263 EUR
Max. fog output: 1200 m3/min
Output control level: 1 – 99 %. 1% steps
Liquid capacity: 5 ltr.
Extra features: Standalone 25 ltr. Fluid container available. External 800 w fan available for haze effect.

ill.26b

Eurolight N-150 [web 13]
Physical dimensions: 670 x 300 x 240. 15 kg
Price: 281 EUR
Max. fog output: 800 m3/min
Output control level: 20% - 100% in 10% steps
Liquid capacity: 6 ltr.

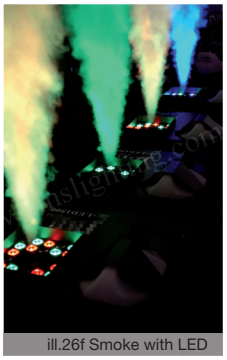
ill.26c

American DJ Fog Fury 3000 [web 12]
Physical dimensions: 475 x 345 x 321
Price: 308 EUR
Max. fog output: 600 m3/min
Output control level: Non
Liquid capacity: 5 ltr.

ill.26d

Antari Z-1200/II DMX [web 14]
Physical dimensions: 480 x 250 x 260. 11 kg.
Price: 299 EUR
Max. fog output: 500 m3/min
Output control level: No.
Liquid capacity (Litre): 2.5 ltr

ill.26e Fire effect



ill.26f Smoke with LED

ill.26g Foam effect

It is chosen to focus on improving the current Club Smoke within the limits of the Martin Smoke division.
There are potential in incorporating a haze-functionality to the Club Smoke, in order to make the product more versatile according to the business of Martin.
The key selling point of the Club Smoke for permanent installation is the ground based fluid supply, which eases the fluid refilling.

Henrik Sørensen points out that different effect machines is not the market for Martin. They once tried LED light into smoke machines, but the light was exposed to condensation. This drastically reduces the life span, which is undesirable for Martin who wants to maintain their high quality products. When discussing different types of smoke with Henrik, their experience shows that the demand for haze is increasing

PRODUCT BENCHMARKING

The type of system with a central base and attached fog heads is not very common on the market. Besides Martins own Jem Hydra, there is only found one competitor; an upcoming product from Smoke Factory [Appendix D]. The important differences with these systems are highlighted with a comparison chart. This chart compares fully equipped systems, with the maximum amount of attached heads.

ill.27a

Club Smoke [web 10]
Max. 4 fog heads
Max. output 2000 m^3 pr. Min
Max. fluid line: 50 m.
Max. fluid rise: 2 m.
Max. fluid capacity: 10 ltr.

Prices in EUR:
Base: 1096
Head: 580
Fully equipped system: 3.415

ill.27b

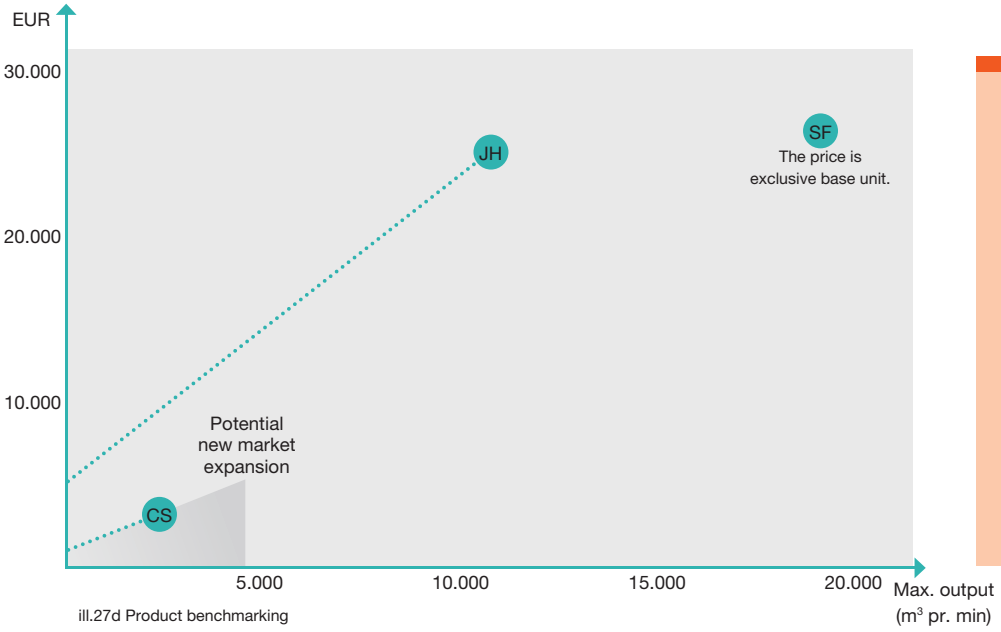
Jem Hydra [web 15]
Max. 16 fog heads
Max. output: 11200 m^3 pr. Min
Max. fluid line: 300 m.
Max. fluid rise: -
Max. fluid capacity: 50 ltr.

Prices in EUR:
Base: 5084
Head: 1319
Fully equipped system: 26.188

ill.27c

Smoke Factory Fog fluid system
Max. 32 fog heads
Max. output: 19200 m^3 pr. Min
Max. fluid line: -
Max. fluid rise: 15 m.
Max. fluid capacity: 200 ltr.

Prices in EUR:
Base: Unknown
Head: 878
Fully equipped system: 28.096 + base unit.



ill.27d Product benchmarking

It is possible to expand the Club Smoke market, by the possibility of attaching more fog heads on one system, without taking market share from Jem Hydra. There is a possibility to control each head individually like the Jem Hydra and Smoke Factory.

SUM UP ON ANALYSIS

!

Based on the preceding analysis and research on Martin Club Smoke and the market of fog machines, it has been confirmed that there are good opportunities and challenges in a redesign of the Club Smoke.

Club Smoke is a part of a small niche market where it is essential to maintain Martin's market power according to the competition, which is in line with Martins wish to keep the overall Club Smoke and not pursue other effects.

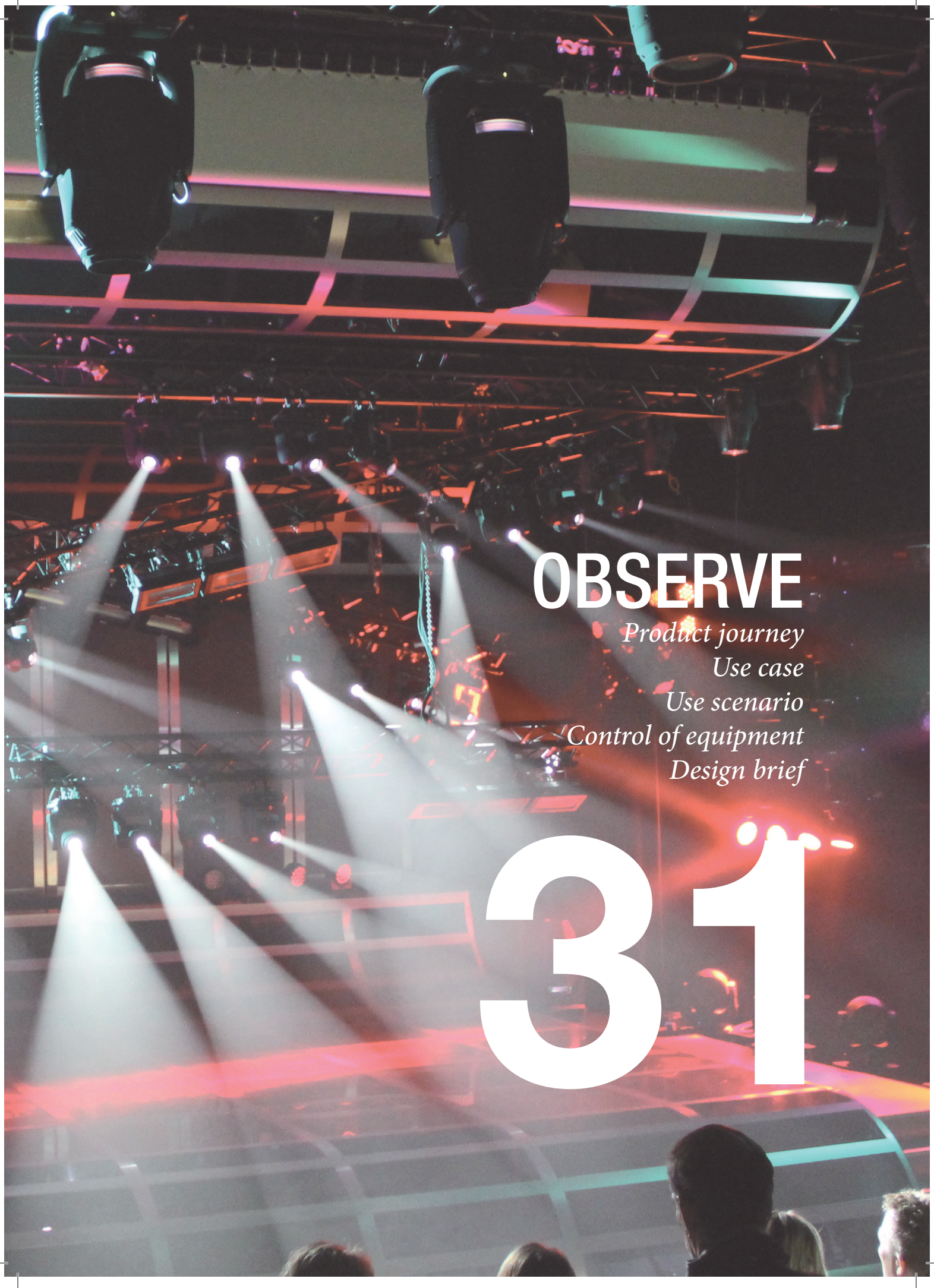
Club Smoke is a fog machine in which the fog fluid container and fog heads are separated – there are a small number of these machines at the market, thus it is essential to retain this concept, as this makes the process of refilling the fog fluid more convenient, and acts as a great selling point.

In the absence of direct competing fog systems, there is plenty of opportunities to expand the market of Club Smoke with the opportunity to to be able to add more smoke heads with better control options, without taking market share from Martin's larger fog machine Hydra.

Besides that, there is a great potential in expanding the Club Smoke concept into haze, as there is seen great development at the haze market.

It is important to maintain the strong brand of Martin by creating a high quality product, and there are seen opportunities in creating a product with great selling points with the ability of revitalizing sales through storytelling.

Martin produces their own smoke fluid, and the opportunity of a continues sale for the products is seen as a great opportunity of creating a long-term revenue.



OBSERVE

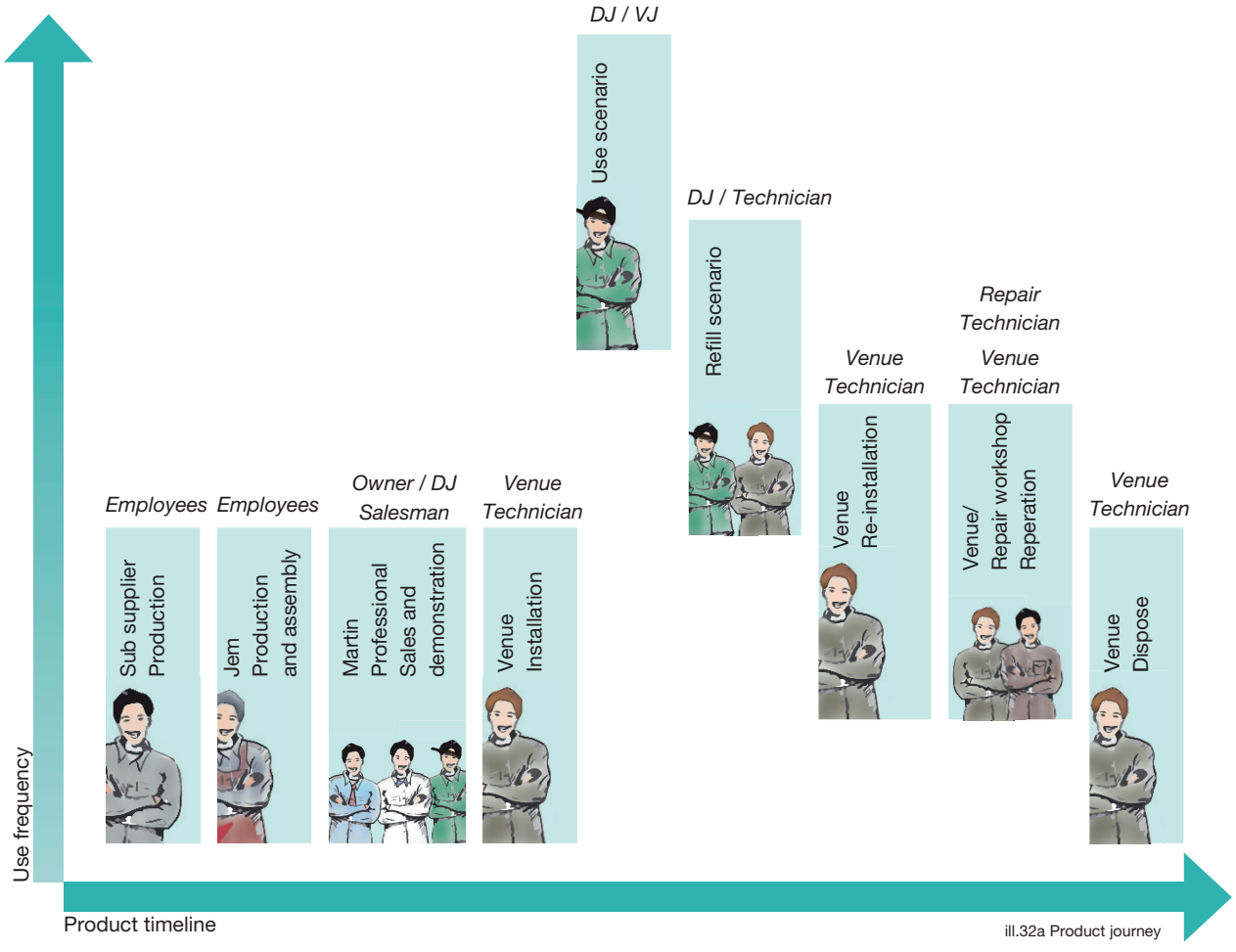
Product journey
Use case
Use scenario
Control of equipment
Design brief

31

PRODUCT JOURNEY

On basis of the initial design brief and Martins wish for a user-based approach a product journey, in regards to smoke machines in general, is carried out in order to identify the stakeholders. The product journey is used to ensure that every phase of the smoke machine's life-cycle is addressed, and to map who should be prioritized.
The product journey is developed on the basis of inside information and quick and superficial conversations with acquaintances in the field of use of smoke machines.
According to Martin they have the best return of investment on the market [web 5], which acts as a great purchase incentive for the venue owners. Therefore the focus is kept on the people who daily or regularly interact with the product - this being venue DJ's and the venue technicians, who acts as use cases in the following episode.

> *The use frequency shows that the use scenario and refilling scenario are of great importance as these happen with a high frequency.*
> *It is important to involve the DJ who use the product daily.*



ill.32a Product journey

USE CASE

Given that the user is chosen to be in focus, it is important to acquire an understanding of the environment the product is to be used in. To aim a broad understanding of smoke machines and the use situations, it is chosen to focus on smoke machines in general. For further insight in the use cases, see appendix E.

AKKC

To detect the need and use of smoke machines in a larger context, Aalborg Kongres og Kultur Center (AKKC) is visited. Here, Søren is one of the responsible for the setup and management of both lights and smoke machines.
AKKC use a MVS Le Maitre haze machine to get an almost invisible haze when not lit by light during shows and concerts. The haze machines are usually positioned directly on the stage.
For AKKC it is not the most important thing with the output of the machine, but the hang time of the haze effect.
The scene at AKKC is very large and the space above the stage is high, therefore it takes a lot of haze to fill up the stage, since the haze rises. If the haze has a long hang time, the maintenance of the effect is minimized.
Søren has attached a wireless DMX system to the haze machines, so there is no need to connect cables every time they want to position machines - what they do for a variety of performances. It works without problems.
They are using RDM to receive information back from many of their connected devices. In addition, they are connecting their DMX system with ethernet cables through sACN – in this way they can respond on more data for each product.
AKKC's newly purchased ETC DMX controller incorporates a new control protocol with fewer limitations than DMX, called ACN, which is the future for both light and smoke products according to Søren. He looks forward to this being embedded into a wide range of products.


ill.33a The MVS Le Maitre

ill.33b Wireless DMX transmitter


ill.33c AKKC's new ETC controller

> ! *The hang time is of utter importance when it comes to haze.*
> *RDM is a smart way of achieving feedback from attached device via DMX.*
> *ACN is potentially the future communication protocol with fewer limitations than DMX.*
> *The product is not going to be wireless.*

The idea of using wireless control is mentioned to Henrik Sørensen. Martin have been tested wireless products once, but it simple didn't work proper for Martins requirements, since there in clubs, are a lot of wireless interference by guests with WIFI- and Bluetooth transmitting cellphones. Besides that the development costs of a proper wireless system will be to expensive to a product like Club Smoke [H. Sørensen, 2014].

USE CASE

It is the wish to get in touch with technicians who on a daily basis both configure and use smoke machines. Søren from AKKC made a reference to Jess and Frederik from the large rental- and sales company "Sound and Light" that is contacted.

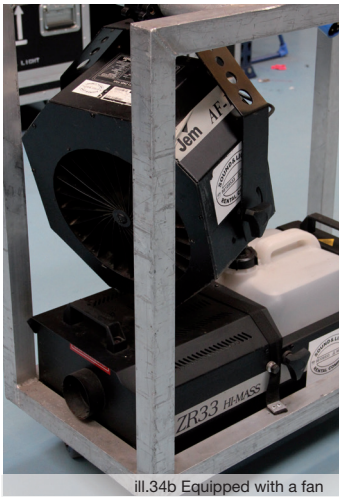
SOUND AND LIGHT

Sound and Light is a company located in Nørresundby who rent out, sell, install and advise on Martin products primarily. Their primary task is to deliver and install intelligent lighting and smoke machines to larger events such as live music venues and theaters.
They see problems with products where some elements protrude, such as handles. These elements are easily damaged during transportation and handling. This would be better with an integrated solution. Besides that there are often problems where a plastic thread meets a metal thread – the plastic thread is simply worn out.

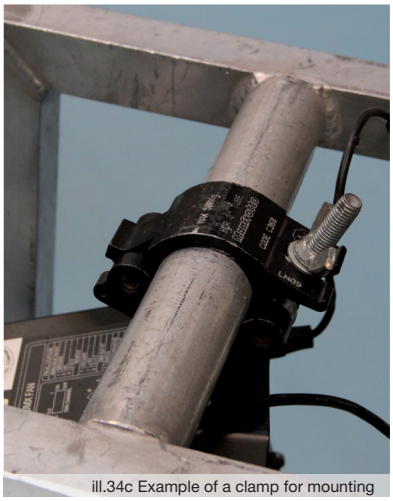
ill.34a The plastic wears out easily

Jess and Frederik sees potential in creating a system with multiple heads, which have separate fluid lines and outputs of each head. If one head malfunctions, the system can still run with the remaining attached heads. It can also be a great effect if the fog head can emit fog individually or in pairs to provide the possibility of creating a more interesting fog effect.
Concerning a product for permanent installation, the wishes and needs for the product can change from time to time. Therefore, it will be a great option if the product is as universal as possible - for example, if the user could choose between haze and fog without having to change the fluid.

Sound and Light often use a fog machine, with a homemade solution with a fan that dilutes and disperses the fog, to create haze as they see the greatest needs within haze. Common fog is not a continuous effect and they see the need to be very limited in their line of work.



ill.34b Equipped with a fan



ill.34c Example of a clamp for mounting

When Sound and Light is buying products for rent or resale, no brackets for the products are pre-installed. They choose the bracket on basis of the need - for heavy products, it is important that they can hang them down before they are clamped for example at a truss.

!

It is chosen to do a more universal product with more options of use.
It is possible to use of fan to make a fog to a haze-like smoke.
Haze is used continuously while fog is an on-demand effect.
It is chosen not to go into the market of brackets, since different users have different preferences when using brackets.
When having a system with separated fluid-lines, the system can still run even if some heads is damaged.

USE CASE

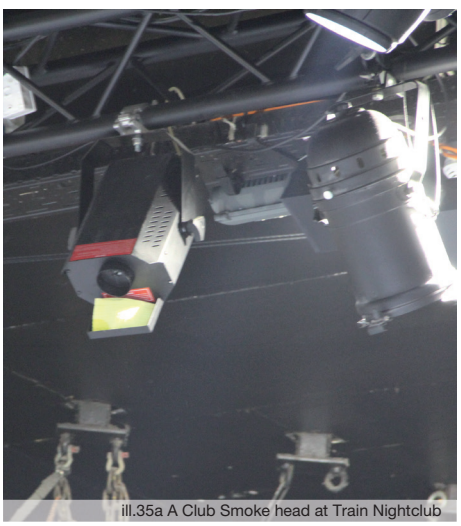
According to Henrik Sørensen, Train in Aarhus is the only club in Jutland using the Club Smoke system. The technicians Johnny and Christian are contacted, to get an insight to the club's use of the system, and the need for smoke in a larger club like Train.

TRAIN NIGHTCLUB

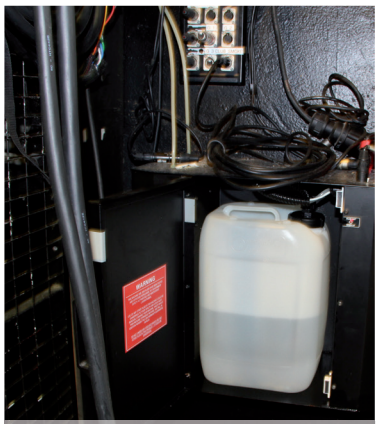
Train is one of the leading nightclubs in Aarhus. It is a two-story club that houses both live performances as well as clubbing. The club can accommodate 1700 guests as a nightclub.

Train is using a Club Smoke system with 4 heads. Besides that they use a Martin AF-1 Fan, two Jem K1 Hazers and a Le Maitre MVS Hazer. Train uses their Club Smoke system for clubbing primarily. The Jem K1 and Le Maitre hazer are used to generate a general haze in the club for both clubbing and during live performances. The Club Smoke system is used to produce a dense fog effect on the dance floor, where the heads are placed in the ceiling of each corner of the dance floor, and the Martin AF1 fan is used to blow the fog towards the floor. It is desirable that this fog rapidly dissipates or turns to haze. The fans help with that.

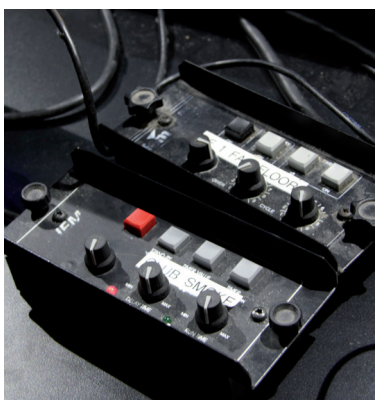
The specified fluid lifting high of 2 meters for Club Smoke is not sufficient for the use at Train, as the heads is placed 4 meters above the base. The system works fine anyway.



ill.35a A Club Smoke head at Train Nightclub



ill.35b The Club Smoke base unit



ill.35c Trains two smoke remotes

According to Christian and Johnny it would be beneficial for Train to be able to incorporate both fog and haze into one system, which could be refilled in one convenient place. Currently, the Jem K1 hazers and the Le Maitre hazer are refilled quite often in inconvenient places which requires a ladder to reach. The Club Smoke base unit is conveniently placed on the stage, but because of the need for both fog and haze their refilling situation is not completely convenient.

At Train they use the included remote control, which lies next to the Jem K1 hazer remote control. It is important that the smoke machine is easy to operate, since many different DJ's, VJ's and technicians are using it. It would be appreciated if each head could be controlled individually. The Club Smoke heads are plenty powerful and are usually operated at 50% output, to provide sufficient fog effect.

Christian predicts issues when refilled a system with both fog and haze if it requires more than one type of fluid. Multiple people refill the system, and may refill with the wrong type of fluid.

During their redecorating of the club all light- and smoke devices was taken down, and when remounting them Johnny was annoyed by all the disordered cables hanging loosely or pulled around the truss.

!

The controls must be intuitive since different people operate the system.
Most clubs are using both haze and fog. Haze is used continuously, while fog is used occasionally as a effect.
Different types of fluid in the same system can cause issues when refilling smoke fluid.
The fluid lifting high must be over 4 meters.
It complicates troubleshooting of the products when disordered cables are hanging from the truss.

USE CASES

For more feedback several Club DJ's and technicians is interviewed through a questionnaire. This contributes to a wider understanding of the overall use and needs of smoke products. The most important points from these interviews are summarized in this section. For further insight in the use cases, see appendix A.

Many DJ's sees haze as the most important type of smoke in clubs.
The smoke equipment in a club is often chosen in collaboration with DJ's and technicians.
It is once again confirmed that the control must be easy to use.

DJ JONAS WITTENDORF

Jonas uses both haze machines as well as fog machines. He thinks that haze machines are the most important as these affect all lighting equipment and the fog machines are used sparser for effects.
When Jonas' employer buys new smoke equipment it is being chosen in collaboration with the DJ's and venue technicians.
In regards to the control of the smoke machines Jonas uses DMX controllers which controls both light and smoke.
When having larger arrangements Jonas uses both CO_2 guns and stage flames.

TECHNICIAN ULRICH ANDERSEN

Ulrich daily supplies and repairs smoke machines and hazers for clubs as well as live venues. His impression is that many DJ's think that the product is secondary, it just need to work. He finds Martin products as being high quality products and the importance is reliable products that are easy to use for everyone - even for non-technical people.
Ulrich's impression is that most clubs use the included DMX remote to control the smoke machines.
Many club owners focus on as little maintenance as possible and that the smoke fluid is cheap. Many of the clubs Ulrich has information about have choosen their smoke products in consultation with the resident DJ or technicians.
He has a little knowledge about ACN and thinks it seems like an easy option to run the signal via cat5 cables.

DJ KENT SIGERSTRØM

Kent Sigerstrøm is an experienced mobile DJ with roughly 10 years of experience, who also plays at smaller clubs in the Aarhus area, where the resident DJ's advice is taken into account when purchasing new equipment. Kent thinks the most important things about a smoke machine are reliability as well as the ability to produce smoke with a good hang-time. In his DJ routine he uses the included remote for his Martin Magnum 2000, which he has used for years. He sees haze as a necessity and fog as a great effect with potential in combining the two. Furthermore, he uses DMX for controlling the light fixtures, which are Martin products as he thinks Martin is the state of the art, and it works with no issues at all.

DJ BAKIR

DJ Bakir plays at Klub M in Frederikssund as well as in his own mobile disco, where he controls music, light and smoke effects.
DJ Bakir thinks that the most important thing about using smoke in clubs is that the haze will have a good hang-time, as well as having a simple easy-to-use controller.
He uses his computer to control the smoke with a USB-DMX transmitter, which operates via DMX with no issues. At smaller clubs such as Klub M, the venue owner choses the smoke equipment for the club, without advice from the DJ's, based on price and quality.

DJ MORTEN GREVEN

DJ Morten Greven has more than 15 years of DJ experience and has used Martin equipment over the same period, and acts as resident DJ at Bernhardt and ZenZa in Aarhus. Furthermore he plays at GBAR and has been playing at events such as Sensation and Smukfest, and was named MTV Club Awards DJ of the Year 2011.
At Bernhardt they only use haze in the form of two Martin 2500 Hz haze machines. These are connected to a touch screen LightJockey controller which runs on a USB-DMX interface box. The LightJockey also controls all light fixtures, and is operated by the DJ. When controlling the haze machines there are three settings; off, half output, full output, in order to adjust the amount of haze in the club. These simple LightJockey setting are used to make it as simple as possible for the different DJ's to use, as this is of key importance.
According to Morten a good smoke machine is defined by reliability and ease of use is the most important issues. The only real issue he sees with DMX is that it is not possible for the DJ to troubleshoot in case of malfunction.
All equipment has been installed by the supplier who also performs maintenance when needed, while refilling of haze fluid is performed by the present DJ or club manager. If the club are to purchase new equipment the club owner/manager consults the resident DJ's for advice.

TECHNICIAN & DJ RENÉ LINDBERG

René has good knowledge of Martin products and recognize them as being good quality. When purchasing and using smoke machines in clubs he thinks the most important factors are reliability and the smoke output. He mostly use fog but recognize that the importance of haze is increasing.
He controls his smoke machines using simple commands on a DMX controller, which does not cope with RDM why he almost never uses RDM, a technology which he in fact sees great potential in. According to René it varies from being the DJ's or the technician who refills the smoke fluid.

DJ FREEDOM

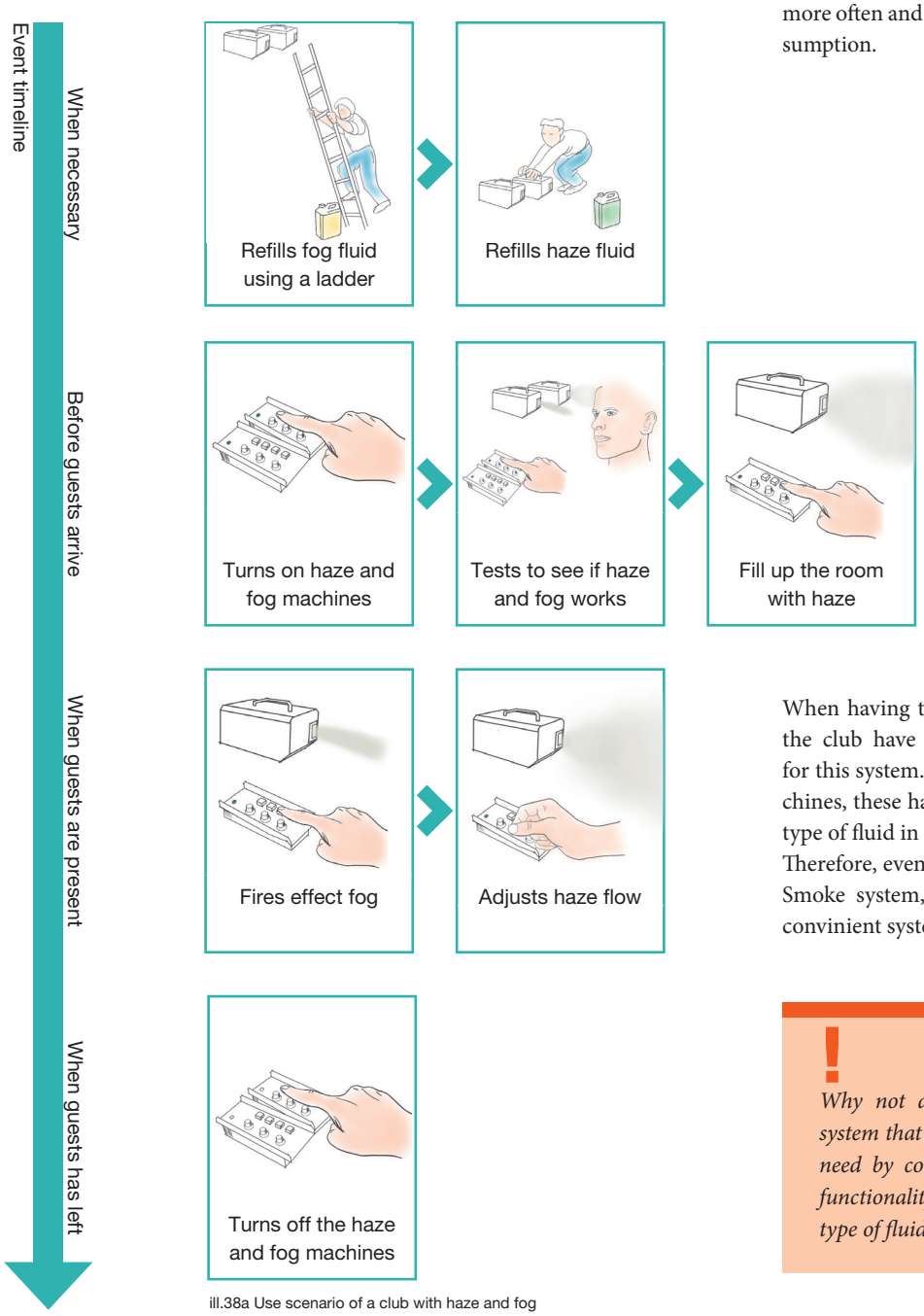
DJ Freedom became publicly known in 2001 with his hit "Hang on" and have played as a DJ many places since; both as a mobile DJ and in nightclubs throughout Denmark. In regards to smoke he sees it as a necessary evil and the controls should be as simple as possible. In the case of haze he prefers a haze that does not require any form of control. Ideally the output should be able to be adjusted for the haze to be on continuously all night. For fog he wants an output adjuster and a "Hold to fire" button. He think there are plenty other things to attend to while DJ'ing. The music has the main priority.

! *Some clubs have both haze and fog machines. The users need a system that can supply the club with both haze and fog. RDM can potentially ease product troubleshooting.*

ill.37a DJ Freedom at a job

USE SCENARIO

Based on the previous use cases, a general user scenario is made. This shows the overall use of smoke machines at larger venues. The vast majority of clubs and DJs use both haze and fog machines, and the following user scenario takes this in principle.



ill.38a Use scenario of a club with haze and fog

Formerly, cigarette smoke helped to fill a club with a haze-like effect. However, after the smoking law occurred, the clubs are using much more haze, to maintain the smoke in the room. Therefore the haze machines have to be refilled more often and the clubs have a larger fluid consumption.

When having the current Club Smoke system, the club have a convenient refilling scenario for this system. But when also having haze machines, these have to be refilled with a different type of fluid in another place.
Therefore, even though the club haves the Club Smoke system, they don't have the complete convinient system.

!

Why not develop a convinient smoke system that solve the clubs overall smoke need by containing both haze and fog functionality, with the use of only one type of fluid?

SUM UP ON USE CASES

The use frequency shows that the most important stakeholders to take into consideration are the club DJ's and technicians. They often have a say when purchasing new smoke equipment for the clubs and reliability is a main priority.

A product that can accommodate the overall smoke need in a club environment, should incorporate both haze and fog, to offer more versatility. It should be sought to create a system that does not incorporate more than one type of smoke fluid as this can cause issues when refilling the system, which happens often.
When using smoke; haze is used continuously to visualize light beams, with hang-time and homogeneous being the main priority, while fog is used sparser as an effect. The current Club Smoke is plenty powerful for the intended use, and there are seen possibilities in mounting a fan to a fog head to create a haze like effect. The specified 2 meter fluid lifting height on the current Club Smoke is not adequate, end need to be increased to at least 4 meter.

When controlling fog and haze the users want easy operation as many different users use the equipment, and the current DMX protocol offers very few complications in daily use, and is used broadly for both lighting effects and smoke machines, which makes it a necessity to implement. Troubleshooting a DMX system is difficult though, why RDM is seen as a great opportunity to ease troubleshooting as well as implementing bi-directional feedback. The ACN protocol is seen as the future communication protocol, but is still in its infancy why this cannot stand alone.
Since Martin Professional previously have experienced problems according to wireless control, and the development costs will be to high for a product like Club Smoke, the aim is a wired product and control.

Different users have different preferences to what type of mounting bracket they prefer, and not all smoke machines are positioned using mounting bracket as they are placed on the floor in some situations. Therefore it is chosen not to go into the mounting bracket market.

CONTROL OF EQUIPMENT

Virtually all smoke machines, including Club Smoke, is operated through DMX 512 (DMX), either via a generic DMX controller or by using the included remote control. To achieve an understanding of the control system of smoke machines, an in-depth analysis of the DMX control system is carried out. For further insight in DMX, see appendix F. [web 16]

DMX

DMX (Digital MultipleX interface) is the marked-leading standard for controlling lighting and smoke devices. The general way of turning a lamp on or off is using an outlet switch for each lamp. In this manner it is needed to run a mains cable from each outlet switch to each lamp. DMX simplifies this system by being able to control multiple lamps through a low-voltage cable.

DMX is a one-directional 8-bit serial protocol, which can control up to 512 channels pr. cable, and each channel can take a value between 0 and 255. When using DMX to control light intensity, each lamp will occupy one channel and the value of 0 will be off and 255 will be full light intensity. Similar manner apply to smoke machines.

Advanced devices which require multiple possible commands, multiple channels will be used for each device, and each channel can handle one function such as light intensity, fog machine pump pressure, focus motor position, mirror position among others. When using DMX with fog machines the first channel controls the fog output, the second channel can control the output angle and so on.

Some devices require greater accuracy than the 8 bit that DMX can provide. If this is the case, DMX can link two channels together. The first channel is called "coarse" and controls the first 256 steps of movement. The second channel is called "fine" and controls 256 steps for each coarse step. This adds up to 65536 (256 x 256) steps in total, which allows much greater accuracy. This type of connection is 16 bit, and is usually employed on advanced lighting devices such as Moving Heads. Obviously this takes up more bandwidth than 8 bit operation.

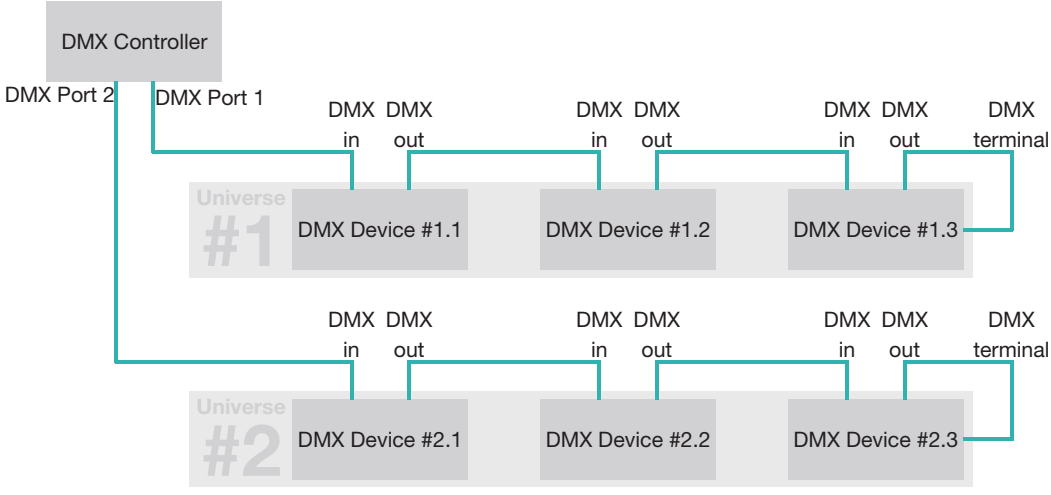
The used cables for DMX are 5-pin XLR cables. Many manufacturers, including Martin, do use 3-pin XLR connectors though, because the fourth and fifth pins are rarely used.

DMX NETWORK

A DMX network is made using a Daily Chain Typology where the controller is wired to the first device, and the first device is wired to the second device and so on. Each device is allocated a certain personal channel to which the controller can address.

When controlling devices on the DMX network the signal from the controller, called master, passes through each device, called slave, in the daisy chain until it reaches the intended device. The output on the last device in the daisy chain is connected to a terminal that completes the network.

Each DMX network is called a "DMX universe", and each output connector on a controller can control a universe. A large controller can control multiple universes through multiple DMX outputs, whereas smaller controllers usually control one universe.



ill.41a DMX

RDM

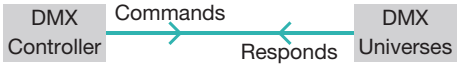
RDM is a protocol enhancement for the DMX 512 standard, which allows bi-directional communication from controller to attached RDM compliant device. The DMX protocol has been used by manufacturers for around 10 years.
The RDM data is sent in-between the existing DMX data packets. These RDM data packets can safely be inserted in between the DMX packets without non-RDM compliant devices attempting to read them, and therefore does this added bi-directional functionality not compromise the functionality of non-RDM compliant devices.
The responses from device to controller can include:

- Fog machines notifying that it has warmed up and ready for use.
- Fog machines or similar effect machines notifying that they run low on fuel.
- Lamps notifying that the bulb needs change.
- Device needs recalibration.
- Control instructions to lamps, fans etc.

All these responses will be received by the controller, and the technician/DJ does not have the need to go to the device for the information.

DMX

DMX WITH RDM



ill.41b RDM

The RDM is made for use with setups being controlled by one main controller. If multiple controllers sends out RDM instructions on the same DMX stream, the possibility of malfunction rises, as the possible respond time will increase, which potentially leads to non-received DMX packages.
Not all RDM compliant devices support all RDM functions, but will always support the discovery function, which acts as an "I am online" command. For further insight in RDM, see appendix G. [web 17]

!

It is necessary to develop a product that is DMX compatible, since most smoke and light equipment runs on DMX.
RDM is a simple way of providing device feedback to the user, which is shown in the user analysis is desirable by the users.

Based on the visit at AKKC and conversation with Søren, some opportunities for incorporating new technologies has been elucidated. This section will provide an overview of these technologies, and their capabilities and limitations.

ACN

ACN is a control architecture designed for controlling audio, lighting and similar devices.
It is a relatively new standard, which is designed to be used with current and future advanced entertainment technologies, which offers more bandwidth than DMX to accommodate advanced lighting and fog systems.
The protocol uses UDP/IP, and thereby works with standard Ethernet, RJ45 connectors and 802.11 wireless networks, and each device holds its own ID. Opposed to DMX, ACN creates a direct line of communication between controller and intended device, and is able to control the device more precisely.
Unfortunately, the ACN standard is very much in its infancy as it is not common among manufacturers. ETC is the only manufacturer who uses the ACN standard across their products range. As long as the industry is not ready to adopt the all-Ethernet connection, the power of ACN cannot be utilized wide-scale. With ACN it is possible to do individual control of each attach device [web 18].

SACN – STREAMING ACN

sACN is a protocol for transmitting DMX512 over a TCP/IP network using ACN.
The idea is to standardize how to send and receive DMX over Ethernet network and RJ45 connectors thus creating a standard which is able to work across manufacturers. The protocol is similar to ACN, it packs the DMX data using ACN packet structure to make efficient use of the network bandwidth. The ACN packets can be converted back to DMX, if needed.
sACN is much more widespread than the ACN standard, but the functionality is limited compared to ACN, as sACN act as an evolution to DMX, opposed to ACN, which is a newly rooted standard. This means the sACN still deals with the limitations that are found with DMX. [web 19]

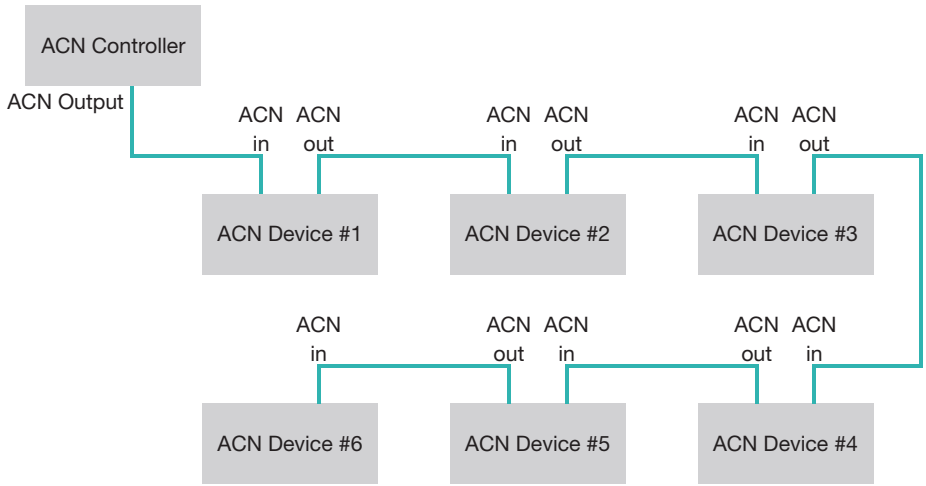
ART-NET

Art-Net is a protocol which converts DMX data with RDM to Ethernet UDP package data, similarly to sACN. The protocol is limited by the standards in DMX, as sACN.
The advantages with Art-Net and sACN are the ability to use Ethernet to carry information. An Ethernet cable with RJ45 connectors can carry a lot more information than a DMX cable, and Ethernet hardware is cheaper than DMX hardware. Furthermore, Ethernet data packages can easily be sent wireless through Wi-Fi, which makes it easy to send DMX data over the Internet. Both protocols support bi-directional RDM data.[web 20]

OVERVIEW

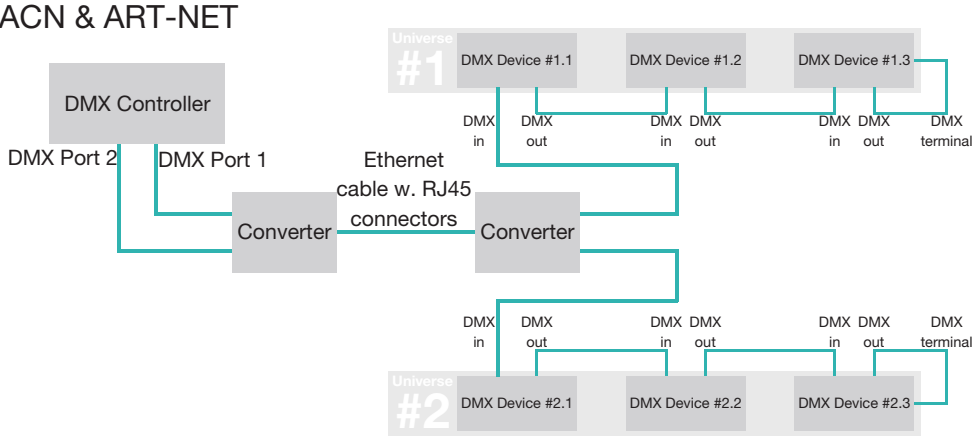
Both sACN and Art-Net are already incorporated in a large variety of intelligent lighting and smoke products on the market, including Martin, with Art-Net being a tad more widespread. Both do suffer from the limitations originated from DMX, as both standards work as an evolution of DMX.
ACN, being a newly developed standard do not suffer from any limitations originated from DMX [Appendix H]

ACN



ill.43a ACN

SACN & ART-NET



ill.43b sACN and ArtNet

The trick is to build a system that can support DMX, Art-Net and sACN devices now, but slowly migrate away from these protocols to ACN with a minimum of fuss.

DESIGN BRIEF 1.0

INTRODUCTION

Martin is a company founded in 1987, primarily as a producer of disco lights and fog machines. Martin offers dynamic lighting solutions for entertainment and architectural markets, lighting controllers and media servers and a complete line-up of smoke machines. Martin has a wide range of customers, from theaters, concerts, cruise ships, DJ's and local partners in nearly 100 countries.

INITIAL POTENTIAL

The Magnum Club Smoke fog machine was introduced in the 1998 and the sales gradually leveled off, partly to the increased wishes for haze in clubs. The Club Smoke is intended for club use as a permanent installation, and the wish is to keep this market position, with the possibility of expanding it. The objective is to reenergize the Club Smoke concept of a ground-based fluid supply and fog head to be installed in inaccessible areas. There are possibilities in taking advantage in the technological developed that has happened since 1998, as well as rethinking interactions with the system through a user based research.

MARKED & BUSINESS

Since the market for use of smoke machines is a niche market, the sales numbers therefore will be limited. Martin have a great position on the world market - on a world basis Martin delivers products for 8 out of 10 live venues.
There are many alternative cheaper smoke products, but there are only a small number of complete and convenient solutions for permanent installations, and these are larger and more expensive. This is the market gap.

BACKGROUND

Through user studies in multiple levels of the market, it is shown that larger clubs and venues are using haze, in order to see the light-beams in the club. After the smoking ban came into force, the need for haze in clubs have increased.
Many clubs also wants effect smoke like fog but in limited situations and volumes. Consequently the clubs have more products to achieve the wanted effects of both haze and fog.

VISION

The goal is to create a complete smoke system solution for use in medium to large clubs.
The objective is a convenient solution for the professional market and improvement of the market sale through storytelling of a complete and convenient solution.

Some demands and wishes are set up to have some guidelines to the following concept development. The demands are points that have to be fulfilled during the development. The wishes are set up with an intention to be fulfilled, but not all is able to be verified.

DEMANDS

- **CONVENIENT REFILLING**
  Separate fluid base and smoke heads, due to the convenience for the user.

- **DELIMITED TO SMOKE**
  There will not be added any other effects to the product.

- **REPLACE CLUB SMOKE**
  In terms of price and functionality.

- **PERMANENT INSTALLATION**
  The primary use is as an installation product in clubs.

- **CLUB USE**
  The primary application is medium to large clubs that can house 1000-2000 guests.

- **COMPLETE SYSTEM**
  Cover the overall need for smoke - both haze and fog with one type of fluid.

- **EASY CONTROL**
  Use one control to ease the way to control both haze and fog.

- **NO WIRELESS**
  Have to be a wired product and control device, due to possible WIFI interference.

- **BI-DIRECTIONAL FEEDBACK**
  Incorporate device-to-user communication for easy troubleshooting

- **FLUID DEMAND**
  The ability to produce a white, fast dissipating fog, and a homogeneous long lasting haze.

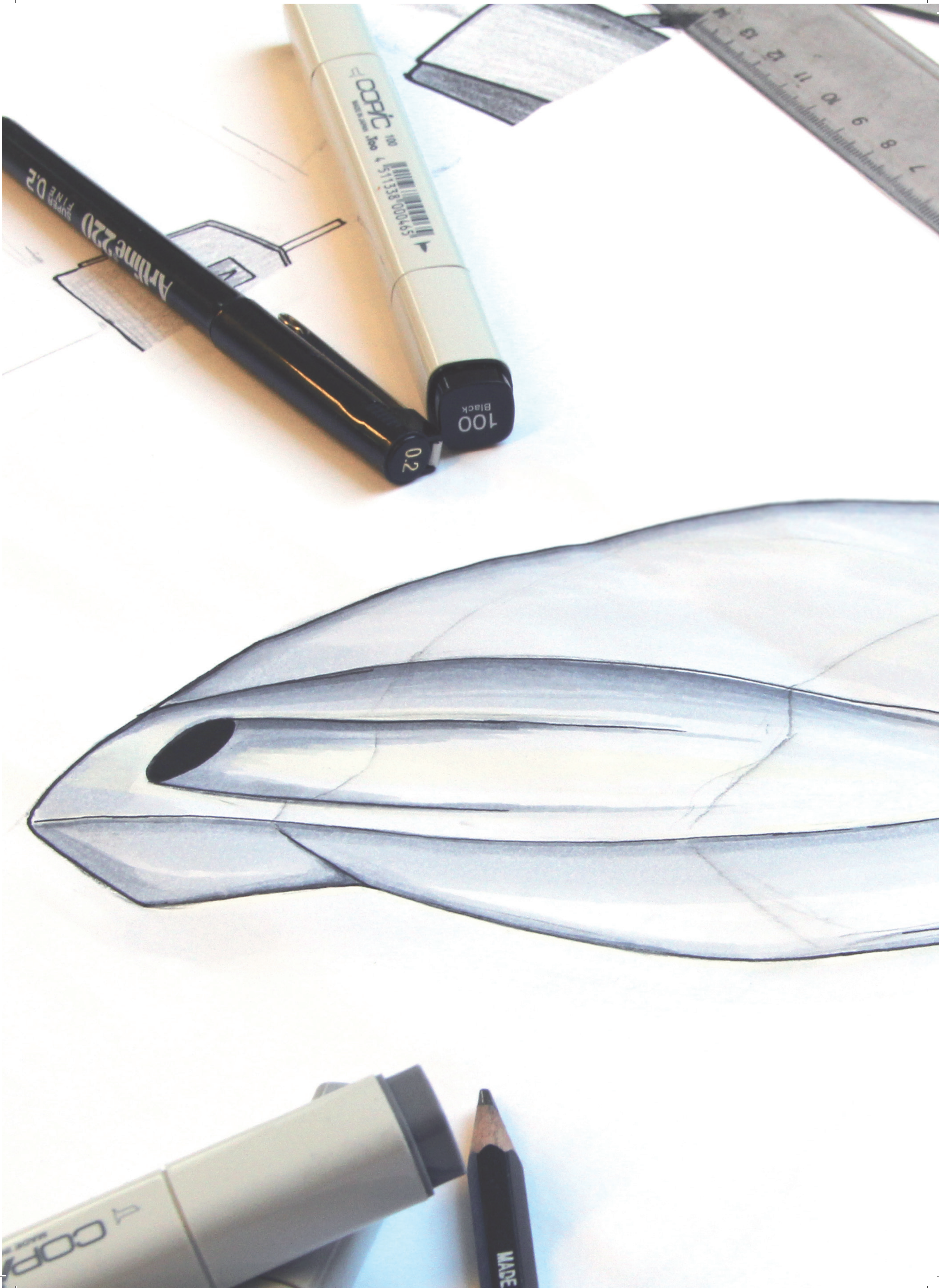
WISHES

- **BENEFICIAL FOR MARTIN BUSINESS**
  Give better sale points and ease sale opportunities for Martin Professional.

- **INCREASED USER VALUE**
  Give the user an increased value when using the product.

- **DONT TAKE MARKET SHARE**
  Dont take any market share from the Jem Hydra system.

- **INCREASE MARKET**
  Grow the market share due to increased functionality.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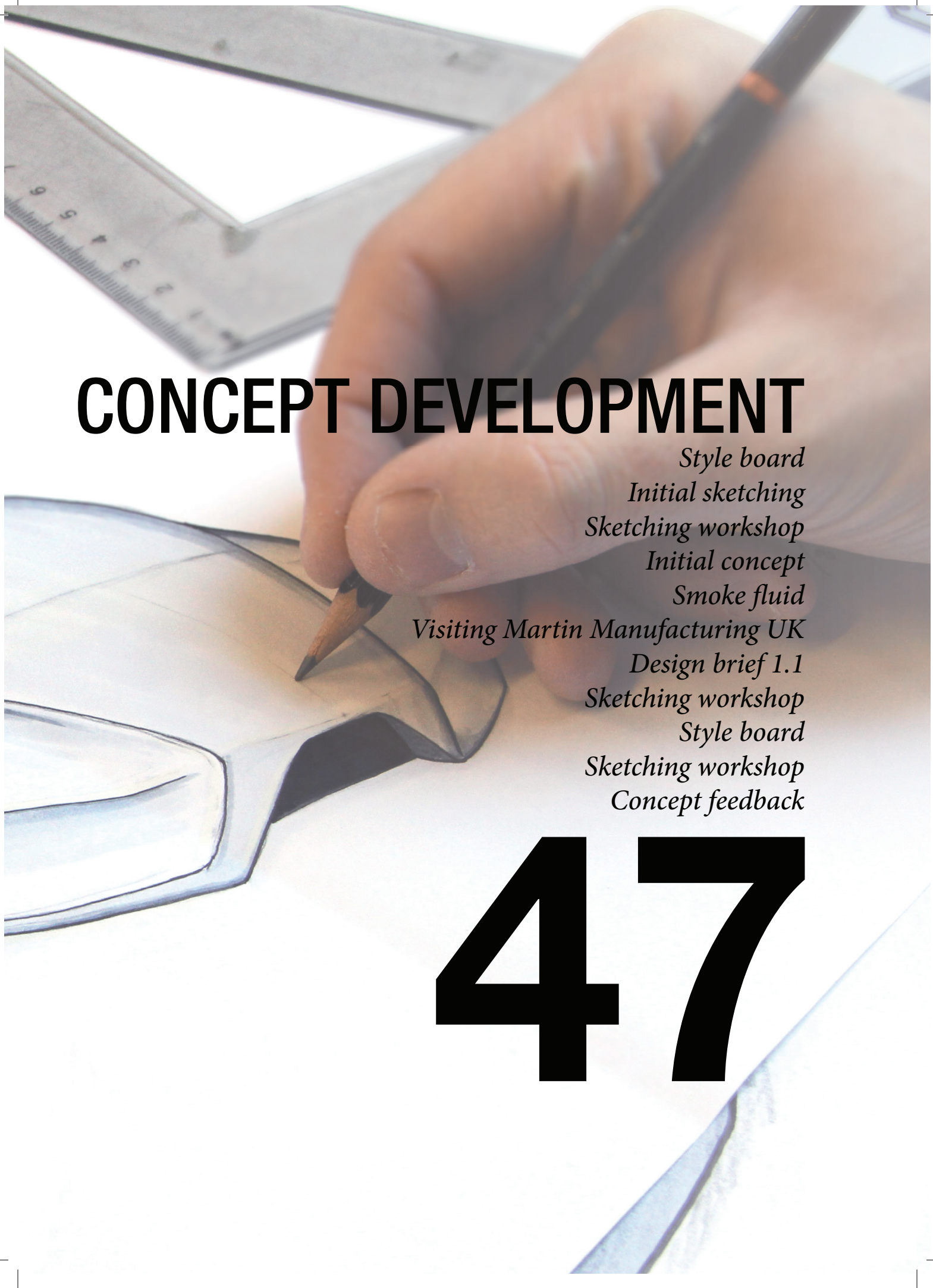

CONCEPT DEVELOPMENT

Style board
Initial sketching
Sketching workshop
Initial concept
Smoke fluid
Visiting Martin Manufacturing UK
Design brief 1.1
Sketching workshop
Style board
Sketching workshop
Concept feedback

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STYLE BOARD

A style board is created to form a starting point for a sketching workshop. The style board is based on both present and future visual inspiration. The purpose of the style board is to get inspiration for the visual expression of the product, with the intension of disregarding the current visual standards that apply to current smoke machines.

Since car designers often develop concepts for future cars, which illustrate the future visual design, these are a recurring topic on the style board. Subsequently, general design points are extracted from the style board. These are seen as potential points in the development of the visual identity of the concept, and will form the basic of the following sketching workshops


ill.48a


ill.48e

ill.48b


ill.48c

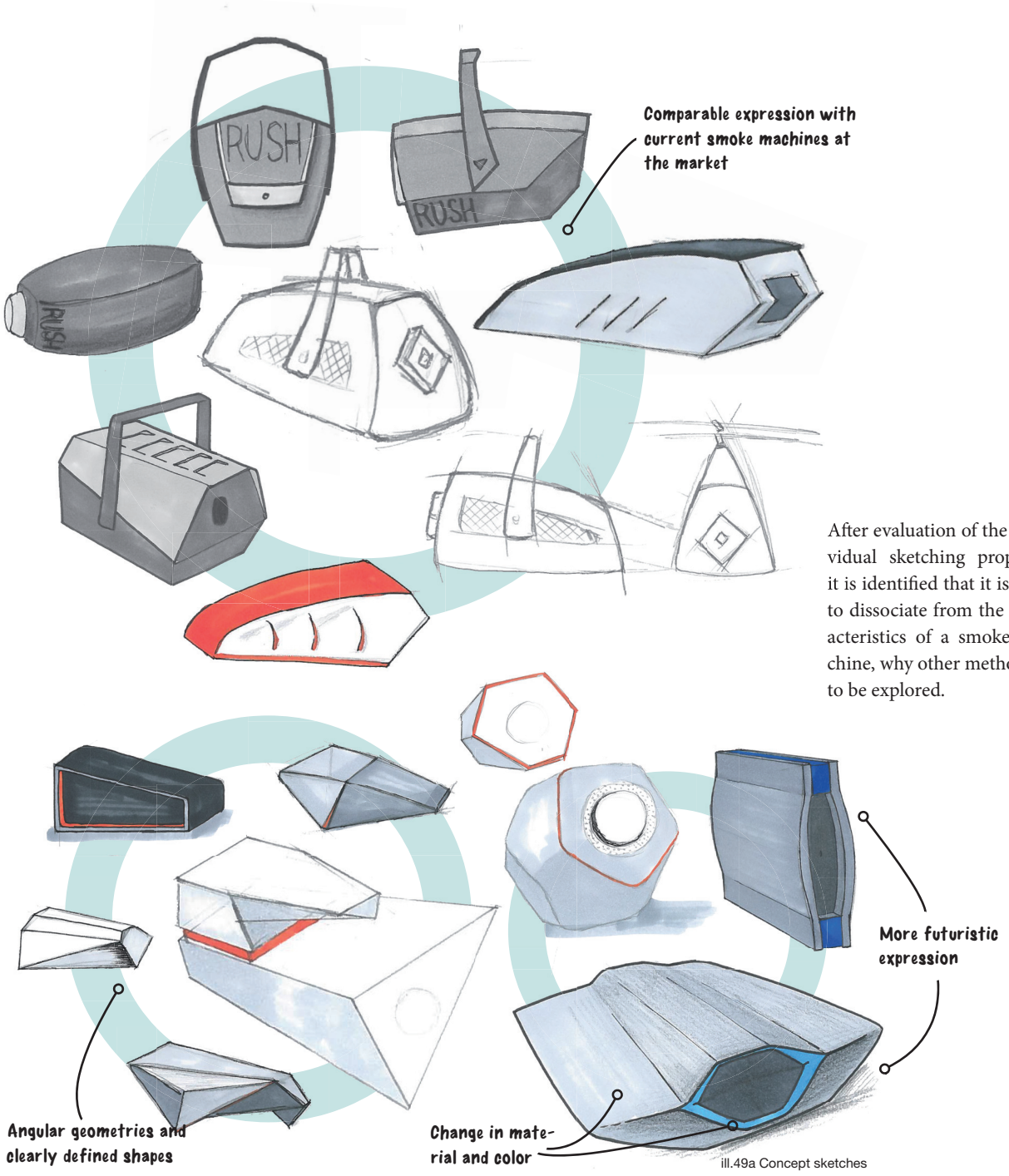

ill.48d

DESIGN POINTS

ANGULAR GEOMETRIC
CLEARLY DEFINED SHAPES
LARGE SURFACES
CHANGE IN MATERIAL & COLOR
SIMPLICITY

INITIAL SKETCHING

The design points from the style board are the basis for a sketching workshop with the purpose of emptying the minds of visual ideas seen in the light of the stated design points. Only the smoke heads are taking into consideration when sketching, not the base unit.

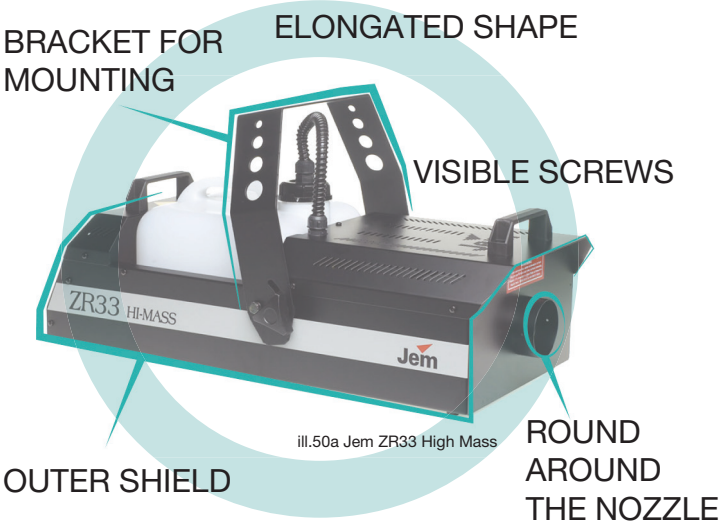


ill.49a Concept sketches

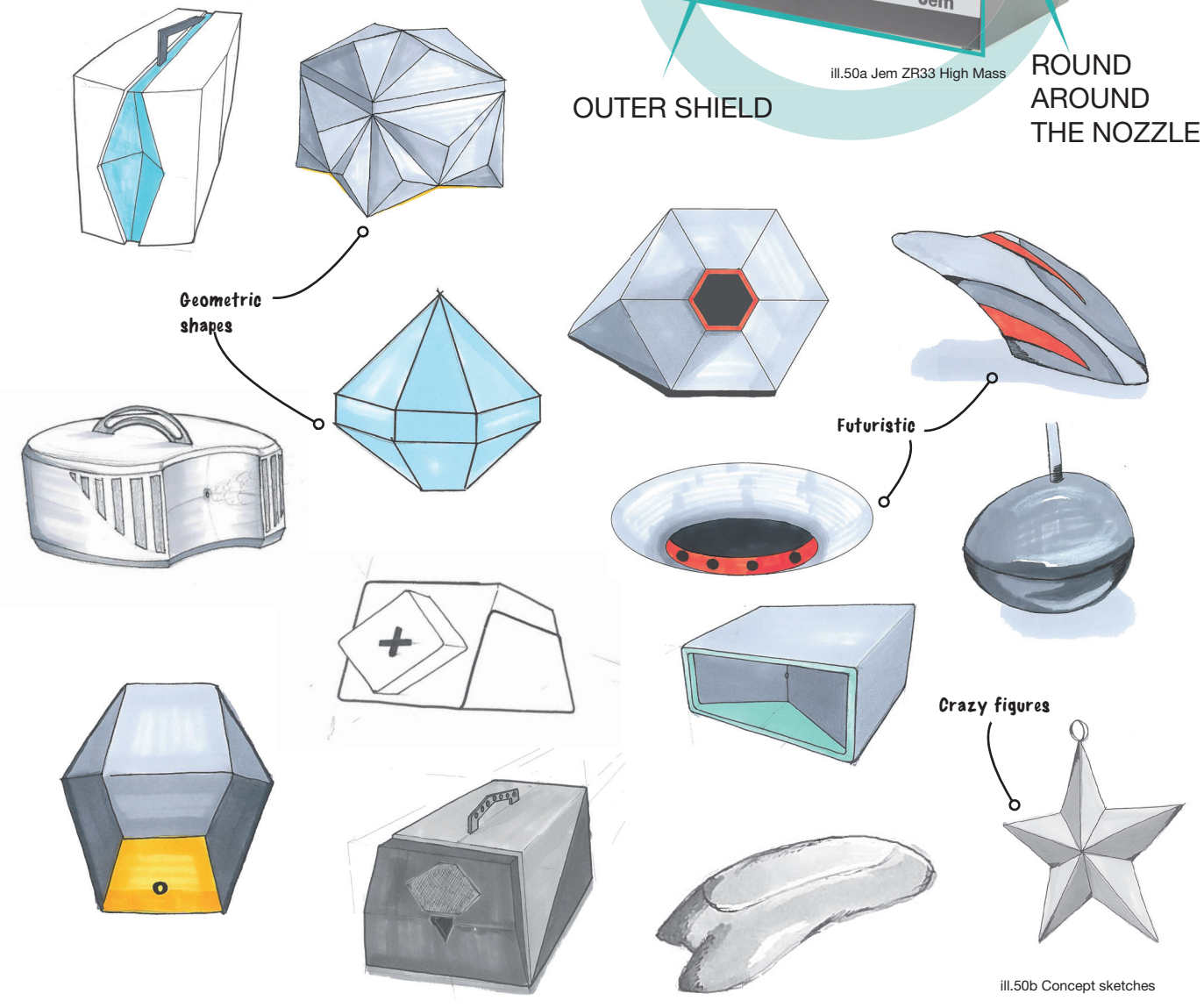
After evaluation of the individual sketching proposal, it is identified that it is hard to dissociate from the characteristics of a smoke machine, why other methods is to be explored.

SKETCHING WORKSHOP

As a basis for a new workshop, the visual characteristics of a typical smoke machine are specified. More smoke machines on the danish market can be seen in appendix C. In order to disregard these characteristics and come up with fresh ideas, it is the intention to come up with visual concepts which differentiate and do not contain any of these specified visual characteristics. The output is plenty sketches, of which these are some extracts.



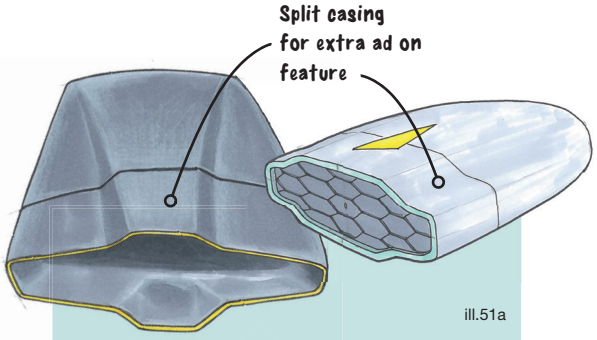
ill.50a Jem ZR33 High Mass



ill.50b Concept sketches

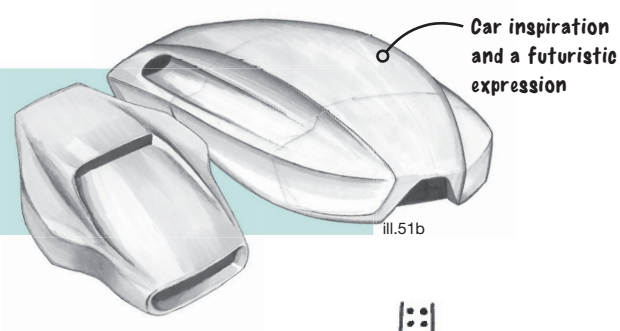
SELECTION

The sketches that show potential is selected for further work. The sketches are selected according to how far they distances themselves from the general characteristics of smoke machines at the market.
The idea of introducing a new visual design distanced from the usual characteristics, is brough to MMUK for validation of production feasibility.



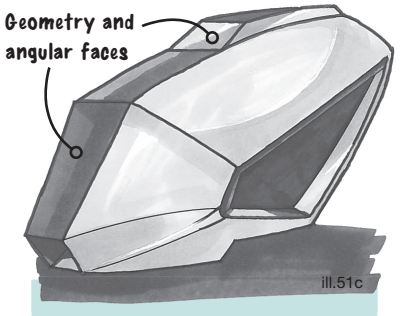
ill.51a

A split casing with the ability to exchange the front part to incorporate different features. The front incorporates an iconic shape derived from car design, with a highlighted edge, and combines angular shapes with a more organic expression.



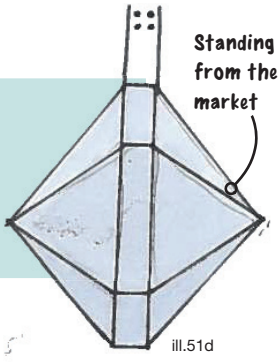
ill.51b

An incorporated angularity with a more fluent expression. On both sketches the nozzle is placed in the front and there are vents incorporated in the overall expression. Both are derived from the front of concept car intakes.



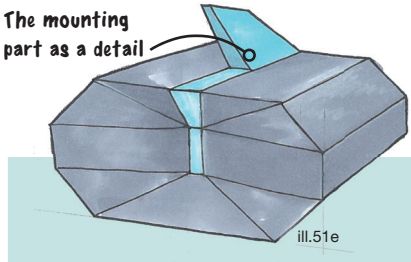
ill.51c

Pure geometric shapes with faces emphasized through color or material.



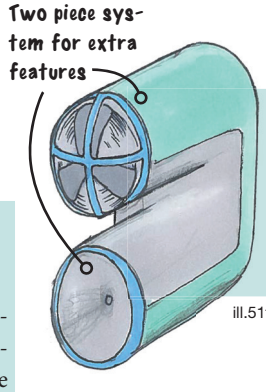
ill.51d

Pure geometric faces with a clear central axe which houses both truss mount and nozzle. The sketch stand out compared to traditional fog machine, as it has no flat bottom.



ill.51e

Pure geometric faces with the truss mount protruding from the blue middle. This acts as a detail that makes it stands out from the crowd. The nozzle in the front is recessed.

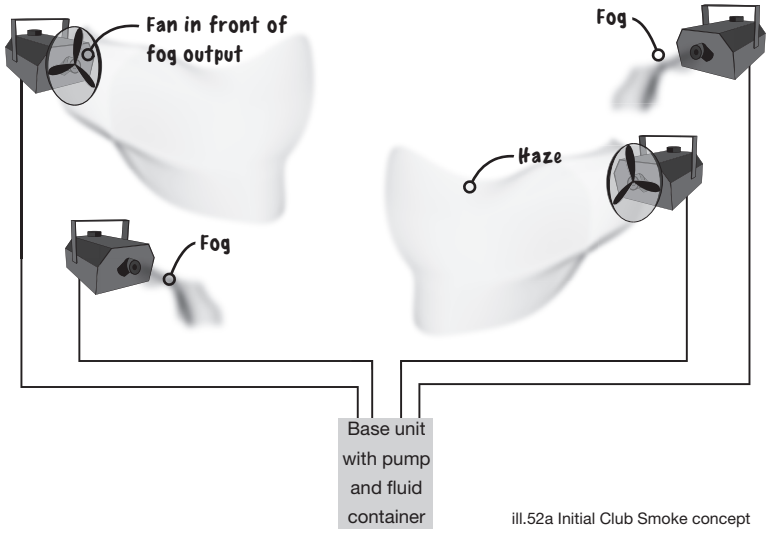


ill.51f

A two-piece example where the bottom part acts as the fog unit and the top part as a fan to mix the fog with air, to create haze.

INITIAL CONCEPT

To benefit from the visit at MMUK the most, a functional concept based on the design brief and the carried out research is presented to MMUK prior to the visit. Furthermore, this concept, a functional concept without styling, is going to be elaborated on while visiting MMUK. They can provide feedback on feasibility in terms of production, specification, pricing, control technologies etc. Furthermore it is to be validated upon whether it is possible to create both haze and fog using one type of fluid.



ill.52a Initial Club Smoke concept

CONVENIENCE IS KEY

- The new Club Smoke system is a modular system that consists of a base unit and minimum 4 smoke heads.
- The base unit provides one type of fluid for all attached heads.
- Each head offers two functions: It can be used as an effect fog head as well as transformed into a hazer by attaching a fan to the front of the head.
- This way each Club Smoke system cover the complete club need with continues haze and dense fog when needed, and convenient refilling of fluid for both haze and fog.
- The new Club Smoke provides a lifting height from base to head(s) of min. 4 meter. This makes a versatile system appropriate for a variety of use scenarios.
- The system can be DMX with RDM controlled as well as being integrated as a part of an ACN system in the future.
- Each head can provide feedback to the controller. This feedback being low fluid warning, system failure etc.
- This bi-directional communication can be based on RDM as well as ACN.
- Each head can be controlled individually, as well as being paired up, that allows for different fog/haze effects.

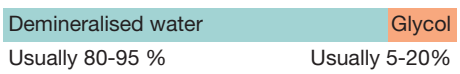
SMOKE FLUID

One of the main features on the initial concept is the ability to create both long lasting haze and dense fast-dissipating fog using one type of fluid. Since no one has done one fluid for both fog and haze before, this is going to be a challenge. The requirements for the wanted fluid are the ability to create a dense white quickly dissipating fog on a high fluid output and at the same time a long hang-time haze by mixing the fog with air using a fan. [web 21]

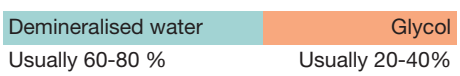
THE CONCEPT

Based on the previous study about smoke fluid and conversations with Henrik Sørensen about the contents in smoke fluid, there has been some consideration of a possible smoke fluid. Since there, as previously mentioned, is a big difference between the glycol content in fog and haze fluid, there is beforehand an intuition that it is not possible to obtain a 100 % good fog and a 100 % good haze with one and the same fluid. Therefore it is admitted that there may be a compromise.

Haze fluid consists of a large percentage of demineralised water to provide a thin fluid for a see-through haze effect.



Fog fluid has a larger percentage of glycol than haze fluid to be able to produce a denser whiter effect.



The intention is to make something between a fog and a haze fluid to see if this can be used for both.

FOG

By running the fog head with a high output a fluid with a relatively low amount of glycol should be able to produce a dense white fog effect while being quickly dissipating. The downside in regards to ordinary fog machines is a larger fluid consumption, but the fluid will be cheaper because of the lowered amount of glycol.

HAZE

The goal is to create a haze with long hang time by mixing air with a low output fog that dissipates quickly, and turn into a homogeneous haze. By using a fan to mix the fog with air the air in front of the haze head will circulate and minimize the chances of a cloudy haze. The downside is a more expensive fluid compared to ordinary haze fluid, but this can be balanced by a lower fluid output, because the fluid is more concentrated compared to ordinary haze fluid.

VALIDATION

The goal is to determine whether or not it is possible to use one type of fluid for both haze and fog. This is to be tested and validated at the fluid plant at Martin Manufacturing in Louth, UK, where it is possible to mix smoke fluids with various amounts of monoethyleneglycol, triethyleneglycol and demineralised water.

!

Since there are no products at the current market that do both haze and fog in one system, it is going to be validated.
Is it possible to make a long lasting fog fluid and a dense white fog with one type of fluid?
Is the concept of the future Club Smoke in line with the intentions and expectations of MMUK?

VISITING MARTIN MANUFACTURING

To gain further insight about smoke machines and for validation of the initial concept, the Martin Manufacturing factory in Louth, UK is visited. Martin Manufacturing have 47 employees and devote 75% of their turnover through Martin Professional. The contacts from Martin Manufacturing is the general manager Jason Andrews, R&D Technical administrator Dan Smith and R&D Manager Nick Scully who is responsible for development of new smoke products in terms of both software and hardware.

!

Keep stock parts to a minimum due to sporadic orders.
Fluid ingress in the smoke heads must be avoided.
A smaller base unit improves production.
A lifting high of 10 meters is possible.
Six heads is able to be controlled in pairs using a converted standard PCB.

FACTORY TOUR

The general manager Jason Andrews showed the factory and its departments. Many parts are made elsewhere and stocked and assembled in Louth. The factory uses many local suppliers to cope with short lead times, and has moved a large part of their Chinese production back to UK. The main focus in the production is standardization to keep part numbers to a minimum, and carry parts in stock, which is why Jason Andrews finds it beneficial to use standard parts for the new Club Smoke.
The current Club Smoke base unit is unpractical big according to production.

VALIDATION

When presenting the initial concept for Jason Andrews and Nick Scully they liked the user-based approach and liked the overall concept. Nick Scully had his concerns on how to make both fog and haze with one type of fluid. He was informed on the beforehand thoughts of using a fog fluid with a smaller percentage of monoethylene glycol and triethylene glycol than regular fog fluid in order to keep the fog density lower and make the dissipation faster. This will hopefully make a good haze fluid that disperses slowly when mixed with air and by using a heat exchanger with higher output create a satisfying fog effect. Nick found the concept interesting, and was prepared to make small batches of test fluid to test on their facilities. With guidance, a suitable stock fog machine and a stock haze machine was to be used for testing.
A huge problem with the current Club Smoke is fluid ingress in the smoke head. This have to be solved in the new design. Furthermore, the specified fluid lifting height of Club Smoke need to be increased from 2 meters, but Nick sees no problems in doing the lifting high for 10 meters with the current fluid pumps. To accommodate larger clubs than the current Club Smoke the possibility of attaching more than four heads to one base unit is presented. Nick is positive on the idea, and had already a control PCB that can be converted to control three pair of heads easily.

ill.54a The Martin Manufacturing facilities

ill.54d Jem products at the factory entrance


ill.54b Componenets for assembly


ill.54c Stock parts inventory

FLUID TESTING

The Martin Magnum 1800 fog machine and the Magnum 2500 Hz haze machine, both stock machines, both suitable to base the new Club Smoke upon, are used for testing potential new fog fluids. A Martin AF-1 fan is used to speed up the process of mixing fog with the surrounding air. The test fluid, mixed by Nick Scully with the beforehand ideas of a smoke fluid, is a cross between fog fluid and haze fluid, with the intention to offer advantages from both. Due to competitive reasons, the respective percentages of glycol and demineralised water can not be mentioned, but the project team is aware of the correct mixture proportion.

To get the wanted mixture between a regular haze and fog fluid, aiming for a dense white quickly dissipating fog and a long lasting homogeneous haze, both tested fluids consist of 60-80 % demineralised water and 20-40 % glycol.

FLUID 1

Start up fluid
60-80 % demineralised water
20-40 % glycol

FOG

The fluid is tested using the Martin Magnum 1800. The result is a great white fog effect, but a lack of density, which may suggest that a larger amount of monoethyleneglycol is needed. The fog dissipates quickly as intended, and the haze effect that remains is great.

ill.55a Fluid 1 Fog test

HAZE

When testing the fluid in the Magnum 2500 Hz haze machine the haze becomes homogeneous and free of clouds quickly. The hang time is more than 20 minutes, which is up to par with current Martin haze fluids.

ill.55b Fluid 1 Haze test

FLUID 2

60-80 % demineralised water
20-40 % glycol
Added monoethyleneglycol content in order to improve the fog density without interrupting the great haze.

FOG

This increased amount of monoethyleneglycol improves the fog effect, making it denser, creating a very good fog effect. This denser fog effect dissipates a little slower than fluid 1, but remains satisfying. The fog effect is rated as being a good fog effect up to par with the intentions by both Nick Scully and Jason Andrews.

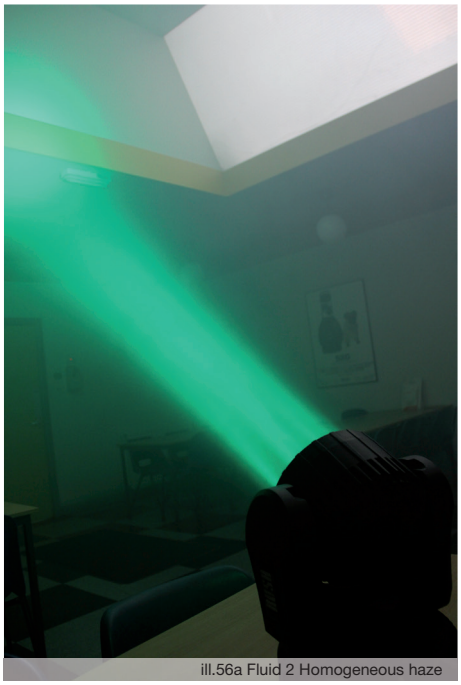
ill.55c Fluid 2 Fog test

HAZE

The effect from the haze machine is similar to fluid 1, while being a tad slower to dissipate into unobtrusive haze. The haze hang-time is tested to be up to par with current Jem haze fluids, lasting more than 20 minutes.

ill.55d Fluid 2 Haze test

Ultimately, the effect from fluid 2 meets the requirements of being able to produce both dense white fog and long-lasting haze, why this, in cooperation, is chosen to be used for the new Club Smoke.



ill.56a Fluid 2 Homogeneous haze

Since the new fluid consist of a smaller amount of glycol than ordinary fog fluid, the fluid usage for fog will increase due to the higher fluid output needed. Furthermore the fog head will not be able to run for longer periods of time with a high output, which is of minor importance for effect fog.

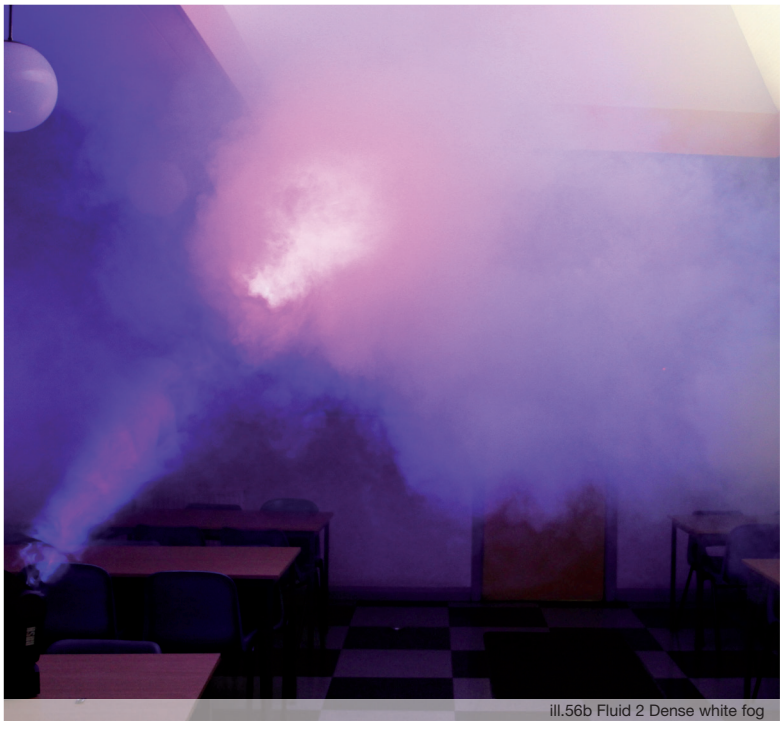
Given that the new fluid consist of a higher amount of glycol than regular haze fluid, the amount used for haze will be reduced due to the lower fluid output needed compared to regular haze fluid.

Due to the higher amount of glycol the new smoke fluid will be more expensive to produce than haze fluid and be around half the price of fog fluid.

According to both Jason and Nick at MMUK, who have great experience and knowledge on smoke, the second smoke fluid tested gives the intended results. Actually Nick thinks that it "*Obviously going to do the job for haze. I think this i cracked!*" and says that "*the cheap fluids on the market won't hang around for the 20 minutes like this.*" When Jason walks into the room with the haze, he exclaim that "*it is a very good haze!*" After a while Jason comes into the room again and exclaim "*the haze is still hanging great!*"

!

The demands for the haze and fog result is validated.
Dense white, quickly dissipating fog on a high output.
Long lasting homogeneous haze by mixing low output fog with air.



ill.56b Fluid 2 Dense white fog

!

The intuition of a compromise of both the haze and fog result shows to be unnecessary. The new fluid gives a great haze and fog effect. The only compromise is a higher fluid output at the fog to reach the same dense effect.

TECHNICAL VALIDATION

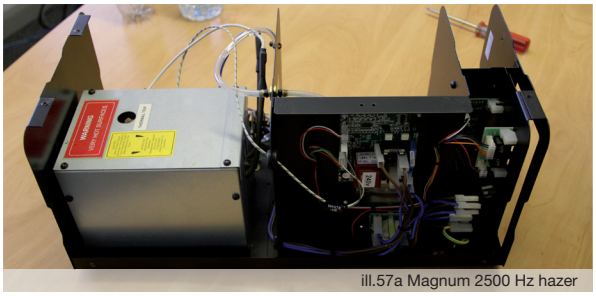
The technical validation is carried out in cooperation with Nick Scully. For production optimization it will be beneficial to design both the haze head and the fog head to fit the same chassis, to keep part numbers to a minimum and keep up production units.
Martin Manufacturing would prefer to make the haze head as a solution with the fan integrated in the chassis, and not as an add-on as presented in the initial concept. This being a solution with no need for external connectors and extra chassis parts for the haze head compared to the fog head. Furthermore, the fog fluid have the risk of leaving fluid residue on an external fan, which is not desirable as it can lead to overheating of the motor.
The Club Smoke system is a product for a niche market with relatively low sales units, why the aim is to keep development costs to a minimum. With this in mind the Club Smoke can be based on already existing parts used in existing Jem manufactured products, as far as possible.
According to the control with ACN, Nick sees this as being to expensive to develop and integrate into a low-cost product like Club Smoke, but the RDM feedback is a possible way to troubleshoot the product as this protocol is incorporated in current products. [N. Scully, 2014]

!

It is the wish to do a Club Smoke system that can run 6 heads.
The heads can be controlled in pairs.
ACN is to expensive to a product like Club Smoke.
RDM solves the need of device feedback and troubleshooting.

FOG HEAD

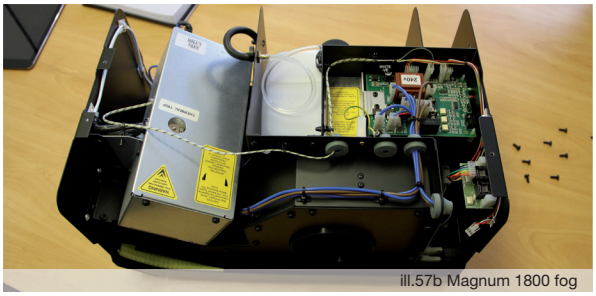
The Martin Magnum 1800 uses an 1150 W heat exchanger comparable in terms of output, to the one used in the current Club Smoke. This heat exchanger offers the needed output as well as no development costs.



ill.57a Magnum 2500 Hz hazer

HAZE HEAD

The Martin Magnum 2500 Hz Hazer uses a 900 W heat exchanger, which offers the perfect base to build the haze head on.



ill.57b Magnum 1800 fog

Both heat exchangers are field-tested and reliable, which can ease the product maturation phase, as unforeseen hardware errors can be kept to a minimum.
The reason for using two different heat exchangers is that a fog heat exchanger can build up fog fluid residue when used with a small fluid flow, due to a smaller diameter of the copper coil. A haze heat exchanger uses a larger diameter copper coil to cope with this. Opposite of a fog heat exchanger, the haze heat exchanger cannot deliver as much output because it will lose its accumulated heat to quickly, but this is of no importance when needed for haze.

!

The fan to create the haze effect is not going to be an add-on part, but is build into the product.
There are needed two different heat exchangers for the fog and the haze, therefore it is going to be different product architectures for each functionality.
It is the intention to keep the same chassis for both heads, to minimize the parts.

PRODUCT ARCHITECTURE

After an in-depth dialogue with Nick, there have been established an overall product architecture which is based on using as many stock parts as possible.

HAZE HEAD

- The heat exchanger is from the Magnum 2500 Hz hazer and will need no modifications.
- The communication PCB is the same PCB as on the Magnum 1800 and the Magnum 2500 Hz Hazer and need no hardware modifications.
- The main PCB for the haze head is the same as in the Magnum 2500 Hz Hazer. This board is an expanded version of the board used in the Magnum 1800 to provide fan control.
- The fan in the haze head is a Sunon fan which is field tested in earlier Jem products. This fan is cost efficient and takes up less space than a turbine fan.

BASE UNIT

- Jem carry two standard fog fluid pumps and the large version will accommodate the needs for fog fluid flow and pressure. Each base unit uses three pumps, one for each fluid line output.
- The main PCB can be transferred directly from the current Club Smoke system.
- For the communication from a controller/remote to the base a new PCB must be developed. The new board can be based on a currently existing PCB, which handles DMX as well as RDM. The existing PCB can carry two channels with communication, where the new PCB must be able to carry three channels of communication. This PCB has a three digit LED display which can be used for DMX setup.

FOG HEAD

- The heat exchanger is from the Martin Magnum 1800, and need no modifications.
- The communication PCB is the same PCB as on the Magnum 1800 and the Magnum 2500 Hz Hazer and need no hardware modifications.
- The main PCB for the fog head is the same as on the existing Magnum 1800, and will carry the same functionality and need no modifications.

BASE TO HEAD COMMUNICATION

- To accommodate bi-directional communication an existing and well-proven Jem communication protocol using RJ45 connectors can be used between the base and the heads. This protocol is field tested on the Jem Hydra system and uses standard RJ45 connectors which are on the standard remote PCB used for a series of Jem products. The existing communication PCB needs to be reprogrammed and can function as it is hardware-wise.
- For the base to know which head is connected to what fluid line, the protocol can send a 3 volt or 10 volt signal to the base via RDM, when the head is ready. 3 volt for the haze heads and 10 volt for the fog heads. This way the base know what type of head is connected and can supply with the correct amount of fog fluid.

A full bill of material for each element can be seen in appendix I.

SUBSEQUENT EVALUATION

Jason sees great potential in the concept becoming a part of the Jem product line. Partly because of the extended functionality and partly because of being a product produced in the UK. At the same time Jason expressed great opportunities in a UI design that can promote additional sales in the Jem line. He consider the market within intuitive interfaces exciting due to no manufacturers have this part in their product portfolio. Therefore, a generic, intuitive interface can be able to create a highly added value for the whole Martin product portfolio.
He expects the new Club Smoke providing a considerable increase in sales, especially with the new ability to produce both fog and haze, as the product will be able to fulfill the full need for smoke in a club. [Appendix Q]

!

Due to the UK production there are great potential for the product to be a part of the Jem product line.
There are seen a great potential in a new generic interface for the Club Smoke that will add great value to the product and the company.
By developing a product that is optimized according to the production of MMUK, it puts some restrictions on the aesthetic development process.

DESIGN BRIEF 1.0

Some additional demands and wishes are set up in design brief 1.1, due to the preceding MMUK visit.
These will also be guidelines in the development process.

DEMANDS

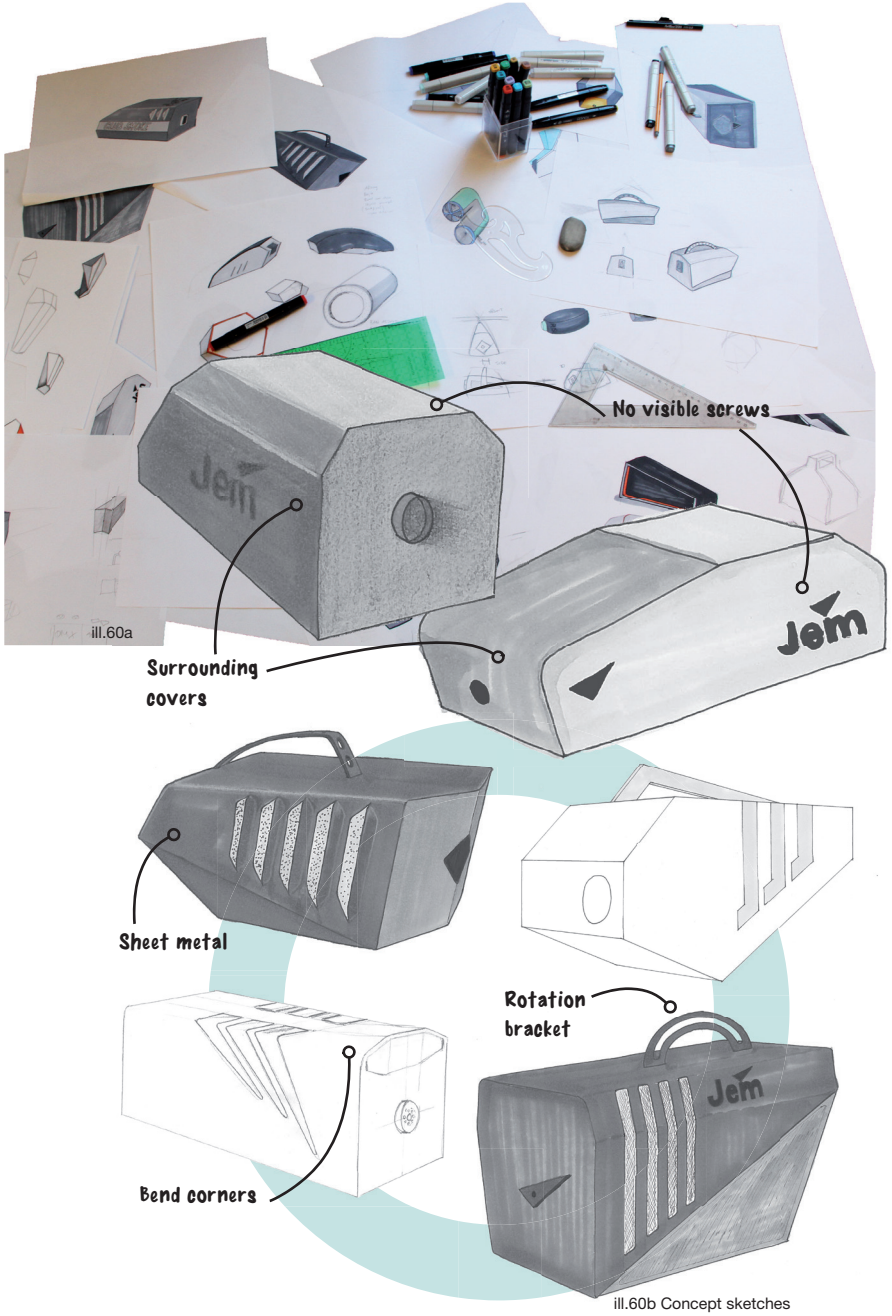
- SOLVE FLUID INGRESS
  Solve the fluid ingress in the smoke head of the current Club Smoke.
- INCREASED LIFTING HIGH
  Have a higher fluid lifting hight of about 10 meters.
- BI-DIRECTIONAL FEEDBACK
  There are a device-to-user communication by RDM

WISHES

- PRODUCTION OPTIMIZED
  Use as many stock parts and shared parts for the product as possible.
- PRODUCTION IMPROVEMENT
  Make every part easy in the production and keep dimensioning down.
- INTUITIVE INTERFACE
  It must be easy to control both haze and fog - even for first time users.

SKETCHING WORKSHOP

To get a visual expression that stands out from competitors, on a production optimized product a quick sketching workshop is made. The key is to examine new expressions with the already existing production capabilities. Roughly, this is including sheet metal with the possibility of bend corners. It is tried to incorporate details, so the product, despite an optimized design, can stand out from the crowd.

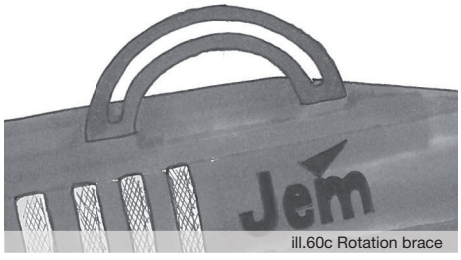


ill.60a

ill.60b Concept sketches

MOUNTING PART

In the quick sketching workshop there is coming up a idea of a mounting solution. This has the same function as the current braces on the smoke-heads, but instead of the brace being rotated, the rotation is in a fixture. Thus, there are no loose parts that can tear up when used.
Even if it, in the use cases, is chosen not to attend to the bracket market, there is seen a potential in the rotation brace.



ill.60c Rotation brace

ill.60d Mounting brace on Club Smoke

When experimenting with details such as ventilation gills, the result ends in an expression similar to competing products.
In addition to ventilation gills, the competing products incorporate sheet metal with visible mounting screws on the side of the products.

!

Avoid visible screws to differ from competitors.
Utilize production methods used in current Jem products.
In spite of a production optimized product, it is still the wish to stand out from the market and competitors.

STYLE BOARD

There is a need for a clear visual guideline in relation to the sketching ideation. It is chosen to go for a simple and minimalistic expression, which is characterized by a Scandinavian design. Thus a style board is created, inspired by the simple design of B&O and Dieter Rams among others.


ill.61a


ill.61e


ill.61h

ill.61b


ill.61c


ill.61f

To distance from the existing smoke machines on the market, there are taken inspiration in the simplicity and minimalist in Scandinavian design.

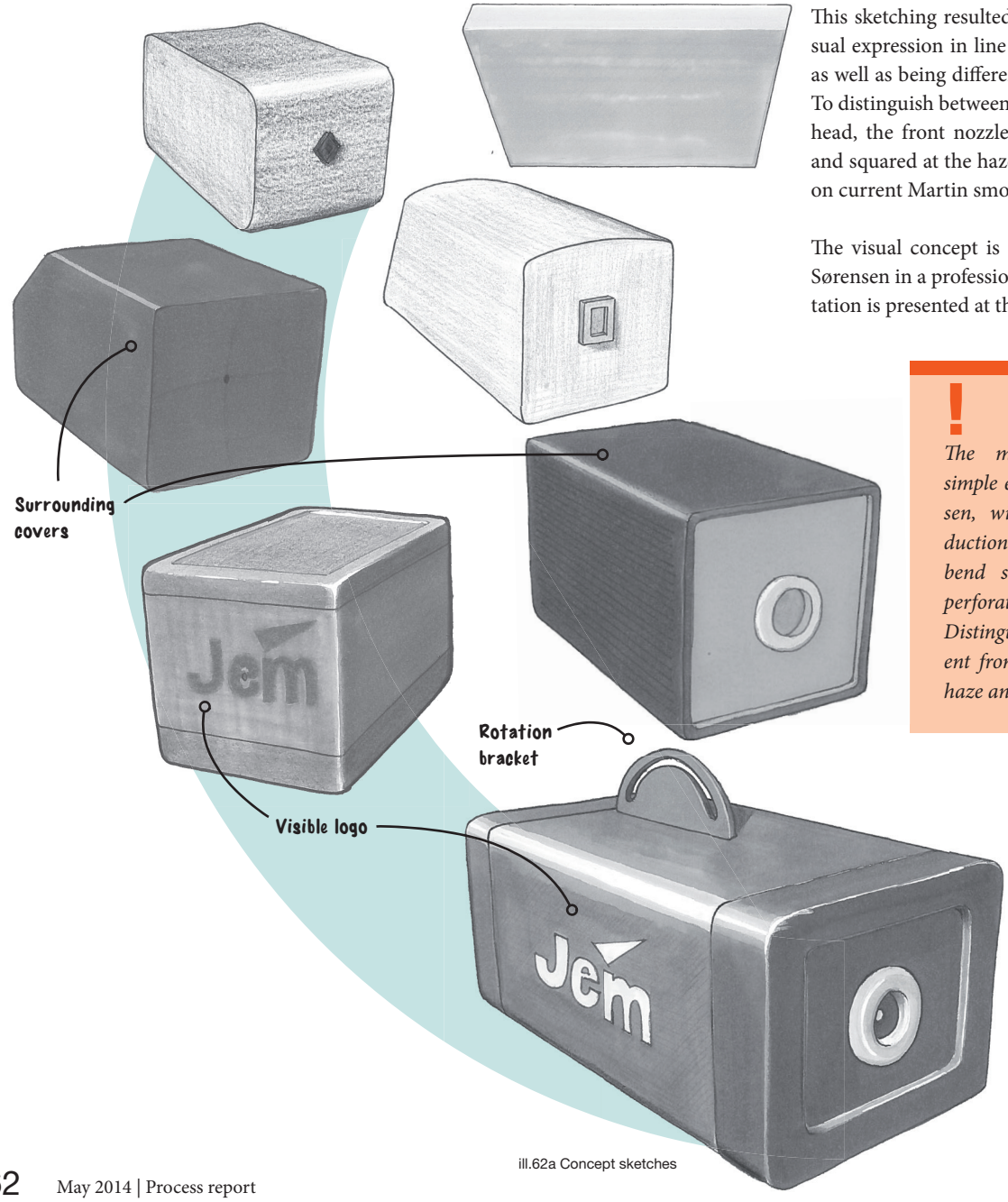

ill.61d

ill.61g

SKETCHING WORKSHOP

Through a workshop it is tested how the internal components can be placed in proportion to each other, to get an overall form to take further for concept sketching. The most practical architecture and form solution according to functionality is an elongated form, where the output is on the short side. For further insight in the products architecture workshop, see appendix J.

The production-optimized design connected with the inspiration from the Scandinavian style board, is clarifying a more focused sketching workshop. There are looked at the production facilities that are available to reduce the cost of a chassis. The preliminary is bended sheet metal and round perforations, because MMUK already use this in current products. Furthermore it is sought to have invisible mounting screws unlike competing products.



ill.62a Concept sketches

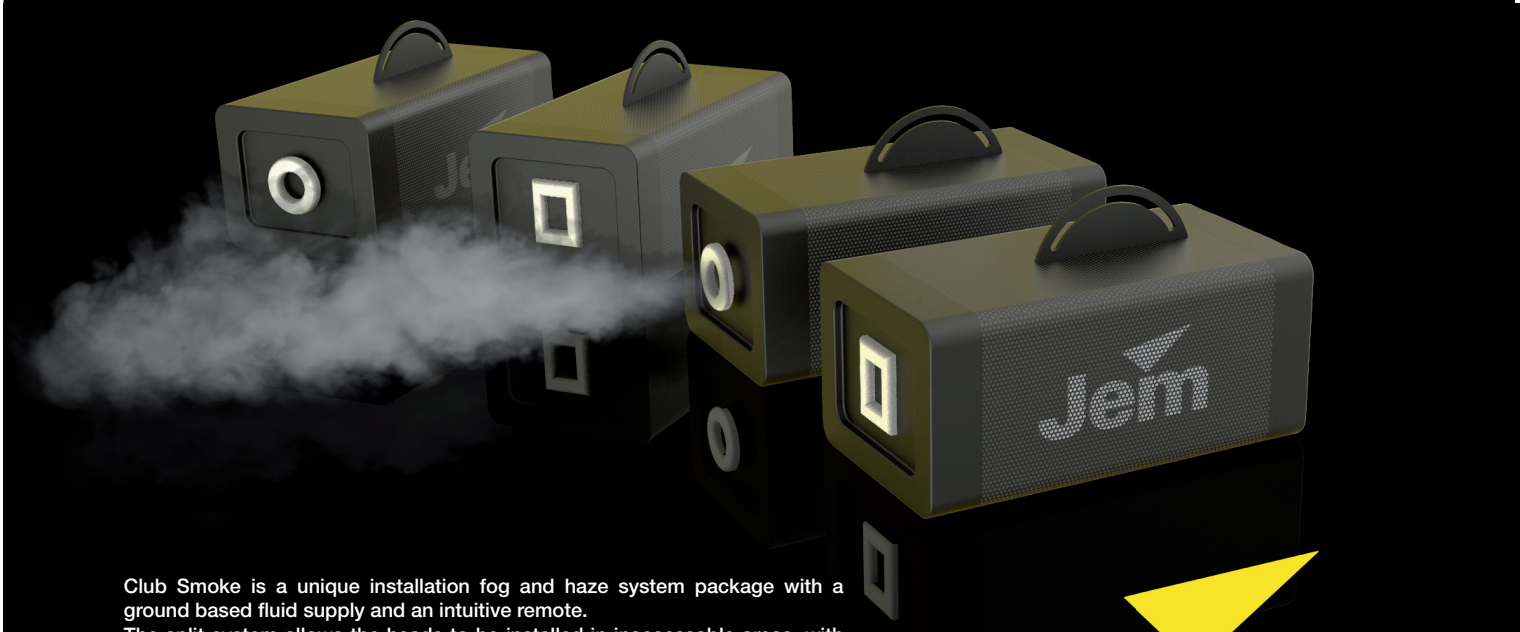
This sketching resulted in a satisfactory visual expression in line with the style board as well as being different from competitors. To distinguish between the haze and the fog head, the front nozzle is round at the fog and squared at the haze head. An idea used on current Martin smoke machines.

The visual concept is presented to Henrik Sørensen in a professional way. This presentation is presented at the opposite page.

!

The minimalistic and simple expression is chosen, with existing production possibilities of bend sheet metal and perforations in mind. Distinguish with different front nozzles on the haze and the fog head.

CONVENIENCE IS THE NEW BLACK



Club Smoke is a unique installation fog and haze system package with a ground based fluid supply and an intuitive remote.
The split system allows the heads to be installed in inaccessable areas, with convenient fluid refill.

- Delivers dense white fog as well as high quality haze
- Heads can be positioned up to 50 meter away from base unit
- Up to 6 heads in one system
- One type of fluid for both fog and haze
- Optional intuitive remote control

Jem

CONCEPT FEEDBACK

ill.64a Presented concept

HENRIK SØRENSEN

When presenting the concept to Henrik he provided positive overall feedback. He quickly understood the concept and the argumentation for the carried out solutions and choices. Actually, he did not provide a whole lot of criticism and though that the main selling point of convenience is the way to go, and solves the discovered issues with the current Club Smoke.
With the complete need for smoke in clubs solved with the new system offering both haze and fog functionality, he expects the product to double in sales numbers in year two [appendix K].
There was briefly presented a more aesthetically exploration concept from the earlier sketching workshops, and Henrik liked that the potential aesthetic possibilities had been explored, but there are many challenges to overcome, and basically the product is to be hid away up in a truss at a club.

JEM PRODUCT

When positioning the product within the Jem product range Henrik thinks the aesthetic expression is good, and the improved functionality and the possibility for a larger system than the current Club Smoke made sense. It is going to be manufactured in the UK along with the more expensive Jem products and not in China like the Rush products.
The Jem brand can improve the buyers' appetite for spending more money in a long-lasting complete solution with a great interface, which potentially provides additional sale.

!

Approval of the intension of the new product being a Jem product.
It is expected that the sales can increase by 100% in year two, due to the additional features.
The standard Martin Omega bracket is going to be a part of the product.

PRODUCT ARCHITECTURE

When presenting the concept consisting of stock parts primarily, it is obvious Henrik sees potential in making the right product at the right price. The prices of the new fog- and haze heads will be lower than the current products, Magnum 1800 and Magnum 2500 Hz hazer, because of the simpler construction, needing no fluid container and pump in each head. This is a way to create better margin or offer a great versatile product at the right price, which can potentially improve sales numbers.

INTERFACE

A new generic interface concept with great hardware development is discussed. It offers the potential for a generic and intuitive interface that can potentially create value for a large variety of Jem products.
Henrik think it sounds interesting. When presented the idea of a new interface design, Henrik quickly admitted that the current remote controls could be improved. By positioning the product in the Jem range it offers the possibility of expanding the value of the new interface to other Jem products. This can make them stand out from the crowd of competitors and Martin can be first-movers with an intuitive interface solution.

MOUNTING

Henrik presented a Martin Omega bracket with quarter turn screws that Martin often uses for their lighting products. This is a simple solution with two mounting holes in the product so the users can use any type of truss-mounting bracket they prefer. The quarter turn is an easy-to-use and well-known standard coupling bracket, with different manufacturers having their own version. This can be used instead of the presented rotation brace [H. Sørensen, 2014].
According to the users, the quarter turn mounting is a quick and simple solution, without any kind of problems.


ill.64b Omega bracket

ill.64c Holes for Omega bracket

SUM UP ON CONCEPT

From the start of the project it have been the intension to develop a product that is beneficial for Martin Professional. This intension was confirmed when visiting the Martin Manufacturing UK, thus it is important to keep the part numbers to a minimum.

The dual-functionality system with both haze and fog function, with the use of only one fluid, to make the refilling scenario convenient, is proved, since a new fluid mixture is developed. This fluid gives the wanted output; dense white fog, and homogeneous haze.

According to the need of PCB's and heat exchangers it is necessary to have different contents in the haze and fog head. Besides that the haze head needs a fan to mix the smoke with air to do the haze effect. This fan was intended to be an add-on to a regular fog head, but this will just add op the part numbers, and give unnecessary product restrictions. But the same chassis can be used to both smoke heads to keep the parts down.

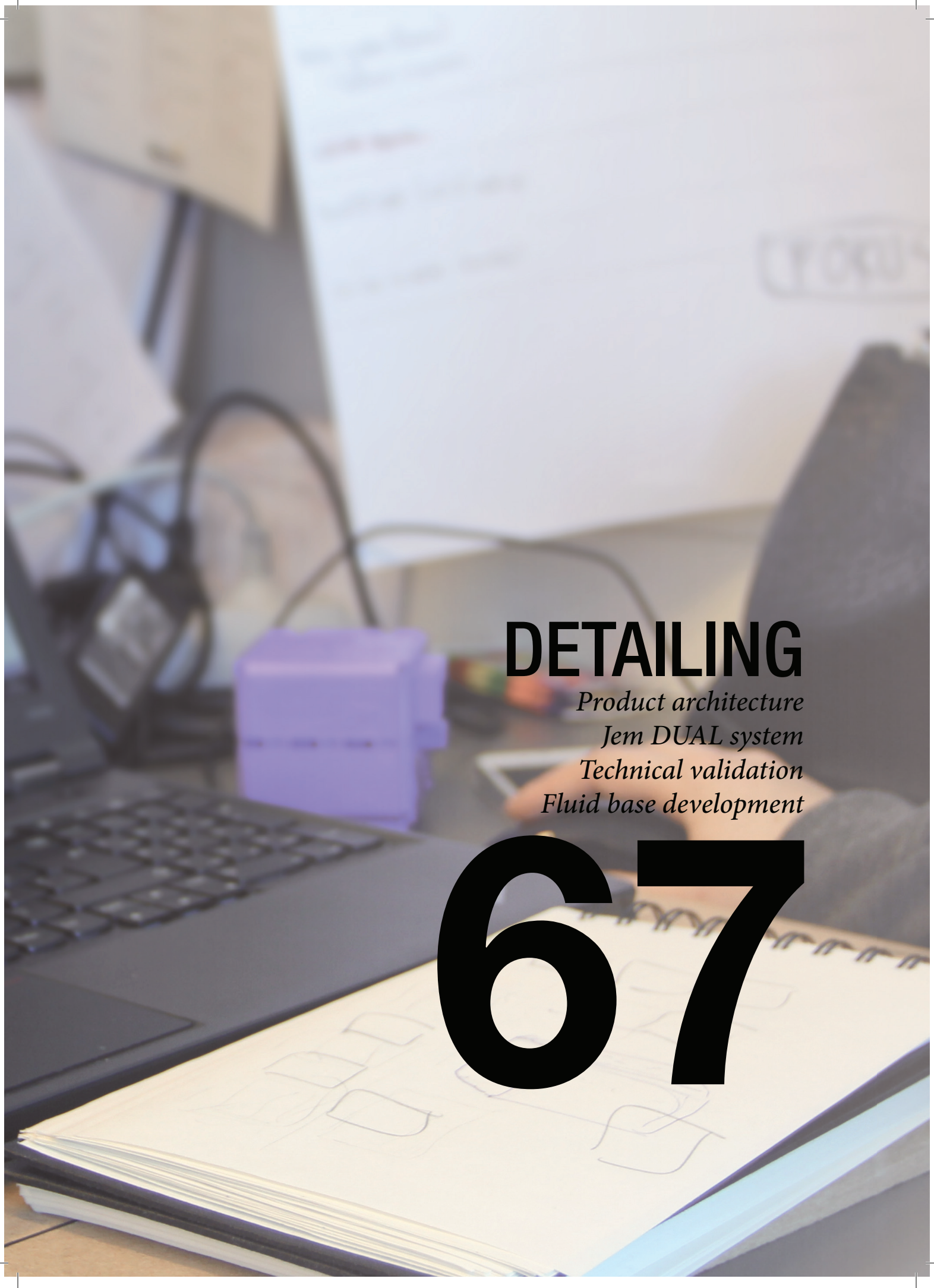
Due to the added functionality the new product is placed in the Jem product line. This may give additional sale with a intuitive and generic interface. Additionally the product is going to be manufactured in the UK, and not in china like Rush products.

To differentiate from other smoke machines on the market, a Scandinavian, simple and minimalistic design is chosen, but still by using the production methods and parts from current Jem products, to keep stock parts low.

The new concept will be controlled by DMX with RDM to have the bidirectional feedback between the user and the device. Additionally the system can be attached up to 6 heads instead of the current 4, to increase the market potential.

!


Jem



DETAILING

Product architecture
Jem DUAL system
Technical validation
Fluid base development

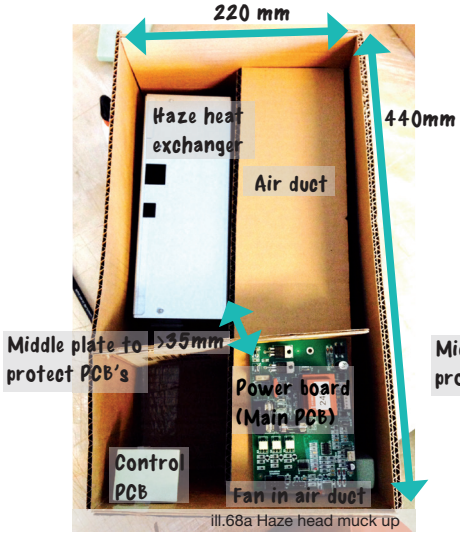
67

PRODUCT ARCHITECTURE

MOCK UPS

In order to meet the desire from MMUK as well as having low material costs the design need to be as compact as possible – preferable as compact as the original Club Smoke despite of its new functionality. In order to create the product architecture in an understandable manner, simple mock ups are made of both the haze head and the fog head, with the content that is identified in UK. See appendix H for bill of material.

HAZE HEAD



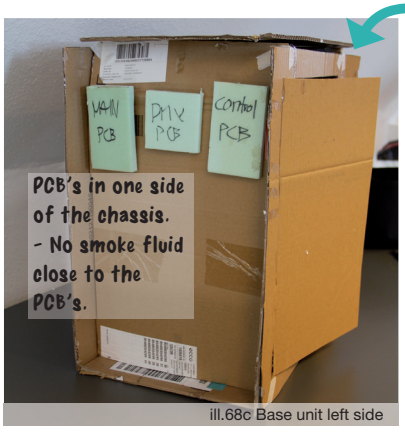
ill.68a Haze head muck up

FOG HEAD

ill.68b Fog head muck up

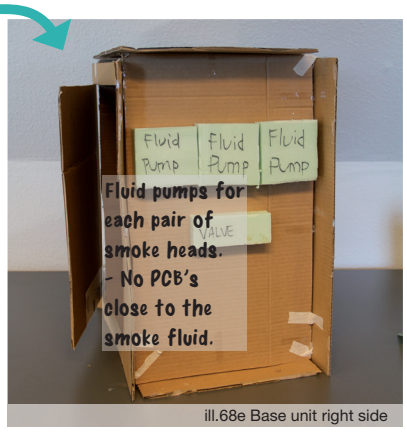
As a rule MMUK design their smoke machines with a minimum of 35 mm air between the heat exchanger and the PCB's. In order to accommodate this, this design guideline is followed in the mock ups.

BASE



ill.68c Base unit left side

ill.68d Base unit front



ill.68e Base unit right side

CHASSIS SIZE

All components in the haze and the fog head is positioned by looking at other products and information from UK, to get an indication on what is possible according to heat from the heat exchanger and the boards [N. Scully, 2014].

The haze head, which is the most crowded one, can be in a chassis sized 180mm x 220mm x 440mm, which is actually the same volume as the current fog heads.

The current base of the Club Smoke is really over-dimensioned. The size of this will be dependent on the size of fluid container chosen.

From UK it is mentioned that there is an ingress of fluid on the PCB's in the current Club Smoke head. Therefore a middle plate is used to shield the PCB's from fluid from the heat exchanger and the nozzle.

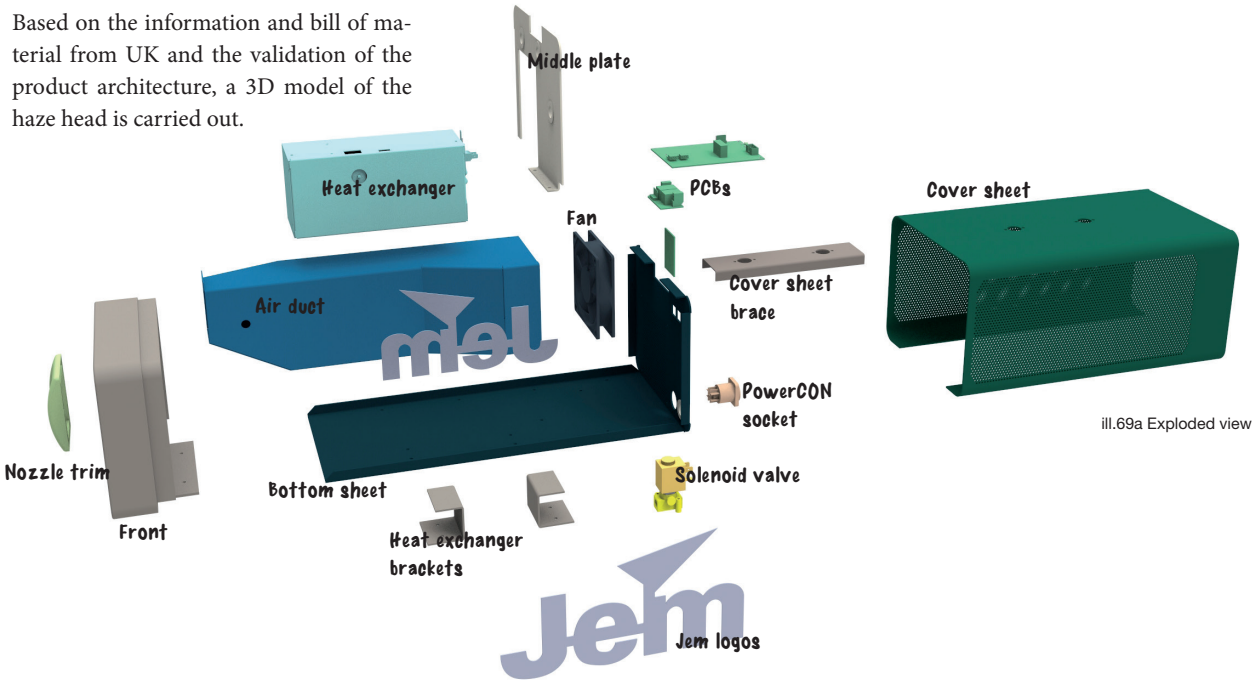
It is evident that the haze head is more complicated and takes up more space than the fog head due to the need of a fan and an air duct, so the focus is put on detailing the haze head down to every detail and let the fog head be on a more general level. With the base unit having rather simple product architecture, this will be detailed to a general level as well.

Therefore, this detailing episode will primarily address the detailing of the haze head as this product architecture and cabinet size will be the basis for the fog head as well. This way it is possible to use as many shared components as possible to keep stock parts to a minimum.

The product architecture is validated by Nick Scully

HAZE HEAD - EXPLODED VIEW

Based on the information and bill of material from UK and the validation of the product architecture, a 3D model of the haze head is carried out.



ill.69a Exploded view

NO VISIBLE SCREWS

To avoid visible screws the overall design consists of a bottom sheet and a cover sheet. The cover sheet is slided over the bottom sheet from the back, and screwed together underneath.

FRONT AND NOZZLE TRIM

The front and nozzle trims are giving the product aesthetic recognizability. These two parts are made of injection molding ABS which is not a new method for Martin, since the current nozzles are injection molded. This makes the product stand out from the crowd.

JEM LOGOS

The Jem logos on each side of the smoke head, is cut out of 1 mm sheet metal. An inverted shape can be used to place the logo correctly on the inside of the cover. The logo changes visibility from different angles, which gives a visual depth to the product.

OMEGA BRACKET

It is decided to go for the first decision of not going into the mounting brackets and use the Martin Omega bracket to be a part of the new Club Smoke concept. In this way the user is given free rein on the choice of mounting bracket to attach the omega bracket.

COVER SHEET BRACE

By choosing the Omega bracket there is a strong pull on the cover sheet. Therefore there is placed a cover sheet brace under the top of the cover. The omega bracket is fastened in the designated holes in the brace.

AIR DUCT

The Martin 2500 Hz Haze machine is used as reference. The air duct is designed using angles no larger than on the air duct on the Martin 2500 Hz hazer in order to provide an efficient air flow.

SOLENOID VALVE

The solenoid valve is placed in each head by recommendation from UK. The valve adjusts the fluid pressure from the pumps in the base, and is a necessary part in both types of head..

PERFORATION

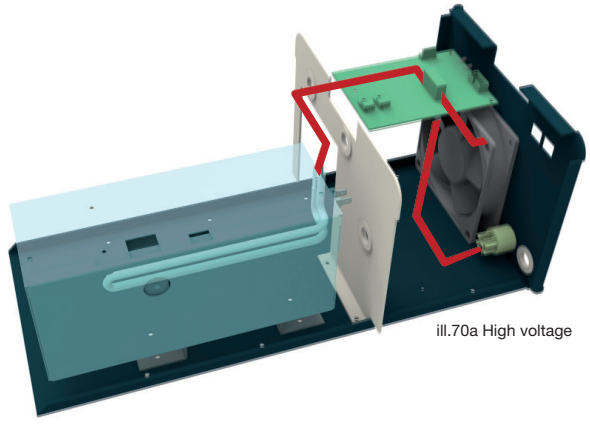
The cover sheet has a lot of perforations on each side. This partly for a visual expression, and due to great ventilation in the smoke heads.
The bottom sheet have perforations on the back plate where the fan is attached. This for the fan to have free passage to air from the outside. The outcome of the perforations is large start-up costs, but this will be of minor importance with a high production number if used generic.

Complete assembly instructions can be found in the product report.

For material considerations, see appendix L.

HAZE HEAD - WIRING

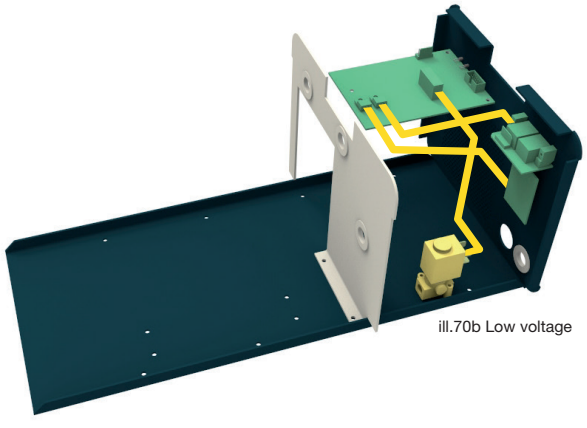
All components in the haze head are placed with consideration to the wiring. It is beneficial that the high and low voltage wiring is separated as much as possible [N. Scully, 2014]. This is illustrated in the following.



ill.70a High voltage

HIGH VOLTAGE

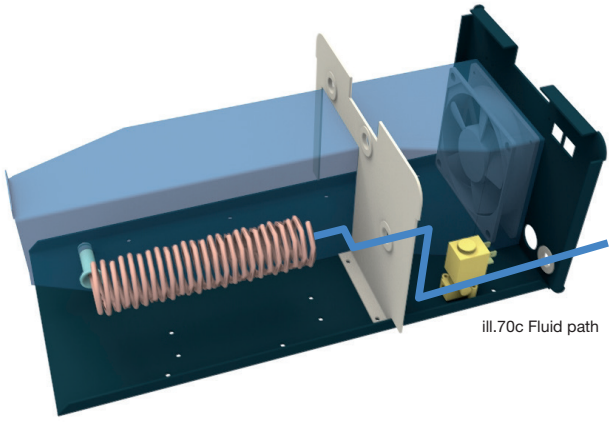
- PowerCON supplies the main board with 230V.
- The main board powers the fan and the heat exchanger with each individual voltage.
- 230V AC for the heat exchanger and 115V DC for the Sunon fans.



ill.70b Low voltage

LOW VOLTAGE

- The main board converts high voltage to low voltage for control connectors and -boards.
- Additionally, the solenoid valve where the fluid goes through is supplied with low voltage.



ill.70c Fluid path

FLUID PATH

- The fluid comes directly from the base, going through the solenoid valve up to the copper coil in the heat exchanger.
- The fluid is heated and blown out the nozzle into the air duct, where the fan mixes the fog with air.

The proper wiring is going to be shown in a upcoming prototype of the haze head.

MATERIAL

The chassis is made of CR4 steel like current Jem products [appendix L]. The sheet thickness is 2 mm to achieve a more solid expression than on current Martin fog machines, typically using 1 mm – 1.5 mm CR4 [web 22]. All parts are powder coated with a jet black RAL 9005 - just like current Jem products. The front piece and the nozzle trim are injection-moulded from ABS, which is tough and can withstand the temperature of the heat exchanger [web 23] [Appendix M].

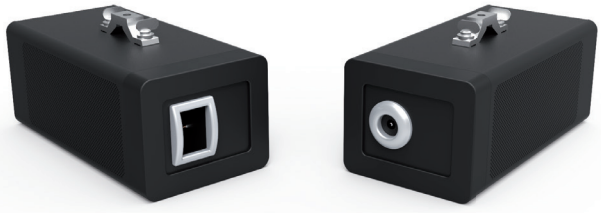
SAFETY WIRE

All Martin and Jem smoke machines for hanging in a truss is supplied with a safety wire in case the truss or mounting bracket fails. This wire prevents the smoke machines from falling down with disastrous consequences as a result. This safety wire is incorporated with a snap hook in the basic structure; the bottom plate to the back plate.

ill.71a Safety wire placement

NOZZLE TRIM

In the current Martin and Jem line-up the nozzle trim design is used to differentiate the fog machines from the haze machines. The fog machines use a circular nozzle and the haze machines use a rectangular. This is passed on in the new product. This way it is evident which machines produce haze and which produce fog, because the front is always pointing into free air. This makes it easy for the DJ to see what devices are positioned where in the club.



ill.71b Different nozzle trims on haze and fog

NAME AND LOGO

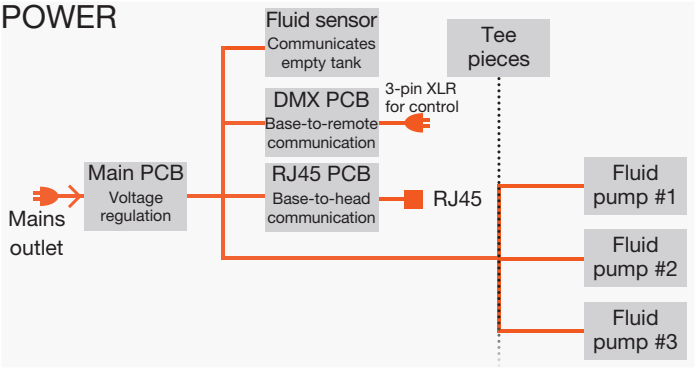
In order to emphasize that Martin is launching a brand new product with new functionality a new name for the smoke system is needed. The main selling points for the new system are convenience and the dual functionality; fog and haze.
Within the new name the focus is on emphasizing the new dual functionality instead of the primary application of clubs as there are many secondary applications. The dual functionality is the basis for the convenience that this system results in why the name is "Jem Dual".
The logo for Jem Dual is done in the spirit of Martins other product logos, maintaining the original Jem logo as a part. The DUAL part visualize a duality in the double outline.

ill.71c The Jem logo at Jem DUAL

JEM DUAL SYSTEM

BASE

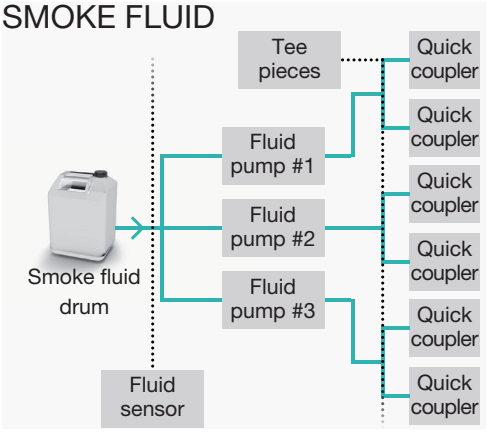
POWER



ill.72a

During the process it is chosen not to detail how to fit the quick couplers as these are standard components used in other Martin products, thereby being easy to implement by MMUK.
The Tee pieces are standard components and fitted to the 6 mm fluid line in order to make each pair of smoke machines share one fluid line.

SMOKE FLUID

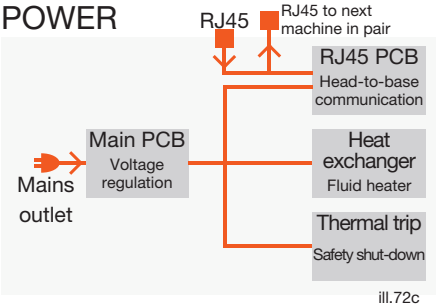


The fluid sensor only signals when the fluid drum is empty. This sensor is chosen instead of more advanced one because of its price.

ill.72b

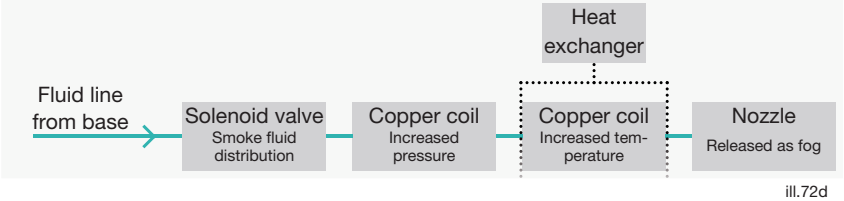
FOG HEAD

POWER



ill.72c

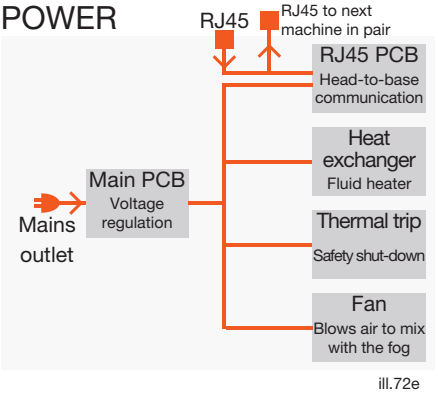
SMOKE FLUID



ill.72d

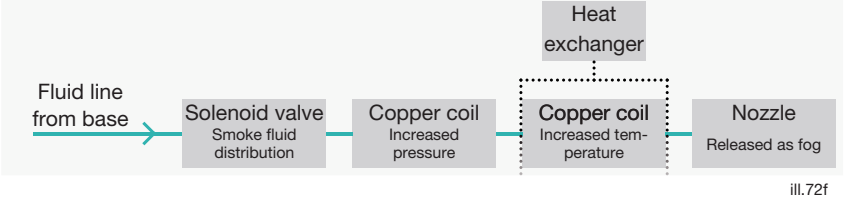
HAZE HEAD

POWER



ill.72e

SMOKE FLUID



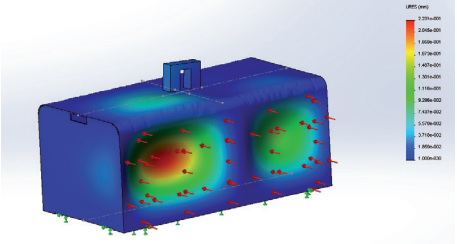
ill.72f

The functionality of the fog- and the haze head is quite similar with different heat exchangers and the fan in the haze head being the major difference.

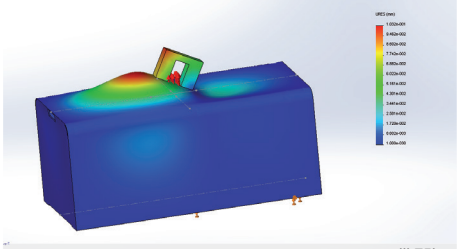
TECHNICAL VALIDATION

FEM ANALYSIS

Strength calculations are carried out using SolidWorks Simulation to achieve an understanding of the construction will be reliable in the intended context or not. For the strength calculations three scenarios are used for calculations. Only the two most different results are shown below.
The whole analysis can be seen in appendix N, O, P and Q.



ill.75a



ill.75b

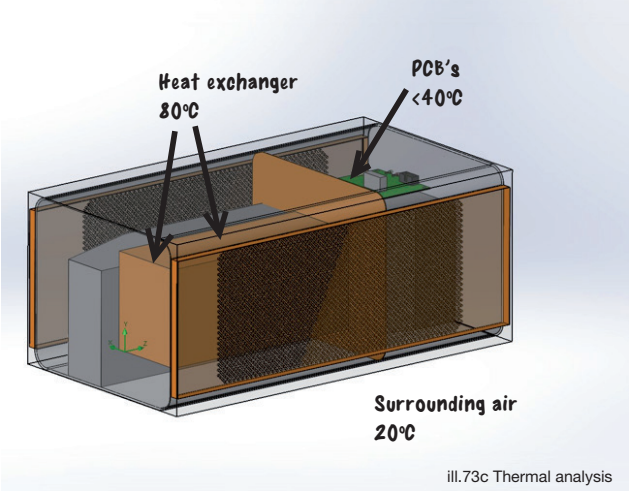
The simulation is done on a simplified model, according to the perforations, that overworked the simulation. The product is deforming about 0.2 mm when providing a pressure from the side. Taking the simplified model into account, there are no problems according to the strength of the chassis.

DROP TEST

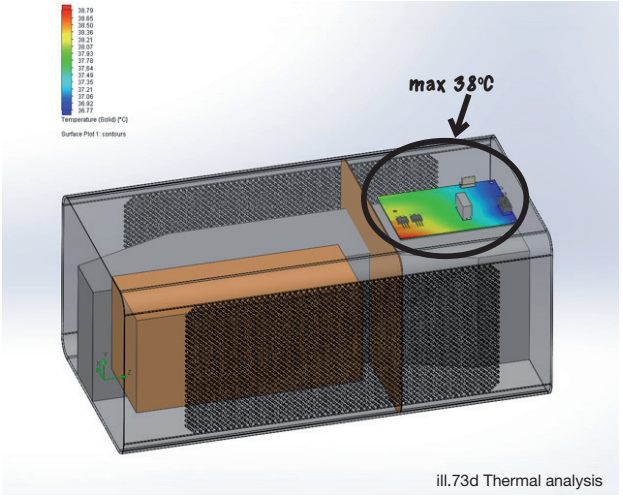
It will be beneficial to do a drop test of the product. It is known that Martin Professional do drop tests of prototypes before sending to the test people. Martin have their own fixed procedure according to drop testing. The drop test of Jem DUAL will be a part of this procedure.

THERMAL ANALYSIS

A thermal analysis is carried out for one reason; to make sure the PCB's does not overheat due to heat transfer from the heat exchanger. According to Nick Scully, the surface temperature of the heat exchanger is 80°C and the PCB's that are to be used, are tested to withstand a continuous temperature of 50°C to reach an operating life of Martin standards [N. Scully, 2014]. In order to simulate the heat transfer through both air and the surrounding material, the model is simplified to the absolute necessary. The thermal analysis is carried out using SolidWorks Flow Simulation. When Martin perform thermal analysis, they are measuring with a surrounding air temperature at 20°C. In that temperature the PCB's should not surpass a temperature higher than 40°C.
The full thermal report can be seen in appendix R.



ill.73c Thermal analysis



ill.73d Thermal analysis

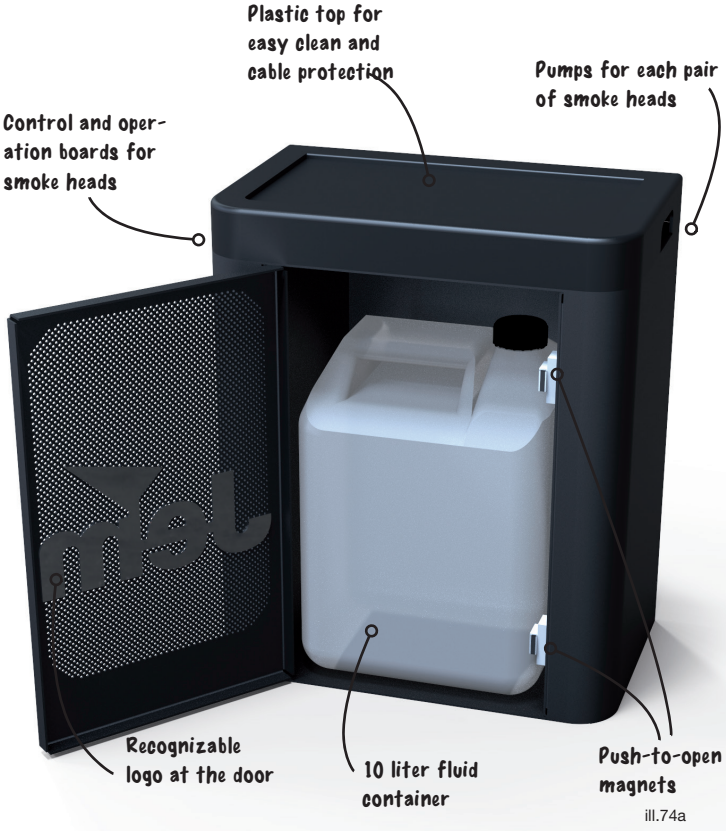
The maximum temperature at the PCB's is 38°C when having a surrounding air temperature at 20°C. This is quite good according to Martin standards.

FLUID BASE DEVELOPMENT

During the whole process, the base unit have been a override visually. Partly due to the early choice of keeping the convenient refilling scenario, and due to the lower technical part than in the smoke heads. After designing the smoke heads fully, the same visual expression can be transfered to the base part. Because of the added functionality according to both fog and haze in the smoke system, a risk of higher fluid consumption occur, which questions the size of fluid container.

FLUID CONSUMPTION

The current Club Smoke use a 10 liter fluid container. According to Train Nightclub, the fluid is refilled approximately every month with a system of 4 fog heads. In the current base there is a lot of wasted space, and the wish is to have as small a base as possible, pointing towards a smaller chassis.
When looking at a Jem DUAL system with 2 x haze and 4 x fog heads used in a club for a 6 hour night, where the haze constantly runs at 20% output, and the fog effect is used in average 10 seconds per half a hour for each of the four fog heads, the fluid consumption is approximate 2 liters a night [Appendix S]. Due to the very convenient refilling scenario, there are no complications in refilling the system. Additional, due to the RDM-control, the base can send a signal to the attached remote when refilling is needed.
According to the Danish Working Environment Service it is harmful to lift more than 15 kilos. Therefore a 20 litre is to heavy for the club staff to refill or replace [Jensen, J., 2005]. When having this in mind the currently used 10 litre fluid container is chosen for the Jem DUAL system as well, since this is a standard container



ill.74a

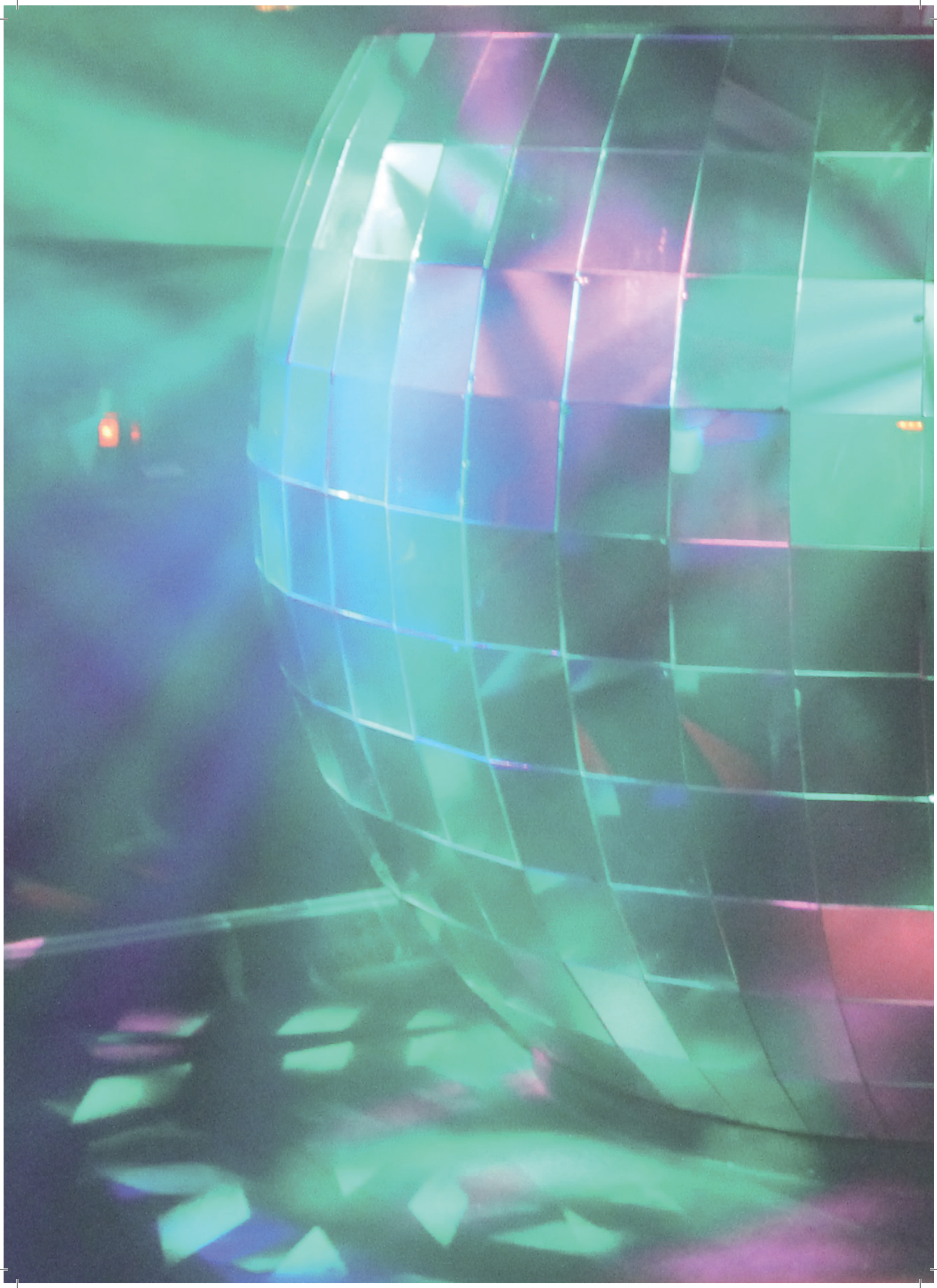
VISUAL EXPRESSION

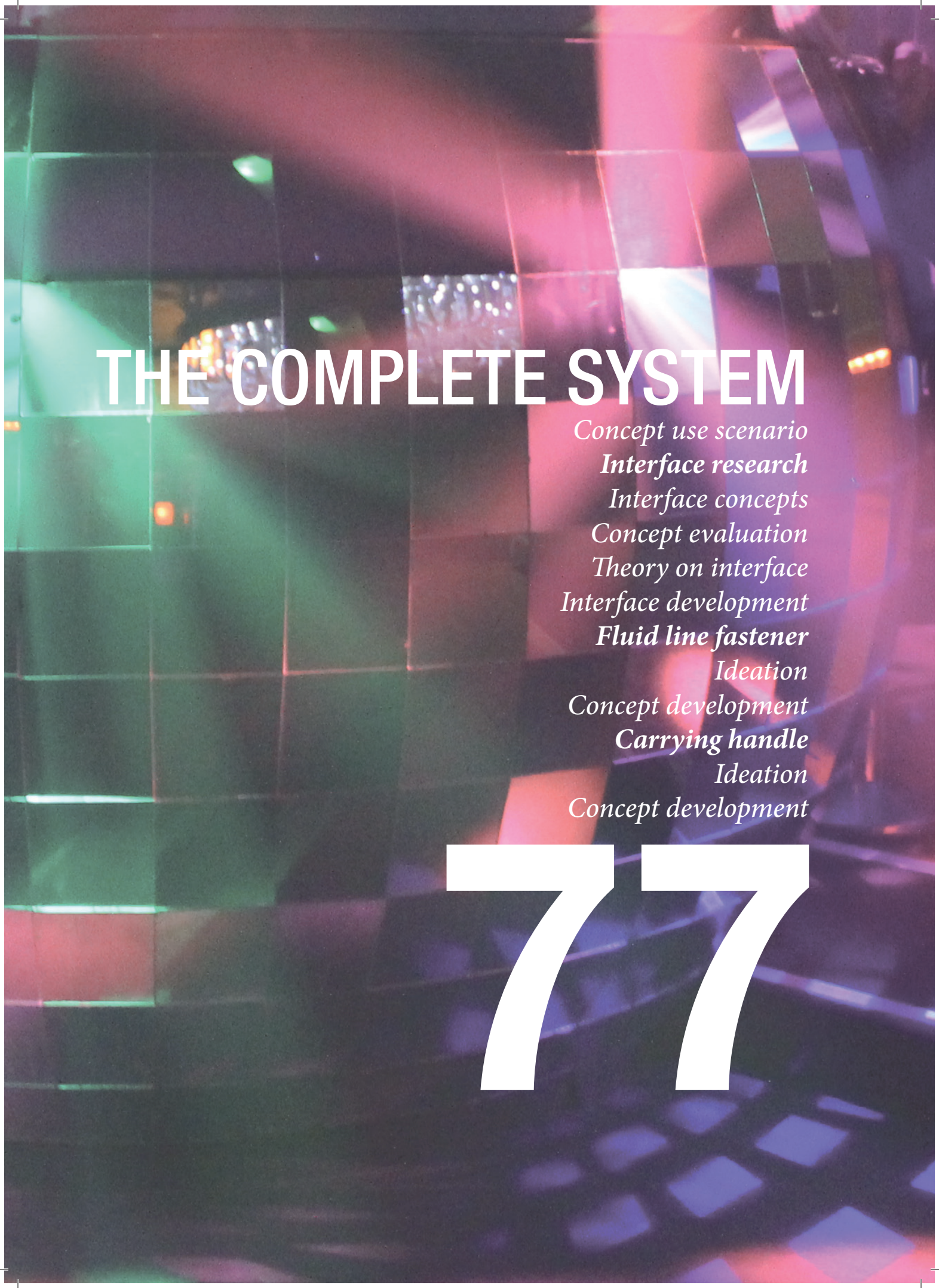
Even though the same size of fluid container is used for the Jem DUAL base, the base is sagnificant smaller than the current one. The Jem DUAL base have the dimensions 450 x 380 x 230 mm (0,039m^3) opposed to the current base that have the dimensions 410 x 290 x 480mm (0,057m^3).
The perforations from the heads is maintained in the base. Likewise is the bended corners and the plastic, which is used as a top part at the base.
In addition to giving the base a visual recognizable expression, the plastic top also covers the attached cables and fluid lines. This partly to secure the cables and to make the base top easy to clean, without having any cables on the top.
The Jem logo from the heads is also identifiable at the base door. The door is connected with one hinge and two magnets using push-to-open, so there isn't any handles protruding.

SUM UP ON DETAILING

The new product, called Jem DUAL referring to the double functionality of haze and fog, gives the user a complete smoke system for the club.
Jem DUAL is designed to stand out from the crowd. The plastic front, perforations, no visible screws and visible Jem logos gives an aesthetic recognizability.
According to safety, each smoke head have separated wiring, thermal trip and the possibility to attach a safety wire.
The haze and fog heads differentiate by the nozzle trim. The nozzle trim at the fog head is circular, while it is rectangular at the haze head. This makes it easy for the DJ to tell each head apart.
The fluid base have the same visual expression as the smoke heads. The plastic top secures the wires and cables, and it makes the base easy to clean.

!





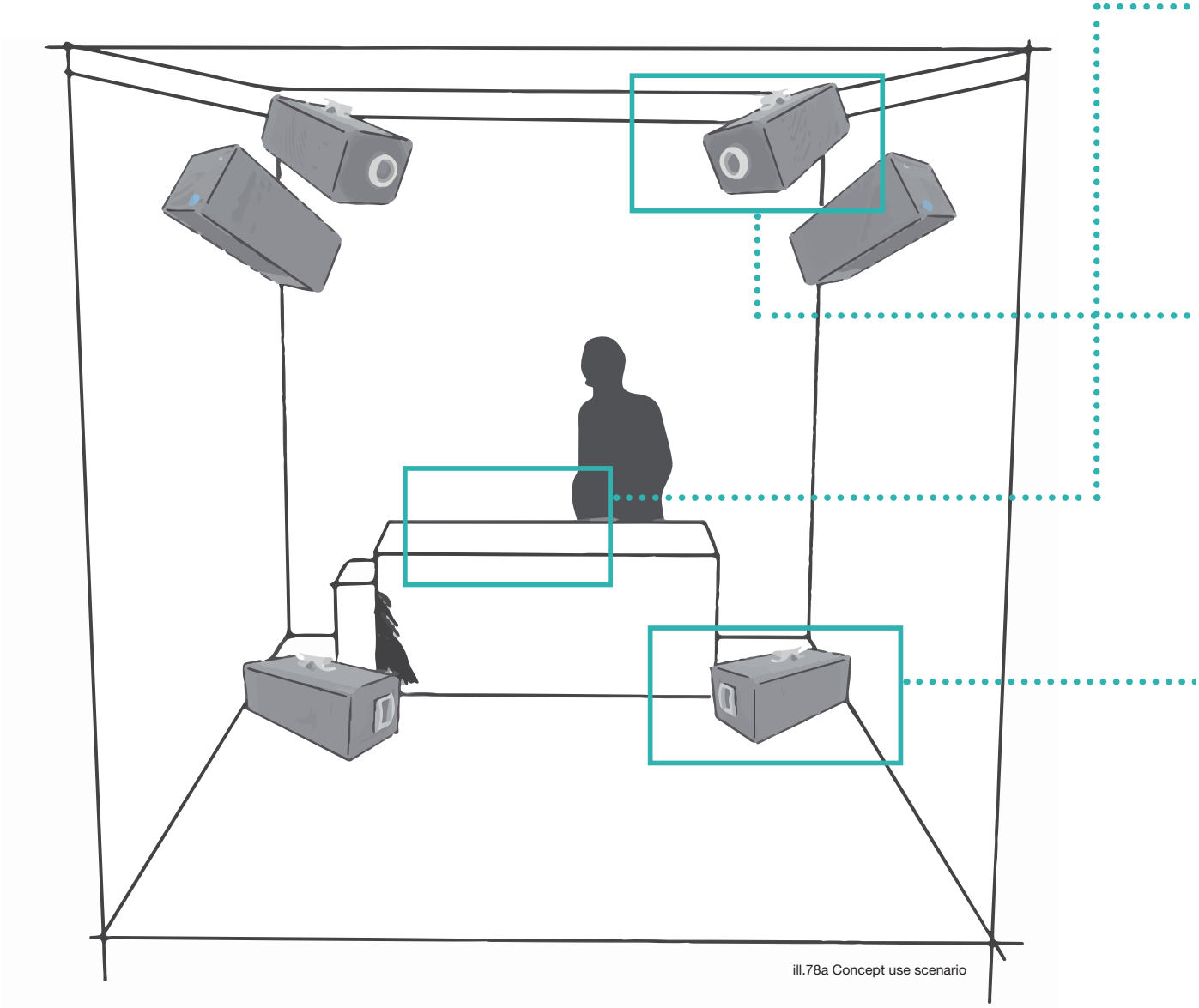
THE COMPLETE SYSTEM

Concept use scenario
Interface research
Interface concepts
Concept evaluation
Theory on interface
Interface development
Fluid line fastener
Ideation
Concept development
Carrying handle
Ideation
Concept development

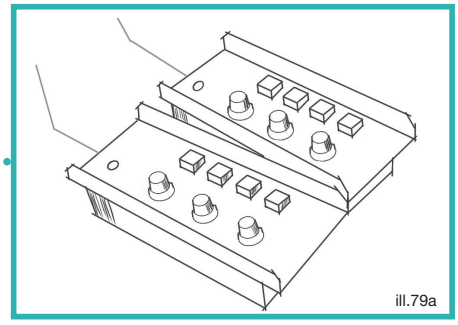
77

CONCEPT USE SCENARIO

Jem DUAL solves the observed need for both fog and haze. At the same time, the convenience of the concept is increased, since only one type of fluid is needed for both fog and haze, which can be refilled in one convenient place.
However, through the earlier user studies there are observed secondary problems in relation to the use and the need of a smoke machine system. These problems are elaborated in the following use scenario.

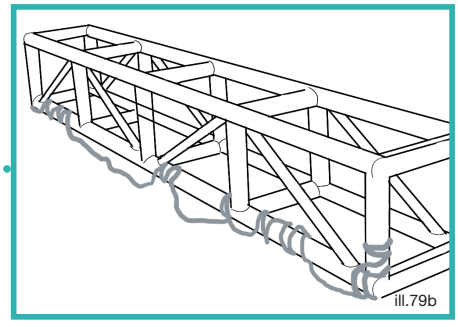


ill.78a Concept use scenario


ill.79a

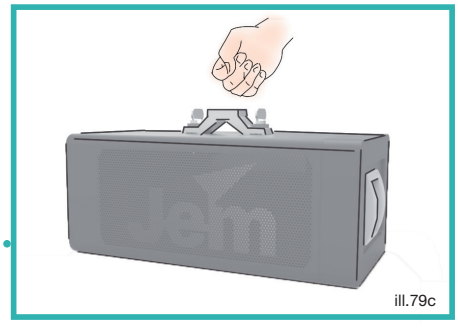
INTUITIVE INTERFACE

As earlier mentioned, clubs often use the supplied remote controls for their smoke and haze machines. These remotes are fairly similar, and therefore difficult to tell apart. When having a system for more purposes the need for a intuitive remote will increase.


ill.79b

CABLE FASTENER

When the smoke machines hang in a truss by the ceiling in a club, there is often a big mess in the cables from the light- and smoke devices. Often the cables are tied around the truss to keep track of both fluid lines and cables. This gives a inaccessible and disordered wiring, which complicates service of the products.



ill.79c

CARRYING ACCESSORY

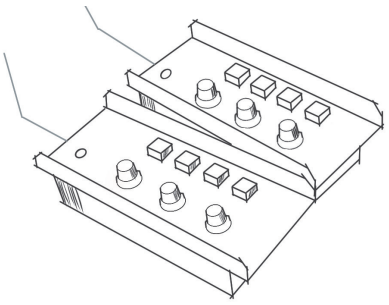
Jem DUAL consists of the Omega bracket, where the user can attach any wanted mounting bracket. But there are no solutions for carrying the product using the Omega bracket.
When solving more needs, there will be different ways and places of mounting each head.

!

Possibilities of improving the overall story of a complete smoke solution for a club can be supported by developing accessories for:

- *An intuitive and easy-to-use interface*
- *Organizing cables and fluid lines in a truss*
- *An Omega bracket carrying accessory*

In order to address the secondary issues shown in the use scenario, possibilities in developing accessories are discovered.
The development in these accessories will be addressed in this episode where each accessory development process will have its own section containing research, ideation and concept development.
The accessories will be kept to a more overall level due to the limited time in the project period and the focus have been on developing Jem DUAL.



INTERFACE RESEARCH

CURRENT MARKET

To gain an overview of how the fog and haze functionalities are controlled, current remote controls from both Martin and competing companies are investigated.

FOG FUNCTIONALITY

ill.80a Fogtec VS-400

ill.80b Martin Magnum 850

ill.80c Martin Magnum 2000

The current fog remotes range from the basic remote which only offers a Hold-to-fire functionality, to the more advanced remote for the Martin Magnum 200 which is able to control both fog output using a dial knob, set timer and a Hold-to-fire functionality as well as turning the device on and off.

!

The controls must be unambiguous.

Hold to fire

- *The smoke is firing while the button is pressed*

Push to fire

- *The smoke is fired continuously from the button is pushed until it is pushed again.*

HAZE FUNCTIONALITY

ill.80d Martin 2500 Hz

ill.80e Chauvet Haze 2D

ill.80f ADJ Haze generator

The Martin controller offers a timer functionality as well as output level. The output level and the timer set are operated with a single dial knob which can cause confusion with its dual functionality. This functionality have received poor customer feedback, and the product is being phased out [H. Sørensen, 2014]. The controller offers bi-directional feedback from the attached haze machine being "Ready" or "Heat" signal, which refers to not being ready.

The Chauvet controller controls timer set, continuous output, on/off, Push to fire functionality as well as manual Hold to fire. There is also an interval functionality that can fire haze with adjustable intervals. Each adjustable function is supported with its own dial knob, which reduces the risk of confusion and non-intended adjustment.

The American DJ controller offer similar functionality as the Chauvet, except output control.

USER SURVEY

By posting a Q&A on the danish DJ community "Danske DJ's" and the large international community "DJs, producers, remixers and labels" on Facebook it is possible to reach many different DJ's in order to achieve their opinion and quantitative feedback on which controls should be available for fog and haze functionality and how they would like to control these functions. Previously contacted DJ is also contacted in order to answer the Q&A to provide a qualitative feedback. The full Q&A can be seen in appendix T and U.

A: What type of remote do you use to control your smoke now?

B: When you use fog and haze as a DJ, do you prefer to use physical buttons or touch screen?

C: When you wish to use the fog machine, do you prefer?

D: When you wish to use the haze machine, do you prefer?

E: When you wish to pack the room with haze would you like a timer function?

Q&A FROM DJ'S

When asking previously contacted DJ's qualitative feedback is obtained. About half prefers physical buttons to touch screen, but recognize the flexibility and that touch screens gains ground in general. The two ways of turning up and down within the DJ industry are a fader or a dial knob, where the fader is preferred by most.

When interviewing Morten Greven he argues that most better club DJ's have been accustomed to using touch screens to control their light fixtures and music. Many DJ's in the larger clubs use Light-Jockey with a touch screen and Traktor DJ and Serato Remote applications for music mixing and touch screens are taking on market shares, so the touch screens are on their way in to the DJ booth.

By using a fader instead of a dial know the visibility of the output can be improved due to the elongated shape of a fader. Very few DJ's use RDM device feedback on their current smoke machines, but recognizes that this feature can improve the ability to troubleshoot devices, and furthermore sees the benefit of system malfunction feedback.

!

The interface have to be very simple and intuitive to use, since the DJ's have a lot to do with the music as well.

The wish is to have "Hold to fire" functionality when using the fog effect. And "Push to fire" when using haze.

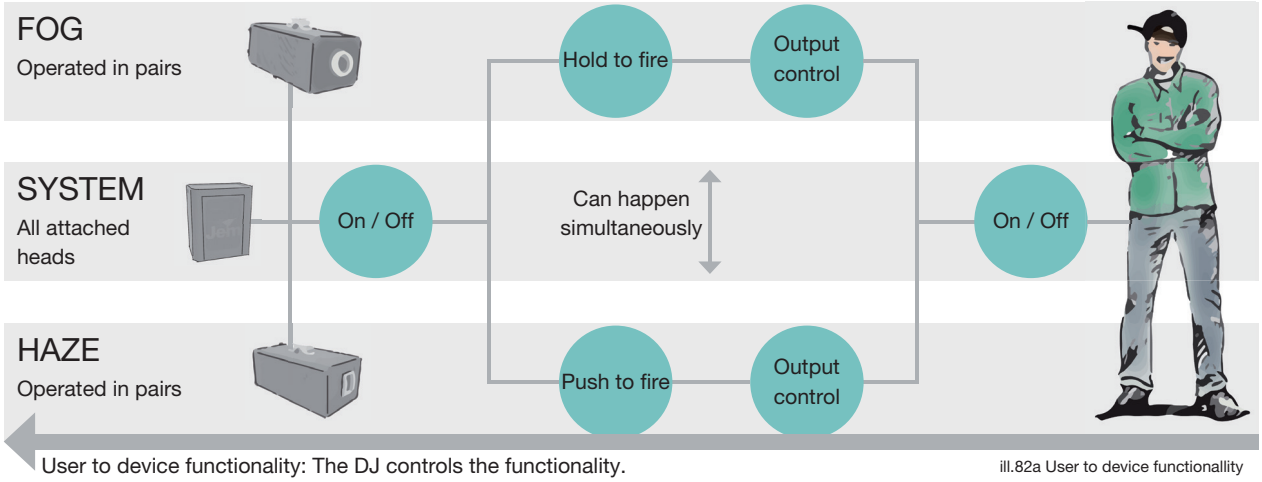
The fader is preferred by most to adjust output.

The touch screen is gaining ground for other DJ applications, and the users have gradually been accustomed to the use.

FUNCTIONALITY MAPPING

To obtain an understanding and overview of the nessesary user needs, a functionality mapping is made, that shows the needed functionality and device feedback. The scenarios are dynamic as the haze and fog functionality are operated multiple times during an event, and two scenarios are usually not identical.

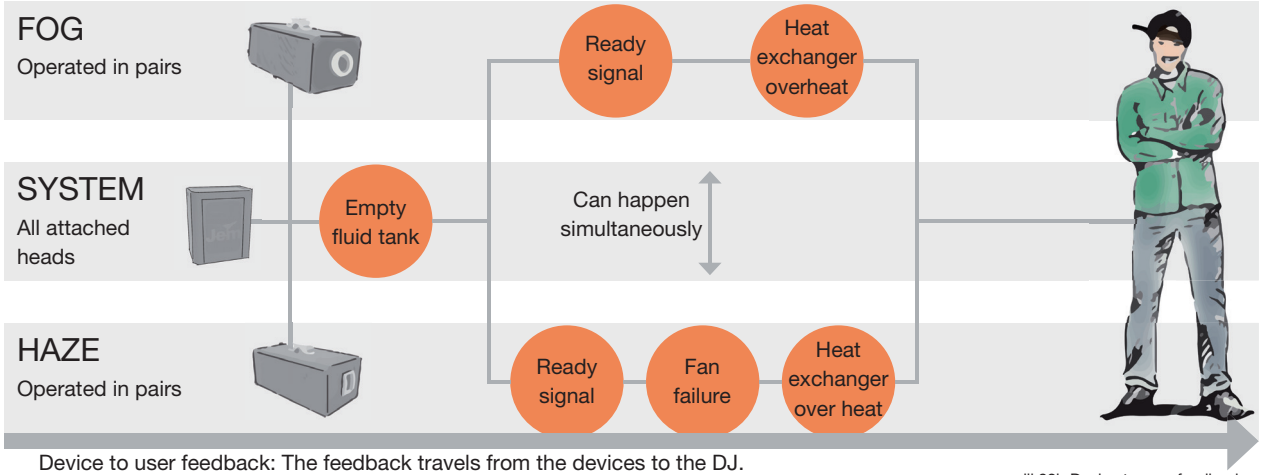
USER TO DEVICE FUNCTIONALITY (DMX) (PRIMARY FUNCTIONALITY)



User to device functionality: The DJ controls the functionality.

ill.82a User to device functionallity

DEVICE TO USER FEEDBACK (RDM) (SECONDARY FUNCTIONALITY)



Device to user feedback: The feedback travels from the devices to the DJ.

ill.82b Device to user feedback

The user-to-device functionality is the primary focus for the interface and the needed functionality shall be visible at all times, whereas the device-to-user feedback can be shown on screen in a simple manner in order to troubleshoot the connected haze- and fog heads. The device feedback is not a user functionality and therefore not necessarily visible at all time – only when needed.

INTERFACE CONCEPTS

The remote interface handles communication from the remote interface itself to the base unit, where the Martin RJ45 DC protocol takes over. The interface shall allow the user to perform the needed tasks as easy and intuitive as possible. As the Jem DUAL system offer a variety of system scenarios, the interface must adapt to the need for smoke in the club.

The following concepts don't express the feedback through RDM between the product and the user. Likewise, the visual expression and the user interaction is not included. It is just overall interface need concepts and possibilities. The concepts deal with three different use scenarios, A, B and C.

A

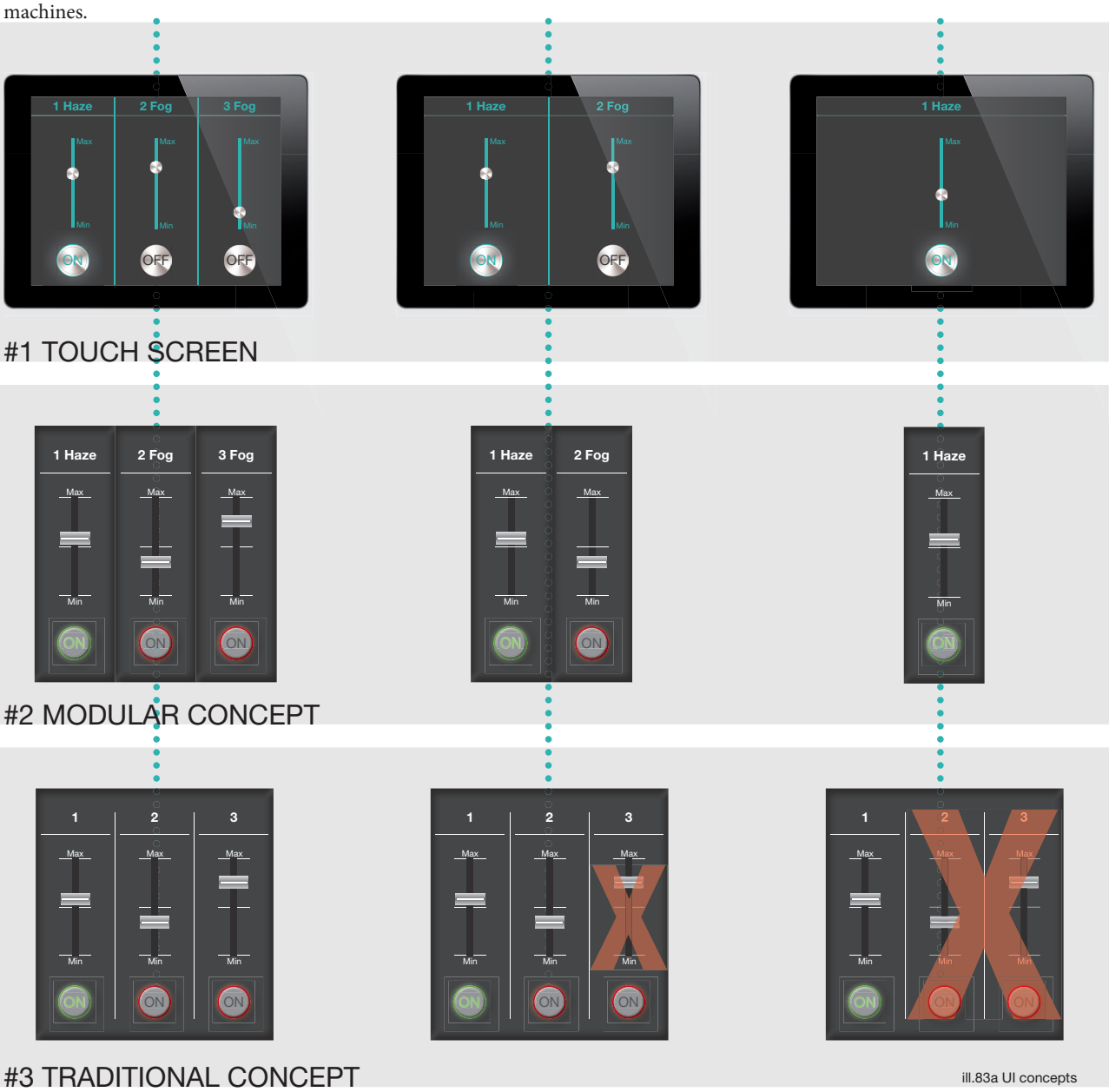
The complete package with one pair of haze machines and two pair of fog machines.

B

One pair of haze machines and a pair of fog machines.

C

A single pair of haze machines for smaller venues.



ill.83a UI concepts

CONCEPT EVALUATION

To figure out what Martin thinks about the three interface concept, they are presented to Henrik Sørensen on a conceptual level. This can provide feedback on whether Martin has gained information on user needs from previous products, and thereby provide further information on which way to go.

!

The controller will only support the necessary functions.
The controller will be connected via DMX, since this technology is fully tested.

#1 TOUCH SCREEN

The touch screen interface has the advantage of being able to adapt to all possible scenarios with ease.
The touch screen is able of showing device feedback with both text and graphics for easy readability, as the screen graphics can change according to the situation. Furthermore it can potentially be updated in terms of new graphics or user based wishes.
The dialogue on this concept mostly concerned whether or not a touch screen is the right way to go.

\+
Adapts to the number and type of attached devices. “One size fits all”
One item number
Updatable
Possibility of easy-to-read device response

\-
Lack of physical buttons

#2 MODULAR CONCEPT

The main incentive with this modular concept offer is the tactile feedback of having physical buttons, which can be operated blind. Through two different sub-parts, one for haze and one for fog, this concept can operate every use scenario, but is more static as the interface cannot change without swapping sub-parts.
The feedback focused on the fact that it is a modular concept which contains sub-parts which can complicate production with higher sales price as the final output.

\+
Physical buttons
Works with all scenarios

\-
Connection system
Complicates device response
Two sub-parts

#3 TRADITIONAL CONCEPT

This concept shows a more traditional approach. It is able to be perfectly designed for one specific scenario, but it will not act intuitive in all occasions. The main issue is the functionality differences between haze and fog. The fog is a “Hold to fire” effect while haze in a “Push to fire” functionality.
It was clear that this is not the way to proceed. The concept offers easy manufacturing, but remains a solution which will only suit certain scenarios perfectly.

\+
One item number
Physical buttons

\-
Only perfect for one scenario
Complicates device response
Non-intuitive except for one scenario

Martin has previously tried to incorporate all sorts of features in some controllers, but without any success from the market, thus it doesn’t make any sense to the users. In parallel, Martin feel that the customers have a wish to have buttons with tactile feeling on controllers. However Henrik do not exclude a touch screen since the trend is going towards touch screens, and customers have gradually been accustomed to the use of touch screens through DMX controllers, as well as computers and tablets.
It is important that the two functions haze and smoke, is shown in a simple and legible manner at any controller, to make the use evident.

It is only the most important features that shall be included in the controller. Since there are many factors that come into play according to the use of smoke, it is difficult to pre program functionality. The most important thing is the possibility to do variations in terms of for example output during a show in a simple way.
When talking about making a wireless remote, Henrik thinks that the "u*se of analogue DMX-technology - then nothing happens unexpectedly*."

TRENDS IN TOUCH INTERFACES

In recent years touch screen devices such as smartphones and tablets have becomes common property, also in the DJ environment. During the user research and through user concept feedback it is discovered that the use of touch screens is gaining ground within the DJ industry, seen in both tablet programs such as Traktor DJ as well as newer DMX controllers using touch screens, including Martins own state-of-the-art M6 lighting console and LightJockey Touch. A touch screen can accommodate all necessary functions, while only having one actual weakness being the lack of tactile feedback which can be achieved through physical buttons.

! A touch screen based device is chosen for further development because of its many advantages. Possibility to incorporate physical buttons.

PHYSICAL BUTTONS

There is seen possibilities in incorporating physical buttons to a touchscreen to achieve tactile feeling. These suction cups are tested to investigate the feeling.

ill.85a Suction cup buttons are tested

DJ'ING

Both Serato Remote and Traktor DJ use a simple dark grey background with distinctive colors for active functionality, making them stand out. Inactive functions are kept in grey nuances to allow them to be less disturbing.
Martin's state of the art M6 console uses a similar visual interface with a black background, inactive functions in grey and active functionality highlighted with distinctive colors.
Is addition to the M6, Martin have the Windows-based LightJockey controller that works via a DMX-to-USB interface box. This controller can be used on a regular computer screen used a mouse or using a touch screen. It can control up to 100 devices including smoke machines. This program is widely used in the DJ industry.

ill.85b Martin M6

ill.85c LightJockey

ill.85d Serato Interface

A touch screen can accommodate all necessary functions, while only having one actual weakness being the lack of tactile feedback. A touch screen offers major opportunities opposed to an interface with physical buttons with adaptability and the possibility of having both text and graphics for both functions, as well as device feedback. In addition, a touch screen based device can be used for every possible scenario through its adaptability. Because of this, a touch screen based device is chosen for further development.

When choosing to develop a touch screen based interface, the question on developing a new device or an app arises.
Because of the many disadvantages seen in developing an app for existing tablets as well the many possibilities seen in developing a new touch screen based device it is chosen to develop a touch screen based interface device with the possibility of being a genuine high quality Jem device with the possibility of being used for multiple Jem smoke devices.

APP

+

- Limited hardware development
- The possibility of having a low sales price to reach many users
- Easy to update via existing eco systems

–

- Must comply with existing operating system and limitations
- Martin cannot sell the full package including the interface itself as it will require a tablet
- Martin will not profit on the tablet sale
- High profit can require an expensive app

DEVICE

+

- Martin can profit on the device sale
- Control of hardware specification
- Only need to develop one app
- Can be branded as a high-end Jem product
- Potentially a cheaper device than an iPad
- Can potentially be used for other Jem products

–

- Hardware development
- A potentially high sales price can limit sales numbers

FIELD RESEARCH

Previously contacted DJ's and local DJ's are used for in-depth qualitative information and feedback on interface. The intention is to achieve an overview of the most important factors in relation to the use of smoke machines. It is chosen to focus on club DJ's at nightclubs, since these are the primary application for the Jem DUAL.

BO ANDERSEN – DJ SKOVGAARD

Bo is resident DJ at Benediktes Nightclub, Aalborg. He uses a Martin 2500 Hz hazer in the club which is sufficient to visualize the light beams. The control of the hazer is done by a LightJockey, which can set the hazer on "off", "20%" or "50%". Usually the hazer is set to 20% during the whole night which suits their need most times, but the ability to fine-adjust the output would be preferred. In his former place of work at Spirit Nightclub, he used fog machines which were operated with one large "Hold to fire" button beneath the DJ console. This hidden position of the controller led him to forget to fire the fog machines now and then because he prefers to spend his time mixing. Because of this he sees potential in making "smoke scenarios" where the DJ could program the smoke machines to fire every 5th minute for example. Bo finds it important that the controller is visible in front of the DJ along with the control devices for the music, while not taking up unnecessary space as the DJ console can be crowded.

QUOTES FROM DJ'S

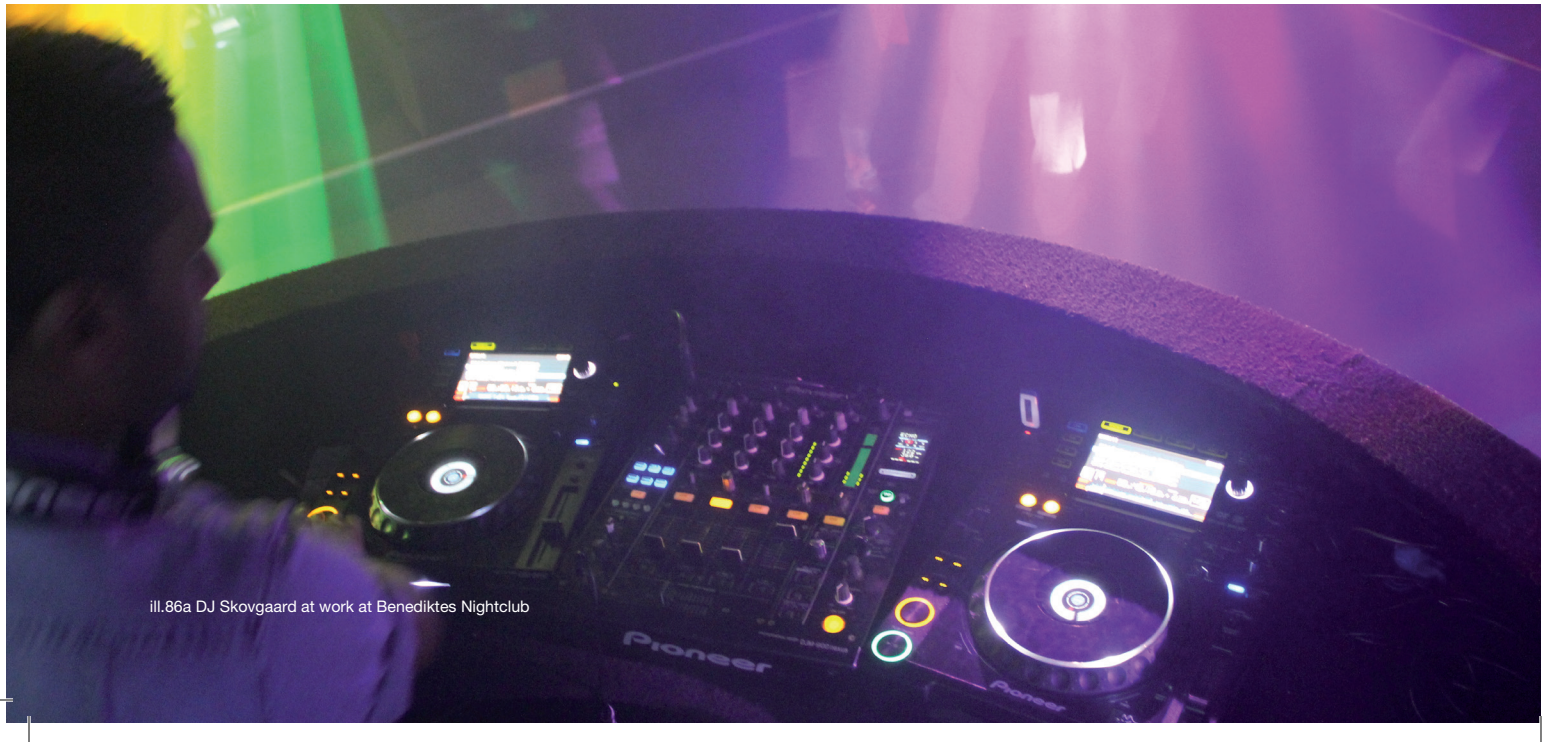
"I prefer physical buttons, but this may just be a matter of habit. I think easily I could grow accustomed to use a touch screen, as I use these often on my cellphone and tablet." - Kent Sigerstrøm, DJ.

"Most DJ's and light technicians are already accustomed to touch screens as almost all better DJ's in DK use LightJockey with a touch screen. I use Traktor for mixing, and the iPad app is great. In addition, it could provide the opportunity to further develop or customize the solution in the long term, rather than a fixed layout. The smoke is not operated as such, ideally it just works on its own for the most part. I clearly see the most potential in a touch-based interface."- Morten Greven, DJ

"For mobile DJ jobs I never connect the remote due to time schedule. For permanent installation, a touch based device, with an easy-to-use interface, would be preferred close to the mixer." -DJ Freedom.

Through a survey among DJ's the current tendency is that DJ's either use a LightJockey to control both light and smoke or use a separate smoke controller, which is positioned close to the mixer and cd-players to be easy to reach.
The ideal place to have the smoke controller is close to the mixer and cd-players or close to the LightJockey used for controlling the light fixtures.
Further insight in the survey can be found in the appendix T.

> !
> *Due to touch gaining acceptance in the DJ environment, and the intension of reaching for the future market, it is chosen not to incorporate physical buttons - going for a intuitive touch interface.*



ill.86a DJ Skovgaard at work at Benediktes Nightclub

THEORY ON INTERFACE

GENERAL GUIDELINES

User input should be as simple as possible, and the focus of the interface should be highlighted. The interface should only show the features that are active and relevant.
The interface should have a clear and simple structure with a single starting point which can be returned to when the user wish. [Buur, J. Windum, 2002] [Maguire, M., C, 1999][Buxton, B, 2007]

USERS

The interface can be operated by both primary users such as DJ's, and secondary users such as bartenders and busboys, and shall be usable for both groups of users. In relations it is distinguished between knowledge-based behavior and skill-based behavior, where experienced DJ's have developed a behavior similar to skill-based behavior due to their experience, where secondary users act on knowledge-based behavior.

OPERATIONAL RESPONSE

No tactile feedback means that the product must create the feedback itself. A visual, physical or auditory effect can reinforce that the digital button is pressed, and the intended action is carried out. The system feedback must be immediate, in order not be interpreted as an error.

Signals and cues
Physical signal is in relations to the operational response as physical buttons can be raised to represent something to be touched and pressed down, which it generally not possible with a touch screen, which makes it harder to operate without looking at the interface itself.

States and transitions
The devices possible states such as "On", "Off" "start-up" must be communicated clearly through the interface.

MMI LAYOUT

Operational sequence
The operational sequence must be logic and can be compared to reading order which most people are familiar with.

Frequency of use
The buttons must be positioned according to how often they are used. Often used buttons closest to the user.

Grid
Column grid is good for block areas which can be used to separate different functionalities for different products.

TEXT AND ICONS

Text
Text shall be presented as clearly and simple as possible, preferably in a sans serif font of at least 16 point.

Icons
Simple icons are preferably to complex images, and can be enhanced via short text labels beneath the symbols themselves. It should be sought to use icons and symbols that are clear to all. The contrast between text, graphics and the background should be high to communicate clearly.

TOUCH GESTURES

Common touch gestures can be categorized as:

Single touch
- Tap and Press/hold.
- Flick or swipe horizontally and wells as vertically.

Multi-touch
- Rotate using two or more fingers.
- Pinch to zoom using two or more fingers.

In order to be able to control more than one function at the time multi-point ability is necessary.

TOUCH TARGET

The sizes of touch targets must be of appropriate size. Sources suggest a button size of no less than 2.6 square cm. Furthermore it is of great importance that the touch areas are easily distinguishable from other graphics. [web 24] [web 25]

SUM UP ON INTERFACE RESEARCH

!

DEMANDS

- The system must be easy to operate, even for first time users
- Bi-directional feedback between user and product
- The interface must be unambiguous
- Adaptable to the types and amounts of heads connected
- Easy-to-read device response
- Must incorporate visible primary functions at all times
- Must show secondary functions when necessary
- The ability to program timer fuctionality for the attached fog machines
- A small device that can be positioned centrally on the DJ console

PRIMARY SCENARIO

- Applications where both haze and fog are used.
- Positioned as close to the mixer and cd-players as possible.

PRIMARY FUNCTIONALITY

Fog
- Hold to fire
- Output control

Haze
- Push to fire
- Output control

System
- On/off

SECONDARY FUNCTIONALITY

- Device feedback

Fog
- Ready signal
- Heat exchanger overheat

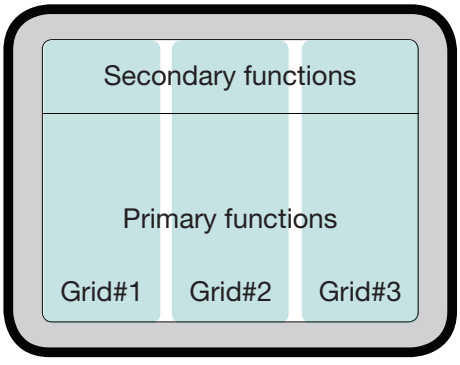
Haze
- Ready signal
- Fan failure
- Heat exchanger overheat

System
- Empty fluid tank
- On / Off

INTERFACE DEVELOPMENT

INTERFACE LAYOUT

The placement of the functionality on the interface relates to the frequency of use, why the primary functions must be placed close to the user for the easiest possible access, and the secondary functions in the top end of the screen to prevent non-intended operation.
The functions are divided in a column grid suitable for block areas used to control multiple functions. [Buur, J. Windum, 2002]



ill.89a Functionality mapping

DJ REFERENCES

In addition to touch devices, well-known DJ equipment is investigated to make the interface as familiar for DJ's as possible. The inspirations are DJ'ing products known in the industry.

ill.89b Denon DN-2500F

ill.89c Technics SL-1210

ill.89d Pioneer CDJ

The well known DJ equipment consists of a great deal of buttons. But common to all, the buttons lights up at either the whole button or around the edge, since its not preferable that the whole interface lights up in a dark club. For same reason the devices often have a dark color as well as providing contrast to the backlit buttons.

INTERFACE DETAILING

The top row contain all the rarely used functionality; "On/off" signal and the "Settings" button.

This row shows what type of devices are connected; circular for fog and rectangular for haze.

This row contains "Timer" and "Fill room" functions. They can be turned on and off with a simple press on the icon. When off the icon fades to grey.

This row shows the output adjustment faders. One for each pair of attached smoke heads. They are large to make fine adjustment easy and the cyan bar shows the selected output at all times.

The bottom row contains the fire buttons. These are illuminated with surrounding light to make them visible at all times. They turn to solid cyan when pressed to provide the visual feedback, that they are pressed.

ill.89e Concept funtionality mapping

PRIMARY FUNCTIONS

MAIN SCREEN

The main screen controls all primary functionality, and the top left corner signals if the system is ready to go. When the heads are heating the symbols for each device are grey.

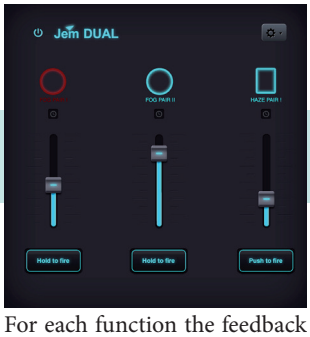
When the heads are ready, the symbols light up cyan. The output faders regulates the output and are visible at all times so the user know how high the output is for each pair of heads.

The large buttons acts as control for each pair of devices. The fog functionality use “hold to fire” buttons and the haze functionality use a “push to fire” button. When interacting with the buttons, they turn cyan.

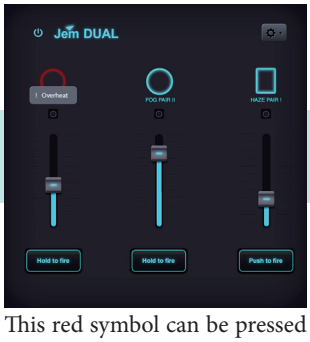
FEEDBACK (SECONDARY FUNCTIONS)

FEEDBACK

On the main screen the “on” signal changes to a red drop if the base unit runs out of fluid.



For each function the feedback are shown on the main screen where the symbol for each device turns red.



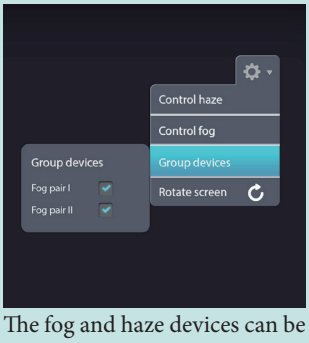
This red symbol can be pressed to read the precise malfunction. This being “Overheat” or “fluid failure” for both fog and haze with the addition of “Fan failure” on the haze functionality.

SECONDARY FUNCTIONS

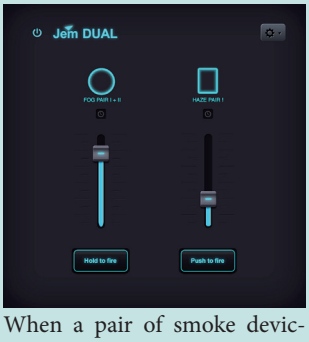
SETTINGS

In the top right corner is the settings button which contains all secondary functionality, except feedback.

GROUP DEVICES

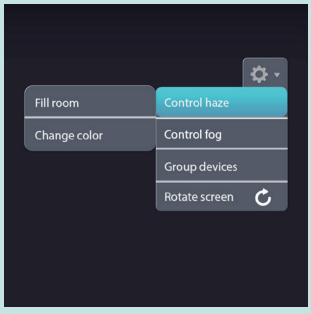


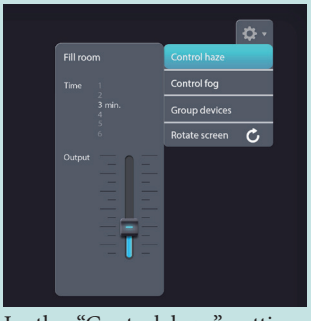
The fog and haze devices can be grouped so the user can control multiple pairs of fog and haze with one "hold/push to fire" button. The timer functionality can be applied to a group of fog machines as well.



When a pair of smoke devices is grouped, the main screen changes.

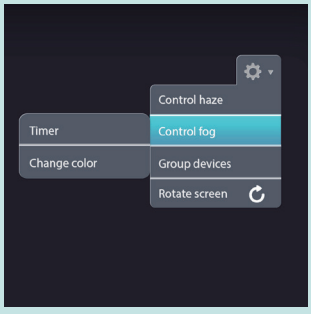
CONTROL HAZE

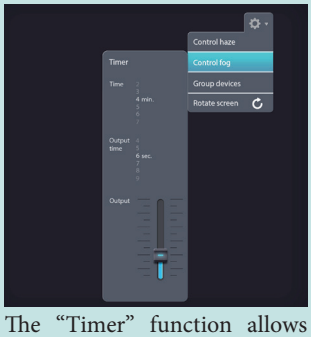




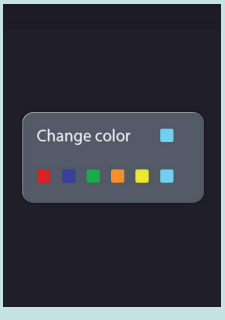
In the "Control haze" settings there are a "Fill room" functionality, that allows the user to select an output for a time period in order to fill the room with haze.

CONTROL FOG



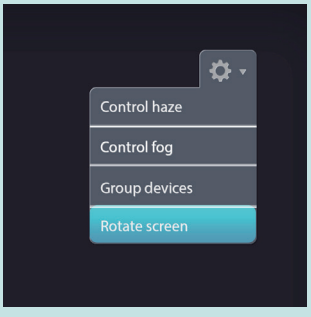


The "Timer" function allows the user to set burst duration and frequency for the fog machines so these can be run without intervention.



For each pair of heads the user have the option to choose a custom color. This can be used to enhance the difference from haze and fog and add a personal touch to the interface.

TURN



The device is designed with all connections on one side. The "Turn screen" function allows the user to position the device both horizontally and vertically and simple turn the screen to fit.

ill.91a Primary and secondary functions at UI concept

INTERFACE CONCEPT

ill.92a Interface remote concept

HARDWARE CASING

The interface casing draws inspiration from the Jem DUAL system with its rounded corners and the coherence between the metal Jem logos and the painted metal casing. This expression translates into a casing with a black top containing a 150 x 150 mm touch screen. The bottom of the hardware is grey rubbery plastic to prevent the device from moving on the DJ console. All connections are on one side and the device can be operated with the connections pointed either way as the screen is square and can be turned in 90° steps. This way the device can be positioned horizontally on top of the mixer with the connections turning upwards, and be positioned vertically next to a cd-player with the connections turned away.

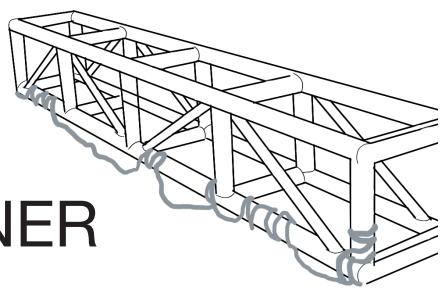
SCALABILITY

One of the main features of the touch screen is the ability to show everything in adjustable bitmaps instead of a fixed physical layout. This allows this Jem DUAL controller to be used for other applications with new software. The intention is that the device can become the new generic Jem controller and replace the current top-of-the-line controller which is not intuitive for all applications. With a high degree of scalability it is possible to position this new generic Jem controller as a stand-alone product and not as an accessory. Via the market standard DMX with RDM protocol it is able to control every Jem smoke product. The touch screen allows new software which can create endless possibilities for control of Jem smoke devices.

CONCEPTUAL LEVEL

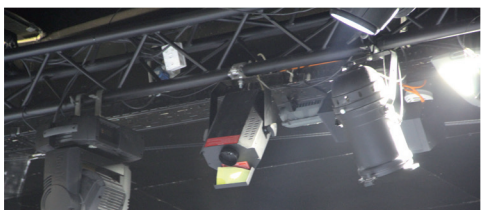
As illustrated in the prioritisation section in the start of the process report, it is chosen to keep the interface at a conceptual level.
Both the hardware and software need further development to be ready for prototyping. The casing need to be ready to install PCB's among other things, and the software need both development, coding and testing.
The next step would be prototyping and field testing, to figure out if the interface actually is intuitive and it covers the need for controlling the Jem DUAL smoke system.

For further inside in the business model of the interface see appendix V.



FLUID LINE AND CABLE FASTENER

An identified issue at Train Nightclub is the experienced issues with tangled wires, which will also apply to any fluid lines running along the truss. This is an issue the technician experience every time he needs to reorganize the light- and smoke devices. Furthermore it looks messy and it is hard to figure out which cables are connected to what device.
This is an area where there is potential in creating an accessory for the Jem DUAL as well as a stand-alone accessory to be sold by Martin for any product.


ill.93a Cable mess in truss


ill.93b Cable mess in truss

CONTEXT

TRUSS DIAMETER

The truss standard diameter used in the industry is 50 mm, why this is the basis to develop for. There are seen examples of trusses using 35 mm diameter tubing, but these are less common, and are discarded in the development process.

CABLE DIAMETERS

The cable measurements are found by investigating products at hand and competing products. Each Jem DUAL head have one fluid line and two cables; mains cable and RJ45 control cable.

Mains cable
<Ø10 mm
Cat 5 RJ45 control cable
Ø4.8 - Ø5.1 mm
Fluid line
Ø6 mm

It is the intention to make a cable fastener that can contain the cables from a pair of smoke heads - therefore 6 cables.

!

A cable fastener inspired by the cable clip ring used to manage the cables on a bicycle frame.
It has to be able to contain up to 6 cables. The biggest one with a diameter of 10mm.

INSPIRATION

Bicycles experience similar issues with cable routing, why this is an area of inspiration. There are multiple products which solves a similar issue of fixating the cables to the bicycle frame.

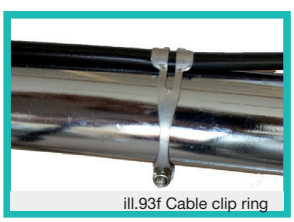

ill.93c On-frame routing

The on-frame routing is opted out because it is incorporated in the frame itself.


ill.93d Cable container

The cable container requires modification to the frame in terms of screw holes why this is also deselected.

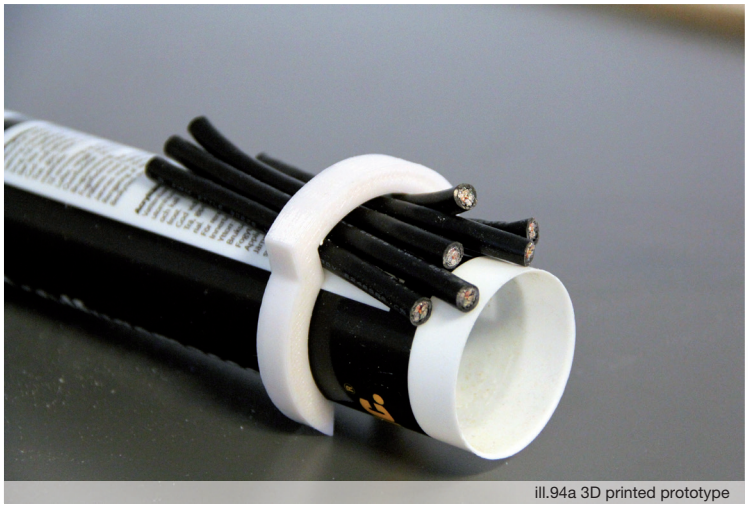

ill.93e Strip cable guide


ill.93f Cable clip ring

Both the cable guide as well as the cable clip ring is able to grab the frame without any modification, but the spring steel cable clip ring is less fragile than the cable guide, and this is chosen as the main inspiration for a fluid line and cable fastener.

IDEATION

A 3D printed version of the inside of the cable clip is made to verify the dimensioning. The retainer is made to accommodate cables up to Ø10 and can hold 6 cables of this size, while holding more cables or fluid lines of smaller diameter. This can accommodate one pair of Jem DUAL heads and this size of retainer is kept.

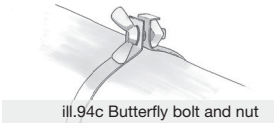


ill.94a 3D printed prototype

The principle of the cable clip ring is continued, and is the focus for the development. The idea of having a cable clip fastener is explored. This will make a product that can be secured in the truss without the risk of falling down.

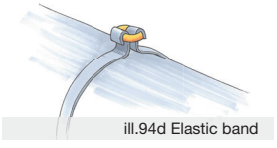
ill.94b Bolt and nut

Fastening the cable clip using a nut and bolt requires tools and takes time to mount, why this concept is deselected. The butterfly bolt deals with the issue of required tools, but still takes time to mount. Furthermore, these two first concepts require multiple parts which can be lost when they are not mounted.



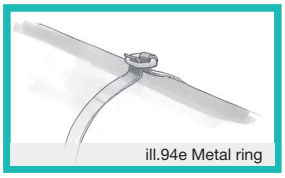
ill.94c Butterfly bolt and nut

The two latter concepts are based on the same principle of using the flexibility of spring steel to tighten the cable clip around the truss. Both concepts can be mounted without the use of tools, but the rubber band can prove vulnerable due to the rubber band breaking if exposed to excess stretching.



ill.94d Elastic band

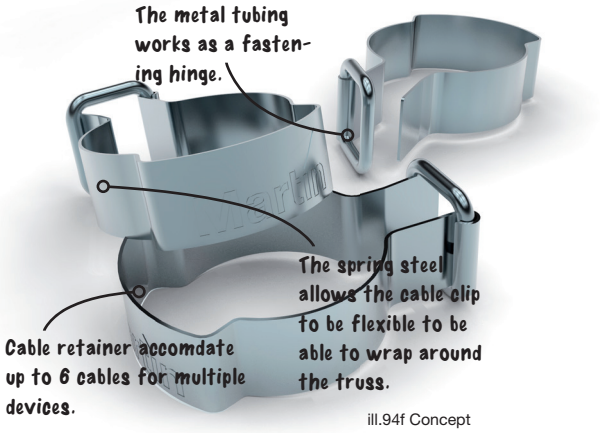
The metal tube is sturdy while offering the same advantages as the rubber band, why this is chosen for further development.



ill.94e Metal ring

CONCEPT DEVELOPMENT

A concept of the cable clip that can accommodate the cables of two Jem DUAL smoke heads is developed. The intension is to have a strong visual expression by using spring steel. A metal ring fasten the clip at the truss and remedy it from falling down.



ill.94f Concept

CONCEPT EVALUATION

When looking for ways to produce a feasible prototype of the concept of spring carbon steel it proved both difficult and expensive as the carbon spring steel need to be rolled in order to keep the shape and being flexible with high yield strength. Furthermore, the product needs to be heat treated in order to remove tension within the material. This heat treatment will alter the shape of the product, why several prototypes must be made in order to accurately produce the right shape. Finally, the product need to be surface treating in order to prevent it from oxidizing [appendix W].

Furthermore, through testing, it is evident that it is not possible to remove one or more cables without dismounting the clip, which is preferable.

!

There is a need for an easy and available production method for the cable clip, in order to ease production and prototyping.

CONCEPT DEVELOPMENT

As the earlier solution proved difficult to remove cables without taking down the whole cable clip and a suboptimal production, a plastic solution is investigated. The starting point is an existing pipe clamp bought for less than 2 €.

ill.95a Pipe clamp as inspiration

By testing this polypropylene pipe clamp the gripping force of the clamp proved very strong – actually eliminating the need for securing the cable clip.

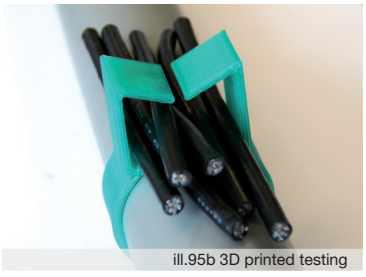
!

There are set up some parameters for the cable clip to follow.

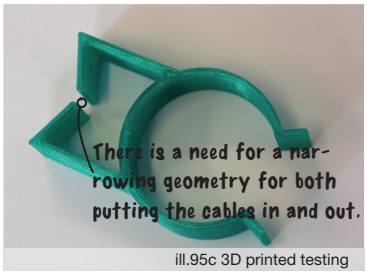
- *Sufficient gripping force without securing the cable clip*
- *The possibility of removing one or more cables without dismounting the cable clip*
- *One-hand mounting*

CABLE RETAINERS

An initial concept using the "M" for Martin is 3D printed. Through testing with cables it is discovered that, while the cables are easy to put in the cable clip they can prove difficult to take out due to the shape of the retainer.

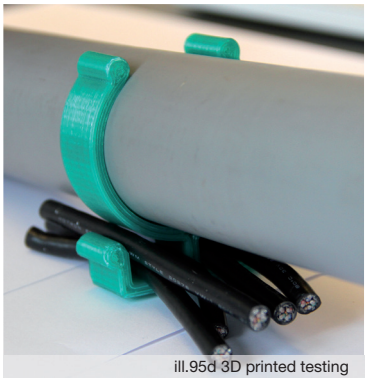


ill.95b 3D printed testing



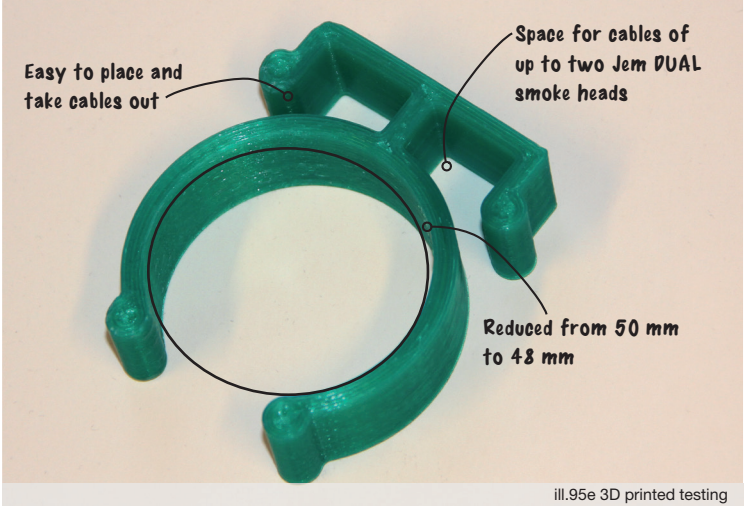
ill.95c 3D printed testing

A new concept is modeled and 3D printed for testing. This new prototype incorporated narrowing geometries for the insertion and removal of cables and fluid lines. The flexibility of the plastic material allows cables and fluid lines of various sizes to remain inside the retainer while still being easy to remove.
This prototype offers insufficient gripping force because it does not grip the truss hard enough.



ill.95d 3D printed testing

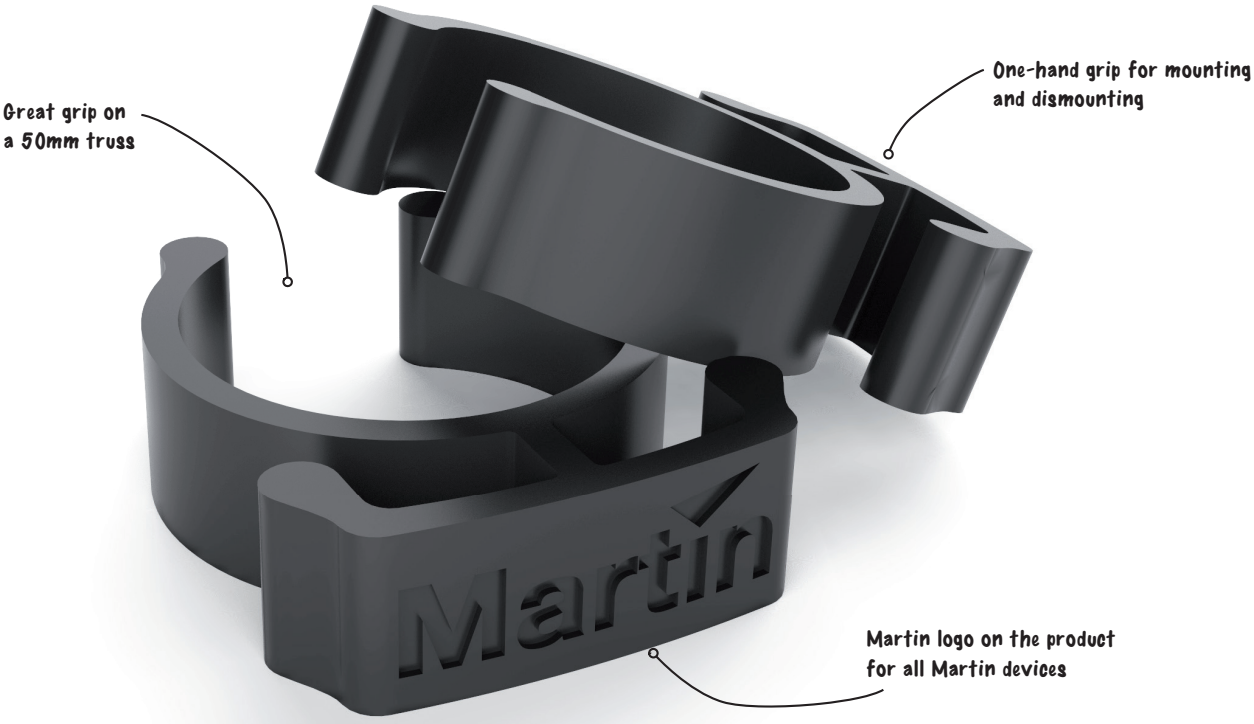
A new 3D printed prototype is made where the inner diameter is reduced from 50 mm to 48 mm to allow the cable clip to grip harder on the truss. This proved to offer great gripping force which makes the cable clip stay in place.



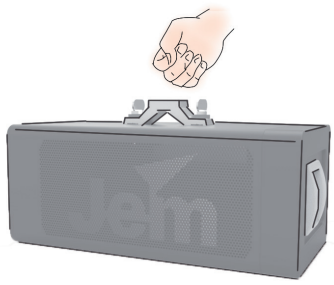
ill.95e 3D printed testing

When putting the cable clip on the truss, the geometry does not feel comfortable on the fingers due to the geometrical shape. This is improved by introducing larger curves on the interaction surfaces.
The cable clip is made by injection molded PP, and gives the user a convenient solution to administrate the cable mess in the trusses. It is easy to operate with one hand, and each cable can be placed and removed independently from the cable clip.
The cable clip is seen as a separate sale component for all Martin products. By selling the cable clip as a part of the Jem DUAL system, the user gets the complete system according to the wiring of the system.
Martin can have a great profit of a product like the cable clip. It is estimated that it can be manufactured in China for approximate 0.1 € and be sold for approximate 2-3 € [appendix X].

ill.96a Clip improvement



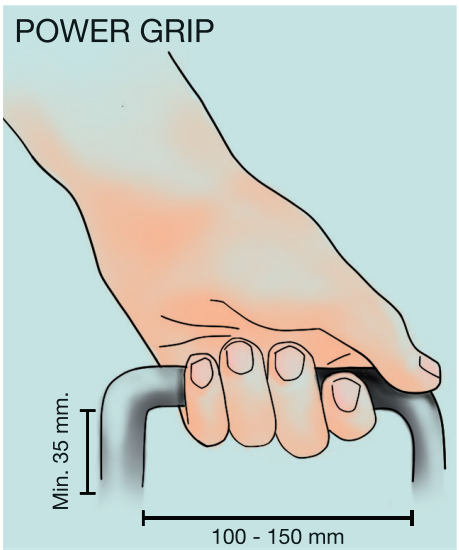
ill.96b Cable clip concept



CARRYING HANDLE

The design of a carrying handle for the Jem DUAL, as well as other quarter turn bracket devices, will be kept on a conceptual level due to the time line of the project, where the main priority is to deliver the Jem DUAL smoke system as production-ready as possible.

Through literature, as well as testing, it is learned that the appropriate power grip handle diameter is around Ø30 for the best forearm muscle yield and there is a need for a 35 x 100 mm clearance inside the handle to accommodate an easy grip.
The handle should have a thickened central area on the gripping surface to prevent the hand from slipping when carrying. The surface of the gripping area must be smooth with no high spots to provide a large area of contact to provide a good grip and prevent the hand from slipping. [Patkin, M., 2001] [Tilley, A., 2002]



ill.97a Theory on power grip

VISUAL IDENTITY

There are seen three interesting visual approaches for designing a carrying handle. Before choosing which way to go, it is necessary to figure out the opportunities and limitations in each.

#1 JEM DUAL IDENTITY

- A design that is in line with the new Jem DUAL incorporating the rounded corners and the same color scheme; black and unworked metal.

This approach provides the benefits of matching the visual expression of the Jem DUAL to act as an extension of the product.

#2 MARTIN/JEM IDENTITY

- A strong visual identity that is able to brand Martin and Jem using the already well-known triangular logo.

This approach brands the handle as a Martin product visually with the bold expression.

#3 OMEGA BRACKET IDENTITY

- A visual identity that is in line with Martins quarter turn Omega bracket which makes for a generic product that fits every product that uses the Omega bracket – an add-on for the Omega bracket.

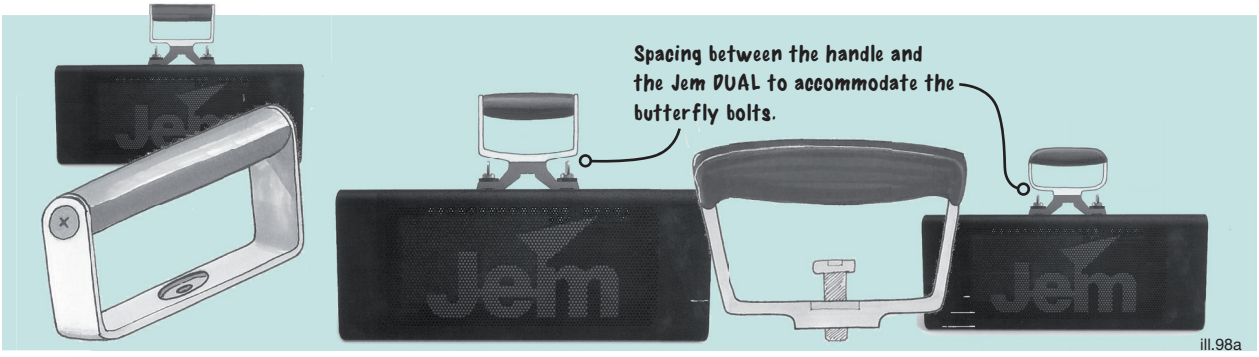
This approach have the opportunity to act as a more generic product to use for a range of Martin and Jem products that incorporate the Omega bracket.

On the following page an ideation for each of the three approaches is visualized.

IDEATION

#1 JEM DUAL IDENTITY

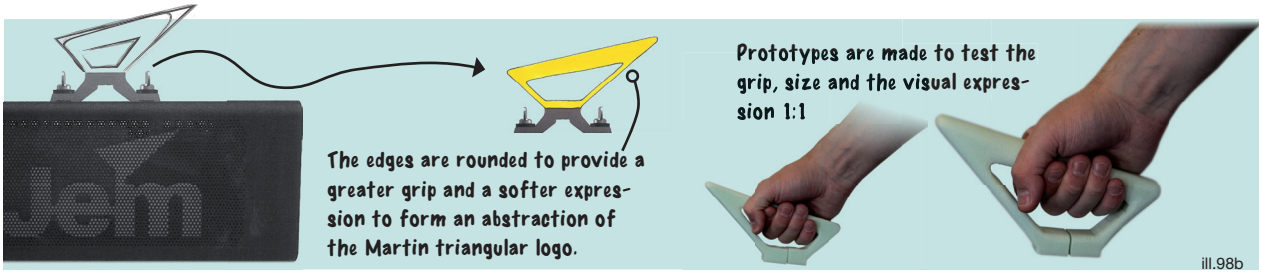
It is sought to create a tight visual expression that is in line with the expression of the Jem DUAL. The result is a handle that looks like every other handle on the market. Furthermore it looks protruding on the Jem DUAL, which looks out of place compared to the horizontally elongated product.



ill.98a

#2 MARTIN/JEM IDENTITY

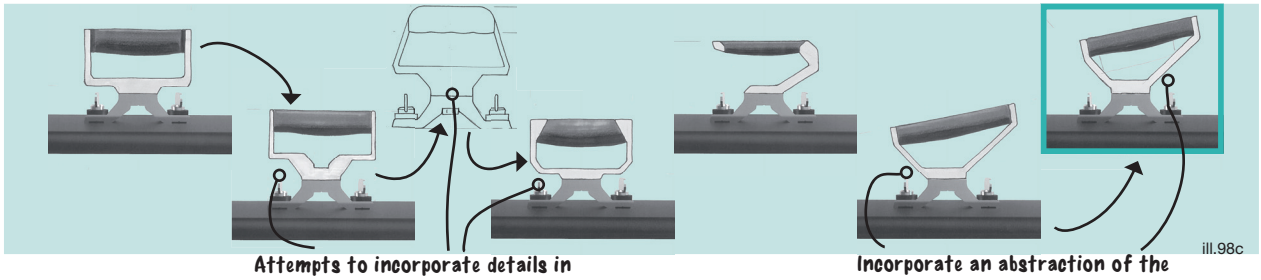
In order to prove a bolder visual expression that shouts out the brand of Martin and Jem from a far, it is tried to turn the yellow triangular shape from Martins logo into a handle. The edges are rounded to provide a greater grip and a softer expression to form an abstraction of the Martin triangular logo.



ill.98b

#3 OMEGA BRACKET IDENTITY

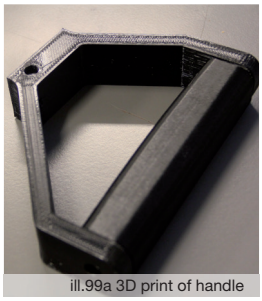
The idea is to design a visual expression that is in line with the Martin Omega bracket to have a generic product that can acts as an extension of the Omega bracket. This makes the products versatile as it fits with the Omega bracket that can be used with a wide array of products.



ill.98c

CONCEPT DEVELOPMENT

To design a new and versatile handle, it is chosen to go for the Omega bracket identity. This can be able to open up for an additional sale for all products using the Omega bracket. Additional, during the ideation, it is made clear that it is difficult to make an optimal solution when going for an expression to fit the Jem DUAL. Therefore the handle will be giving the Omega bracket expression, and not be limited to the visual expression of the Jem DUAL.



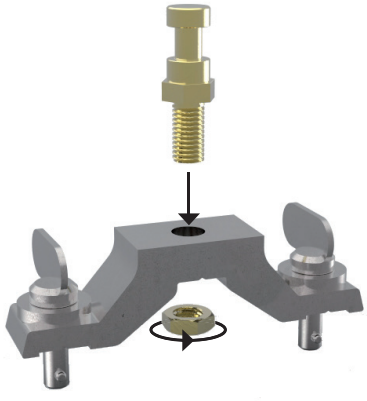
ill.99a 3D print of handle

OMEGA BRACKET CONNECTION

Two possibilities are spotted when designing the connection between the handle and the Omega bracket;

According to the freedom and ease of use and position, the quick coupler spigot is chosen. The only downside is multiple parts. But the scenario is seen as the user attach the handle before placing the Omega bracket to the product.

ill.99b



ill.99c

QUARTER TURN CONNECTOR

+

Easy to attach
No loose parts

-

Need for modifications to the Omega bracket
No protection against twist
The handle can only be positioned one way

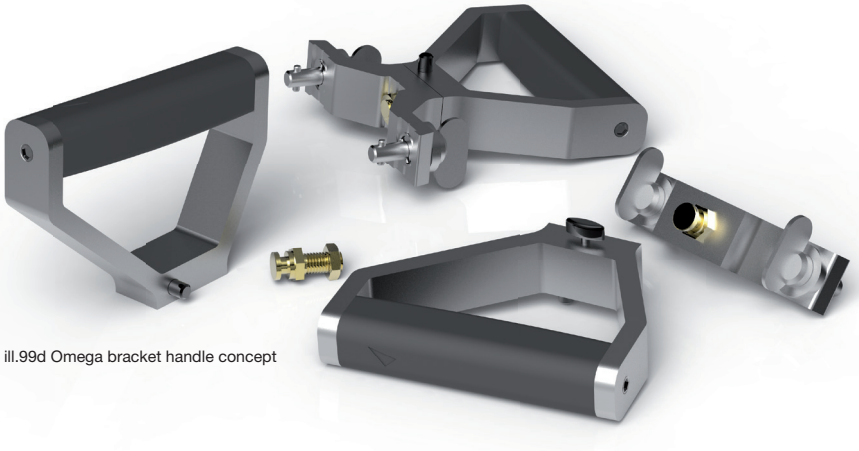
QUICK COUPLER SPIGOT

+

Easy to attach
Easy to secure against twist
Can be securely positioned at any angle
Need no modification to the Omega bracket

-

Multiple parts



ill.99d Omega bracket handle concept

CONCEPTUAL LEVEL

The handle is kept on a conceptual level. Before any kind of prototyping would be realistic, there are many considerations to do. Both referring to the ergonomics of the handle, the production and the spigot connector.
The intention is to make the handle of extruded aluminum, with a soft rubber grip.

SUM UP ON THE COMPLETE SYSTEM

!

During the user research and development process there have been identified additional problems in relation to the use of smoke machines. All accessories are kept on a conceptual level, due to the time and resources of the project period. The main focus have been the Jem DUAL.

INTERFACE

Jem DUAL have more purposes, and therefore there is a need for controlling each purpose. Research have shown that a controller for smoke have to be easy to operate since the DJ's often spend most of their time mixing music.
An intuitive touch remote have been developed with an interface where the primary functions such as firing and output adjustment is available and simple to operate. By using a touch screen interface, it is possible to integrate secondary functions, where the user can set up some pre-installed functions. Since having more scenarios with both haze and fog heads, the interface is able to adapt to each of these scenarios.

The interface is seen as a generic product, that can be used for all future Jem products. In that way Martin can be first movers according to an intuitive remote.

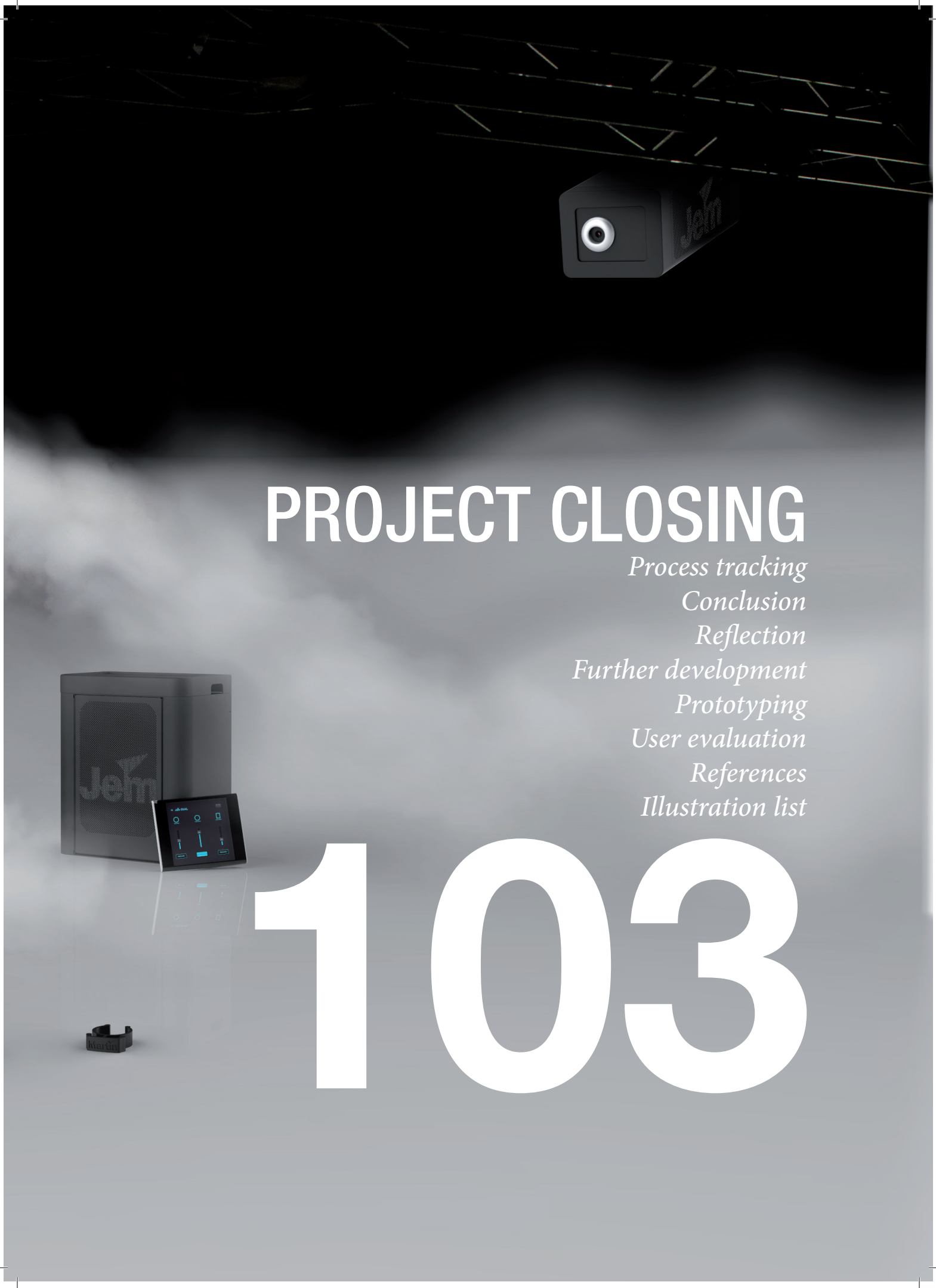
CABLE FASTENER

To manage the cable mess in the truss when installing several products, a cable clip is made. The cable clip is easy to operate with one hand, and can contain cables from two Jem DUAL smoke heads. The cable clip can provide great profit for Martin Professional, by marketing it to all products as it suits most cables on the market.

OMEGA HANDLE

The Jem DUAL is able to be connected to the Martin Omega bracket. The Omega bracket handle solves the issue by lifting and moving the smoke head when used on the floor. The handle is made as a generic product for the specific Omega bracket, and use a visual abstraction of the Martin triangular logo to make it recognizable.


Jem
Jem
Jem



PROJECT CLOSING

Process tracking
Conclusion
Reflection
Further development
Prototyping
User evaluation
References
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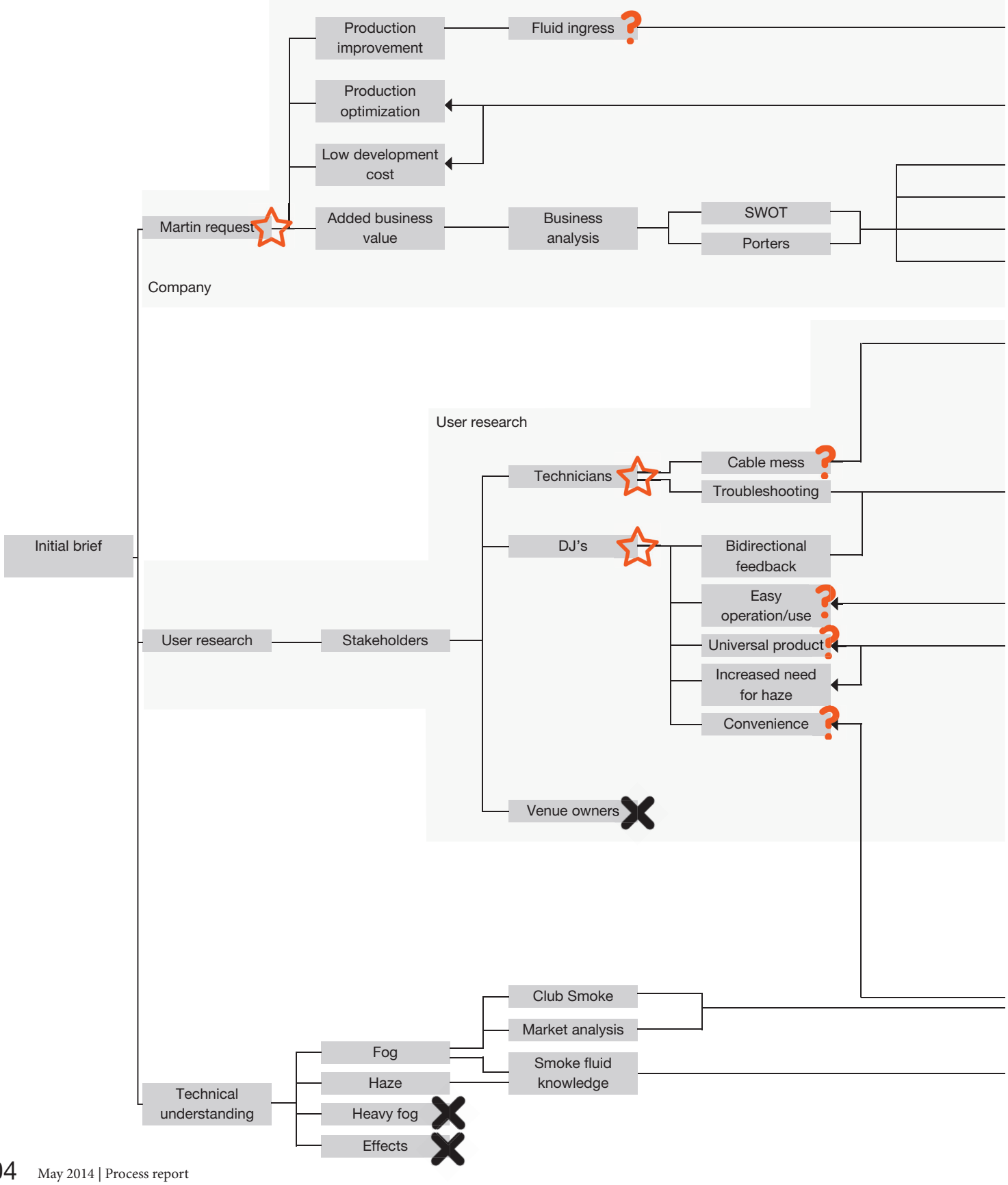
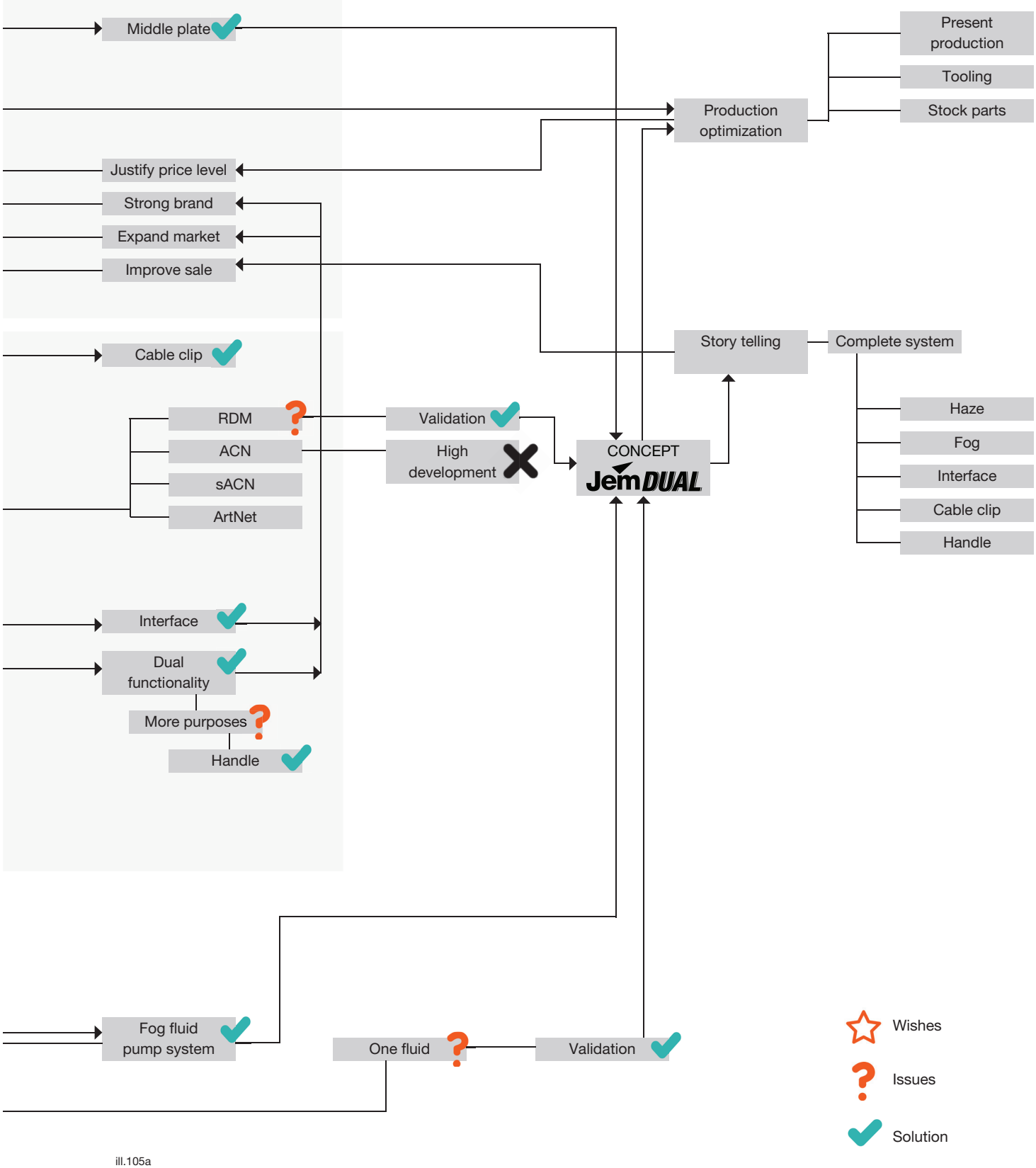
PROCESS TRACKING




Middle plate
Present production
Tooling
Stock parts
Production optimization
Justify price level
Strong brand
Expand market
Improve sale
Cable clip
Story telling
Complete system
RDM
Validation
ACN
High development
CONCEPT
JemDUAL
sACN
ArtNet
Haze
Fog
Interface
Cable clip
Handle
Interface
Dual functionality
More purposes
Handle
Fog fluid pump system
One fluid
Validation
Wishes
Issues
Solution

ill.105a

CONCLUSION

The set up wishes is difficult to evaluate upon, since these are marketing and user values. But due to the production optimization and added features, the hope is that these, along the way, are fulfilled.
The following is an evaluation of the stated demands that have been set up during the process of Jem DUAL. These have been evaluated on what have been achieved and changed by the redesign.

- ✓ REPLACE CLUB SMOKE
- ✓ DELIMITED TO SMOKE
- ✓ PERMANENT INSTALLATION
- ✓ CLUB USE
- ✓ COMPLETE SYSTEM
- ✓ CONVENIENT REFILLING
- ✓ NO WIRELESS
- ✓ BI-DIRECTIONAL FEEDBACK
- ✓ SOLVE PROBLEMS
- ✓ INCREASED LIFTING HIGH
- ✓ EASY CONTROL
- ✓ DEMANDS ON FLUID

It is evaluated that the Jem DUAL system fulfill all the demands.

The outcome of the collaboration with Martin Professional is the Jem DUAL system - an updated version of the current Club Smoke system, based on existing technologies. The redesign is based on ongoing studies where optimization points are observed through interviews, observations, experiments and tests. During the process, there have been two essential focus areas to make certain reservations about; a user-based approach, where user observations and analysis have provided a strong insight into the use and need for smoke machines, and a production approach, where ongoing dialogue with Martin Professional and MMUK has made the company's requirements clear. Therefore, Jem DUAL is a system that provides value to the user through convenient use and provides worthy for Martin Professional through a production-optimized design.

USER VALUE

There has been a huge focus on understanding the users, to be able to develop a product that is beneficial for the end-user. The primary user is DJ's at medium to large clubs that have the need for both haze and fog.
The users sees an increased need for the use of haze, since it is an on-going effect to make the light visible mid-air, while fog is used few times during a night. Observations show that the user need and appreciate a convenient system that can deliver both types of smoke. By developing a new smoke fluid, it has been possible to design a system with both haze- and fog functionality, in one convenient system. The smoke fluid deliver a white, fast-dissipating fog, and a homogeneous long-lasting haze.
When having a split system with a base unit and smoke heads, the user gets a convenient refilling scenario, and since the system consists of haze and fog, the user only has to refill one system with one type of fluid – this gives the complete system for the club.

PRODUCTION

Jem DUAL is sold in a niche market, and it is therefore beneficial to a make a production-optimized product. By using stock parts from the current Magnum 1800 and 2500 Hz machines, and use current production methods and materials, the Jem DUAL can be incorporated in the current production at MMUK with a minimum of effort.
According to the aesthetics at Jem DUAL, form follows function with great ventilation and no organic shapes due to production. Furthermore the product is very compact, especially for haze machines which optimizes production costs as well as taking up less space in a truss. The product has to blend into the environment at a club, and is therefore painted black like all other Martin products.

MARKETING

In order to help the Martin Sales team sell the product there has been focus on improving the storytelling of Jem DUAL with the dual functionality and the convenient refilling scenario being the key sale points. Furthermore, the custom-formulated Jem DUAL fluid can be well priced with a good margin to ensure Martin a future revenue.
The intuitive interface can open up for additional sale for Martin Professional due to being first movers. As well can the cable clip and the carrying handle, since this will complete the whole system and the storytelling for the users.

DESIGN PROCESS

Working on different conceptual levels is used in this project. Designing for production have required a great level of detailing, and therefore the Jem DUAL consist of a great deal of technical information, to make it all come together.
Besides the development of a redesigned smoke system with added features, there have, during user research, been observed some additional needs. Therefore there have been made both a cable clip, to organize cables in the truss, a handle for carrying the Jem DUAL if used at the floor, and an intuitive interface for controlling the new system in an easy way.

REFLECTION

COMPANY COLLABORATION

The main priority of the project was to engage in a company collaboration and work from a design brief from Martin Professional, to produce a product that is able to get on the market within a reasonable time-frame. The initial assignment from Martin was a very open redesign on an existing product, with the wish for a user-based approach. Through Martins engagement in the assignment it has been possible to gain multiple insights on the assignment, from the production in UK to a more marketing point of view from Smoke CEO Henrik Sørensen, which has helped in the development of a product that is designed with both production optimization and overall marketing in mind. It has been hard to reach the Martin sales team to gain info on their struggle when selling smoke products. This information could have provided a greater insight into what key selling point and storytelling can lead to increased sales. Yet it feels like the functionality of the Jem DUAL provides great selling points for the Martin sales team.

PRODUCTION

One main focus have been on designing a product that is beneficial for Martin Manufacturing UK in terms of production, which have been achieved through using many stock parts. When detailing the product thoroughly there are still some questions to be answered from the prototype in development such as chassis material thickness, which indicates the possibility of decreased the sheet metal. It is a balance between productions cost, product weight and the feeling of quality that a thicker sheet metal offers. The plastic front piece is new to Jem who usually use sheet metal for the front of their smoke machines. This will potentially lead to increased start-up costs with the potential of beneficial production if the Jem DUAL achieves high sales numbers or the front piece is used in other Jem products. The assembly time is an area which is to be tested, validated and potentially optimized at Martin Manufacturing. The first prototype will provide the first indication on the assembly time
It would have been beneficial to go to MMUK a second time, to validate the product on a manufacturing level, to figure out where the product could have been optimized even more according to production.

USER RESEARCH

With user-based research being the main factor in the development of the Jem DUAL and accessories, questions about quantitative vs. qualitative feedback arises. The focus have been on incorporating both, but focus on qualitative information to gain deep insight from the users perspective and use the more qualitative feedback as support. This has worked well, and all involved parties have been open and interested in the project and supported the concept when they were introduced to it. It would have been beneficial for the project to be in touch with more DJ's working in nightclubs using both fog and haze, as this is the primary application for Jem DUAL. Although it is the impression that most DJ's have quite similar opinions on use of smoke why the discovered needs seems accurate.

TIME CONSUMPTION

With the time frame in mind, the focus have been on detailing the most advanced part of the product; the haze head, and leave the remaining parts of Jem DUAL on a more overall level as this will require a lot of time spent in relation to the potential gained knowledge. Furthermore, a part of the time have been spend on designing accessories for the Jem DUAL to support the storytelling of the product. This have led to multiple products with varying degree of detailing, illustrating the diversity of competences.

PRODUCT

Early in the process the new technology ACN was discovered and showed future potential. It was necessary to exclude this from the final product though, because of increased development costs. It is still the thoughts that ACN can become the future standard, with the ability of incorporating it into the Jem DUAL in the future with few hardware changes.

With the few competitors in mind, it is seen as an opportunity to expand the system to control even more attached smoke heads to target a larger market share, with the risk of taking market share from the Jem Hydra in mind. The aesthetics have been a focus in the design process where the elimination of visible screws have helped to achieve a clean and simple expression that contrasts the competitors. The project group hope that this can be carried on in future Jem products to help Jem stand out from the competition.

MARKETING

The final product is intended to be positioned in the Jem product range because it is a genuine UK-made product with high quality and performance. The initial proposal was to position the product as a Rush product in order to use the great sales numbers of Rush lighting fixtures help push the sales of the Jem DUAL (potentially Rush DUAL) for club use. This makes sense, but the opinion is that it is a shame to position a high quality UK-made product in the same range as a series of OEM lighting products made in China. Furthermore, it is the intention that the Jem brand can help push the sales of the new Jem DUAL Remote Control because potential buyers perceive the system as a high quality, long-lasting product for which they are willing to spend money on accessories.

MARKET POSITION

The Jem DUAL fulfils the same market position as the current Martin Club Smoke and furthermore expands the market through the possibility of haze and attaching up to six heads to one base unit. Due to the price difference of the Jem DUAL and the Jem Hydra, this should have no impact on the Hydra sales, but the future will provide an accurate answer. It should be quite an easy job for Martin Manufacturing to convert the Jem DUAL to be able to handle more attached heads, with the risk of affecting Hydra sales. The new dual functionality that is found in the Jem DUAL has the possibility to be used in other products, such as Jem Hydra to increase sales. In addition, it is the possibility that Jem DUAL will affect the sales of the Martin 2500 Hz and the Magnum 1800 and similar products negatively, as these are used in permanent installations. The Jem DUAL have the same output but is more convenient for many permanent installations. This will not affect the total profit for Martin though, as the total sale will move from these products to Jem DUAL with similar mark-up.

FEM

Late in the process, FEM analysis have been carried out. These revealed a very durable product according to the chosen sheet metal. If the FEM analyses have been incorporated earlier as an integrated part of the product development, it could have proved insight on the strengths of different thicknesses of sheet metal.

FURTHER DEVELOPMENT

When developing new products, Martin Professional follow a development cycle. This includes all steps from the initial business case to the full production. Given that the intention is to put Jem DUAL at the market, it is chosen to follow this cycle, to gain a knowledge of which steps is worked out during this project, and which steps is needed for further development, to obtain a product that is ready for market launch.

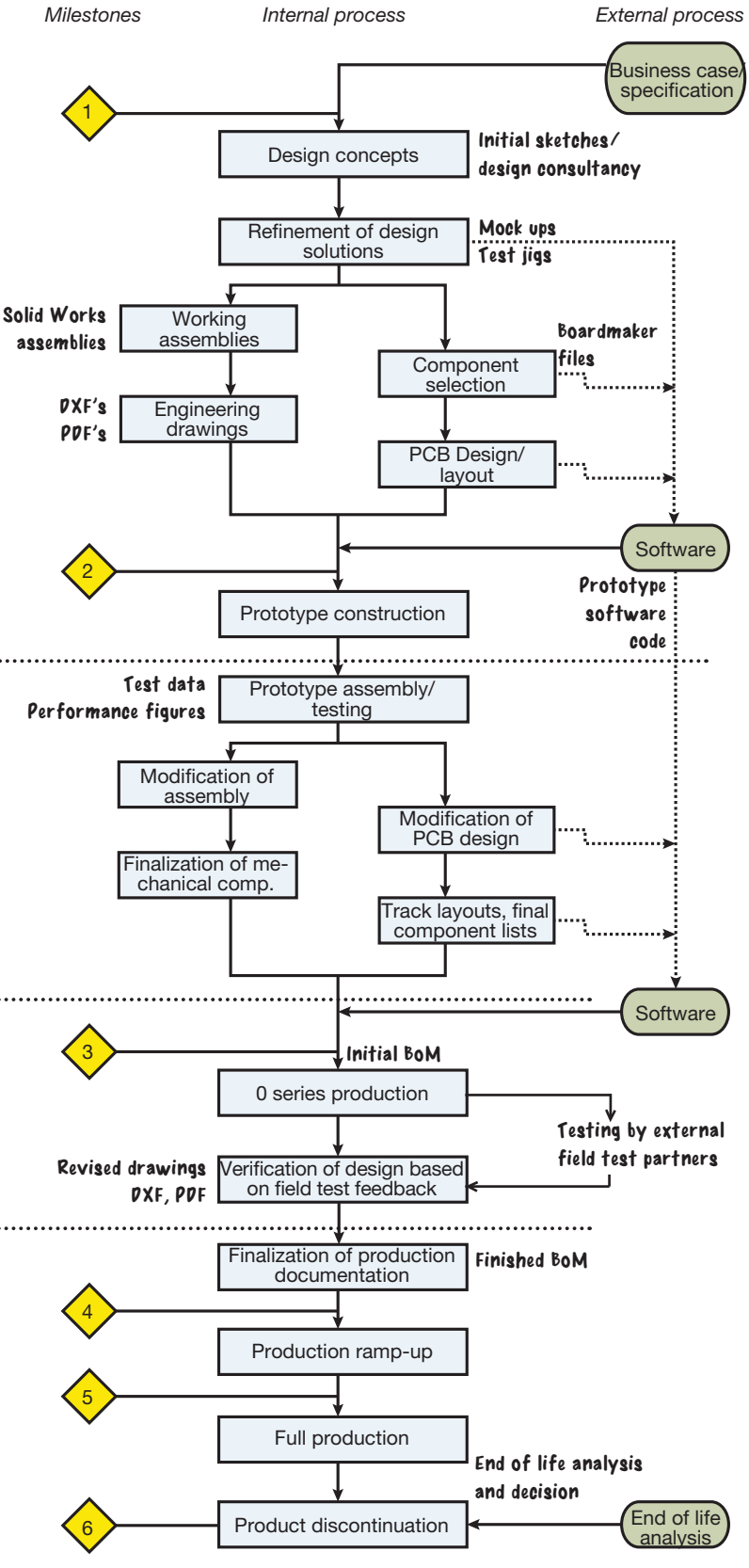
Jem DUAL

When finishing this project, the Jem DUAL has gone through a great deal of research and development down to the first prototype that is in the making.
Some of the software PCB's need some modifications, but most of the boards are already used boards, and are therefore ready to use.

The next step will be field testing of at least 5 systems. When getting the test results the product will go through a modification process according to troubleshooting.
The software will on the way be updated according to field tests.

When the product have been through modification due to the field test, it is going through another field test by external partners.

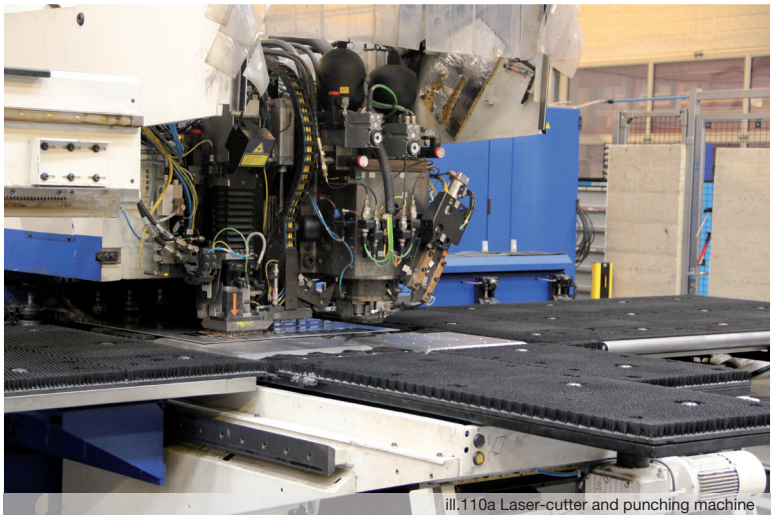
With no troubleshooting left, the cycle goes to the final milestones, where the BoM and Transfer of purchase data is finished. This includes work instructions, spare parts list and test instructions.
The product is now fully implemented into the production facilities. After the product is discontinued and production stopped the project reaches "end of life". Service support will be the only ongoing area.



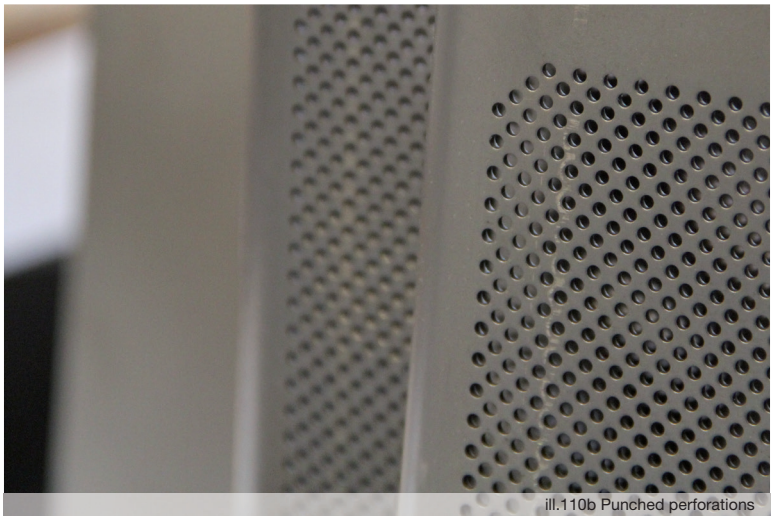
ill.109a Martin Manufacturing development cycle

PROTOTYPING

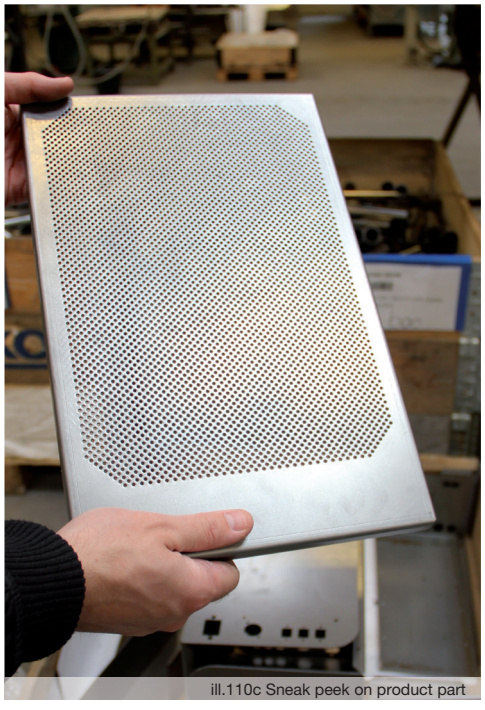
The first prototype of Jem DUAL is in the making. The intention is to have a functional prototype of at least the haze head. The metal parts are made at Reservedelsfabrikken in Hjallerup. Here they use a laser-cutter and a punching machine to make the logos and the perforations.
The plastic parts are rapid prototyped at Davinci Development in PA and painted afterwards.



ill.110a Laser-cutter and punching machine

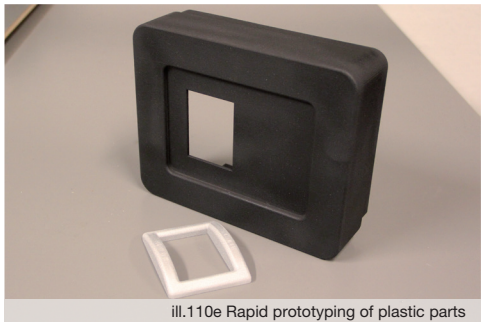


ill.110b Punched perforations



ill.110c Sneak peek on product part

ill.110d Laser cuttet Jem logos



ill.110e Rapid prototyping of plastic parts

USER EVALUATION

For verification of Jem DUAL, presentation material is presented to potential future users to achieve feedback.

DJ FREEDOM

DJ Freedom used to be a popular club DJ, and now works as a mobile DJ. When presented for the Jem DUAL he find it clever to use one type of fluid for both fog and haze, and he have experienced refilling issues in previous DJ jobs, where it was not obvious what type of fluid goes into what smoke machine. As a mobile DJ, he loves the Cable Fastener as he uses strips now, and has to fasten all cables at once and cannot move a product to a new truss position without cutting the cable strip and use a new one. He could imagine having 20 cable clips and reuse them over and over again.

ill.111a DJ Freedom at work

DJ SKOVGAARD

DJ Skovgaard is a resident DJ at Benediktes nightclub and is very positive about the Jem DUAL system, especially the remote. He currently uses a LightJockey for haze, but it is too large to be positioned within easy reach, why it is positioned behind him. Because of this he sees great potential in the Remote Control which is small enough to be positioned on top of his mixer - always visible and within reach. Furthermore he loves the ability of adjusting the haze output very accurately to specific purposes making it operate without his interference, giving him more time to focus on the music.

ill.111b DJ Skovgaard playing at Benediktes

MARIYA BUGARCHEVA – TECHNICIAN AT STUDENTERHUSET, AALBORG

To expand the feedback to more than nightclubs, Mariya, the technician from Studenterhuset, is visited with presentation material of the Jem DUAL. Her feedback is overwhelmingly positive, and would solve her need to perfection. They use a haze machine during concerts but struggle with having a great haze in the concert room due to their effective air condition system which have a tendency to suck out the haze before it spread to the entire room. They are not really interested in having multiple haze machines, because they are annoying and time-consuming to refill. Jem DUAL can provide a system with multiple haze heads positioned different places in the room which can spread the haze evenly throughout the room before sucked out by the air conditioning system, and provide easy refilling of the smoke fluid. Furthermore Studenterhuset will achieve the opportunity of having effect fog.

ill.111c Haze at Studenterhuset Aalborg

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APPENDIX A
MARTIN LINE UP

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ill. 120b Magnum 850

ill. 120c Magnum 1200 and 1800

ill. 120d Magnum 2000

ill. 120e Jem ZR44 Hi-Mass

ill. 120f Jem Roadie Compact

ill. 120g Jem Roadie X-Stream

ill. 120 h Jem Hydra

APPENDIX B
CLUB SMOKE SPECIFICATIONS

Magnum Club Smoke is a unique twin-headed fog package with a remote, ground based fluid supply. The two compact fog heads (each with a 1000 W heater) deliver a continuous, high volume of dense white fog.

Features

- Base unit allows heads to be positioned up to 50 meters away
- Up to 4 heads in one system
- Continuous output
- 500 m³/min fog output (per head)
- 1000 W heat exchanger
- 7 min heat-up time
- Truss mounting
- 10 liter fluid capacity
- Different fluid options for different applications
- Onboard DMX
- Multifunctional remote control

Physical

Length (Head): 330 mm (13.0 in.)
Width (Head): 310 mm (12.2 in.)
Height (Head): 165 mm (6.5 in.)
Dry Weight (Head): 10 kg (22.0 lbs.)
Length (Base): 410 mm (16.1 in.)
Width (Base): 290 mm (11.4 in.)
Height (Base): 480 mm (18.9 in.)
Dry weight (Base): 12 kg (26.5 lbs.)

Performance

Max. fog output (approx.): 500 m^3 per minute per head
Max. operating time at full output (approx.): 71 minutes (full 4-head system)
Operating time: Continuous, automatic level adjustment
Warm-up time (approx.): 7 minutes

Control and Programming

Control options: Remote control (supplied), DMX, 0-10 V analog
Remote control features: Instant or timer-controlled variable output
Timer range: Delay time 2-144 seconds, run time 2-144 seconds
DMX channels: 1
Protocol: USITT DMX512/1990

Construction

Housing: Steel & aluminum
Heat exchanger: 1000 W, direct thermal protection

APPENDIX C
MARKET COMPETITORS

It is chosen to focus on fog machine competitors with comparable flow as the Martin Club Smoke (500 – 2000 m3/min.) available on the Danish market.

ANTARI FOG MACHINES

Antari Z-1200/II DMX
Physical dimensions. (mm, kg): 480 x 250 x 260. 11 kg.
Price (EUR): 299.-
Max. Fog output m3/min: 500
Output control level: No.
Liquid capacity (Litre): 2.5 ltr
Max. Fluid line length: -

ill.122a

Antari Z-1500/II DMX
Physical dimensions. (mm, kg): 688 x 285 x 188. 14 kg.
Price (EUR): 399.-
Max. Fog output m3/min: 700
Output control level: 1% - 100% in 1% steps.
Liquid capacity (Litre): 6 ltr.
Max. Fluid line length: -

ill.122b

Antari Z-3000/II DMX
Physical dimensions. (mm, kg): 735 x 310 x 192. 20 kg.
Price (EUR): 539.-
Max. Fog output m3/min: 1400
Output control level: 1% – 100% in 1% steps.
Liquid capacity (Litre): 6 ltr.
Max. Fluid line length: -

ill.122c

AMERICAN DJ FOG MACHINES

American DJ Fog Fury 3000
Physical dimensions. (mm, kg): 475 x 345 x 321
Price (EUR): 308.-
Max. Fog output m3/min: 600
Output control level: No
Liquid capacity (Litre): 5 ltr.
Max. Fluid line length: -

ill.122d

EUROLITE FOG MACHINES

Eurolite N-150
Physical dimensions. (mm, kg): 670 x 300 x 240. 15 kg.
Price (EUR): 281.-
Max. Fog output m3/min: 800
Output control level: 20% - 100% in 10% steps.
Liquid capacity (Litre): 6 ltr.
Max. Fluid line length: -

ill.122e

Eurolite FSM-150
Physical dimensions. (mm, kg): 560 x 350 x 390
Price (EUR): 368.-
Max. Fog output m3/min: 900
Output control level: No. Awaiting reply
Liquid capacity (Litre): 5 ltr.
Max. Fluid line length: -
Extra features: Adjustable output angle. (+ / - 70°)

ill.123a

SMOKE FACTORY FOG MACHINES

Smoke Factory Captain D. Case
Physical dimensions. (mm, kg): 500 x 325 x 465. 19 kg.
Price (EUR): 878.-
Max. Fog output m3/min: 600
Output control level: 1 – 99 %. 1% steps.
Liquid capacity (Litre): 5 ltr.
Max. Fluid line length: -
Extra features: Stand.alone 25 ltr. Fluid container available.


ill.123b

Smoke Factory Enterprice TC4
Physical dimensions. (mm, kg):455 x 320 x 465. 23 kg.
Price (EUR): 1263.-
Max. Fog output m3/min: 1200
Output control level: 1 – 99 %. 1% steps.
Liquid capacity (Litre): 5 ltr.
Max. Fluid line length: -
Extra features: Stand.alone 25 ltr. Fluid container available.
External 800 w fan available for haze effect.


ill.123c

Smoke Factory Data II
Physical dimensions. (mm, kg): 585 x 230 x 247. 12.8 kg.
Price (EUR): 977.-
Max. Fog output m3/min: 1200
Output control level: 1 – 99 %. 1% steps.
Liquid capacity (Litre): 5 ltr.
Max. Fluid line length: -
Extra features: Stand.alone 25 ltr. Fluid container available.
External 800 w fan available for haze effect.


ill.123d

The price range is dominated by 300 – 500 euro machines, with the Smoke Factory machines being more expensive. (878 – 1263 euro.) The common fluid capacity is 5 - 6 ltr.
The majority of the machines have adjustable flow output, which can be adjusted with remote or using DMX.
The Smoke Factory fog machines have the possibility of attaching an external 25 litre Fluid container to achieve longer duration times. The max. distance between fluid container and the fog machine is 5 meters, and the container can be placed up to 2 meters under the fog machine. They are launching a fog fluid pump system in the short future to accommodate the demand for placing the fluid further away from the fog machine itself. This system makes it possible to place the fluid 15 meters under the fog machine. Furthermore, two of the Smoke Factory machines have the possibility to attach an 800 w fan to the machines to achieve a haze effect.

APPENDIX D
MAIL CORRESPONDENCE

SMOKE FACTORY

Start på videresendt besked:

Fra: Tom Jarosch Fog Smoke & Haze Factory GmbH <tom@smoke-factory.de>
Emne: Vedr.: Information on fog machines
Dato: 11. feb. 2014 15.31.04 CET
Til: Thue og Camilla Dahl Kristensen <idmaster2014@gmail.com>
Svar til: tom@smoke-factory.de

Hi Thue,

I know the Martin Club Smoke, I thought you are talking about standard fog machines.

Find attached a picture of the pumping station comming out this year.
The machine in the picture with the pumping station is a Captain D.
Our pumping station is additionally, wich means you can use every machine as an independant fog machine.

You can use it with up to a 200Ltr barrel and it probably will work for up to 32 fog machines.

The machine is just a prototype for now, release will be in the midyear 2014 and we are showing the system on this years Prolight + Sound in Frankfurt.

Best regards,

Tom

Am 11.02.2014 15:16, schrieb Thue og Camilla Dahl Kristensen:

> Hi Tom
>
> Thanks for the reply. It makes sense.
>
> The system I am talking about is a special system called Martin Club Smoke, which has a built-in pump at the fluid container.
> See link if interested:
> http://www.martin.com/product/product.asp?product=clubsmoke
>
> Your help is much appreciated.
>
> Best regards
> Thue Kristensen

APPENDIX E
USE CASES

MØDE MED SØREN KABBEL DALGAARD VED AALBORG KONGRES OG KULTURCENTER (AKKC)

På AKKC benyttes to MVS Le Maitre haze maskiner.

På AKKC´s hazer maskiner kan udgangsvinklen på røgen ændres via to blæsere internt maskinen. Dette kan gøres fra controlleren via DMX. Søren har tilkoblet trådløs DMX til røgmaskinerne så der ikke skal trækkes kabler hver gang de skal positioneres, hvilke de gør til mange forskellige forestillinger. Det virker uden problemer. Den trådløse modtager sidder forrest i siden ved scenen.
Denne maskine opvarmes uden et stort varmelegeme, men ved at kobberrører bliver meget varmt. Dette gør også at den renser sig selv ved opstart, ifølge Søren.
Søren mener at Jem ”2407” kan ændres på temperatur og på røgvæske for at få forskellige effekter af røgen.

I AKKC er det vigtigste at røgen fordeles i lokalet. Det er kun vigtigt at se lyskeglerne – ikke selve røgen.
AKKC har problemer med at rummet over scenen er meget stort
Røgen stiger opad, så der skal bruges meget røg, for at det bliver på scenen, men når det først er der, kan en god hængetid sørge for meget lav vedligeholdelse af røgen.

Der bruges CO2 til effektrøgen når dette er nødvendigt i en forestilling.
Kort hængetid, væk hurtigt. Dette er vigtigt da det ellers ikke virker realistisk. Det er dog sjældent der er brug for mere end haze i deres forestillinger.

Væskeforbruget på en hazer er meget mindre end på en røgmaskine.

Problemet med en oliebaseret maskine er at det ligger sig som en film på konteksten.
Derfor kan de bedre lide de vandbaserede væsker og maskiner
Det optimale ville være en vandbaseret hazer/cracker som producerer mindst mulige partikler. Dette sikrer lang hængetid og god gennemsigtighed.

For AKKC er det vigtigste ikke outputtet, men hængetiden af den røg der kommer ud. Rummet skal nok bliver fyldt hvis røgen bliver hængende.

De benytter RDM for at kunne modtage information fra deres apparater mens de ikke ved dem. Fx når de monterer lamper ved loftet eller sidder ved controlleren.

De sammenkobler deres DMX system med Ethernet kabler vis sACN. Det er nemmere at have med Cat 6 kabler at gøre, da de skaber færre problemer. Derudover kan køre mere data i dem, og de slipper for at køre mange kabler fra controller til scenen.
Der er en konkurrerende standart som Martin vist har brugt som hedder Art-Net. Så vidt Søren ved kan denne standard det samme.

ACN er absolut fremtiden ifølge Søren. Hans drømmescenarie er at alle apparater har deres egen IP adresse og MAC adresse og kører via samme netværk via ACN. På denne måde slipper man for begrænsningerne i DMX, og for at køre med flere universer med dertilhørende kabler. Hans controller fra firmaet ETC har indbygget ACN, og han glæder sig til at få nogle produkter så han kan udnytte det.

SPØRGESKEMA DJ BAKIR

Martin
Har du generelt kendskab til Martin?
-Ja, har et par Martin Raptors
Hvordan oplever du mærket / brandet Martin?
-Det bedste mærke på marked, lidt dyrt, men man får noget for pengene.
Røgmaskiner på klubber
Hvad synes du er vigtig ved køb og brug af røgmaskiner på en natklub?
-En røgmaskine som kan fylde rummet godt op så lyseffekter bliver fede. Helst en haze maskine.
Hvilket røgudstyr benytter du når du spiller?
-Stairville sf 1000 samt Stairville E-HD Røgvæske og en stairville haze maskine.
Ud fra hvilke parametre er disse produkter valgt?
-Effektivitet og pris.
Hvem bestemmer hvilket lys- og røgudstyr, som indkøbes til klubben?
(Er DJ´s med til at bestemme udstyr, eller styres det benhårdt af klubejer? Evt. feedback fra in-house tekniker)
-Kommer an på sted til sted, men vil mene DJ ikke har noget at skulle have sagt. Sådan har det i hvert fald været de steder jeg har spillet.
Hvem sætter systemet op?
(Leverandøren, in-house eller andre?)
-Det gør klubbens ansatte.
Hvem fylder væske på røgmaskinerne?
-Klubejeren eller teknikerne.
Hvem udfører vedligeholdelse (Rensning mm)?
-Klubejeren eller teknikerne.
Hvilke behov ser du for røg/haze. Hvilke apparater / effekter er der brug for i klubberne?
-Synes det vigtigt med en simpel controller til røgmaskinen, også selvfølgelig en haze maskine der let kan fylde rummet godt op, samt en haze som holder lang tid i luften og ikke bare forsvinder efter 2 sek. (det pisse irriterende at blive ved med at trykke), og til sidst synes jeg også det er fedt med en røgmaskine som ikke har brug for så lang tid for at blive varm før den kan skyde røg ud, men det gælder primært når jeg spiller mobildiskotek og vi har lidt travlt.

Klub DJ
Som DJ, styrer du så også alt lys og røg?
-Ja
Hvordan styres røgen?
Medfølgende remote? DMX controller? Auto program? Mm.
-Via computer hvor jeg bruger en USB – DMX dongle.
Benytter du RDM til at få feedback fra lys / røgmaskiner?
-Nej det er gammeldags DMX.
DMX er jo en gammel standard, oplever du nogle problematikker med denne standard som DJ?
-Ikke rigtigt, det er nemt og simpelt.
Kender du til ACN?
-Nej
-Hvis ja, ser du det som en mulighed i fremtiden?

SPØRGESKEMA JONAS WITTENDORF PETERSEN

Martin
Har du / I generelt kendskab til Martin?
-Ja. – Der hvor jeg er ansat bruger vi både Martin Mac 700 Profile, og Martin Mac 301.
Hvordan oplever du / I mærket / brandet Martin?
-Helt klart en af mine fortrukne mærker inden for lys. Det er noget af det dyrere, men topkvalitet.

Røgmaskiner på klubber
Hvad synes du / I er vigtig ved køb og brug af røgmaskiner på en natklub?
-Jeg er personligt mest til hazere, og så nogle enkelte show røgmaskiner.
Hvilket røgudstyr benytter du / I på klubben?
-Jeg er både tilknyttet klub og liveproduktioner. – Og i det firma jeg er ansat bruger vi Antari Z-1020 som effektrøgmaskiner, Antari M-5 som almindelig røgmaskine og Antari H2500 som hazer.
Ud fra hvilke parametre er disse produkter valgt?
-Vi har valgt Antari, da vores chef kan få billige priser på det. – Vi har tidligere brugt Martin og Jem, men dem vi havde gik hurtigt i stykker.
Hvem bestemmer hvilket lys- og røgudstyr, som indkøbes til klubben?
(Er DJ´s med til at bestemme udstyr, eller styres det benhårdt af klubejer? Evt. feedback fra in-house tekniker)
-Det gør vi lysmænd / DJ's i samarbejde med vores chef.
Hvem sætter systemet op?
(Leverandøren, in-house eller andre?)
-Det gør teknikeren på produktionen. I klubberne er det typisk in-house teknikere.
Hvem fylder væske på røgmaskinerne?
-Det gør den pågældende tekniker der bruger dem. Der kan derfor være mange forskellige mennesker som fylder væske på. Der skal vi være obs. på at fylde den rigtige væske på de rigtige maskiner.
Hvem udfører vedligeholdelse (Rensning mm)?
-Det gør vi selv.
Hvilke behov ser du for røg/haze. Hvilke apparater / effekter er der brug for i klubberne?
-Altså til at få lyskeglerne frem vil jeg altid foretrække en hazer, og så bruge røgmaskiner som effekt.
Benytter I andre effektmaskiner i klubben? (Såsom CO2, konfetti og lign.)
Hvis ja, hvilke?
-Ja, vi har både en CO2 Gun, Co2 kanon og 2 konfetti kanoner + nogle stageflames. Dette er dog til live event og ikke på klubberne.
Styring af røg
I jeres klub styrer DJ´en også alt lys og røg, eller benytter i VJ´s og lign?
-Vi bruger altid lysmænd når det er større produktioner eller live events. I klubbene styre DJ'en næsten altid det hele.
Hvordan styres røgen?
Medfølgende remote? DMX controller? Auto program?
-Vi kører *dmx* på vores røgmaskiner, som styres fra samme controller som lyset. Det *kvæver at man kender controlleren får at styre op timalt.*
Benytter du RDM til at få feedback fra lys / røgmaskiner?
-Nej, men det kunne være fint, specielt når lyseffekterne skal sættes op.
DMX er jo en gammel standard, oplever du / I problemer med DMX?
-Nej, det syntes jeg ikke vi gør.
Kender du til ACN?
-Nej
-Hvis ja, ser du det som en mulighed i fremtiden?

KENT SIGERTSTRØM

Martin
Har du generelt kendskab til Martin?
-Ja
Hvordan oplever du mærket / brandet Martin?
-Som et brand af høj kvalitet, state of the art inden for sit felt.

Røgmaskiner på klubber
Hvad synes du er vigtig ved køb og brug af røgmaskiner på en natklub?
-At maskinen kan levere et bredt men ikke for tungt rødslør, som bliver hængende.
Hvilket røgudstyr benytter du når du spiller?
-Har i mange år været glad for Martin Magnum 2000.
Ud fra hvilke parametre er disse produkter valgt?
-Den er driftssikker, har et stort varmelegeme som gør den stabil i røg produktionen.
Hvem bestemmer hvilket lys- og røgudstyr, som indkøbes til klubben?
(Er DJ´s med til at bestemme udstyr, eller styres det benhårdt af klubejer? Evt. feedback fra in-house tekniker)
-Klubejer har naturligvis det sidste ord, men de faste dj's input bliver dog taget med i overvejelserne. Man kan jo sige det er os der står med det, og ved hvad der virker og hvad der ikke gør.
Hvem sætter systemet op?
(Leverandøren, in-house eller andre?)
-Husets tekniker.
Hvem fylder væske på røgmaskinerne?
-Husets tekniker.
Hvem udfører vedligeholdelse (Rensning mm)?
-Husets tekniker.
Hvilke behov ser du for røg/haze. Hvilke apparater / effekter er der brug for i klubberne?
-Haze er en fed effekt, røg er en nødvendighed. Mulighederne for at få begge dele, og få dem til at samarbejde på en funktionel måde, har altid været få, så det har bare altid været lidt en enten eller ting. En kombination kunne give en god effekt, og være sjovt at bruge.

Klub DJ
Som DJ, styrer du så også alt lys og røg?
-Ja
Hvordan styres røgen?
Medfølgende remote? DMX controller? Auto program? Mm.
-Medfølgende remote
Benytter du RDM til at få feedback fra lys / røgmaskiner?
-Nej
DMX er jo en gammel standard, oplever du nogle problematikker med denne standard som DJ?
-Overhoved ikke.
Kender du til ACN?
-Hvis ja, ser du det som en mulighed i fremtiden?
-Det gør jeg desværre ikke

DJ MORTEN GREVEN THOMSEN

Martin
Har du generelt kendskab til Martin?
-Ja, jeg har arbejdet med Martins produkter de sidste 12-15 år.
Hvordan oplever du mærket / brandet Martin?
-Anerkendt og meget populært på klubberne i Danmark.

Røgmaskiner på klubber
Hvad synes du er vigtig ved køb og brug af røgmaskiner på en natklub?
-De skal være stabile og nemme at bruge.
Hvilket røgudstyr benytter du på klubben?
Bernhardt? *-Magnum 2500 Hz*
Zensa? *-Har ikke røg.*
Andre?
Ud fra hvilke parametre er disse produkter valgt?
-Jeg var ikke med, da valget faldt på Magnum 2500 Hz, så det ved jeg ikke præcis.
Hvem bestemmer hvilket lys- og røgudstyr, som indkøbes til klubben?
(Er DJ´s med til at bestemme udstyr, eller styres det benhårdt af klubejer? Evt. feedback fra in-house tekniker)
Bernhardt? *-Udstyr vælges i samarbejde med resident DJs på stedet.*
Zensa? *-Udstyr vælges i samarbejde med resident DJs på stedet.*
Andre?

Hvem sætter systemet op?
(Leverandøren, in-house eller andre?)
-Leverandøren (Illumination).
Hvem fylder væske på røgmaskinerne?
-Typisk DJ's, men ligeså ofte er det ansvarshavende/bestyreren.
Hvem udfører vedligeholdelse (Rensning mm)?
-Leverandøren.
Hvilke behov ser du for røg/haze. Hvilke apparater / effekter er der brug for i klubberne?
-Pas… sorry!

Klub DJ
Som DJ, styrer du så også alt lys og røg?
-Ja
Hvordan styres røgen?
Medfølgende remote? DMX controller? Auto program? Mm.
-Vi har en LightJockey med et par forudprogrammerede funktioner – halv, hel og slukket.
Benytter du RDM til at få feedback fra lys / røgmaskiner?
-Ikke mig bekendt, men det ville vel også være leverandørens opgave?
DMX er jo en gammel standard, oplever du nogle problematikker med denne standard som DJ?
*-Tja.. vi oplever problemer med udstyret fra tid til anden – men som regel ikke noget der ikke kan løses med en genstart af Light*Jockey og udstyr… som oftes er det bare problematisk at udstyret er så kompliceret at fejlsøge på, da ansvarshavende og DJ's ikke nødvendigvis har teknisk indsigt.
Kender du til ACN?
-Hvis ja, ser du det som en mulighed i fremtiden?
-Jeg kender ikke til ACN.

TEKNIKER RENÉ LINDBERG

Martin
Har du generelt kendskab til Martin?
-Ja. Rimelig godt kendskab til deres produkter.
Hvordan oplever du mærket / brandet Martin?
-Som god kvalitet som folk er villige til at betale for på trods af den højere pris.

Røgmaskiner på klubber
Hvad synes du er vigtig ved køb og brug af røgmaskiner på en natklub?
-Det er vigtigt at maskinerne er pålidelige og kan levere noget røg.
Hvilket røgudstyr benytter du når du spiller?
-Både alm. Røg samt haze.
Ud fra hvilke parametre er disse produkter valgt?
-Pris og kvalitet.
Hvem bestemmer hvilket lys- og røgudstyr, som indkøbes til klubben?
(Er DJ´s med til at bestemme udstyr, eller styres det benhårdt af klubejer? Evt. feedback fra in-house tekniker)
-DJ´en fungerer som rådgiver, men nogle gange er det leverandøren som kommer med et komplet sæt.
Hvem sætter systemet op?
(Leverandøren, in-house eller andre?)
-Leverandøre for det meste.
Hvem fylder væske på røgmaskinerne?
-Det er forskelligt, men kan være DJ´s eller teknikere.
Hvem udfører vedligeholdelse (Rensning mm)?
-Det tror jeg de færreste gør egentlig.
Hvilke behov ser du for røg/haze. Hvilke apparater / effekter er der brug for i klubberne?
-Jeg opfatter behovet for alm. Røg som størst, men det kan hænge sammen med at de benytter ældre røgmaskiner som de købte før der *blev lavet gode haze maskiner. Haze er absolut på vej frem.*

Klub DJ
Som DJ, styrer du så også alt lys og røg?
-Ja.
Hvordan styres røgen?
Medfølgende remote? DMX controller? Auto program? Mm.
-Jeg benytter en DMX controller som kan kontrollere de mest basale funktioner såsom at fyre af og styre styrken. Det virker fint.
Benytter du RDM til at få feedback fra lys / røgmaskiner?
-Sjældent da vi benytter noget ældre udstyr. Men det er en god feature.
DMX er jo en gammel standard, oplever du nogle problematikker med denne standard som DJ?
-Meget sjældent.
Kender du til ACN?
-Nej
- Hvis ja, ser du det som en mulighed i fremtiden?

TEKNIKER ULRIK ANDERSEN

Martin
Har du generelt kendskab til Martin?
-Ja.
Hvordan oplever du mærket / brandet Martin?
-Som en mærkevare i høj kvalitet.

Røgmaskiner på klubber
Hvad synes du er vigtig ved køb og brug af røgmaskiner på en natklub?
-Det er vigtigt at maskinerne er pålidelige og hurtige om at starte op samt nemme at betjene, også for almindelige personer uden kendskab til teknik. Derudover må de gerne være til at betale da mange ejere af klubberne ikke vil bruge for mange penge på udstyr og væske.
Hvilket røgudstyr benytter du når du spiller?
-Antari Showtec og Martin produkter.
Ud fra hvilke parametre er disse produkter valgt?
-Pris og kvalitet.
Hvem bestemmer hvilket lys- og røgudstyr, som indkøbes til klubben?
(Er DJ´s med til at bestemme udstyr, eller styres det benhårdt af klubejer? Evt. feedback fra in-house tekniker)
-Bestyreren eller ejeren bestemmer efter vejledning af husets DJ's og tekniker.
Hvem sætter systemet op?
(Leverandøren, in-house eller andre?)
-Installatør eller husets tekniker. I nogle tilfælde kan det være bestyreren.
Hvem fylder væske på røgmaskinerne?
-Det gør afryddere eller DJ's.
Hvem udfører vedligeholdelse (Rensning mm)?
-Leverandøren.
Hvilke behov ser du for røg/haze. Hvilke apparater / effekter er der brug for i klubberne?
-I de fleste klubber er der behov for både effektrøg og haze. Nogle større klubber har også behov for CO2, evt. pyro og konfetti.

Klub DJ
Som DJ, styrer du så også alt lys og røg?
-Ja, i langt de fleste tilfælde.
Hvordan styres røgen?
Medfølgende remote? DMX controller? Auto program? Mm.
-Typisk benyttes den medfølgende remote, og i nogle tilfælde DMX controller som også styrer lyset.
Benytter du RDM til at få feedback fra lys / røgmaskiner?
-Nej.
DMX er jo en gammel standard, oplever du nogle problematikker med denne standard som DJ?
-De problemer jeg oplever, relaterer sig typisk til opdatering af computere hvis disse benyttes som controller.
Kender du til ACN?
-Ja
- Hvis ja, ser du det som en mulighed i fremtiden?
-Jeg har ikke arbejdet så meget med ACN, men det virker som en god og nem mulighed for at køre signal via Cat5 kabler.

APPENDIX F
DMX

DMX (Digital MultipleX interface) is the marked-leading for controlling lighting and fog devices. The general way of turning a lamp on or off is using an outlet switch for each lamp. In this manner it is needed to run a mains cable from each outlet switch to each lamp. DMX simplifies this system by being able to control multiple lamps through a low-voltage cable.
DMX is a one-directional 8-bit serial protocol, which can control up to 512 channels pr. cable, and each channel can take a value between 0 and 255. When using DMX to control light intensity, each lamp will occupy one channel and the value of 0 will be off and 255 will be full light intensity.
Advanced devices which require multiple possible commands, multiple channels will be used for each device, and each channel can handle one function such as light intensity, fog machine pump pressure, focus motor position, mirror position among others.
When using DMX with fog machines the first channel controls the fog output, the second channel can control the output angle and so on.

16 bit
Some devices require greater accuracy than the 8 bit that DMX can provide. If this is the case, DMX can link two channels together. The first channel is called "coarse" and controls the first 256 steps of movement. The second channel is called "fine" and controls 256 steps for each coarse step. This adds up to 65536 (256 x 256) steps in total, which allows much greater accuracy. This type of connection is 16 bit, and is usually employed on advanced lighting devices such as Moving Heads. Obviously this takes up more bandwidth than 8 bit operation.

Connecting DMX
The used cables for DMX are 5-pin XLR cables. Some manufacturers do use a 3-pin XLR connector though, because the fourth and fifth pin is rarely used.

DMX Network
A DMX network is made using a Daily Chain Typology where the controller is wired to the first device, and the first device is wired to the second device and so on. Each device is allocated a certain personal channel to which the controller can address.
When controlling devices on the DMX network the signal from the controller, called master, passes through each device, called slave, in the daisy chain until it reaches the intended device. The output on the last device in the daisy chain is connected to a terminal that completes the network.
Each DMX network is called a "DMX universe", and each output connector on a controller can control a universe. A large controller can control multiple universes through multiple DMX outputs, whereas smaller controllers usually control one universe.

IP & UDP

Definition of Ethernet, IP and UDP/IP.

Ethernet
Ethernet is the common family for wired local networks (LANs) when connecting computer and other network based devices. The devices are usually connected with Ca 5 / Cat 6 cables with RJ45 connectors.

IP (Internet Protocol)
IP is the definition of the network protocol that is the standard for controlling packaging within network based traffic. All devices with IP must have their own specific identity – address, called their IP-address. This IP-address is provided by the network.
Furthermore each device is provided with a specific MAC-address that is assigned to the products no matter what network it is connected to.

UDP/IP (User Datagram Protocol)
UDP is a protocol for transferring data which utilizes a minimum of protocol mechanism. It has no handshaking functionality, thus no guarantee of data delivery, and no feedback about this failed delivery.
If error correction is of key importance, other protocols such as TCP or SCTP which are designed for this purpose can be used.

APPENDIX G
RDM

An official ANSI protocol enhancement for the DMX 512 standard, which allows bi-directional communication between controller and attached RDM compliant device. The DMX protocol has been used by manufacturers for around 10 years.

The RDM data is sent in-between the existing DMX data packets. These RDM data packets can safely be inserted in between the DMX packets without non-RDM compliant devices attempting to read them, and therefore does this added bi-directional functionality not compromise the functionality on non-RDM compliant devices.

All RDM-compliant devices hold a unique identity, which consists of the manufacturer ID and the serial number. This will be referred to as the UID.

All RDM communication is started by the DMX controller, and the attached RDM-compliant devices can only reply if addressed directly by the controller. (This does not apply for discovery communication though. See below)

There are three types of RDM communication:
Discovery
Unicast
Broadcast

Discovery
In this case, the controller will send out a discovery signal to all attached RDM-compliant devices in order to list all attached devices. Only when all devices have responded the controller, the controller holds a list of attached devices, and the discovery process will end. The only possible respond for the devices with discovery communication, is to mute, and not send back information. The functions acts as a "Who is ready" functionality.

Unicast
Unicast is two-way communication which is based on a request-response pattern. The controller sends out a request and the intended device, addressed by its UID, transmits its response back to the controller. If the response has not been received by the controller within a given period of time, the controller may retry.

Broadcast
With broadcast communication, the controller is able to send instructions to multiple devices at the same time. This can be all attached devices or all devices from a single manufacturer. In the same respond matter as with discovery communication, the devices are not able to respond, but only follow the controller's instructions.

Benefits of RDM
The two-way responses can include:
Fog machines notifying that it have warmed up and ready for use.
Fog machines or similar effect machines notifying that they run low on fuel.
Lamps notifying that the bulb needs to be changes.
Recalibration of devices.
Control instructions to lamps, fans etc.
All these responses will be received by the controller, and the technician / DJ does not have the need to go to the device itself.

Limitations
The RDM is made for use with setups being controlled by one main controller. If multiple controllers sends out RDM instructions on the same DMX stream, the possibility of malfunction rises, as the possible respond time will increase, which potentially leads to non-received DMX packages.

Not all RDM compliant devices support all RDM functions, but will always support the discovery function.

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Fog machines or similar effect machines notifying that they run low on fuel.
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Control instructions to lamps, fans etc.
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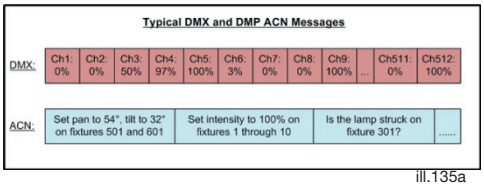
Not all RDM compliant devices support all RDM functions, but will always support the discovery function.

APPENDIX H
ACN, SACN & ARTNET

ACN

ACN is a control architecture designed for controlling audio, lighting and similar devices.
It is a relatively new standard, which is designed to be used with current and future advanced entertainment technologies such as Moving Heads.
The protocol uses UDP/IP, and thereby works with standard Ethernet and 802.11 wireless networks. Opposed to DMX, ACN creates a direct line of communication between controller and intended device, and is able to more precisely control the device.



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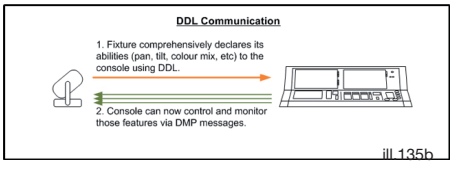
DMP is the part of the protocol that handles instructions from controller to device. This can be to tell a fixture to change its position, intensity or colour. Furthermore DMP allows for bi-directional data streams, even for multiple products at the same time.



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DDL handles the responses from the devices, which can tell the controller what they are or are not able to do. DDL allows devices to address other devices within the same network, not only the controller. Furthermore these messages do not need to be responses to the controller, but can be a declaration of a devices´ abilities directly from device to controller.

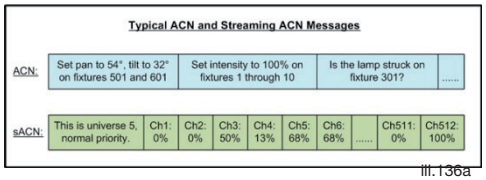
Session Data Transport (SDT)
SDT is able to send messages between ACN devices. The protocol packs multiple messages into packets which utilize the network bandwidth more efficiently. The messages can be sent to multiple receivers. Opposed to RDM, every ACN compliant device can act as both receiver and sender.

ACN can directly instruct a device to set output to 50% and set pan to 20% for example, as opposed to DMX which utilized different channels for different settings. Furthermore the communication is direct and does not need to go through the remaining devices within the system.
The foremost feature with ACN opposed to DMX, is the fact that there is no actual limit to the amount of features each device can have. This means that the need for condensing the functionality into the least amount of channels possible, which DMX holds, will be gone. Each device holds its hold unique ID, which removes the need for addressing devices through DMX channels.
When setting up a large entertainment system containing both light and smoke, it may requires multiple DMX universes, as DMX only handles 512 channel pr. Universe, and a Moving Head might take up to 80 channels alone.
Limitations
Unfortunately, the ACN standard is very much in its infancy as it is not common among manufacturers. ETC is the only manufacturer who uses the ACN standard across their products range. As long as the industry is not ready to adopt the all-Ethernet connection, the power of ACN cannot be utilized wide-scale.
Automated Lighting: The Art and Science of Moving Light in Theatre, Live Performance, Broadcast, and Entertainment - Richard Cadena

sACN – Streaming ACN

sACN in a protocol for transmitting DMX512 over a TCP/IP network using ACN.
The idea is to standardize how to send and receive

DMX over Ethernet network thus creating a standard which is able to work across manufacturers. The protocol is similar to ACN, it packs the DMX data using ACN packet structure to make efficient use of the network bandwidth. The ACN packets can be converted back to DMX, if needed.



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Using sACN
Typical ACN Message
Typical sACN message

The sACN is much more widespread than the ACN standard, but the functionality is limited compared to ACN, as sACN act as an evolution to DMX, opposed to ACN, which is a newly rooted standard. This means the sACN still deals with the limitations that are found with DMX.

Art-Net

Art-Net is a protocol which converts DMX data with RDM to Ethernet UDP package data, similarly to sACN. The protocol is limited by the standards in DMX, as sACN.
The adaptation of Art-Net is far more progressed than ACN, and products are available from a large variety of manufacturers. Feedback from users of Art-Net is commonly used to enhance the functionality of the protocol.
The advantages with Art-Net are the ability to use Ethernet to carry information. An Ethernet cable can carry a lot more information than a DMX cable, and Ethernet hardware is cheaper than DMX hardware. Furthermore, the Art-Net UDP packages can easily be sent wirelessly through Wi-Fi, which makes it easy to send DMX data over the internet. The protocol furthermore supports bi-directional RDM data.

Other ways of integrating DMX with ethernet

ShowNet.

Shownet, developed by Strand Lighting, is not yet publicly available.

Pathport

Pathport is a series of DMX to Ethernet to DMX converters

KiNet

KiNet is a Ethernet lighting protocol developed by Philips Colour Kinetics that is made in order to use DMX based devices with Ethernet based devices.

Conclusion

Both sACN and Art-Net are already incorporated in a large variety of intelligent lighting and smoke products on the market, with Art-Net being a tad more widespread. Both do suffer from the limitations originated from DMX, as both standards work as an evolution of DMX.
The limitations being:
Only 512 channels per universe.
Each universe requires a cable
No sharing of data between devices.
Only bi-directional data transfer from controller to devices one at the time

APPENDIX I
BILL OF MATERIAL

The BOM in carried out in corporation with Nick Scully, R&D manager. The following prices are estimates, and the final prices will be identified during prototyping. Since many parts are stock parts the prices below will be adequate for estimating production costs.

FOG HEAD

Chassis:	30 €
Main PCB:	15 €
RJ 45 connectors:	1 €
PowerCON socket:	5 €
Valve:	12 €
Wiring:	6 €
Heat exchanger:	18 €
Trips:	4 €
Tubes:	4 €
Total:	95 €

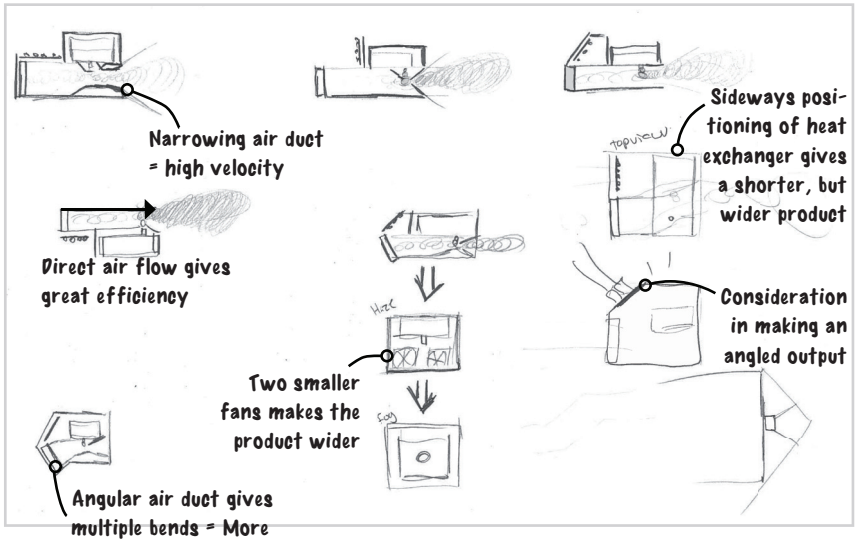
HAZE HEAD

Chassis:	60 €
Main PCB:	18 €
RJ 45 connectors:	1 €
PowerCON socket:	4 €
Valve:	12 €
Wiring:	6 €
Heat exchanger:	18 €
Trips:	4 €
Tubes:	4 €
Fan: Sunon: 4 € / Turbine Fan: 18 €	4 € / 18 €
Total:	131/145 €

BASE UNIT

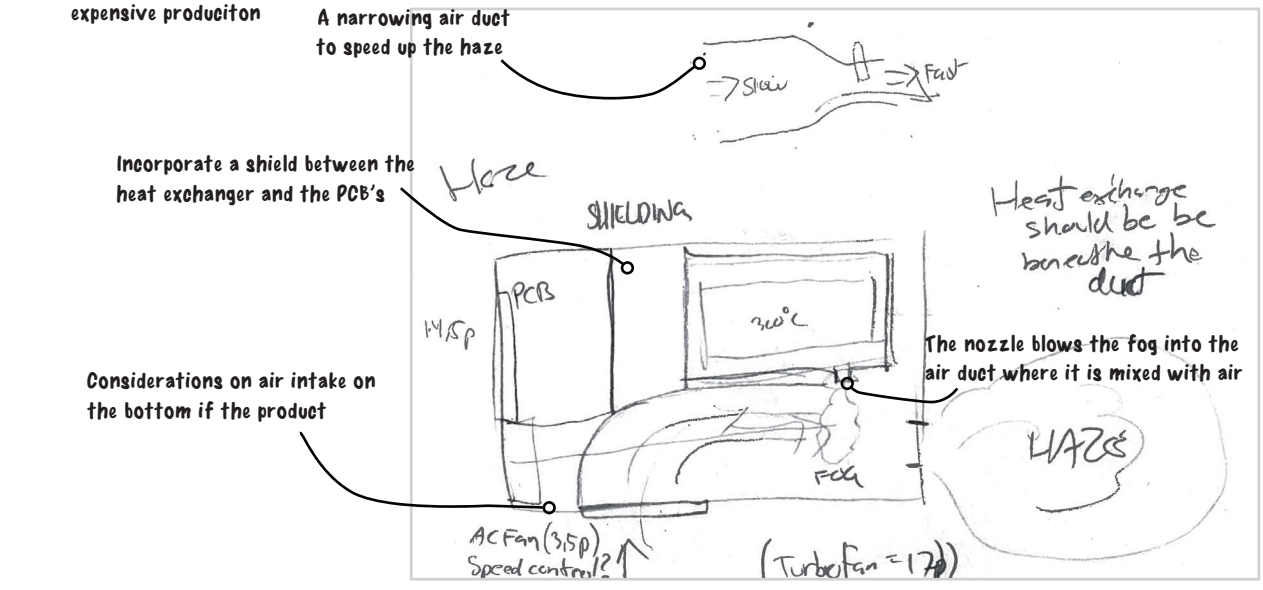
Chassis:	73 €
Pumps: (4£ each)	14 €
Fittings:	4 €
DMX interface PCB:	18 €
Main PCB:	18 €
RJ45 connectors: (1 £ each)	7 €
Mains socket:	4 €
Fog fluid tank:	2.5 €
Tubes:	7 €
Fluid sensor:	7 €
Control PCB:	12 €
Wiring loom:	6 €
Total:	172.5 €

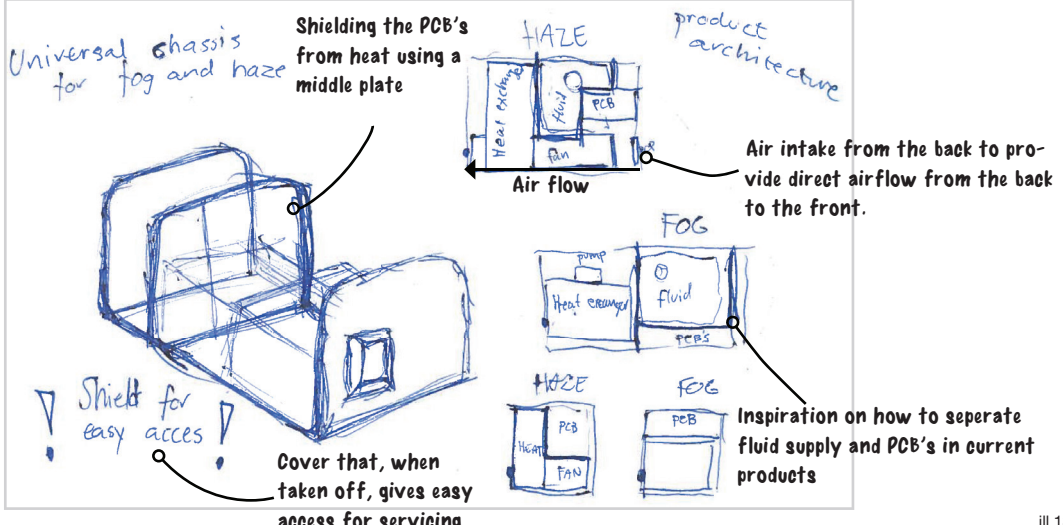
APPENDIX J
PRODUCT ARCHITECTURE WORKSHOP



The main focus have been on sketching on the haze architecture as this is the most complex product, and the components will take up more space than the components in the fog head.

The main considerations revolve around optimizing the airflow through a direct path with intake on the back and the output on front of the product. When having products hanging in a truss the most important parameter according to size is the width. This is why is will be beneficial to place the heat exchanger in the longitudinal direction and not sideways. The focus on narrowing the product also suggests one large fan instead of two smaller ones.





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APPENDIX K
MAIL CORRESPONDENCE

HENRIK SØRENSEN - SALES NUMBERS

Mail correspondence with Henrik Sørensen

fra:	**Henrik Sørensen** Henrik.soerensen@harman.com
til:	Thue og Camilla Dahl Kristensen <idmaster2014@gmail.com>
dato:	16. apr. 2014 kl. 14.27
emne:	Re: Club Smoke salgstal

Hej I to,

Hermed salgs tal.

Med hensyn til fremtidigt salg vil jeg regne med en fordobling i år 2 efter Jeres update.

Vi kan lave prototypen i Hjallerup ved reservedelsfabrikken.

Det kan vi lige tale om efter Påske.

Henrik

Best regards,

Henrik Sørensen
Vice President - Smoke

From: Thue og Camilla Dahl Kristensen <idmaster2014@gmail.com>
Date: tirsdag den 15. april 2014 12.38
To: Henrik Sørensen <henrik.soerensen@harman.com>
Subject: Club Smoke salgstal
Hej Henrik

Jeg tror aldrig at vi fik salgstallene på den nuværende Club Smoke pr. mail.

Kan vi få dig til at sende dem til os?
Vi skal nok lade være med at bruge dem i rapporten som aftalt.

Derudover kunne vi godt tænke os et estimat på fremtidigt salg fra din side på den nye Jem Club Smoke.

Denne kunne være estimat på:
- Base units:
- Antal Haze hoveder?
- Antal røg hoveder?

Har du forresten hørt fra Nick angående prototype og hvor vi skal sende tekniske tegninger hen?

Venlig hilsen
Camilla & Thue

APPENDIX L
JEM SHEET METAL MATERIAL

Fra: **Nick Scully** nick.scully@martinpro.co.uk
Emne: RE: Sheet metal specs.
Dato: 14. maj 2014 15.11
Til: Master 14 idmaster2014@gmail.com

1.0mm, 1.2mm,1.5mm.
CR4

Best regards,

Nick Scully
R&D Manager

Martin by HARMAN

D +441507353717 | O: +441507604399 | www.martin.com |

From: Master 14 [mailto:idmaster2014@gmail.com]
Sent: 14 May 2014 14:11
To: Nick Scully
Subject: Re: Sheet metal specs.

Yeah the flat type - we both need the thickness and the specifications of the steel..

Best regards
Camilla

Den 14/05/2014 kl. 15.07 skrev Nick Scully <nick.scully@martinpro.co.uk>:

> The flat type that is made of steel ?
> Do you mean thickness or spec?
>
> **From:** Thue og Camilla Dahl Kristensen [mailto:idmaster2014@gmail.com]
> **Sent:** 14 May 2014 14:06
> **To:** Nick Scully
> **Subject:** Re: Sheet metal specs.
>
> Hi Nick
>
> What type of sheet metal do you use for the chassis of your other smoke machines?
>
> We look forward to receiving the parts.
>
> Best regards
> Camilla

APPENDIX M
MATERIAL CONSIDERATIONS

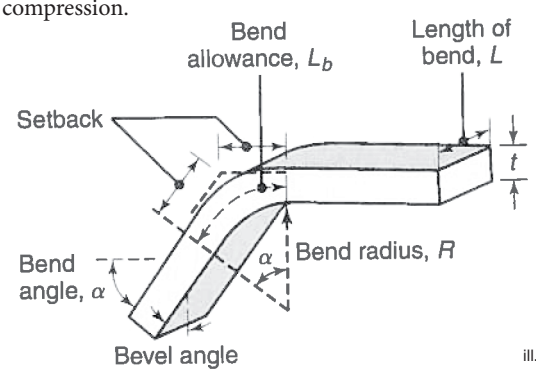
SHEET METAL

Sheet metal is produced by the rolling process, which is a process for reducing thickness or changing the cross section of a long work piece by compressive forces applied through a set of rolls.
Generally sheet metal is less than 6 mm thick and is provided as flat pieces to manufacturing facilities for further processing into products.
Martin Professional use CR4 steel for most purposes, and this material is also used for Jem DUAL.
Sheet metal have a huge variety of forming processes. Each process have specific characteristics and uses different types of tooling.
It is chosen to go for the same process as Martin Professional already uses. Therefore Jem DUAL includes bending of sheet metal and stamping.

BENDING OF SHEET METAL

Bending is one of the most common metalworking processes, that is used to form parts as flanges, curls etc., but is also used to impart stiffness.

When bending a piece of sheet metal, the outer fibers of a part are subjected to tension, while the inner fibers are subjected to compression.

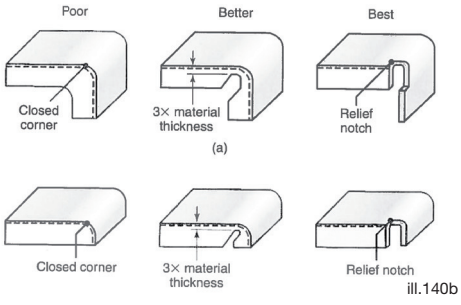


ill.140a

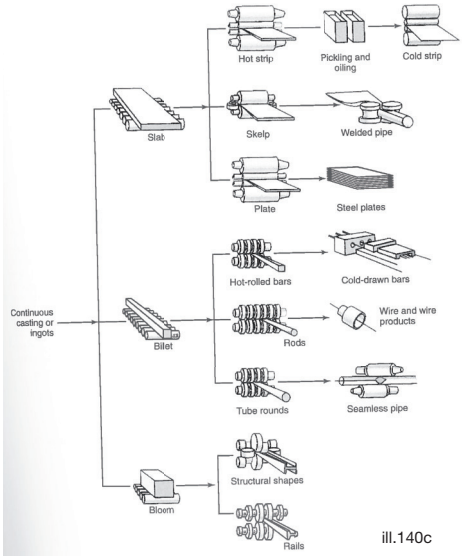
The radius at which a crack appears on the outer surface is called the minimum bend radius, and express to which radius a part safely can be bended, is given by the thickness of the sheet.

FLANGING

To assembly components with other components, and to imparting stiffness, the sheet metal of Jem DUAL have flanges of 90°.

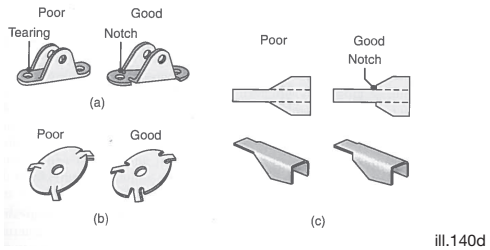


ill.140b



ill.140c

The main concerns in bending of sheet metal are fracture of the material, wrinkling and inability to form the required bend. These considerations have to be done when making flanges. The flanges will undergo compression, but by incorporating a relief notch the stress can be limited.

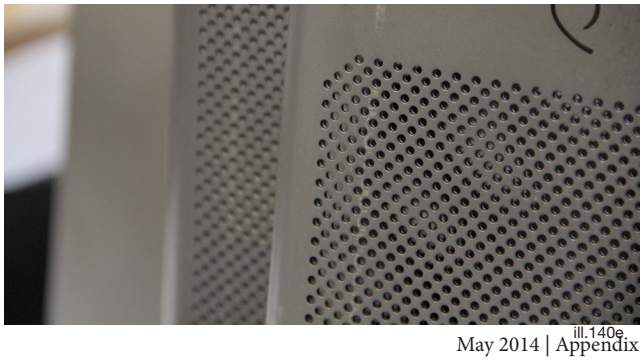


ill.140d

STAMPING OF SHEET METAL

According to stamping of the sheet metal it is advantageous to reduce the number of features to a minimum in order to minimize tooling costs.

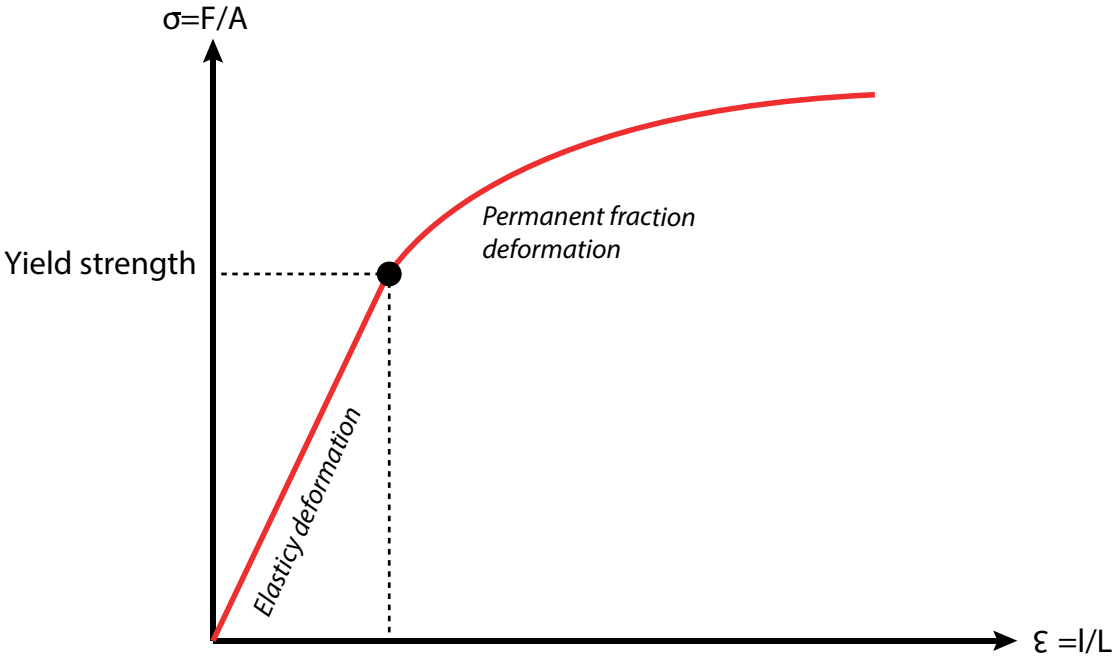
Jem DUAL consists of a great deal of punched perforations, in order to ventilate and for the visual expression. This will give a high tooling cost, but the cover of Jem DUAL is seen as generic platform, and therefore the amount will increase. [Kalpakian, S., 2008]


ill.140e

FEM RESULTS

YIELD STRENGH

When plotting in material properties into the Solid Works analysis, the yield strength is set to 6.28 N/m2. The yield strength defines the stress where the material begins to deform plastically. Prior to the yield point the material will deform elastically and will return to its original form when the affected stress is detached. Once the yield point is passed, some fraction of the deformation will be permanent and non-reversible.
The yield strength in the simulations is set wrong, since the used CR4 steel have a lower yield strength. The correct max. yield strength is specified to 2.10 N/m2 according ISO 3574 standard. [Web 22]



ill.141a

VON MISES

Von misses stress relates to the yield strengths. Von Mises stresses have to be considered to be safe according to the construction. If the maximum value of Von Mises stresses is higher than the yield strength of the material, a permanent deformation will happen.

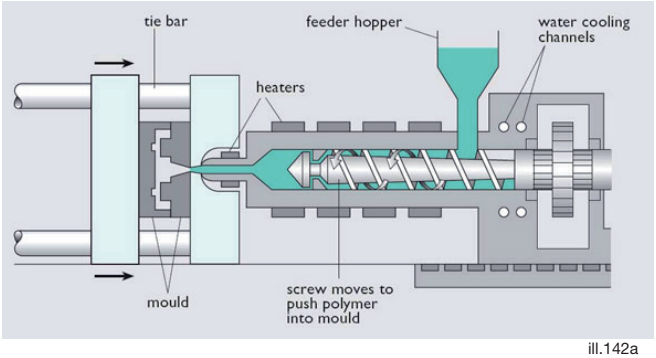
When looking at the results of the analysis the Von Mises of the first FEM simulation with a fixed bottom with a side pressure have a maximum of 2.9e7 N/m2.
Even if the FEM simulations results is not quite realistic due to the missing perforations and simplified geometries, the Von Mises stress is really low in relation to the yield strength of the material, and therefore there are no problems according to a permanent deformation.

PLASTIC PARTS

To gain more possibilities of the visual expression, the front of Jem DUAL is made of ABS. ABS is a two-phase polymer blend. ABS is used because it, because of the design, is required with a superlative surface quality, colorfastness and luster. ABS has a great balance of properties, toughness/strength, and temperature resistance and has a high quality surface finish. ABS is great for injection molding.

INJECTION MOULDING

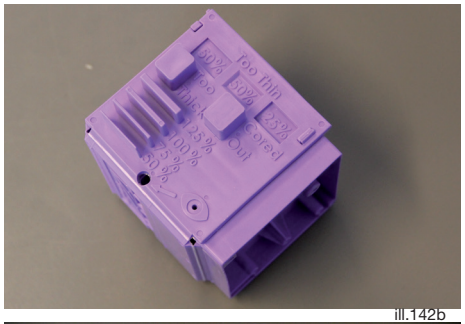
The ABS is introduced to the injection-moulding machine. The machine consists of a heated barrel, which feeds the molten ABS into a temperature controlled split mould with a feeder hopper via a channel system. The tools for injection moulding tend to be manufactured from steels. The cost according to tool manufacture means that injection moulding tends to lend itself to high amount manufacture. [Leftere, C., 2007]



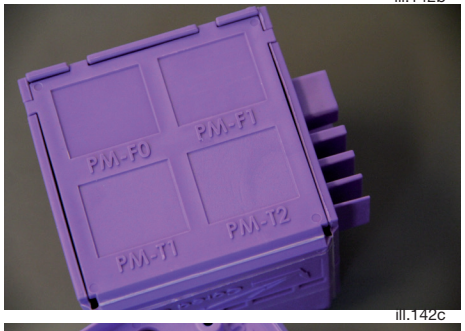
ill.142a

CONSIDERATIONS

For inspiration a protomold-cube is acquired. According to the plastic parts at Jem DUAL, it is important to take the material thickness into considerations. When moulding a part, it is important that the thickness of the material is quite similar all over the part. If there are huge different between the thickness, there can easily be a distortion when the material is cooling.


ill.142b

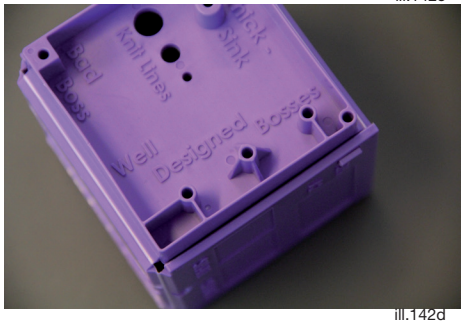
The finer the surface needed for the product, the more expensive mould, due to the visibility of the mill marks. For The Jem DUAL front piece the wish is a bead blast finish, making the mould cheaper with reduced need to polish mill marks.



ill.142c

The rough surfaces needed will increased the draft angles needed. Proto labs suggests draft angles of around 3° for a light bead blast texture in ABS.

The front have to be screwed to the bottom plate, why bosses is needed. These bosses have to be designed correct, for not to give any distortions at the other side of the boss. Minor distortions can visually be diminished by the bead blast texture.



ill.142d

APPENDIX N
SIMPLE CONSTRUCTION CALCULATION

To figure out how much influence the perforations in the design of the smoke heads in relation to the strength of the structure, there are calculated on simple geometries.

There are first reckoned on the strength of a piece of sheet metal without perforations, and then compare to a piece of sheet steel with perforation, in order to compare the result of the deflection of the two elements.

Measurements on the piece of sheet metal reckoned on
$a = 393mm = 0{,}393m$
$b = 146mm = 0{,}146m$
$s = 2mm = 0{,}002m$

$A = 0{,}057m^2$

E-module for steel is a reference work in Solid Works
$E = 2{,}1e^{11}\frac{N}{m^2} = 210.000.000.000\frac{N}{m^2}$

It is chosen to apply pressure on the plate equivalent to
$p = 100\ kg \approx 980N$

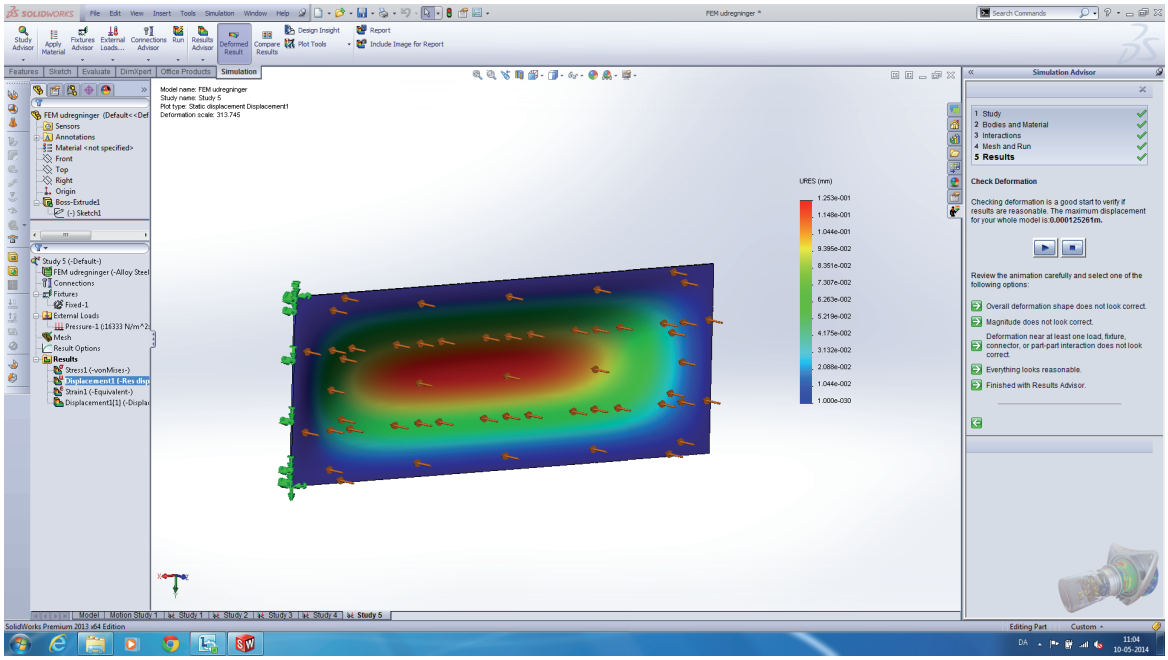
[Krex, H, E., 1986]

Simple geometry without perforations

When you put pressure on a surface in Solid Works, it must be plotted in as N/m^2, in order to obtain the given force at the given area.

Therefore,

$$\frac{980\text{N}}{0{,}057\text{m}^2} \approx 17193\,\frac{\text{N}}{\text{m}^2}$$



In Solid Works the deflection at the middle becomes

$\underline{f = 0{,}000125\text{m} \approx 0{,}13\text{mm}}$

Simple geometry with perforations

Since the perforations in the plate makes the area of the plate is smaller, another force have to be added in Solid Works

$$A_{HUL} = \pi \cdot r^2 = \pi \cdot 1{,}25^2 = 4{,}9mm^2 = 0{,}0000049m^2$$

There are 2873 holes distributed on the plate

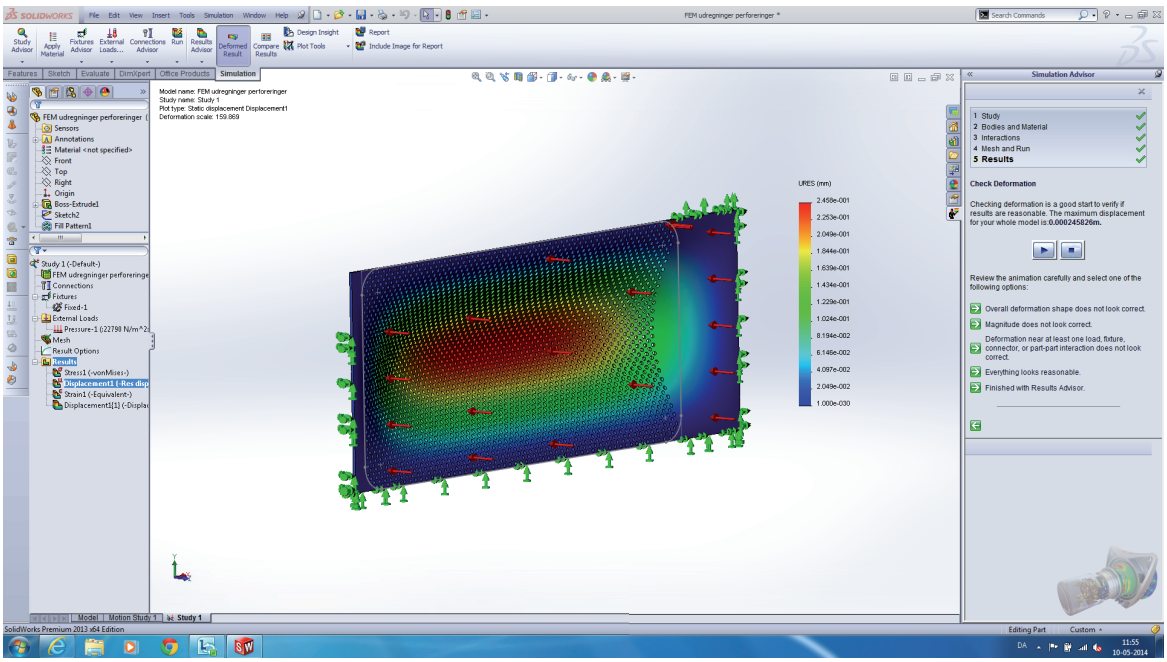
$$A_{HULLER} = 2873 \cdot 0{,}0000049m^2 = 0{,}014m^2$$

It gives a surface area of

$$A_{FLADE} = 0{,}057m^2 - 0{,}014m^2 = 0{,}043m^2$$

Since the equal pressure is wanted on a now smaller surface, the pressure gets distributed with the following force

$$\frac{980N}{0{,}043m^2} \approx 22790 \frac{N}{m^2}$$



In Solid Works the deflection at the middle becomes

$$f = 0{,}000246m \approx 0{,}25mm$$

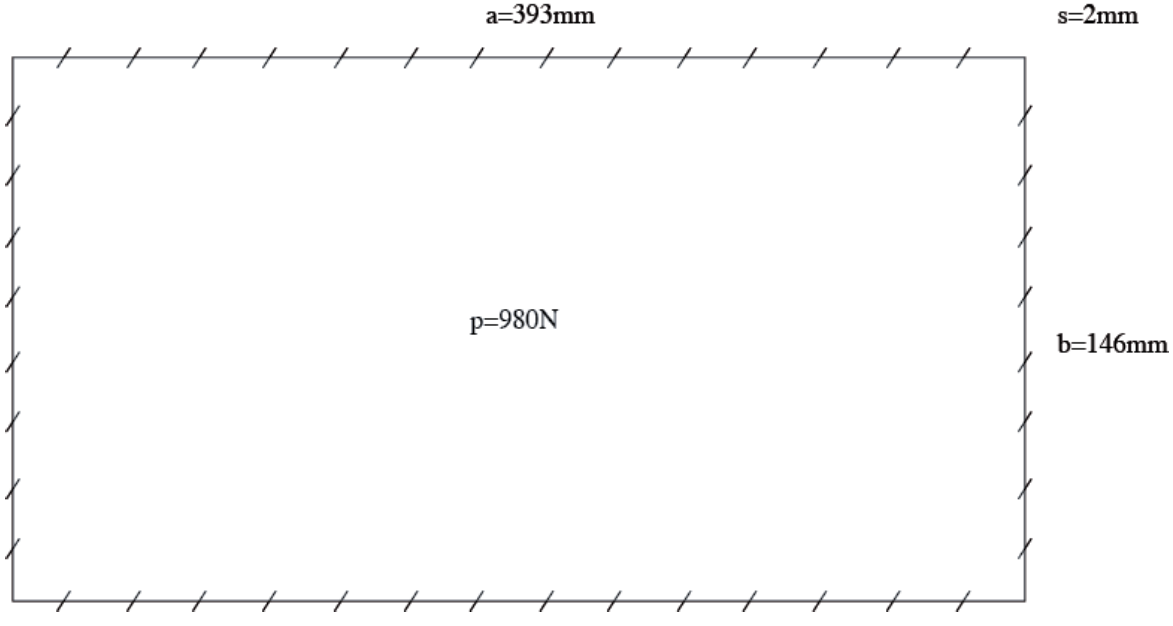
Construction elements
Plates subjected to pressure

To get an identification of the results in Solid Works is trustworthy, there are calculated at the same simple geometries using the formula for plates subjected to pressure

Maximum tension in the middle

	I centrum	ψ
Underpinning along edge	$\varphi_r = \varphi_t = 1{,}24$	0,7

Rectangular plates with the sides a> b and thickness s
The plate is underpinned along all edges



Deflection in the middle is given by

$$f = \frac{1}{16} \cdot p \cdot \frac{b^4}{E \cdot s^3} \cdot \psi$$

[Krex, H, E., 1986]

Deflection of an item without perforations

The deflection at the middle of the given sheet without perforations

$$f = \frac{1}{16} \cdot \frac{980N}{0{,}057m^2} \cdot \frac{0{,}146m^4}{210.000.000.000 \frac{N}{m^2} \cdot 0{,}002m^3} \cdot 0{,}7$$

This gives a deflection at the middle

$f = 0{,}000193m \approx 0{,}19mm$

Compared to the results in Solid Works the calculating is acceptable.

Deflection of an element with perforations

The deflection at the middle of the given sheet without perforations

$$f = \frac{1}{16} \cdot \frac{980N}{0{,}043m^2} \cdot \frac{0{,}14m^4}{210.000.000.000 \frac{N}{m^2} \cdot 0{,}002m^3} \cdot 0{,}7$$

This gives a deflection at the middle

$f = 0{,}000269m \approx 0{,}27mm$

Compared to the results in Solid Works the calculating is acceptable.

These results show that the simulations in Solid Works are trustworthy.
Concurrently, the perforations in the structure have an impact on the strength of the structure. The perforations impact about twice the deflection with the same given pressure.
Since Solid Works has difficulty to deal with the many perforations in the cover of the product, there are made a FEM analysis of a simplistic design without perforations. It should do the simulation in Solid Works simpler.

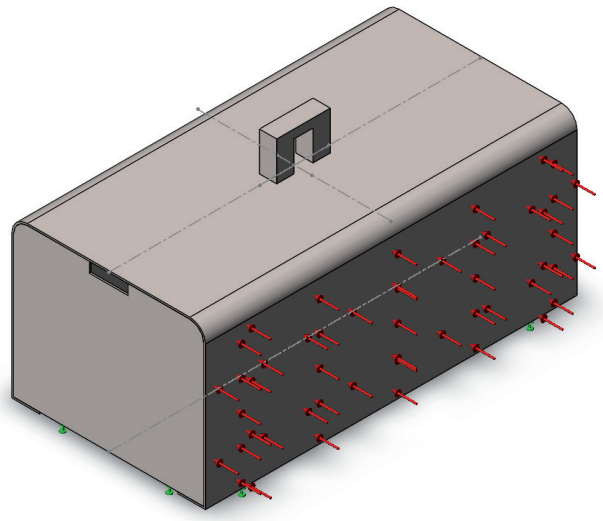
APPENDIX O
FEM ANALYSIS - FULL REPORT

FIXED BOTTOM - SIDE PRESSURE

Model Information

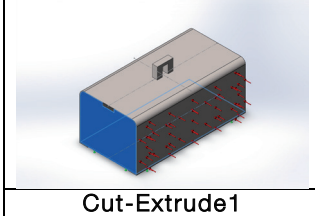
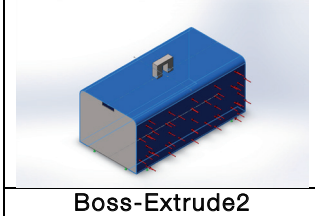
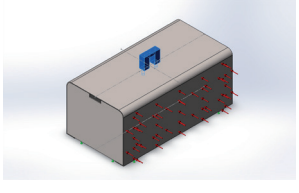
A push on the device

This provides an estimate on whether or not the casing and bracing offer sufficient stiffness in order to maintain its shape and protects the electronics. This calculation uses a force of 980 N



Model name: Assem1
Current Configuration: Default

Solid Bodies

Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
Cut-Extrude1 	Solid Body	Mass:2.0499 kg Volume:0.00026622 m^3 Density:7700 kg/m^3 Weight:20.089 N	C:\Users\camilla.hansen\Desktop\Helt simpel\Bund.SLDPRT May 13 14:39:13 2014
Cut-Extrude1 	Solid Body	Mass:4.19287 kg Volume:0.000544529 m^3 Density:7700 kg/m^3 Weight:41.0902 N	C:\Users\camilla.hansen\Desktop\Helt simpel\Cover.SLDPRT May 13 14:39:13 2014
Boss-Extrude2 	Solid Body	Mass:0.326562 kg Volume:4.24106e-005 m^3 Density:7700 kg/m^3 Weight:3.20031 N	C:\Users\camilla.hansen\Desktop\Helt simpel\Håndtag.SLDPRT May 13 14:39:13 2014

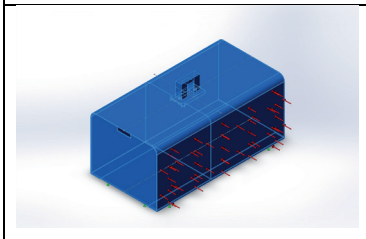
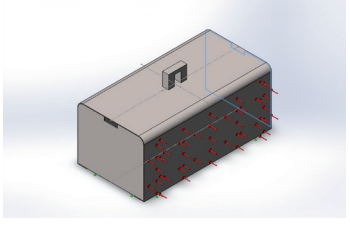
Study Properties

Study name	Study 2
Analysis type	Static
Mesh type	Solid Mesh
Thermal Effect:	On
Thermal option	Include temperature loads
Zero strain temperature	298 Kelvin
Include fluid pressure effects from SolidWorks Flow Simulation	Off
Solver type	FFEPlus
Inplane Effect:	Off
Soft Spring:	Off
Inertial Relief:	Off
Incompatible bonding options	Automatic
Large displacement	Off
Compute free body forces	On
Friction	Off
Use Adaptive Method:	Off
Result folder	SolidWorks document (C:\Users\camilla.hansen\Desktop\Helt simpel)

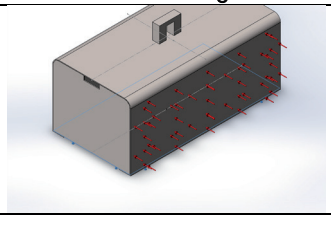
Units

Unit system:	SI (MKS)
Length/Displacement	mm
Temperature	Kelvin
Angular velocity	Rad/sec
Pressure/Stress	N/m^2

Material Properties

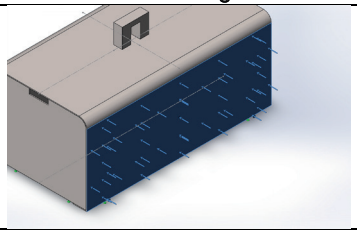
Model Reference	Properties	Components
	Name: Alloy Steel Model type: Linear Elastic Isotropic Default failure criterion: Max von Mises Stress Yield strength: 6.20422e+008 N/m^2 Tensile strength: 7.23826e+008 N/m^2 Elastic modulus: 2.1e+011 N/m^2 Poisson's ratio: 0.28 Mass density: 7700 kg/m^3 Shear modulus: 7.9e+010 N/m^2 Thermal expansion coefficient: 1.3e-005 /Kelvin	SolidBody 1(Cut-Extrude1)(Bund-1), SolidBody 1(Cut-Extrude1)(Cover-1), SolidBody 1(Boss-Extrude2)(Håndtag-2), SolidBody 1(Cut-Extrude1)(Mellem-1), SolidBody 1(Cut-Extrude1)(Stiver-1)
Curve Data:N/A		
	Name: PP Copolymer Model type: Linear Elastic Isotropic Default failure criterion: Unknown Tensile strength: 2.76e+007 N/m^2 Elastic modulus: 8.96e+008 N/m^2 Poisson's ratio: 0.4103 Mass density: 890 kg/m^3 Shear modulus: 3.158e+008 N/m^2	SolidBody 1(Cut-Extrude1)(Mellem-2)
Curve Data:N/A		

Loads and Fixtures

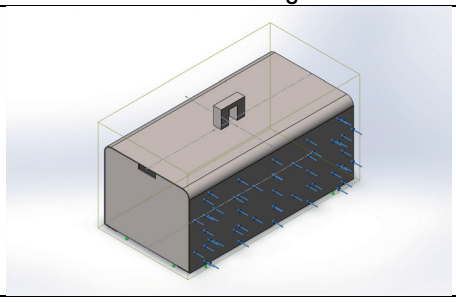
Fixture name	Fixture Image	Fixture Details
Fixed-1		Entities: 1 face(s) Type: Fixed Geometry

Resultant Forces

Components	X	Y	Z	Resultant
Reaction force(N)	1227.02	1.76066	-0.199064	1227.02
Reaction Moment(N·m)	0	0	0	0

Load name	Load Image	Load Details
Pressure-1		Entities: 1 face(s) Type: Normal to selected face Value: 17193 Units: N/m^2

Contact Information

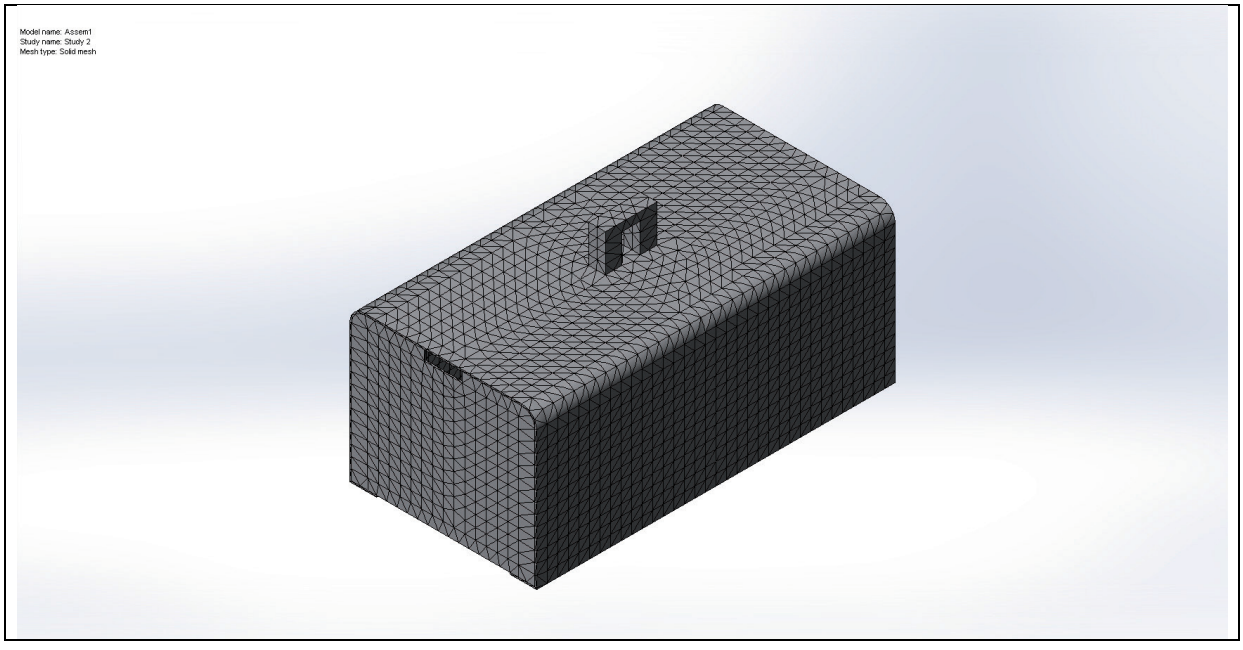
Contact	Contact Image	Contact Properties
Global Contact		Type: Bonded Components: 1 component(s) Options: Compatible mesh

Mesh Information

Mesh type	Solid Mesh
Mesher Used:	Standard mesh
Automatic Transition:	Off
Include Mesh Auto Loops:	Off
Jacobian points	4 Points
Element Size	12.9729 mm
Tolerance	0.648643 mm
Mesh Quality	High
Remesh failed parts with incompatible mesh	Off

Mesh Information - Details

Total Nodes	37406
Total Elements	19448
Maximum Aspect Ratio	37.016
% of elements with Aspect Ratio < 3	4.66
% of elements with Aspect Ratio > 10	3.52
% of distorted elements(Jacobian)	0
Time to complete mesh(hh;mm;ss):	00:00:04
Computer name:	DKARHL198



Resultant Forces

Reaction Forces

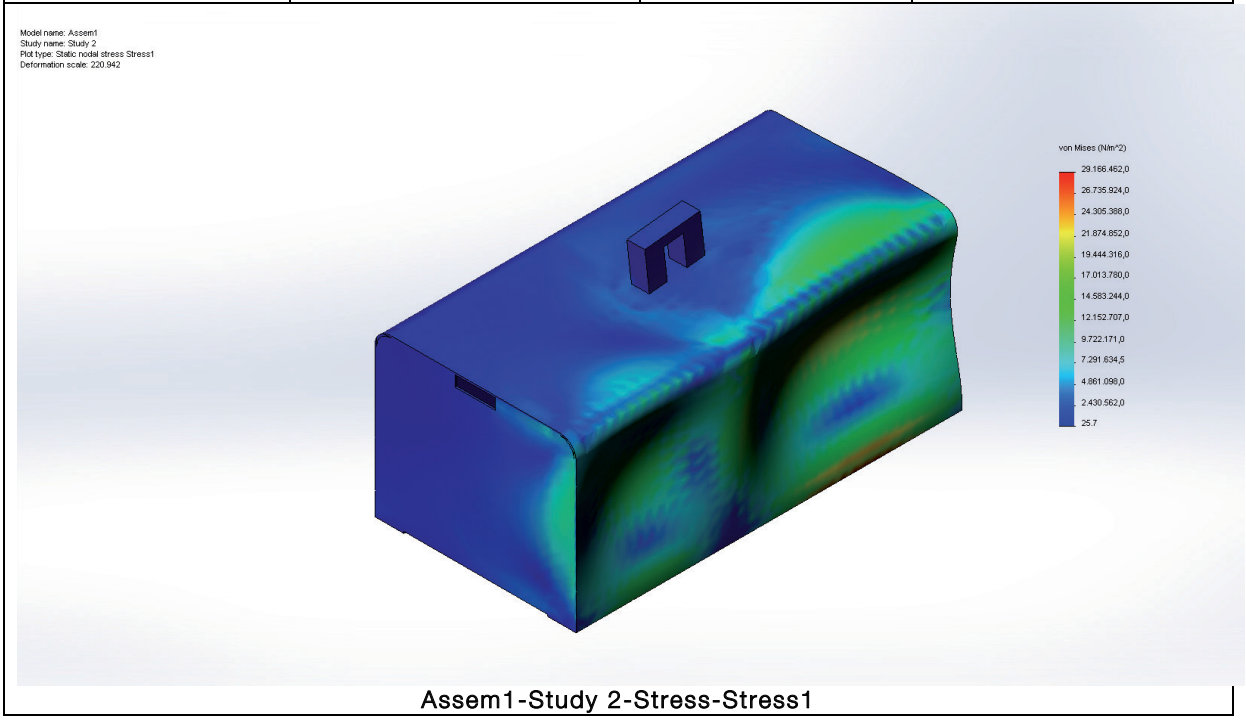
Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N	1227.02	1.76066	-0.199064	1227.02

Reaction Moments

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N·m	0	0	0	0

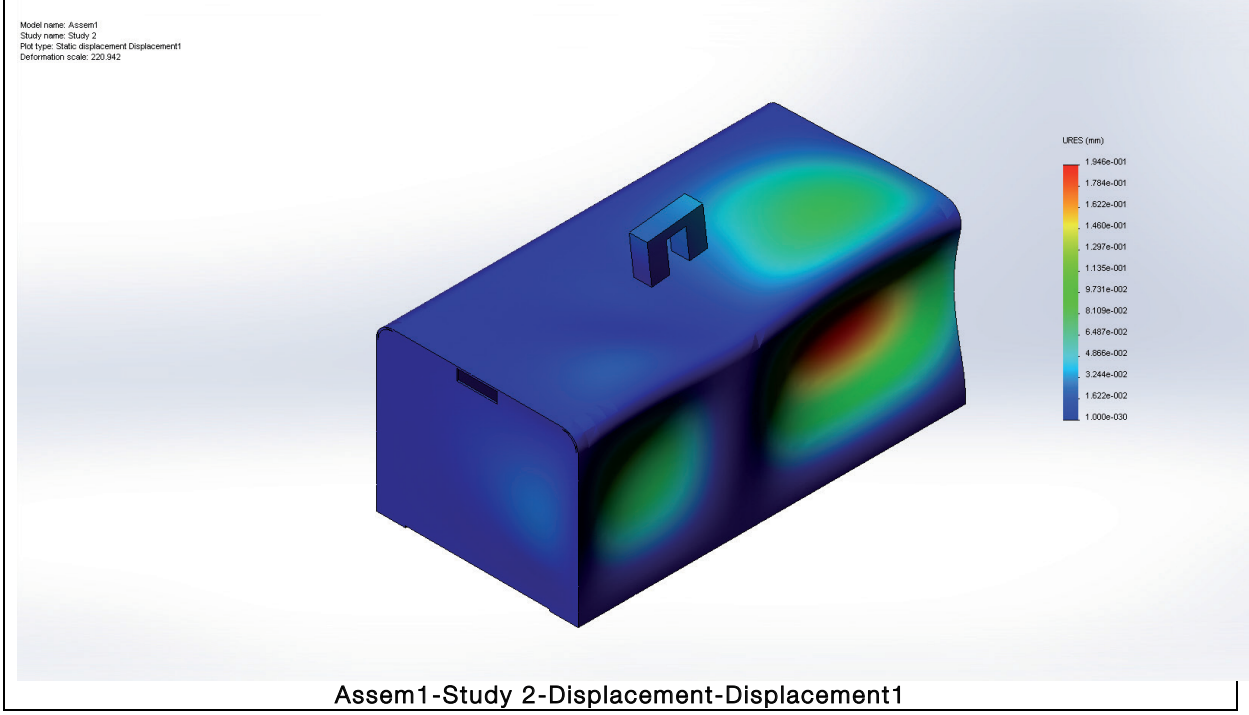
Study Results

Name	Type	Min	Max
Stress1	VON: von Mises Stress	25.7194 N/m^2 Node: 6689	2.91665e+007 N/m^2 Node: 17827



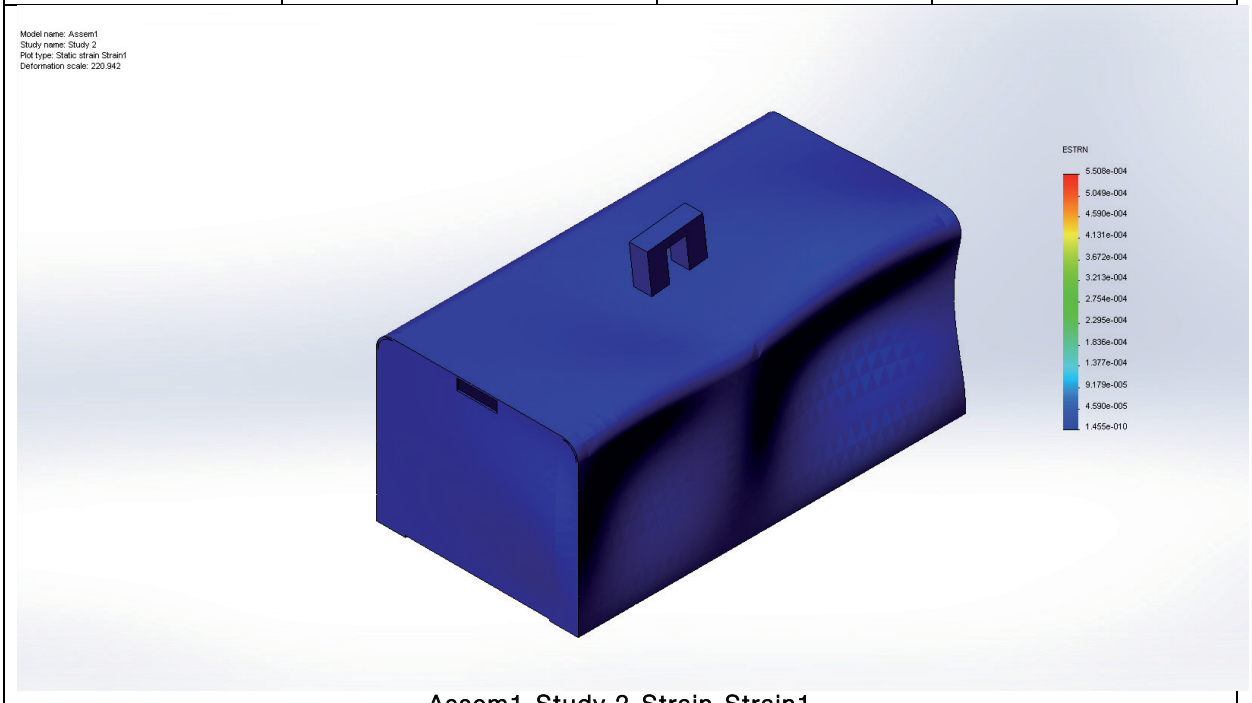
Assem1-Study 2-Stress-Stress1

Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0 mm Node: 381	0.194622 mm Node: 12290



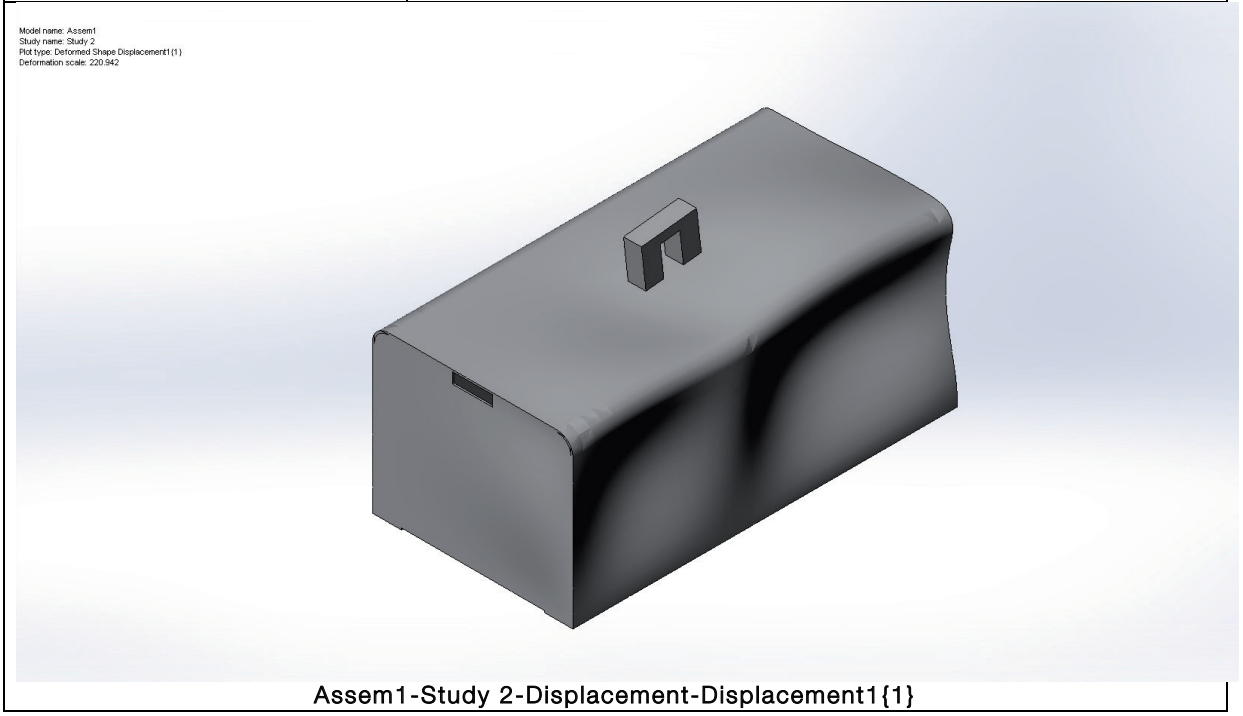
Assem1-Study 2-Displacement-Displacement1

Name	Type	Min	Max
Strain1	ESTRN: Equivalent Strain	1.4546e-010 Element: 1450	0.000550765 Element: 18474



Assem1-Study 2-Strain-Strain1

Name	Type
Displacement1{1}	Deformed Shape



Assem1-Study 2-Displacement-Displacement1{1}

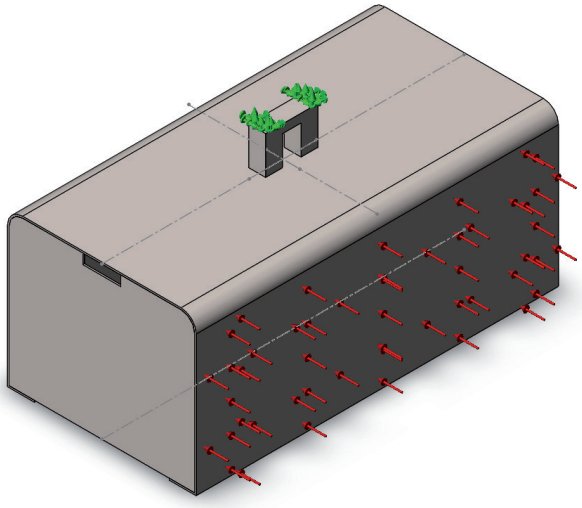
APPENDIX P
FEM ANALYSIS - FULL REPORT

FIXED TOP - SIDE PRESSURE

Model Information

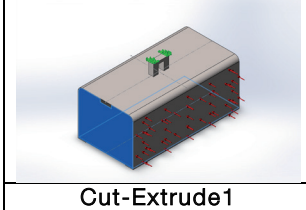
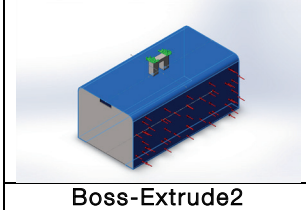
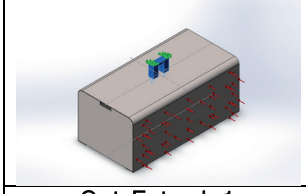
A push obliquely from below

This setup imitates a scenario where a ladder is pushed towards a Jem Dual fog head or it is hit obliquely from below. This calculation uses a force of 980 N.



Model name: Assem1
Current Configuration: Default

Solid Bodies

Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
Cut-Extrude1 	Solid Body	Mass:2.0499 kg Volume:0.00026622 m^3 Density:7700 kg/m^3 Weight:20.089 N	C:\Users\camilla.hansen\Desktop\Helt simpel\Bund.SLDPRT May 13 14:39:13 2014
Cut-Extrude1 	Solid Body	Mass:4.19287 kg Volume:0.000544529 m^3 Density:7700 kg/m^3 Weight:41.0902 N	C:\Users\camilla.hansen\Desktop\Helt simpel\Cover.SLDPRT May 13 14:39:13 2014
Boss-Extrude2 	Solid Body	Mass:0.326562 kg Volume:4.24106e-005 m^3 Density:7700 kg/m^3 Weight:3.20031 N	C:\Users\camilla.hansen\Desktop\Helt simpel\Håndtag.SLDPRT May 13 14:39:13 2014
Cut-Extrude1	Solid Body	Mass:0.593056 kg Volume:7.70202e-005 m^3 Density:7700 kg/m^3 Weight:5.81195 N	C:\Users\camilla.hansen\Desktop\Helt simpel\Mellem.SLDPRT May 13 14:39:13 2014

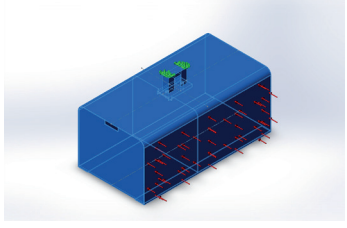
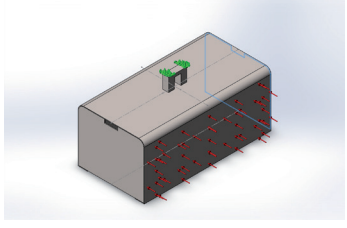
Study Properties

Study name	Study 2
Analysis type	Static
Mesh type	Solid Mesh
Thermal Effect:	On
Thermal option	Include temperature loads
Zero strain temperature	298 Kelvin
Include fluid pressure effects from SolidWorks Flow Simulation	Off
Solver type	FFEPlus
Inplane Effect:	Off
Soft Spring:	Off
Inertial Relief:	Off
Incompatible bonding options	Automatic
Large displacement	Off
Compute free body forces	On
Friction	Off
Use Adaptive Method:	Off
Result folder	SolidWorks document (C:\Users\camilla.hansen\Desktop\Helt simpel)

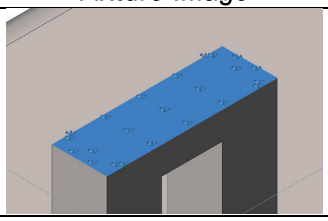
Units

Unit system:	SI (MKS)
Length/Displacement	mm
Temperature	Kelvin
Angular velocity	Rad/sec
Pressure/Stress	N/m^2

Material Properties

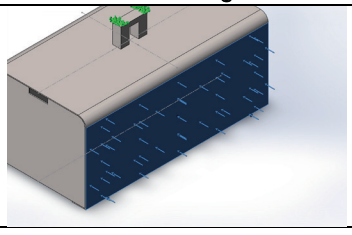
Model Reference	Properties		Components
	Name: Model type: Default failure criterion: Yield strength: Tensile strength: Elastic modulus: Poisson's ratio: Mass density: Shear modulus: Thermal expansion coefficient:	Alloy Steel Linear Elastic Isotropic Max von Mises Stress 6.20422e+008 N/m^2 7.23826e+008 N/m^2 2.1e+011 N/m^2 0.28 7700 kg/m^3 7.9e+010 N/m^2 1.3e-005 /Kelvin	SolidBody 1(Cut-Extrude1)(Bund-1), SolidBody 1(Cut-Extrude1)(Cover-1), SolidBody 1(Boss-Extrude2)(Håndtag-2), SolidBody 1(Cut-Extrude1)(Mellem-1), SolidBody 1(Cut-Extrude1)(Stiver-1)
Curve Data:N/A			
	Name: Model type: Default failure criterion: Tensile strength: Elastic modulus: Poisson's ratio: Mass density: Shear modulus:	PP Copolymer Linear Elastic Isotropic Unknown 2.76e+007 N/m^2 8.96e+008 N/m^2 0.4103 890 kg/m^3 3.158e+008 N/m^2	SolidBody 1(Cut-Extrude1)(Mellem-2)
Curve Data:N/A			

Loads and Fixtures

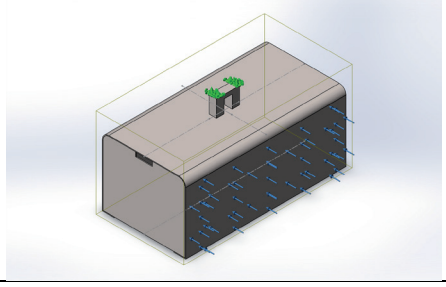
Fixture name	Fixture Image	Fixture Details
Fixed-1		Entities: 1 face(s) Type: Fixed Geometry

Resultant Forces

Components	X	Y	Z	Resultant
Reaction force(N)	1227.23	-0.147095	-0.093811	1227.23
Reaction Moment(N·m)	0	0	0	0

Load name	Load Image	Load Details
Pressure-1		Entities: 1 face(s) Type: Normal to selected face Value: 17193 Units: N/m^2

Contact Information

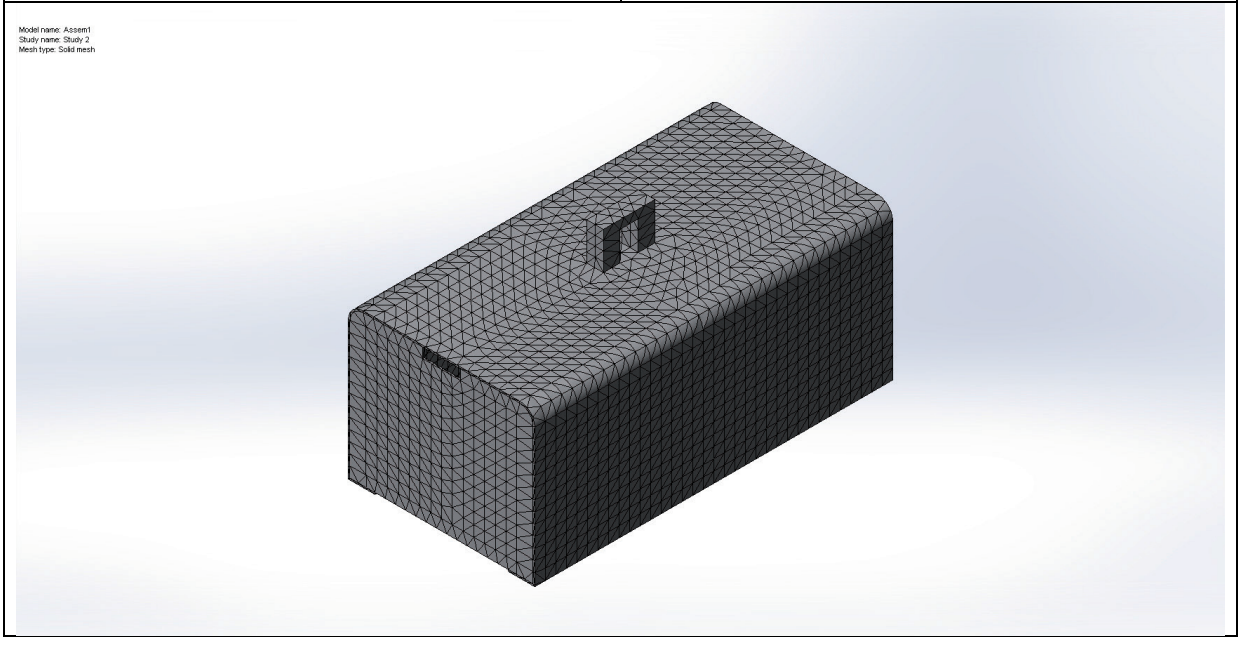
Contact	Contact Image	Contact Properties
Global Contact		Type: Bonded Components: 1 component(s) Options: Compatible mesh

Mesh Information

Mesh type	Solid Mesh
Mesher Used:	Standard mesh
Automatic Transition:	Off
Include Mesh Auto Loops:	Off
Jacobian points	4 Points
Element Size	12.9729 mm
Tolerance	0.648643 mm
Mesh Quality	High
Remesh failed parts with incompatible mesh	Off

Mesh Information - Details

Total Nodes	37406
Total Elements	19448
Maximum Aspect Ratio	37.016
% of elements with Aspect Ratio < 3	4.66
% of elements with Aspect Ratio > 10	3.52
% of distorted elements(Jacobian)	0
Time to complete mesh(hh;mm;ss):	00:00:05
Computer name:	DKARHL198



Resultant Forces

Reaction Forces

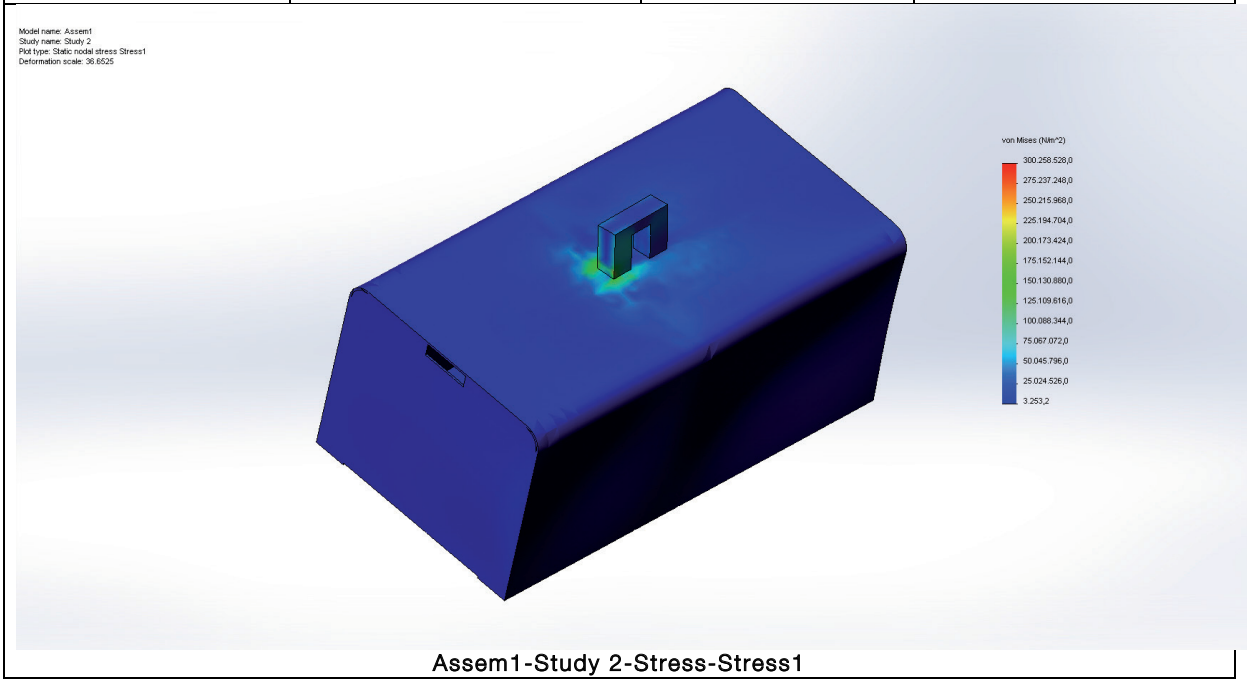
Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N	1227.23	-0.147095	-0.093811	1227.23

Reaction Moments

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N·m	0	0	0	0

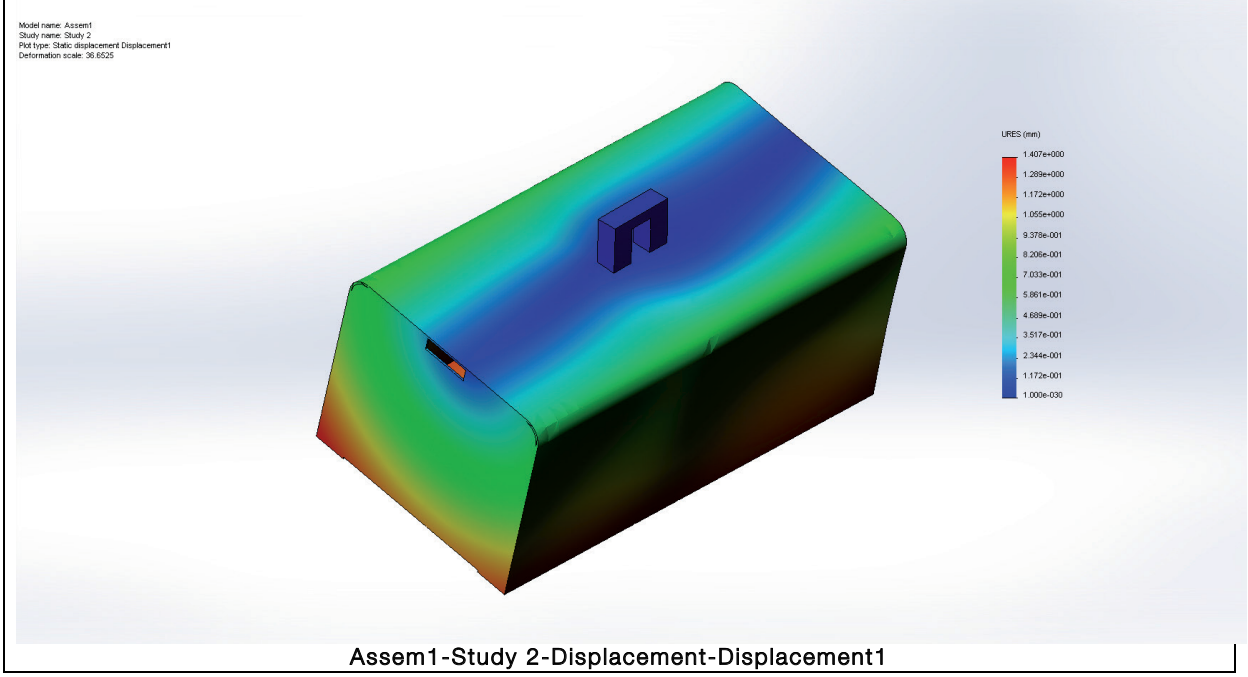
Study Results

Name	Type	Min	Max
Stress1	VON: von Mises Stress	3253.25 N/m^2 Node: 30950	3.00259e+008 N/m^2 Node: 33968



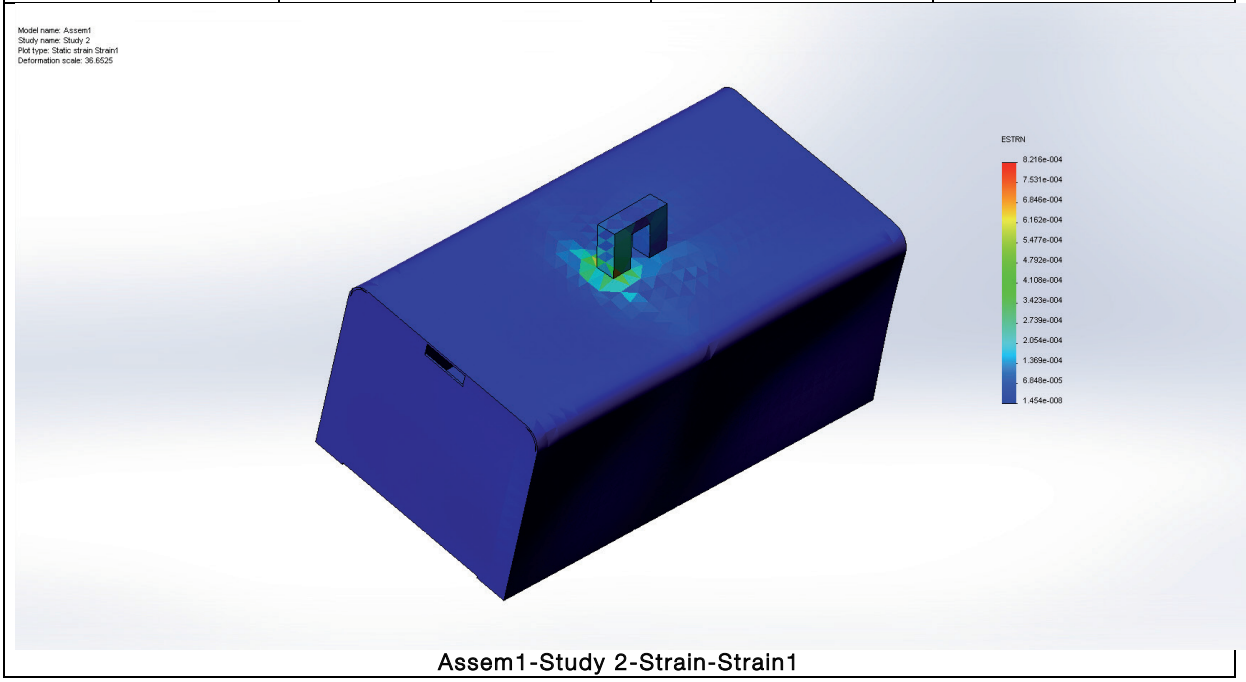
Assem1-Study 2-Stress-Stress1

Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0 mm Node: 30126	1.40666 mm Node: 12532



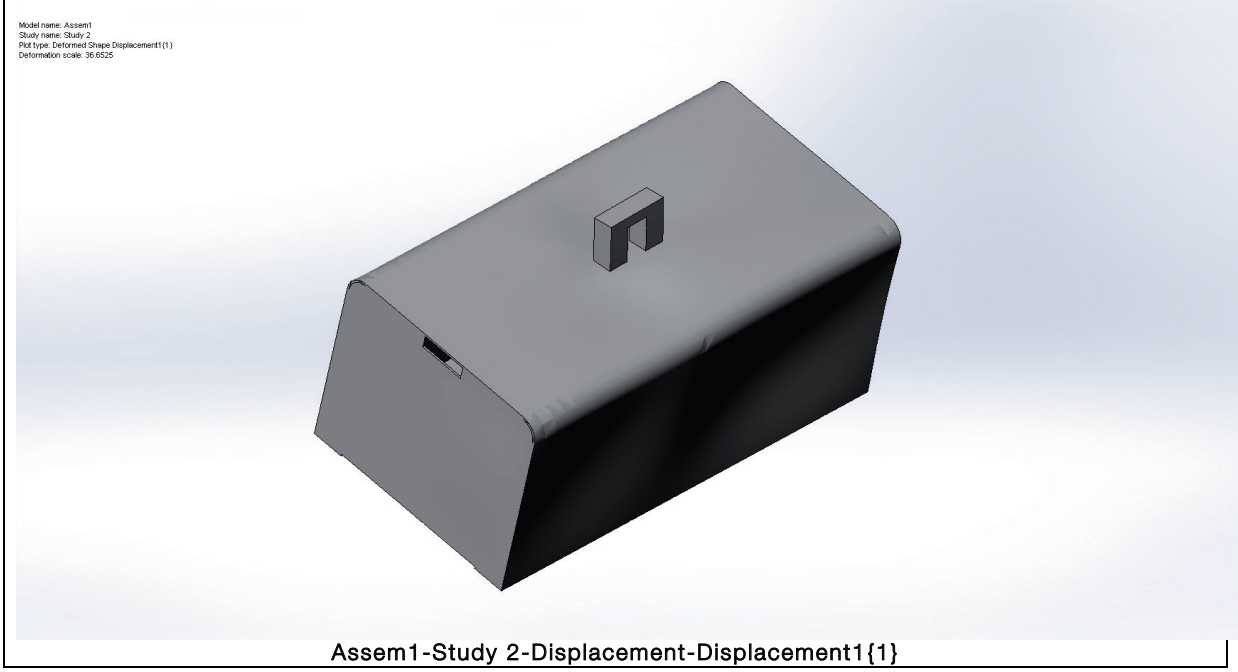
Assem1-Study 2-Displacement-Displacement1

Name	Type	Min	Max
Strain1	ESTRN: Equivalent Strain	1.45438e-008 Element: 15718	0.000821559 Element: 17310



Assem1-Study 2-Strain-Strain1

Name	Type
Displacement1{1}	Deformed Shape

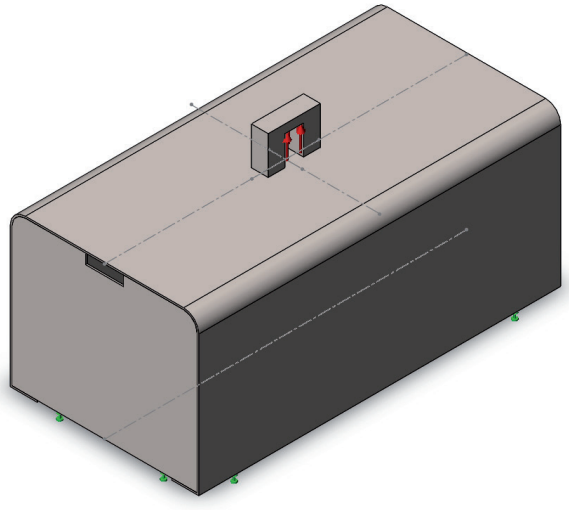


Assem1-Study 2-Displacement-Displacement1{1}

APPENDIX Q
FEM ANALYSIS - FULL REPORT
LIFT IN HANDLE

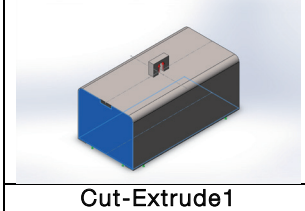
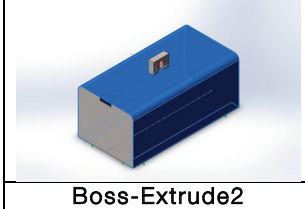
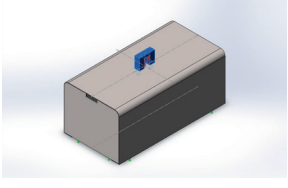
Model Information

Lifting the device by handle
This will provide an understanding on whether or not the casing and the quarter turn bracing offer sufficient stiffness in order to resist deformation. This calculation uses a force of 200 N to imitate 20 kg. This provides a safety margin relative to the approximated 10 weight of the product.



Model name: Assem1
Current Configuration: Default

Solid Bodies

Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
Cut-Extrude1 	Solid Body	Mass:2.0499 kg Volume:0.00026622 m^3 Density:7700 kg/m^3 Weight:20.089 N	C:\Users\camilla.hansen\Desktop\Helt simpel\Bund.SLDPRT May 13 14:39:13 2014
Cut-Extrude1 	Solid Body	Mass:4.19287 kg Volume:0.000544529 m^3 Density:7700 kg/m^3 Weight:41.0902 N	C:\Users\camilla.hansen\Desktop\Helt simpel\Cover.SLDPRT May 13 14:39:13 2014
Boss-Extrude2 	Solid Body	Mass:0.326562 kg Volume:4.24106e-005 m^3 Density:7700 kg/m^3 Weight:3.20031 N	C:\Users\camilla.hansen\Desktop\Helt simpel\Håndtag.SLDPRT May 13 14:39:13 2014

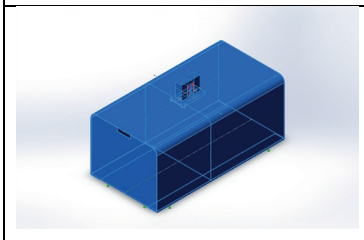
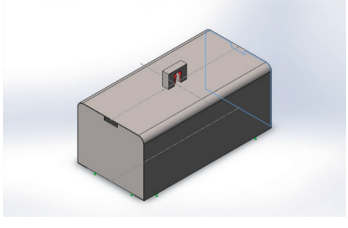
Study Properties

Study name	Study 2
Analysis type	Static
Mesh type	Solid Mesh
Thermal Effect:	On
Thermal option	Include temperature loads
Zero strain temperature	298 Kelvin
Include fluid pressure effects from SolidWorks Flow Simulation	Off
Solver type	FFEPlus
Inplane Effect:	Off
Soft Spring:	Off
Inertial Relief:	Off
Incompatible bonding options	Automatic
Large displacement	Off
Compute free body forces	On
Friction	Off
Use Adaptive Method:	Off
Result folder	SolidWorks document (C:\Users\camilla.hansen\Desktop\Helt simpel)

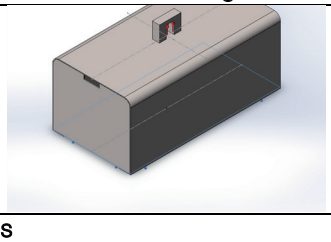
Units

Unit system:	SI (MKS)
Length/Displacement	mm
Temperature	Kelvin
Angular velocity	Rad/sec
Pressure/Stress	N/m^2

Material Properties

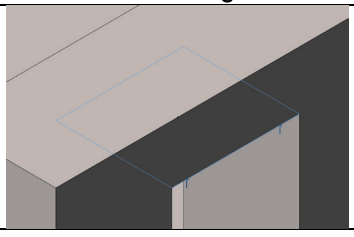
Model Reference	Properties	Components
	Name: Alloy Steel Model type: Linear Elastic Isotropic Default failure criterion: Max von Mises Stress Yield strength: 6.20422e+008 N/m^2 Tensile strength: 7.23826e+008 N/m^2 Elastic modulus: 2.1e+011 N/m^2 Poisson's ratio: 0.28 Mass density: 7700 kg/m^3 Shear modulus: 7.9e+010 N/m^2 Thermal expansion coefficient: 1.3e-005 /Kelvin	SolidBody 1(Cut-Extrude1)(Bund-1), SolidBody 1(Cut-Extrude1)(Cover-1), SolidBody 1(Boss-Extrude2)(Håndtag-2), SolidBody 1(Cut-Extrude1)(Mellem-1), SolidBody 1(Cut-Extrude1)(Stiver-1)
Curve Data:N/A		
	Name: PP Copolymer Model type: Linear Elastic Isotropic Default failure criterion: Unknown Tensile strength: 2.76e+007 N/m^2 Elastic modulus: 8.96e+008 N/m^2 Poisson's ratio: 0.4103 Mass density: 890 kg/m^3 Shear modulus: 3.158e+008 N/m^2	SolidBody 1(Cut-Extrude1)(Mellem-2)
Curve Data:N/A		

Loads and Fixtures

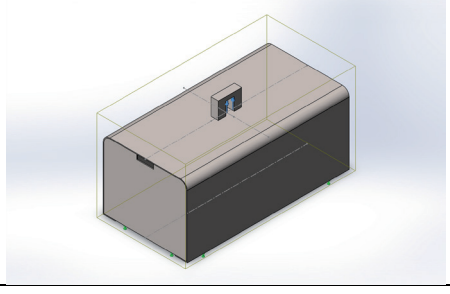
Fixture name	Fixture Image	Fixture Details
Fixed-2		Entities: 1 face(s) Type: Fixed Geometry

Resultant Forces

Components	X	Y	Z	Resultant
Reaction force(N)	0.167951	-245.258	-0.59819	245.259
Reaction Moment(N·m)	0	0	0	0

Load name	Load Image	Load Details
Pressure-1		Entities: 1 face(s) Type: Normal to selected face Value: 556818 Units: N/m^2

Contact Information

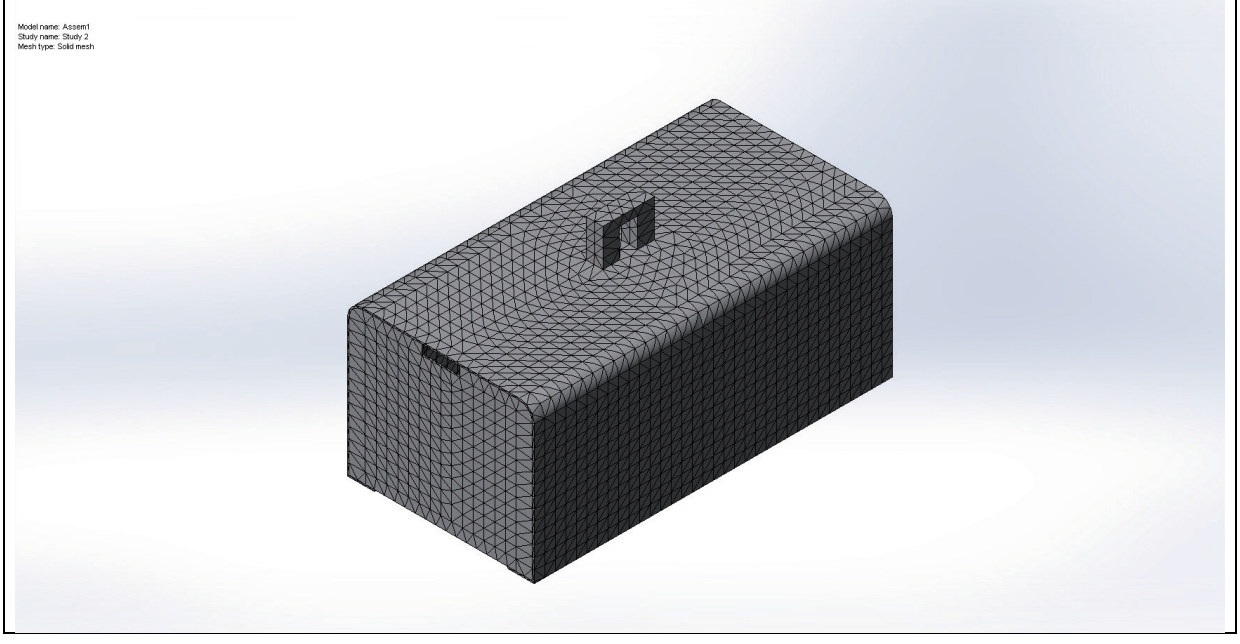
Contact	Contact Image	Contact Properties
Global Contact		Type: Bonded Components: 1 component(s) Options: Compatible mesh

Mesh Information

Mesh type	Solid Mesh
Mesher Used:	Standard mesh
Automatic Transition:	Off
Include Mesh Auto Loops:	Off
Jacobian points	4 Points
Element Size	12.9729 mm
Tolerance	0.648643 mm
Mesh Quality	High
Remesh failed parts with incompatible mesh	Off

Mesh Information - Details

Total Nodes	37406
Total Elements	19448
Maximum Aspect Ratio	37.016
% of elements with Aspect Ratio < 3	4.66
% of elements with Aspect Ratio > 10	3.52
% of distorted elements(Jacobian)	0
Time to complete mesh(hh;mm;ss):	00:00:04
Computer name:	DKARHL198



Resultant Forces

Reaction Forces

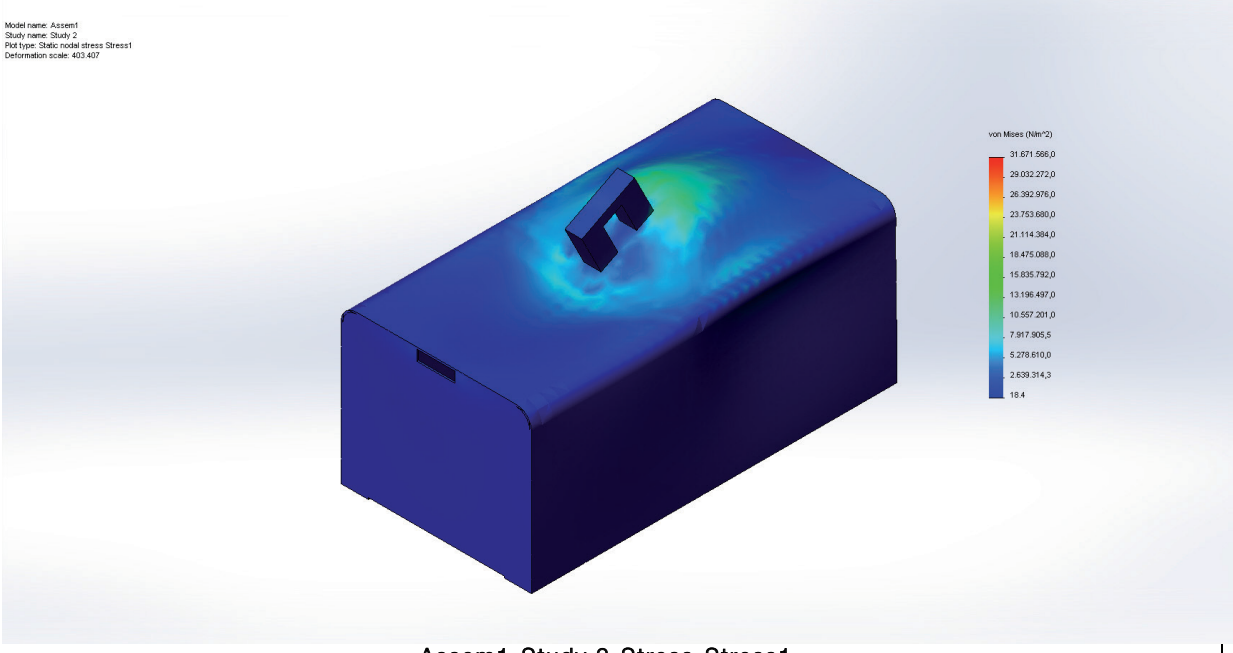
Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N	0.167951	-245.258	-0.59819	245.259

Reaction Moments

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N·m	0	0	0	0

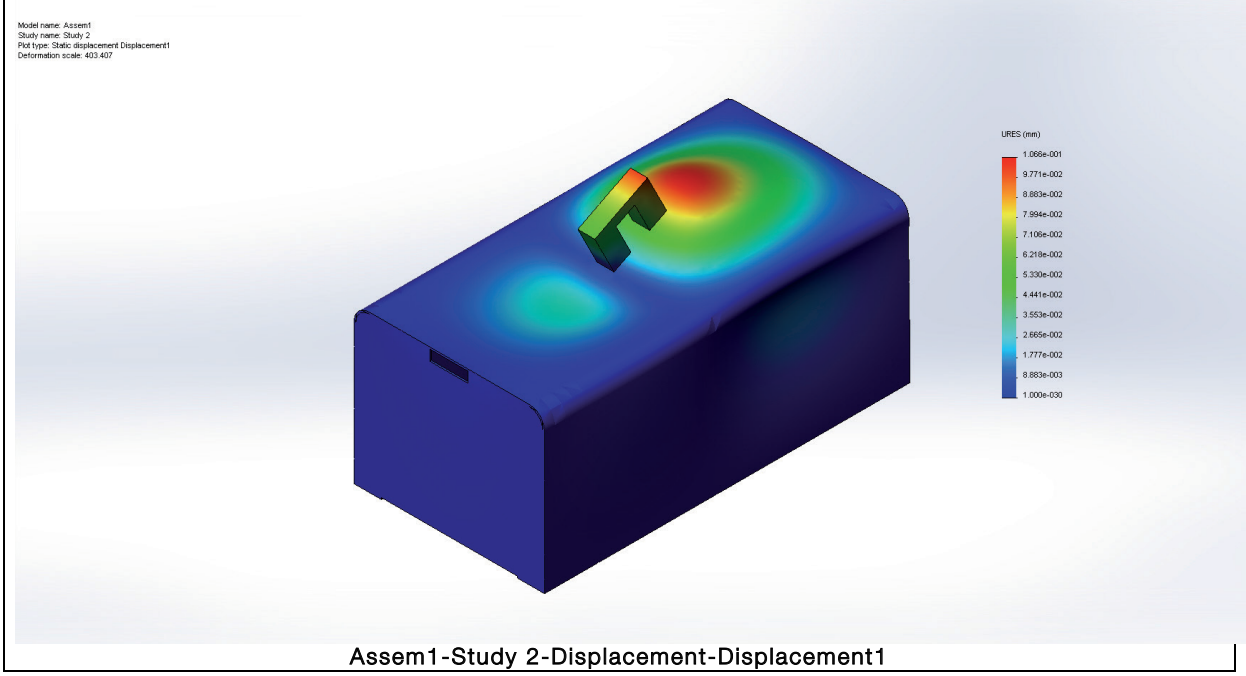
Study Results

Name	Type	Min	Max
Stress1	VON: von Mises Stress	18.4445 N/m^2 Node: 846	3.16716e+007 N/m^2 Node: 37175



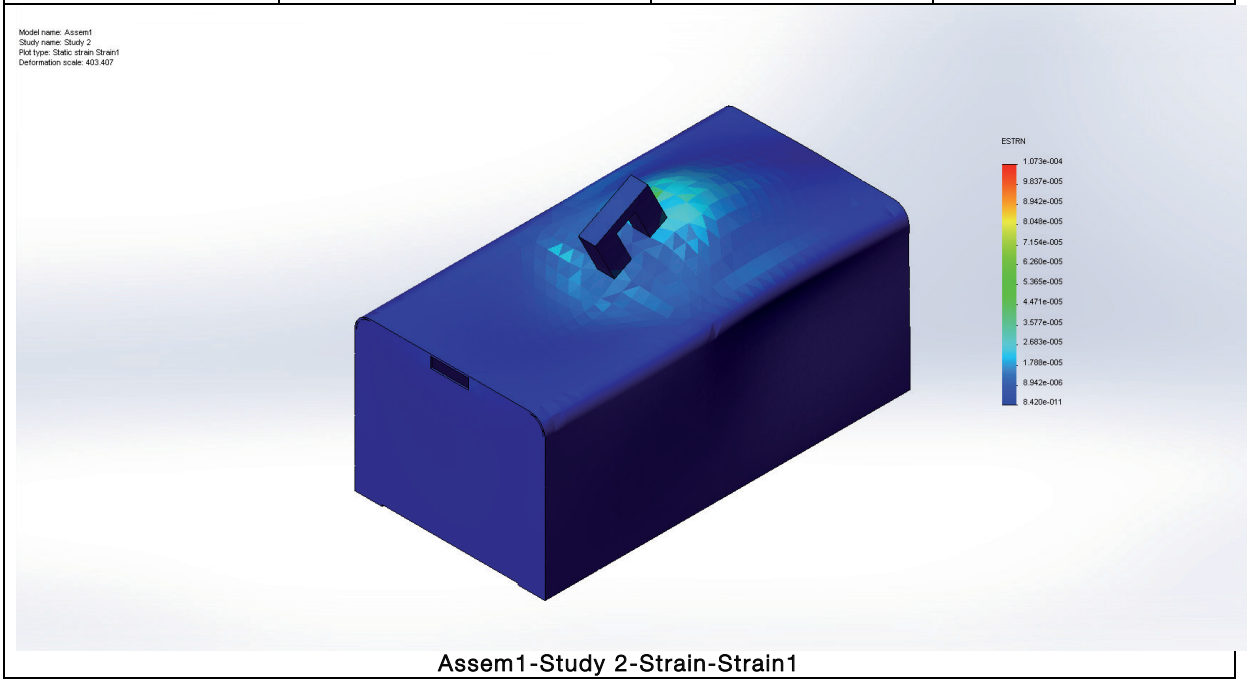
Assem1-Study 2-Stress-Stress1

Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0 mm Node: 381	0.106592 mm Node: 27281



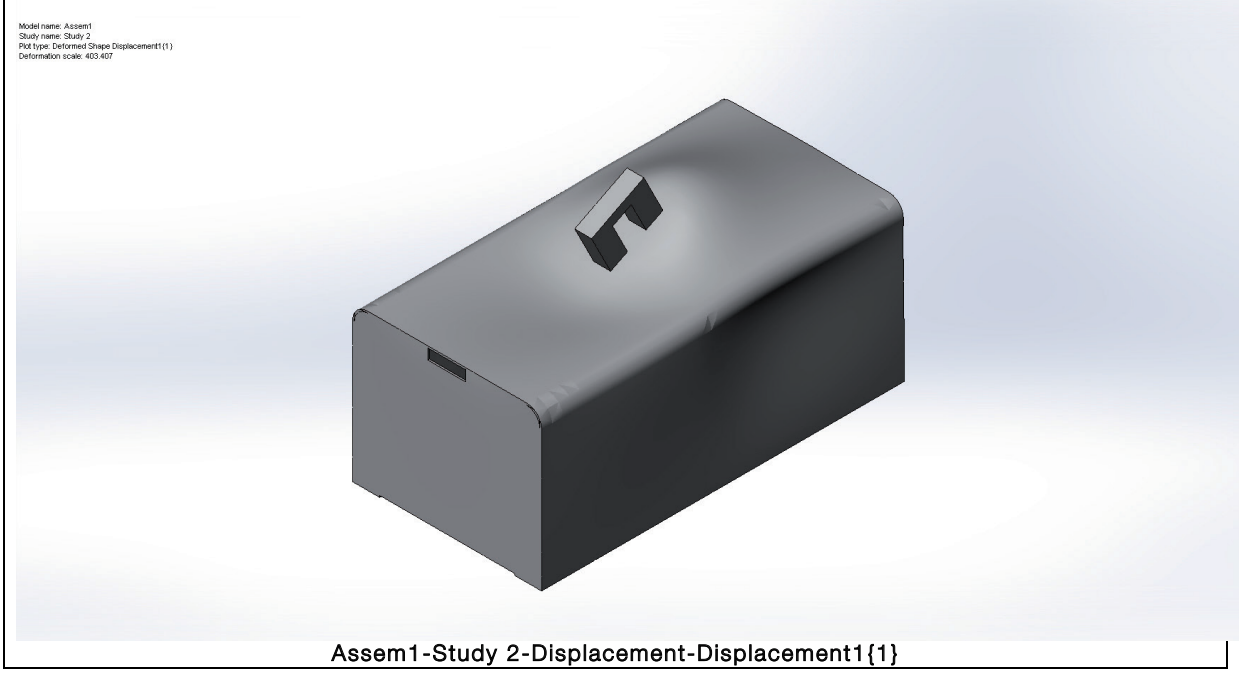
Assem1-Study 2-Displacement-Displacement1

Name	Type	Min	Max
Strain1	ESTRN: Equivalent Strain	8.42031e-011 Element: 3754	0.000107309 Element: 18793



Assem1-Study 2-Strain-Strain1

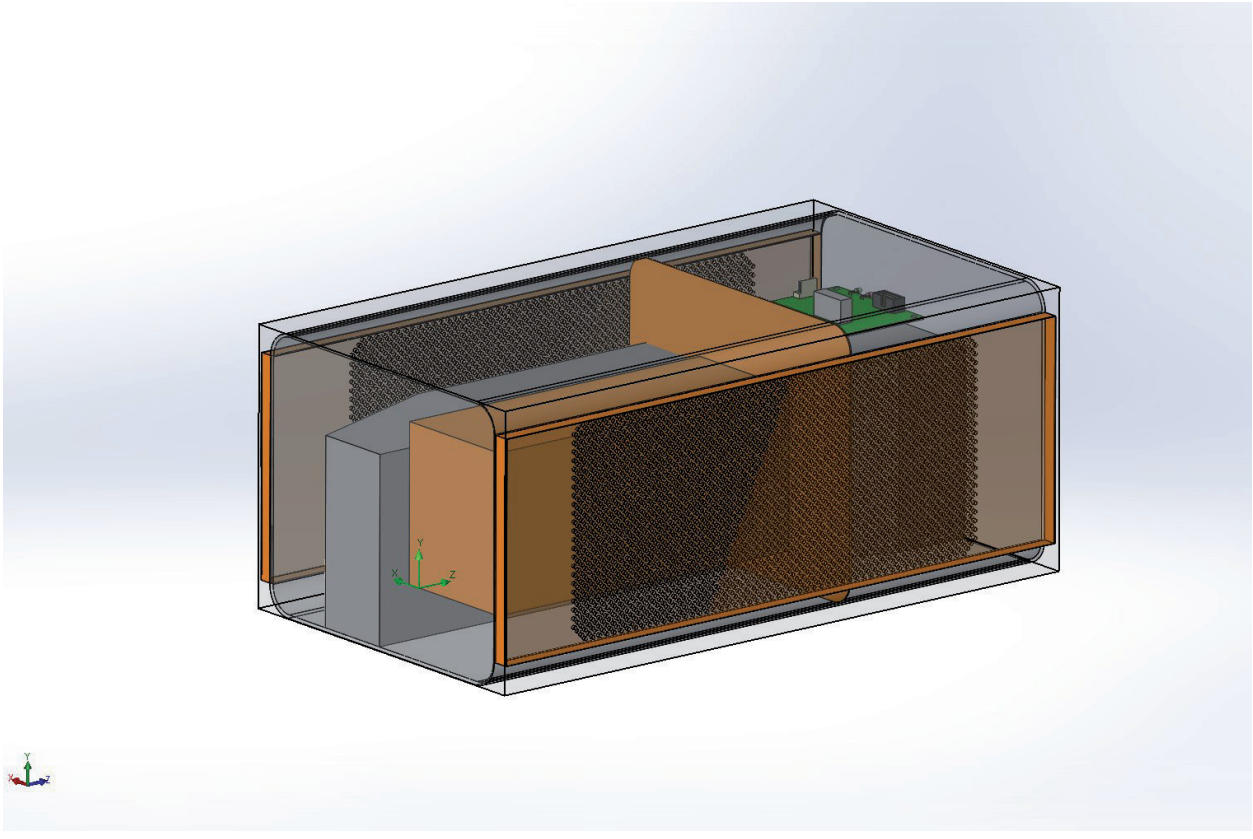
Name	Type
Displacement1{1}	Deformed Shape



Assem1-Study 2-Displacement-Displacement1{1}

APPENDIX R
THERMAL ANALYSIS - FULL REPORT

FULL REPORT



System Info

Product	Flow Simulation 2013 SP5.0. Build: 2512
Computer name	MP2014ch
User name	rd
Processors	Intel(R) Core(TM) i7-4700MQ CPU @ 2.40GHz
Memory	16009 MB / 8388607 MB
Operating system	Windows 7 Service Pack 1 (Build 7601)
CAD version	SolidWorks 2013 SP5.0
CPU speed	2401 MHz

General Info

Model	C:\Users\rd\Desktop\Club smoke\Flowsimulation\Test Assy.SLDASM
Project name	Test

Project path	C:\Users\rd_lbk\Desktop\Club smoke\Flowsimulation\1
Units system	SI (m-kg-s)
Analysis type	Internal
Exclude cavities without flow conditions	On
Coordinate system	Global coordinate system
Reference axis	X

INPUT DATA

Initial Mesh Settings

Automatic initial mesh: On

Result resolution level: 3

Advanced narrow channel refinement: Off

Refinement in solid region: Off

Geometry Resolution

Evaluation of minimum gap size: Automatic

Evaluation of minimum wall thickness: Automatic

Computational Domain

Size

X min	-0.086 m
X max	0.156 m
Y min	-0.049 m
Y max	0.134 m
Z min	-0.001 m
Z max	0.438 m

Boundary Conditions

2D plane flow	None
At X min	Default
At X max	Default
At Y min	Default
At Y max	Default
At Z min	Default
At Z max	Default

Physical Features

Heat conduction in solids: On

Heat conduction in solids only: Off

Radiation: On

Time dependent: Off

Gravitational effects: Off

Flow type: Laminar and turbulent

High Mach number flow: Off

Humidity: Off

Default roughness: 0 micrometer

Radiation

Default wall radiative surface: Blackbody wall

Radiation model: Ray Tracing

Default outer wall radiative surface: Blackbody wall

Environment radiation

Environment temperature	20.05 °C
Spectrum	Blackbody

Default outer wall condition: Adiabatic wall

Initial Conditions

Thermodynamic parameters	Static Pressure: 101325.00 Pa Temperature: 20.05 °C
Velocity parameters	Velocity vector Velocity in X direction: 0 m/s Velocity in Y direction: 0 m/s Velocity in Z direction: 0 m/s
Solid parameters	Default material: Aluminum 5052 Initial solid temperature: 20.05 °C Radiation Transparency: Opaque
Turbulence parameters	Turbulence intensity and length Intensity: 2.00 % Length: 0.002 m

Material Settings

Fluids

Air

Solids

Aluminum 5052

Insulator

PCB 8-layers

Solid Materials

Aluminum 5052 Solid Material 1

Components	Part15^Test Assy-1@Test Assy Heat Source-1@ Test Assy airduct_top_part - Flow-1@Test Assy Cover sheet metal - Flow-1@Test Assy
Solid substance	Aluminum 5052
Radiation Transparency	Opaque

Insulator Solid Material 1

Components	Part2^Test Assy-1@Test Assy Part3^Test Assy-1@Test Assy Part4^Test Assy-1@Test Assy Part5^Test Assy-1@Test Assy
Solid substance	Insulator
Radiation Transparency	Opaque

PCB 8-layers Solid Material 1

Components	Fan Power board_MagHaz_idm-1@Test Assy/ Fan power board_idm-1@Fan Power board_ MagHaz_idm
Solid substance	PCB 8-layers
Coordinate system	Global coordinate system
Axis	X
Radiation Transparency	Opaque

Boundary Conditions

Environment Pressure 1

Type	Environment Pressure
Faces	Face<1>@Part4^Test Assy-1 Face<2>@ Part5^Test Assy-1
Coordinate system	Global coordinate system
Reference axis	X
Thermodynamic parameters	Environment pressure: 101325.00 Pa Temperature: 20.05 °C
Turbulence parameters	Turbulence intensity and length Intensity: 2.00 % Length: 0.002 m
Boundary layer parameters	Boundary layer type: Turbulent

Heat Volume Sources

VS Temperature 1

Source type	Temperature
Temperature	80.00 °C
Components	Heat Source-1@Test Assy
Coordinate system	Global coordinate system
Reference axis	X

Radiative Surfaces

Radiative Surface 1

Faces	Face<6>@Cover sheet metal - Flow Face<7>@ Cover sheet metal - Flow Face<1>@Cover sheet metal - Flow Face<2>@Cover sheet metal - Flow Face<3>@Cover sheet metal - Flow Face<5>@Cover sheet metal - Flow Face<4>@ Cover sheet metal - Flow
Type	Aluminum Anodized Black

Goals

Surface Goals

SG Max Temperature (Solid) 1

Type	Surface Goal
Goal type	Temperature (Solid)
Calculate	Maximum value
Faces	Face<1>@Fan Power board_MagHaz_idm/Fan power board_idm
Coordinate system	Global coordinate system
Use in convergence	On

Calculation Control Options

Finish Conditions

Finish conditions	If one is satisfied
Maximum travels	4
Goals convergence	Analysis interval: 5e-001

Solver Refinement

Refinement: Disabled

Results Saving

Save before refinement	On

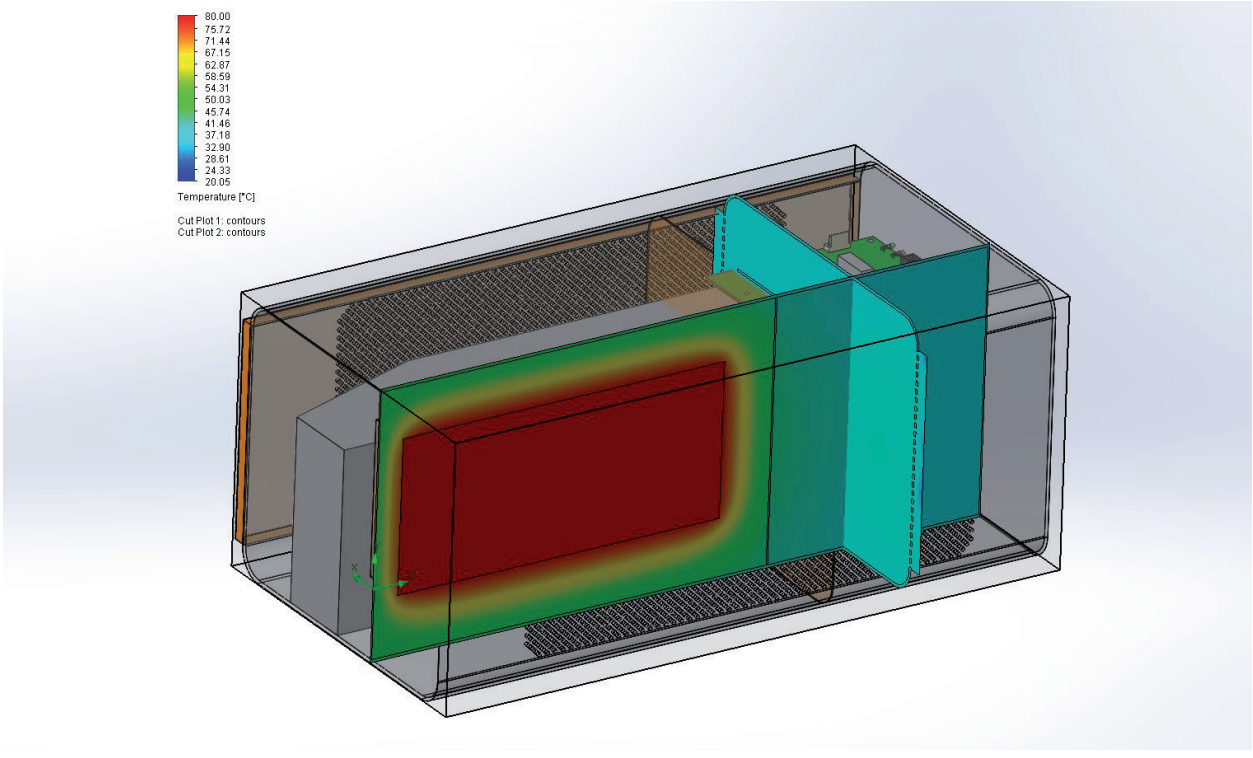
Advanced Control Options

Flow Freezing

Flow freezing strategy	Disabled

View factor resolution level: 3

RESULTS



General Info

Iterations: 167

CPU time: 4914 s

Log

Mesh generation started	14:38:22 , May 06
Mesh generation normally finished	14:46:17 , May 06
Preparing data for calculation	14:46:20 , May 06
Calculation started 0	14:46:53 , May 06
Calculation has converged since the following criteria are satisfied: 166	16:08:19 , May 06
Goals are converged 166	
Calculation finished 167	16:09:16 , May 06

Calculation Mesh

Basic Mesh Dimensions

Number of cells in X	20
Number of cells in Y	16
Number of cells in Z	36

Number Of Cells

Total cells	378782
Fluid cells	155767
Solid cells	43795
Partial cells	179220
Irregular cells	0
Trimmed cells	0

Maximum refinement level: 5

Goals

Name	Unit	Value	Progress	Use in convergence	Delta	Criteria
SG Max Temperature (Solid) 1	°C	38.79	100	On	0.550259795	0.560283103

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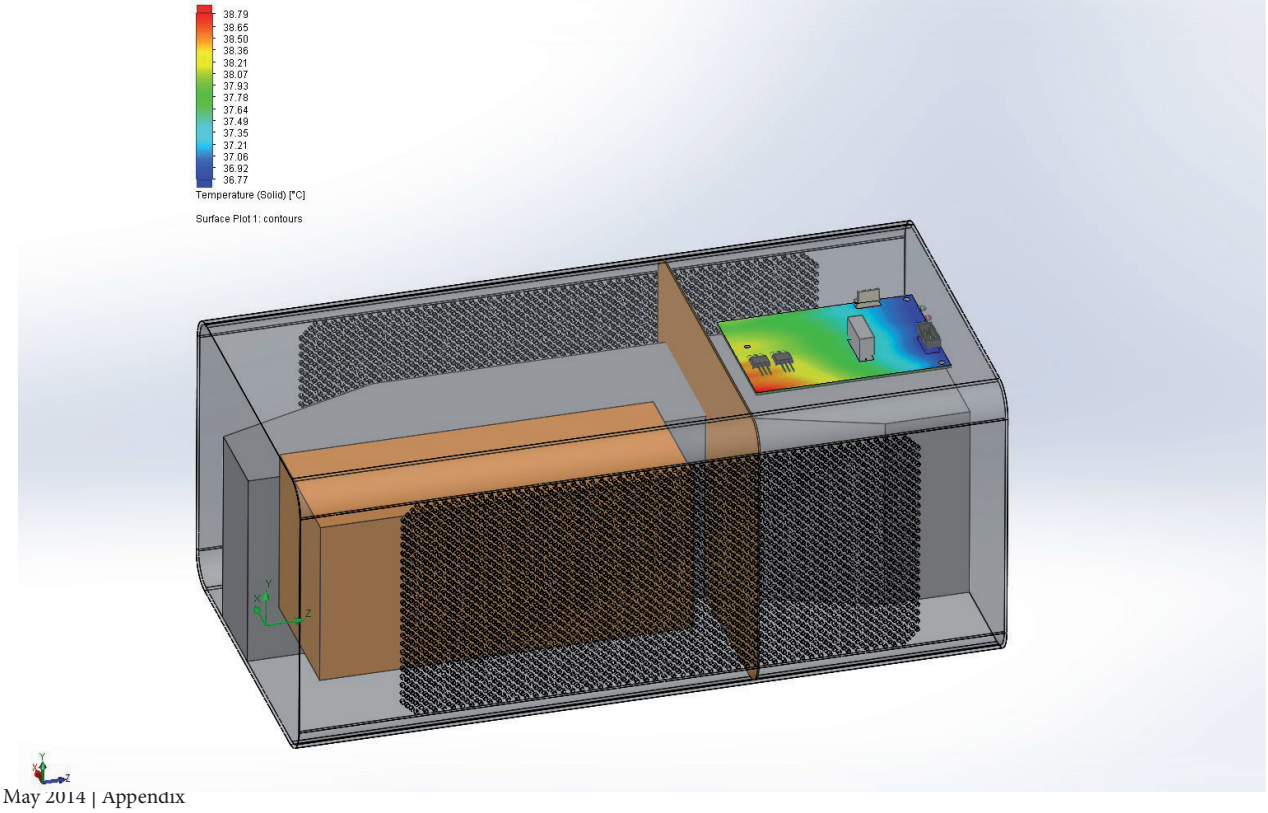


Min/Max Table

Name	Minimum	Maximum
Pressure [Pa]	101325.00	101325.00
Temperature [°C]	20.05	80.00
Density (Fluid) [kg/m^3]	1.00	1.18
Velocity [m/s]	0	1.843e-017
Velocity (X) [m/s]	-4.627e-018	4.799e-018
Velocity (Y) [m/s]	-5.887e-018	1.525e-017
Velocity (Z) [m/s]	-6.332e-018	9.668e-018
Temperature (Fluid) [°C]	20.05	80.00
Temperature (Solid) [°C]	36.40	80.00
X (cartesian) [m]	-0.085	0.155
Y (cartesian) [m]	-0.049	0.134
Z (cartesian) [m]	-0.001	0.437
Phi (cylindrical) [rad]	1.584e-004	6.283
Radius r (cylindrical) [m]	0.002	0.193
Z-axis (cylindrical) [m]	-0.001	0.437
Phi (spherical) [rad]	1.584e-004	6.283
Theta (spherical) [rad]	-0.549	1.565
Position Vector R (spherical) [m]	0.002	0.476
Mach Number [ ]	0	5.17e-020
Axial Velocity [m/s]	-6.332e-018	9.668e-018
Radial Velocity [m/s]	-3.269e-018	4.659e-018
Circumferential Velocity [m/s]	-1.524e-017	7.193e-018
Total Pressure [Pa]	101325.00	101325.00
Dynamic Pressure [Pa]	0	1.90e-034
Friction Coefficient [ ]	0	0
Reference Pressure [Pa]	101325.00	101325.00
Relative Pressure [Pa]	-1.49e-007	-1.49e-007
Specific Heat (Cp) [J/(kg*K)]	1006.6	1010.2
Dynamic Viscosity [Pa*s]	1.8146e-005	2.0892e-005
Prandtl Number [ ]	0.6952473	0.7073882
Fluid Thermal Conductivity [W/(m*K)]	0.0262	0.0304
Solid Thermal Conductivity (X) [W/(m*K)]	0.2800	140.0000
Solid Thermal Conductivity (Y) [W/(m*K)]	32.7000	140.0000

Solid Thermal Conductivity (Z) [W/(m*K)]	32.7000	140.0000
Stanton Number [ ]	0	0
Total Enthalpy [J/kg]	298013.495	358451.347
Heat Flux [W/m^2]	0	74764.529
Heat Flux (X) [W/m^2]	-27605.945	38417.750
Heat Flux (Y) [W/m^2]	-55847.134	74239.053
Heat Flux (Z) [W/m^2]	-68536.920	25147.015
Wall Temperature [°C]	25.84	80.00
Reference Fluid Temperature [°C]	20.05	20.05
Net Radiant Flux [W/m^2]	-1098.707	361.087
Leaving Radiant Flux [W/m^2]	392.604	881.963
Net Radiant Flux (thermal) [W/m^2]	-1098.707	361.087
Leaving Radiant Flux (thermal) [W/m^2]	392.604	881.963
Net Radiant Flux (solar) [W/m^2]	0	0
Leaving Radiant Flux (solar) [W/m^2]	0	0
Net Volume Radiant Flux [W/m^3]	0	0
Net Volume Radiant Flux (thermal) [W/m^3]	0	0
Net Volume Radiant Flux (solar) [W/m^3]	0	0
Absorption Volume Radiant Flux [W/m^3]	0	0
Absorption Volume Radiant Flux (thermal) [W/m^3]	0	0
Absorption Volume Radiant Flux (solar) [W/m^3]	0	0
Turbulent Viscosity [Pa*s]	0	2.1460e-016
Turbulent Time [s]	2529.231	6.291e+021
Turbulence Length [m]	7.242e-005	0.017
Turbulence Intensity [%]	0.14	1000.00
Turbulent Energy [J/kg]	3.125e-048	4.099e-014
Turbulent Dissipation [W/kg]	4.97e-070	1.36e-017

APPENDIX S
FLUID CONSUMPTION

The haze head have a fluid consumption of 10,5 ml/min
The fog head have a fluid consumption of 70 ml/min

When setting up a scenario of 2 haze heads and 4 fog heads, used at a club for 6 hours, where the haze head constantly runs on a 20% output, and the fog is fired frequently for approximate 10 seconds pr. half a hour, the fluid consumption of one night of use will be

Haze

$$(10{,}5\text{ml} \cdot 20\%) \cdot 360\text{min} = 756\text{ml} \cdot 2 = 1512\text{ml}$$

Fog

$$2\text{min} \cdot 70\text{ml} = 140\text{ml} \cdot 4 = 560\text{ml}$$

One night fluid consumption is

$$\underline{1512\text{ml} + 560\text{ml} = 2072\text{ml}}$$

[web 26] [web 27]

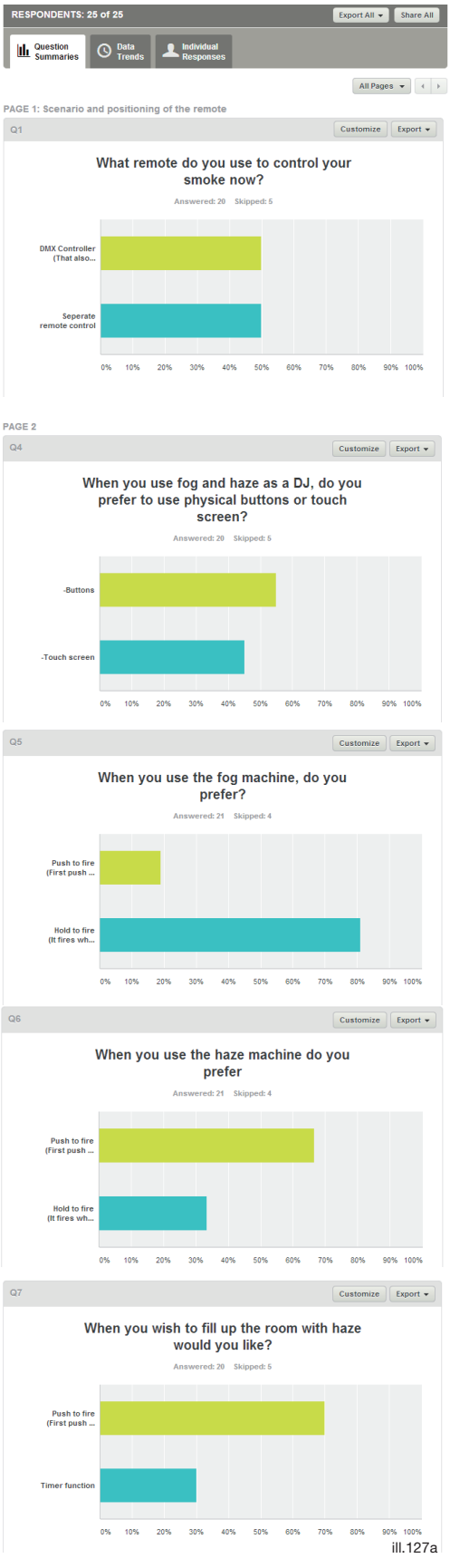
APPENDIX T
SURVEY FEEDBACK

Where is your controller positioned now?

- In the DJ booth on a touch-screen with the light controller.
- Screen
- Besides the right CDJ
- Nearby the mixing deck
- So i can reach it from my DJ booth
- Beside my music player, so I always can adjust the smoke level
- On the lightjockey screen
- at the light controller
- To the left from the decks.
- Lige ved siden af min pult. Til venstre for mig.
- In the basement
- right next to the cd players
- Lige ved siden af pulten
- At the front, next to one of my towers.
- Under the scene
- Ved DJ pulten
- I use it for parties, and I just leave the controller on a table so the guests can use it and fill the room with smoke.
- To the left of the left-most CDJ.

Ideally, what place do you consider the optimal to have your smoke controller?

- In the DJ booth on a touch-screen with the light controller.
- Screen. Same Place as lights
- More centered. Maybe a compartment right Bellow the mixer, or even besides the mixer itself
- Where I have it now
- Right next to me
- Auto, or another person to controle it
- with the LJ (LightJockey)
- To the left from the decks.
- Hvor jeg har den nu. Hvor jeg nemt kan komme til den og ikke behøves at flytte mig for meget.
- Next to the mixer pult
- i think the best position is near the mixer and cd players
- tæt på mig
- Center, or one in each side if you have two. (they should work with the same remote then so they can be triggered at the same time.
- Under the scene
- Som en knap tæt ved pulten.
- One-button seems alright for my need
- Ideally the smoke controller was automatically tuned to the room, and a big red button could be used for CO2 cannons, for added effect.



ill.127a

APPENDIX U
USER FEEDBACK

Q&A ON THE DANISH DJ COMMUNITY “DANSKE DJ’S”

Joachim Dittmann A: 2, B: 1, C: 1, D: nej tak
1. april kl. 12:06 · Synes ikke godt om længere · 1

Jens Petersen A: Knap man trykker på for at starte og stoppe . B: Knap man trykker på for at starte og stoppe. C: Knap man trykker på for at starte og stoppe D: Nej tak
1. april kl. 12:07 · Redigeret · Synes ikke godt om længere · 1

Jacob Strandeng A: fysisk knap
B: En knap som affyrer røg når den holdes inde
C: En knap som affyrer haze ud når den holdes inde
D: Nej
1. april kl. 12:11 · Synes ikke godt om længere · 4

Kasper Drastrup DeCain Olesen En knap med interval timer til røg + ekstra affyring manuelt.
1. april kl. 12:21 · Synes godt om

Kasper Drastrup DeCain Olesen En knap med interval timer til røg + ekstra affyring manuelt.
1. april kl. 12:21 · Synes godt om

Jesper Kropz Christoffersen Men den må godt stå med tider på.. Så man kan se - pause er 2 min og affyring 10 sek
1. april kl. 12:27 · Synes godt om · 1

Camilla Dahl Hansen Tak for foreløbige svar. Bliv endelig ved med at svare - Jeres mening er uundværlig
1. april kl. 15:55 · Synes godt om

Camilla Dahl Hansen Kunne være super fedt med flere svar
3. april kl. 08:39 · Synes godt om

ill.128a

MARTIN CHRISTENSEN -DJ AT HR. NIELSEN NIGHTCLUB

Martin and Lars + New Message | Actions

Thue Kristensen 10:28
Fedt Martin. Here goes:

1: Hvilken styring benytter du typisk til røg- og haze maskinen når du er ude og spille?
- LightJockey?
- Anden DMX controller som også styrer lys?
- Separat røg / haze controller?

2: Hvor er denne styring placeret?

3: Ideelt set, hvilket slags controller kunne du helst ønske dig at bruge til at styre røg og haze?

4: Ideelt set, hvor ville denne styring være placeret?

Martin Christensen 10:35
1 seperat kontroller (dog mest fordi at systemet via lys er i stykker, det virker klart bedre at styre via DMX sammen med lys.

2 den ligger til højre for pulten nås jeg spiller (da det virkede, så,sidder knappen sammen med knap til stetoskop lys knap)

3 uden tvivl er det som sagt bedst når det virker via DMX.

4 fungere super med knap som beskrevet oven over

Hvis du gerne vil have billeder kan vi evt. Mødes på Hr Nielsen en dag lige hurtigt.... Måske du har så meget forstand på det at du kan fikse what ever der nu er galt siden knappen ikke virker mere ? der er sku ikke nogen i gaden der bekymre sig om den slags.

ill.128b

APPENDIX V
BUSINESS MODEL CANVAS

REMOTE CONTROL

Key Partners

- Interface Designers
- Product designers

- Outsourcing
  - Tooling
  - Software engineers
  - Hardware manufacturers
- Retailers

Key Activities

- First movers
- Field testing
- Sales knowledge
- Branding
- Market research
- Grow product line

Key Resources

- Researchers and developers
- Better marketing
  - Storytelling
- Global sales & distribution network
- Sourcing and quality assurance

Value Proposition

Partnership

- Global smoke leader
- Long-term commitment

Product

- Convenience
- Strong brand
- Both haze and fog control
  - News value

Customer

Support

- Global mindset
- Standardized service via Martin service organization
- 24/7 service hotline

Supply

- Global presence
  - Experienced partners
- Trusted reputation
- Professional organization

Customer Relation

- Dedicated personal assistance
- Brand growth
- MyMartin
- Social media
- Trade shows

Channels

- Distributors
  - Dealers
  - Installers
- MyMartin
- Trade shows

Customer Segments

End users

- Install
  - Clubs, bars & night venues
  - Cruise lines
  - Theme parks
  - Small theatres

- Mobile DJ's
- Live venues

Optional accessory for other Jem products

Cost Structure

- Design and engineering
- Quality assurance and approvals
- Stock and distribution
- Sales and marketing

- Value driven for Martin Professional
- Value driven for the users

Revenue Streams

- Asset sale
- List price
- Service contracts

- Additional sale
  - Storytelling

ill.180a

Since the Jem Remote Control is a new product type for Jem and Martin in general there are many resources involved in the development of such a product. These range from software and hardware developers and designers to quality control because many parts will be outsourced as they are not part of their current production portfolio. This means that the cost structure will change from their current products to include quality assurance and approvals to a higher extend than on other products.

The outcome of these activities is the potential of being first movers with a brand new Remote Control aimed for the future marked with the ability of acting as a natural accessory for many Jem smoke products due to its touch screen. This have the potential of not just being an accessory, but becoming a stand-alone product itself because it supports the market standard DMX w. RDM and can potentially control all DMX compatible products through software development.

APPENDIX W
PRODUCTION PROPOSAL CABLE CLIP

Fra: **Torben Søgaard Schaltz** ts@hagens.com
Emne: SV: Studerende fra Aalborg Universitet - prototype
Dato: 15. apr. 2014 12.19
Til: Thue og Camilla Dahl Kristensen idmaster2014@gmail.com

Hej Thue,

Jeg har bedt vores lager om at finde:

10 stk 0,8/20 mm x 250 mm rustfri båndstål jf. standarden EN 10151, W. 1.4310
10 stk Ø 4 mm x 100 mm rustfri tråd jf. standarden EN 10270-3, W. 1.4310 NS

Når i har bukket og valset bør i varmebehandle emnerne for at fjerne spændinger i materialet. Brug 350°C i minimum 30 minutter. I denne proces trækker i også brudstyrken en smule op, så ren fordel!

Bemærk at under varmeprocessen vil emnerne oxidere en smule (blive gullige), og de vil ændre form – så det er en god idé at lave en varmeprøve først før i bukker alle emnerne, og så kompensere for dette inden varme.

Sig til, hvis i skal have mere info herfra!

Best Regards / Med venlig hilsen

Torben Søgaard Schaltz
R&D Engineer

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M: +45 2613 0935
E: ts@hagens.com

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APPENDIX X
PRICE ESTIMATE CABLE CLIP

Fra: **Candy Pan** sales04@gnfortune.com
Emne: Re:Re: Details of Clips for Camilla Dahl Hansen in Denmark
Dato: 24. apr. 2014 08.16
Til: Camilla Dahl Hansen

Hi Camilla,

Thanks for your prompt feedback, pls kindly check the following details:

1. 32mm clip
1000pcs is US$0.13/pcs
5000pcs is US$ 0.085/pcs

May I know your address with post code? so that I could check the shipping cost from my factory to your country.
Before that, may I know your finaly order quantity?
So that the shipping cost will be more exactly.

Waiting for your kindly reply, thanks.

Best Regards

Candy Pan(Ms)
Sales Manager

G And N Fortune Limited

T: 86 769 23185150
F: 86 769 23185160
Mob: 86 136 5252 0370

E: sales04@gnfortune.com
Skype: gnfortunesales04

W: http://www.gnfortune.com
http://www.gnfortune.com.cn

在2014-4-23 18:28:50，"Camilla Dahl Hansen" <camilla.hansen88@hotmail.com> 写道:

> -----原始邮件-----
> **发件人：** "Camilla Dahl Hansen" <camilla.hansen88@hotmail.com>
> **发送时间：** 2014-4-23 18:28:50
> **收件人：** "Candy Pan" <sales04@gnfortune.com>
> **主题：** Re: Details of Clips for Camilla Dahl Hansen in Denmark
>
> I might need the price of 1000 and 5000 psc ..
>
> Best regards
> Camilla Dahl Hansen

APPENDIX Y
MAIL CORRESPONDENCE

JASON ANDREWS - SALES NUMBERS

Mail correspondence with General Manager Jason Andrews

Hi Camilla & Thue,

Please find my response below:

From: Thue og Camilla Dahl Kristensen [mailto:idmaster2014@gmail.com]
Sent: 15 April 2014 09:06
To: Jason Andrews
Subject: New Club Smoke system

Hi Jason

We have a couple of question regarding the expected sales number of the new Jem Club Smoke.

The question is actually, how many units do you expect so sell per year in the years to come?
- How many base units?***[Jason Andrews]*** 80
- How many haze heads?***[Jason Andrews]*** 100
- How many fog heads?***[Jason Andrews]*** 120

It would be nice if you can supply us with an estimate on these numbers.***[Jason Andrews]*** This is only based on sales history of the Club Smoke, Henrik may add more commercial insight than what I can, especially on Haze heads.

In addition, do you have an idea on how many user use use supplied remote control opposed to using a DMX controller og LightJockey?
[Jason Andrews] On average we sell 4 Remotes as accessories per year!! However I'm not sure how many end users actually use the remote supplier. I honestly imagine majority use such a install product via DMX.

These numbers will be used to support our research in the report.
[Jason Andrews] Sorry I cannot be more specific.

Best regards
Camilla & Thue

Best regards,

Jason Andrews
General Manager