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ARTIFICIAL INTELLIGENCE AS A SUPPORTING TOOL FOR SHIP DESIGN

– Foreship



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ARTIFICIAL INTELLIGENCE AS A SUPPORTING TOOL FOR SHIP DESIGN

- Foreship

This thesis examines Foreship's opportunity to use artificial intelligence in drawing revising and as a supporting tool for designers. The aim was to determine whether the AI programs found on the Internet are developed enough to produce reliable and professional assistance. Background research was done on multiple programs from several different service providers, the chosen programs for this thesis were ChatGPT, Microsoft Copilot and Claude.

To find out the abilities of the programs, 3 types of ship design drawings were used. The given tasks were to interpret the SOLAS rules and regulations. Answer questions based on this interpretation, compare drawings and generate textual and visual responses.

The results achieved revealed that AI can be partially used as a supporting tool for certain drawing types. All the programs can recognize text and numerical data well, but only ChatGPT was able to compare and produce useful visual responses. Not a single program was able to revise or generate drawings based on the regulations. For now, the best feature that common AI programs can offer is comparing and difference detection between two drawings.

Keywords:

Artificial intelligence, Ship design, Mechanical engineering, Drawing revising

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TEKOÄLY LAIVASUUNNITTELUN APUVÄLINEENÄ

- Foreship

Tämä opinnäytetyö käsittelee ja selvittää, voisiko Foreship hyödyntää tekoälyohjelmia laivasuunnittelun piirustusten tarkistuksessa ja käyttää tekoälyä apuvälineenä suunnittelijoille. Tavoitteena on selvittää onko yleisistä internetistä löytyvät tekoälyohjelmat kehittyneet riittävälle tasolle, jotta ne voisivat tarjota luotettavaa ja ammattitaitoista tukea. Taustatyössä on tarkasteltu useampaa eri ohjelmaa, monelta eri palveluntarjoajalta. Tarkempaan tarkasteluun valikoituivat ChatGPT, Microsoft Copilot ja Claude.

Ohjelmien ominaisuuksien selvittämiseen käytettiin kolmea eri piirustustyyppiä. Ohjelmien tehtävänä oli lukea ja tulkita SOLAS-säännöstöä. Vastata kysymyksiin tulkinnan perusteella, vertailla piirustuksia ja tuottaa tekstuaarisia ja visuaalisia vastauksia.

Työn tuloksena selvisi, että tekoälyä voidaan osittain käyttää apuvälineenä tiettyjen piirustustyyppien kanssa. Ohjelmat tunnistavat teksti- ja numerodataa hyvin, mutta vain ChatGPT pystyi vertailemaan ja tuottamaan hyödyllisiä visuaalisia vastauksia. Yksikään ohjelma ei pystynyt tarkistamaan tai luomaan säännöstöön perustuvaa piirustusta. Tällä hetkellä yleisten tekoälyjen paras tarjoama mahdollisuus on eroavaisuuksien havainnointi ja merkintä piirustuksen välillä.

Avainsanat:

Tekoäly, Laivasuunnittelu, Konetekniikka, Piirustusten tarkastus

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USED ABBREVLATIONS AND SYMBOLS

AI	Artificial Intelligence
BIM	Building Information Modelling
FCP	Fire Control Plan
FR	Frame number
IMO	International Maritime Organization
LLM	Large Language Model
MEP	Mechanical, Electrical and Plumbing
ML	Machine Learning
NLP	Natural Language Processing
PS	Portside
SB	Starboard
SFPP	Structural Fire Protection Plan
SOLAS	Safety of Life at Sea

1 INTRODUCTION

This thesis explores the use of artificial intelligence (AI) as a supporting tool for ship design. The aim is to examine whether AI could speed up and reduce the workload of inspectors or be used to lighten the workload of designers. It also investigates whether AI programs are capable of following international rules and regulations, such as Safety of Life at Sea contract (SOLAS), and providing reliable support for both designers and inspectors.

Artificial intelligence is a very current topic, because it is developing all the time. During the last couple of years, it has taken some major steps forward and, for example, many companies and students are currently using it to help and advise them with different kinds of issues. It is important to become familiar with artificial intelligence and the opportunities it can offer to the user. AI can improve the quality of work by providing new perspectives, viewpoints and solutions. For companies' artificial intelligence can be an extremely valuable supporting tool if the users are familiar with it and interpret it critically. Due to its relevance and growing role, it is necessary to become familiar with AI and stay engaged in its development.

This thesis is divided into two major parts, literature and research. The literature section presents the history and the pros and cons of AI, as well as how it is currently used in mechanical engineering and specifically in marine technology. The research section is the main part of the thesis, and its conclusions will be valuable for the company with which the study is conducted in collaboration. Research is built around three artificial intelligence software. The primary aim is to figure out how well different AI's can read and interpret rules, compare drawings, revise drawings and provide support for ship designers.

The thesis is conducted in collaboration with Foreship. The company specializes in ship design and consulting. Foreship mainly works with conversion projects but takes also part in newbuilding and sustainability projects. The design work and consulting offered on drydocks by the company is widely appreciated. Foreship was founded in 2002, and the headquarters is in

Helsinki, Finland. Foreship has branch offices in five different countries and the total amount of the offices is nine. The company has almost 100 employees and the aim is to grow even more in the future. The thesis aims to determine whether it would be possible to start utilizing artificial intelligence at Foreship, and which AI program would perform best in carrying out the tasks assigned to it. AI has not made a breakthrough in ship design yet, but it could happen in the near future and Foreship wants to be ready to use it when it is ready and reliable. Artificial intelligence may not be ready to replace human in design projects, but it could still be a valuable asset. Even though modern advanced assets such as artificial intelligence could be capable of reducing workload and increasing companies' capabilities, these AI tools still require humans to reach the best outcome. (Barhorst-Cates & Schwartz n.d.) For Foreship, while labour markets are increasing, it would be a great asset if AI could revise drawings, even partially, or support designers during the design process and that way release resources for other tasks.

2 ARTIFICIAL INTELLIGENCE IN GENERAL

Artificial intelligence is a broad concept, which includes machine learning, artificial neural networks and deep learning as shown in (Figure 1). Many people think that AI is quite a new thing, but that is not correct. Artificial intelligence has a long history, but the biggest developments, those what normal citizens pay attention to, have happened in recent years.

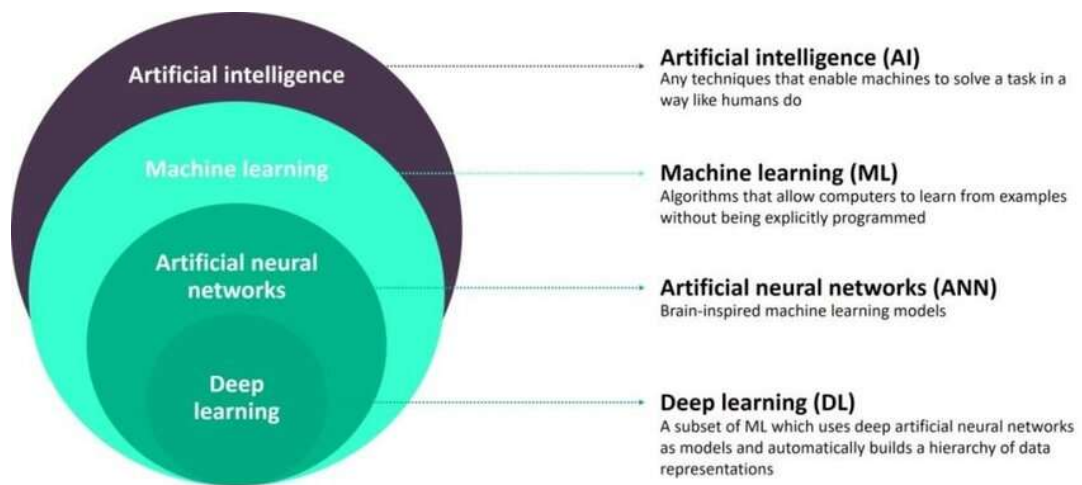


Figure 1. AI and related keywords (Veidith, n.d.).

Nowadays people cross paths with AI every day. Artificial intelligence has already been used in several branches of industry. AI is here to stay, and it is impacting our daily lives. Modern homes are run by AI, for example all the smart systems at home are under AI's command. Artificial intelligence also affects our daily habits such as finance control, education, transporting and healthcare. For example, AI is making investment strategies and fraud detection in the field of finance. Also, AI is used in healthcare, for example to create virus and disease studies and analyse X-rays and MRI images with high accuracy. (Prete 2025.) For more daily use AI can be detected while using smartphones and smart systems, such as Alexa or Siri. Search platforms and apps are also using AI broadly, applications like Google, Yahoo, TikTok and Facebook. (Tableau n.d.)

2.1 History of Artificial Intelligence

Humans have always wanted to develop new machines and new ways to learn and increase their knowledge. AI's history starts with machines and slowly develops into chatbots and realistic supporting tools. Before jumping to the 21st century, some important turning points in AI's early history will be presented.

Artificial intelligence started its development early in the 20th century. A Spanish engineer Leonardo Torres brought to day light the first machine that could play chess without human help in 1914. In the middle of the 20th century the interest about artificial intelligence started growing and a British mathematician Alan Turing presented a question "Can machines think?" in 1950. He rephrased the question later and asked, "Can a machine exhibit intelligent behaviour?". This led to the born of "Turing test", which is still used. (Mucci 2024.) This test is about questioning. A human acts as an interrogator and blindly asks different questions from both human and computer and then tries to figure out which answers comes from a computer and which ones from a human. (Grant 2024.)

In 1956 John McCarthy, who is also known as one of the pioneers of AI, released a statement where he defines the term "Artificial Intelligence". He explained it as follows; "The goal of AI is to develop machines that behave as though they were intelligent". (Wolfgang 2024,1.) McCarthy also discovered LIST processing, which is also known as Lisp language, in 1958. He wanted to create a programming language that could handle more information, such as symbols. This Lisp is nowadays very popular and used in AI research. (Mucci 2024.)

During the rest of 20th century AI become more popular year by year and humans created a lot of machines that used artificial intelligence. Waseda university in Japan created WABOT-1 robot, which was capable to move and communicate with human. Later, the same university created WABOT-2, which was able to read notes and even accompany a human soloist. (Mucci 2024.)

In 1997 IBM created a chess playing computer. They challenged Russian Gary Kasparov who was at the time reigning chess world champion. This machine used its artificial intelligence to create 200 million chess positions per second. The computer won human in just 19 moves and made history. This event caused people to think that AI has resources to even exceed human intelligence in certain areas. (Grant 2024.)

In the 21st century AI's have developed even further, and many companies are using them to solve issues and increase the working pace. In 2022, OpenAI released ChatGPT, and it received over one million users only in five days (Marr 2023). Especially, it made possible for the students to use AI. Of course there were also other AI's before, but ChatGPT received so much attention in social media that it even crashed sometimes due to the number of users simultaneously.

In 2023, OpenAI released ChatGPT Plus, which included DALL-E 3. This program can generate highly demanded images, and it can create whatever you tell it to do. For example, it can create a poster for your project in seconds. In 2024, many big companies like Google, Apple and IBM released their own AI based software (Mucci 2024).

2.2 AI's pros and cons

Artificial intelligence has many benefits, but also some disadvantages. This chapter gathers the most important ones from both categories. In 2023, a US company called Krista conducted a survey for 1000 American adults and asked if they are ready to trust AI to shape our lives (King 2023). According to the study, over 60 % of the respondents do not trust AI to make live changing decisions, such as let AI to be jury in a trial or letting AI fly an airplane. Also, over 70% think that humans can do their job better than AI, for example humans should administer medicines and write the laws. (Koetsier 2023.)

Artificial intelligence can provide many advantages to companies, according to the European parliament, artificial intelligence can increase work productivity by

11-37% by the year 2035. Also, according to them using AI in public transport can decrease the costs and increase the sustainability of products. Greenhouse gas emissions could be decreased by 1,5-4% by the year 2030. (Duch 2023.)

The EU parliament expresses also the downsides sides of AI. Maybe the biggest question is who has the responsibility while using AI. For example, if we have cars driving by themselves and having collisions, who has the responsibility, the owner of the car, the manufacturer of the car or the AI software manufacturer. Humans are also worried about losing their jobs, because AI is replacing some work tasks. While AI creates new jobs, the tasks it creates usually demand higher education to be able to work with. Safety is also on the table while having conversations about artificial intelligence. If people with the wrong intention use AI to create, for example deepfake videos or hacking to achieve for example money or personal information, it creates uncertainty for normal humans who do not know how to interpret AI correctly. (Duch 2023.) Cybersecurity is also one of the biggest concerns, while letting AI take power in several fields. For example, if AI software controls a ship, and gets invaded of hackers, the cyber-attack can put the ship totally out of action and bring the entire logistic chain down. (Raveling 2021.)

2.3 The three sides of future AI

Artificial intelligence will bring different viewpoints in future. Often people only praise AI and the benefits it creates, but humans easily forget the bad and scary sides of AI. Especially in the future when AI develops even further and becomes daily work partner for many people, it needs to be remembered how to use and interpret it critically and how to not let it take totally over our minds and normal everyday life. This chapter will contain the main points from these three categories. These points of view come from professors in various fields, for example from computer science, construction science, mechanical engineering as well as aerospace and ocean engineering.

2.3.1 The good

When using artificial intelligence correctly, humans can achieve significant results and, for example, help people with disabilities. Humans can create supporting tools and vehicles for people with restrictions. (Losey 2023.) Nowadays, AI is so advanced that we can have deep conversations and even brainstorm opportunities with it. Additionally, AI can even provide emotional support and act like a friend if needed. In this scenario, however, it must be remembered that AI is still a supporting tool and not a replacement. (Rho 2023.)

Artificial intelligence has enabled benefits that have not been seen before for optimizing costs, schedules, sustainability and safety protocols. It has also improved productivity and efficiency. The use of artificial intelligence can also release resources, for example from design and management and navigate these resources to other more demanding tasks that only humans can perform. (Shojaei 2023.) AI also saves time, because information that used to take years to go through by human, AI can now read the data in milliseconds and summarize it to us. Artificial intelligence is constantly evolving, and humans try to create new algorithms and applications that simplify our day-to-day life. Especially transportation, production and healthcare can be eased and enhanced with the help of new applications. It needs to be remembered that things people take for granted, such as robots, Netflix, and YouTube, could not have been developed without artificial intelligence. (Saad 2023.) One major advantage of AI is its incredible performance that it can achieve in certain issues. AI is capable of completing certain tasks with greater speed and precision compared to humans. Artificial intelligence and machine learning can process more information that humans cannot even comprehend. (Atkins 2023.)

2.3.2 The bad

Modern world Internet is full of different kinds of AI based supporting software. This creates a risk for intentional misunderstanding, meaning the software is taught to treat different topics unequally. This leads humans to pre-determined

directions to gain, for example money or visibility. (Losey 2023.) There is a notable risk that in the future people start blindly believing everything that AI says without using their own sense and interpreting things critically (Rho 2023).

One of the most notable risks is the ethicality of using AI. Humans are using artificial intelligence to gather personal data, so what about an individual's privacy? Where should we draw the line when it comes to these ethically important questions? Another major concern is the carbon footprint and environmental friendliness. All AI based tools and machines are based on computers and databases. These machines need a lot of electricity to work and a lot of water for cooling down. While AI is solving some environmental issues, it also creates its own carbon footprint and environmental problems. Thus, there is an important task for humans to try designing green sustainable AI algorithm. (Saad 2023.)

Are there any borders to developing AI further and further? If, in the future, humans create the first ultra intelligent machine, is it the last one to develop? Where does the line go when developing AI becomes a risk for humanity? In 1990 humans developed a machine that had intelligent to win a human in chess, so there is risk that people are starting to create machines for wrong reason, for example robots that will do robberies or harm other humans. (Muller 2024.)

2.3.3 The scary

Future AI also creates fear for people. Everything is evolving really quickly nowadays. People cross paths with AI every day. Companies use artificial intelligence to create ads directly just for you and with that they are trying to affect your purchasing habits. Same style repeats with politics. AI based ads and information try to affect your voting. This happens, because humans want to maximize their profits and votes. (Losey 2023.)

People are relying on AI so much that there is a growing fear we may be losing genuine human connection entirely. AI can give us straight answers and we are

happy with the first outcome. When having a real conversation with a human, there is chance of arguing against and creating new ideas and perspectives. It is ethically scary if humans completely forget direct interaction. (Rho 2023.)

Perhaps the major scary scenario for normal human beings is losing jobs to AI. Artificial intelligence will be able to drive cars and make medical decisions in the future. This raises a question on whether we need doctors or drivers anymore. However, in the future, humans should still make big decisions by themselves and use AI only as a supporting tool. (Saad 2023.) If people use AI for important decisions, it should be used similarly to missiles. You need two keys to make the launch. In the context of AI, this means that one key is AI and the other is humans. (Atkins 2023.)

2.4 Artificial Intelligence in Mechanical Engineering

Artificial intelligence is growing in popularity in the field of technology. Nowadays many companies are trying to reduce costs and workloads with AI software. Humans are inventing new ways to exploit artificial intelligence all the time in the field of work and that is why AI is developing fast nowadays. This forces companies to stay tuned and try to catch features that might help them.

Generative artificial intelligence is used widely in manufacturing, because AI offers new ways to increase productivity and to simultaneously lower costs (Sheridan 2023). Nowadays, the goal of almost each company is to be as productive as possible while saving as much money as possible. AI can deliver new solutions for companies. It can recommend new and better ways to production lines, which are more sustainable and more efficient. AI programs can also design new products or develop already existing products for companies. This could move manufacturing businesses to the next level. According to Google Cloud Gen AI Benchmarking study, over 82% of organizations are using or are considering using AI believe it will change the industry totally in the near future. (Sheridan 2023.) Manufacturing companies use predictive maintenance systems which are based on artificial intelligence.

These systems identify problems before they become a great harm. AI is, for example, used to monitor machines' temperature, patterns and vibration. By monitoring these coded priorities, AI can optimize schedules for maintenance work and reduce machines downtimes. (Johns Hopkins 2024.) According to Deloitte, predictive maintenance increases productivity by 25%, lowers maintenance costs by 25%, and could reduce breakdowns by 70% (Sheridan 2023).

Currently AI is capturing the field of engineering. Artificial intelligence helps engineers in several fields, for example in designing, producing and analysing. AI can meet higher standards of precision and functionality of products. AI programs are reshaping every stage of development, whether it is manufacturing, designing or improving efficiency. With the help of AI programs engineers no longer need to use hours to refine their designs, because AI tools can automatically generate multiple other options and variations based on engineers' order. This opportunity provides engineers to explore a wider range of design possibilities and improve creativity while still conserving efficiency, functionality and high standards. Nowadays, companies use AI-assisted drafting tools to help engineers in noticing potential errors. This can save money, while fewer revisions could be possible. It can also reduce manufacturing delays. (BlueCollar 2024.) Computer-aided design, that involves artificial intelligence and algorithms, can free up engineers to other tasks. When providing certain constraints and goals of the project, AI can create multiple solutions and alternatives. After AI design, engineers can choose the best one and improve it by themselves or give AI new orders to improve the design. (Siemens n.d.) This can be also done for existing design. AI can provide possible improvements and alternative designs. This ensures products' continuous development. AI programs can reduce prototype costs greatly. Artificial intelligence can create desired circumstances and test how the product behaves. This saves money, time and materials. After great results from AI testing, companies can now create only one real prototype instead of many. (BlueCollar 2024.)

Many companies that provide assistance for customers are nowadays leaning towards AI supporting tools. This is because, according to Salesforce, 80% of customers expect to get answers in real time, and if this is possible, they will be more loyal to the company. (Sheridan 2023.) With carefully coded AI program real-time assistant service is possible and very profitable in certain fields. Perhaps the most famous voice AI is the “Speech Plus CallText 5010”, which allowed the famous physicist Stephen Hawkins to speak again after the disease that took his ability to speak normally (Sanusi 2024). Voice AI assistants can be a valuable asset, for example in the maintenance field. It can collect information from machines and warn for potential upcoming issues. It can also work as a real assistant for maintenance work, while it can provide guidance and step-by-step instructions for repairers. Voice AI can also work as a trainer for new workers. This can release other senior workers to other tasks and provide time savings and ensure that new workers are able to complete the assigned tasks. The AI program is taught to answer all the typical questions that new workers could have. This ensures clear instructions and change to clarified uncertainties. (Purplescape n.d.)

Artificial intelligence is also widely used in autonomous industry. Many machines and robots work with AI based software. The automotive industry is developing all the time and humans are creating self-driving cars and other vehicles. These machines could not work without artificial intelligence. Car manufacturers are using AI throughout the manufacturing process. AI based robots are building vehicles and machine learning will navigate the cars through traffic. Self-driving vehicles will be the future, and engineers are aiming to improve vehicle safety, increase fuel efficiency, and make travelling more comfortable (Schroer 2025).

2.5 Artificial Intelligence in Marine architecture and design

Marine architecture differs from mechanical engineering slightly when it comes to discussion about artificial intelligence. AI is not yet very common in marine design technology, but AI support has already its place in practical work, such

as navigating and other systems used on board. Humans try to improve the status of AI onboard, because approximately 80% of accidents at sea are a result of a human error (Raveling 2021). When it comes to designing it is still quite a new feature. In the near future AI supporting tools could make a difference for designing projects in marine architecture like it made in basic engineering design. One of the most respected and leading shipyards, Fincantieri, made an agreement with AI company iGenius in 2024. They are trying together to combine AI experience with the creation and development of AI models. The main aim is to use AI to improve the performance, efficiency, and safety of their products. According to the iGenius CEO, they want to redefine the standards of shipping industry. (Fincantieri 2024).

Artificial intelligence is more common on hull design than in basic design. It has been used for a couple of years as a supporting tool for hull modelling in certain companies. Many people still believe that human expertise is more valuable and reliable than AI. Approximately 70% of the costs come from hull design and traditional methods are based on human iterative processes and engineering analysis. While utilizing AI, it can provide countless computational algorithms and optimize the best possible design for ship hull. (Thaur 2024.)

This thesis focuses on interior basic design, which includes documents like structural fire protection plan (SFPP) and fire control plan (FCP). Working on these documents, AI tools are not very common yet, because these documents are strongly related to the rules and expertise of engineers. There is under way research, which is focusing on "ACQUAINT". This module has an AI-driven engine, and it can be integrated into AutoCAD through a Python code. The module is capable of understanding rules and requirements and could reduce the interaction of humans. (Shahzad etc. 2024.) This module is not very common yet, and it is still developing, but it may affect ship design processes in the near future. AI programs are not intended to replace human expertise. They should be used as tools. While AI can process data, interpret rules and find patterns it lacks the nuanced judgement which is necessary for designing projects. For example, making decisions between competing priorities like

layout design and structural weight, there is a need for human insight to make the right call. This is something that AI algorithms cannot fully replicate. (BMT 2024.)

3 SELECTED AI PROGRAMS FOR CLOSER RESEARCH

The Internet is full of different AI programs. Before selecting the main programs to proceed with, multiple AI software was examined. A total of 8 different AI programs from several different service providers were examined. The reviewed criteria were the capability of reading and interpreting PDF-files and images, because the benefit sought from AI requires this feature. Without this capability it is pointless to proceed with the program. The main sought-after feature is the capability of understanding SOLAS PDF-file and capability to examine images.

Many AI programs found on the Internet are free to use and have the capability to reading PDF-files, for example Google Gemini AI and Textcortex. These programs could be used for interpreting SOLAS, but both are lacking the ability to examine images. While searching the programs to proceed, AIs received couple of questions that identified the capabilities of the programs. First, the programs received a PDF-file and a simple question “Can you read and interpret this PDF-file”. After receiving responses that presented the ability, the next question was also quite simple, “Can you examine images and make markings on top of the existing image”. If both features were found even partly from the program, the certain AI was selected for closer investigation. Three AI programs were selected for a closer look. These were ChatGPT, Microsoft Copilot and Claude. Next, the selected AI programs are presented. DALL-E and Autodesk AI products will be also presented shortly. DALL-E is presented, because it could be useful for the company, not for designing or revising, but for marketing. This program is one of the leading AI programs that have the capability to generate and modify images. Autodesk AI’s opportunities are also presented and examined, because Autodesk is an important partner for the company and most of the designing is done with Autodesk’s product called AutoCAD.

3.1 ChatGPT

ChatGPT was released by OpenAI in 2022. This program uses artificial intelligence chatbot to create conversations. It uses natural language processing (NLP) to make conversations more humanlike. (Hetler n.d.) ChatGPT reached 200 million active weekly users in 2024 (Nyst 2024). ChatGPT is developing all the time. It has received a couple of major updates in the past two years, but the program is built so that users can give thumbs up and thumbs down feedback or literary feedback. This way the AI bot can develop itself to give more accurate answers to the next person who presents the same question. (Hetler n.d.) ChatGPT is free for all registered users, but it can be upgraded to plus version with a monthly fee. The plus version provides, for example, more detailed responses and the newest features, such as Sora, ChatGPT's own video generating software. (Hetler n.d.) In this thesis examinations will be done with the plus version which is called ChatGPT 4o. While using ChatGPT, the user must interpret the given answers carefully, because AI might not fully understand complexity of human language. It is also taught to not take sides when discussing politics. ChatGPT also summarizes the answers and sometimes focuses on the wrong part of the question. Hence, the person asking the question has the responsibility to check and adjust for receiving the best answer. Additionally, ChatGPT does not provide sources if you do not ask them separately. (Hetler n.d.)

3.2 Microsoft Copilot

Copilot is an AI program which uses chatbot, created by Microsoft. The program is free for all users and offers the same kind of services as ChatGPT. Copilot offers also licenses that include all of the newest features and maximize the best outcome from the program. Microsoft Copilot uses large language models (LLM), and users own Microsoft Graph and app data to provide the most productivity tool for user (Spataro 2023). Microsoft released "Think Deeper" tool to Copilot. This feature is available for anyone, and the main idea is that the

program takes thirty seconds to think and process the issue. After that, the program gives answers and solutions from several different angles. (Warren 2025.) Copilot has the advantage of being capable of working with other Microsoft applications. For example, it can create live notes for Teams meeting. (Powers n.d.) Conversation with Copilot is limited to 20-30 responses. After reaching the limit the user must start a new chat. The company owns a license for Copilot, so the research part uses this license to achieve the best outcome from Microsoft Copilot.

3.3 Claude

Claude AI was founded by the company called Anthropic in 2021. Anthropic is comprised of several ex-employees of OpenAI, the firm that developed ChatGPT. Claude AI is a chatbot that uses LLM and NLP. With these features the program can handle text, audio, and visual context. In 2024, Anthropic released Claude 3, which is the newest version of the software. Claude 3 includes a free version and two different premium versions. (Belcic & Stryker 2024.) Claude AI has similar ability like Copilot's "Think deeper". Claude has "Extended thinking mode". This feature is available in all versions of Claude 3. (Anthropic 2025.) Claude 3 can generate prompts up to 200 000 tokens, which is approximately equivalent to 350 pages of text. Anthropic also has strict data privacy politics and all the chats with Claude will be permanently deleted after 30 days. Claude's disadvantages are the lack of ability to use Internet browsing and limited capability to generate images. (Belcic & Stryker 2024.) Also, if using the free version, there is a daily messages limit, which is based on the number and demand of the questions (Anthropic 2025). For example, with questions according to SOLAS table 9.1, the program could answer only 7 times. After limitation is reached the program cannot answer for the next 5 hours.

3.4 Autodesk AI

Autodesk has invested in artificial intelligence already for over a decade, and they are trying to provide the best possible tools for customers. Today, Autodesk AI can do, for example repetitive tasks and creative problem solving. Autodesk uses AI in multiple software that it provides for customers, for example programs such as Revit and AutoCAD. (Autodesk n.d.) Revit and AutoCAD are maybe the biggest designing tools that Autodesk provides. The company uses AutoCAD and could also use Revit in future, that is why this thesis takes a little closer look at these two software AI features.

Revit was released in 2020, and it has received updates regularly. The software is directed at architects and several fields of engineering. This product is developed directly for professional users who want to create 3D and 2D drawings. Revit's engine uses Building Information Modelling (BIM) and utilizes AI, ML and its own database to do repeated tasks (CTC SOFTWARE 2024). Revit is directed more at the construction and architecture industry, but it could also be used in shipbuilding with some considerations. Revit could be used, for example while designing a ship's structure. Another section could be mechanical, electrical, and plumbing (MEP). Revit has its own MEP tool, which could be used while designing ship's system layouts, like electrical, piping or HVAC. Revit could also be used to create detailed 3D models and renderings of the ship. Revit does not have all the specific tools for ship designing, but integrating Revit with other specific CAD-tools can help to achieve the most optimal result. (Autodesk representative, interview 13.3.2025.) Revit is reliable and has a lot of users, because it can simulate real-world scenarios so well. Some countries have even mandates for companies to prioritize the use of Revit. It provides relevant solutions for engineers and architectures. (Bhattacharjee 2024.)

AutoCAD also offers both 2D and 3D modelling. The latest release AutoCAD 2025 has new AI options. The program can now identify handwritten text from the drawing and convert it automatically to text data. (Autodesk n.d.) AutoCAD

2025 has a new feature called “Smart Blocks”. This detects all the similar objects from the drawing and convert them to block with the help of AI. This tool can save a lot of time while working with drawings that are converted from PDF or done with non-AutoCAD based applications. The user can clean up the drawing faster while using “Smart Blocks”. Autodesk Assistant was also added to the AutoCAD. This AI based chatbot is available all the time and can answer almost any questions that you might have while working with AutoCAD. With the same interface you can get in touch with support agents, if the AI does not solve your problem. AutoCAD 2025 is working in cooperation with Autodesk docs, which has new capabilities. The Markup Import tool has been upgraded and DWG history path has also been upgraded. Both AutoCAD Architecture 2025 and AutoCAD MEP 2025 have received upgrades that allow users to work simultaneously with certain drawings. This is possible, because these programs now support Autodesk Docs DWG-file automatic synchronization. (The AutoCAD Team 2024).

3.5 DALL-E 3

DALL-E 3 was released in 2021 by OpenAI, which is the same company that released ChatGPT. The program is named after Pixar’s movie WALL-E and the famous artist Salvador Dali. (Ozgon 2021). DALL-E was the first text-to-image AI platform on the market (David 2023). DALL-E is an AI tool, which can transform text to image. The program uses extremely deep learning to create high-quality and accurate detailed images (Zhou & Nabus 2023). OpenAI released DALL-E 3 in late 2023, which is the newest version of the program.

DALL-E 3 can integrate with ChatGPT, so if the user does not have a clear prompt to the program, they can ask ChatGPT to generate prompt suggestions. This option extends the creativity of users who may not have specific ideas to represent the software. (David 2023.) Using DALL-E 3 users face ethical questions, because when image is created by AI, humans forget the patents and copyrights. Main question is who should own the rights for images produced with DALL-E 3? (Zhou & Nabus 2023.) As AI-generated images

become more common, humans should interpret images and their rights properly. This is because deepfake images are nowadays easy to create and can be used, for example, in phishing scams or to manipulate public opinions. (Zhou & Nabus 2023.)

DALL-E 3 can be a great tool for humans when used correctly. Humans with limited design experience or limited technical skills are now capable of creating professional-looking drawings. Designers can ask AI to modify proposed images to be more accurate or include more specific factors or requirements in drawing. This can provide time savings and release resources to other tasks. (Zhou & Nabus 2023.)

DALL-E 3 is not capable of drawing marine architecture drawings, such as fire control plans or structural fire protection plans. DALL-E 3 creates more poster style pictures. This program cannot be used for drawing revising, but for example, for marketing this could work as a supporting tool. DALL-E generates high quality images and can modify them with very specific instructions. For example, this could be used when creating posters or other advertisements.

4 UTILIZATION OF ARTIFICIAL INTELLIGENCE IN SHIP DESIGN

4.1 Teaching AI programs to interpret rules

The research part of this thesis will start with teaching the chosen AI software to read and interpret the necessary rules. The International Maritime Organization (IMO) is going to work as a reference site, because SOLAS can be found there. The problem is that IMO's website contains the 1974 version of SOLAS. The company has the 2020 version of SOLAS. The idea is that it will be tested whether AI read straight from IMO's website, but the main research will be done with 2020 version. To protect the company's licensed version of SOLAS, AIs will receive a trimmed version of the document. This PDF-file will contain only chapter 2-2. The chapter in question includes fire protection rules.

Teaching process starts by telling AI programs to enter IMO's website and find SOLAS document. Copilot and ChatGPT can enter the website and are able to find SOLAS 1974 version. Claude does not have the ability to browse the Internet. Next, the programs will receive a PDF-file of the trimmed version of SOLAS. Programs will receive couple of questions about chapter 2-2. After receiving right answers from the AI, this program in question can move forward to revise drawings.

The questions asked were:

"Can you find tables 9.1 and 9.2, tell me what tables contain?"

"Do you understand how the tables work?"

"Use table 9.1, which bulkhead is needed between category 3 and category 8?"

"Which bulkhead is needed between category 7 and category 7?"

"Use table 9.2, which insulation is needed when above is cat.8 and below is cat.7?"

“Which insulation, space below cat.13 and space above cat.8?”

ChatGPT was capable of finding the tables and telling how the tables are working straight away, but when asking more detailed questions about the needed bulkheads the AI gave first incorrect answers. Next AI received an example image, shown below (Figure 2), which showed how to read the intersection of certain columns and rows.

Table 9.1 – Bulkheads not bounding either main vertical zones or horizontal zones

Spaces	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Control stations	(1) B-0 ^a	A-0	A-0	A-0	A-0	A-60	A-60	A-60	A-0	A-0	A-60	A-60	A-60	A-60
Stairways	(2)	A-0 ^a	A-0	A-0	A-0	A-0	A-15	A-15	A-0 ^c	A-0	A-15	A-30	A-15	A-30
Corridors	(3)		B-15	A-60	A-0	B-15	B-15	B-15	B-15	A-0	A-15	A-30	A-0	A-30
Evacuation stations and external escape routes	(4)				A-0	A-60 ^{b,d}	A-60 ^{b,d}	A-60 ^{b,d}	A-0 ^d	A-0	A-60 ^b	A-60 ^b	A-60 ^b	A-60 ^b
Open deck spaces	(5)					A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Accommodation spaces of minor fire risk	(6)					B-0	B-0	B-0	C	A-0	A-0	A-30	A-0	A-30
Accommodation spaces of moderate fire risk	(7)						B-0	B-0	C	A-0	A-15	A-60	A-15	A-60
Accommodation spaces of greater fire risk	(8)							B-0	C	A-0	A-30	A-60	A-15	A-60
Sanitary and similar spaces	(9)								C	A-0	A-0	A-0	A-0	A-0
Tanks, voids and auxiliary machinery spaces having little or no fire risk	(10)									A-0 ^a	A-0	A-0	A-0	A-0
Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk	(11)										A-0 ^a	A-0	A-0	A-15
Machinery spaces and main galleys	(12)											A-0 ^a	A-0	A-60
Store-rooms, workshops, pantries, etc.	(13)												A-0 ^a	A-0
Other spaces in which flammable liquids are stowed	(14)													A-30

Figure 2. Example How to interpret the table.

After interpreting this image, ChatGPT started to give correct answers. The program received more questions from table 9.1 and table 9.2 and was able to answer them correctly. ChatGPT is now ready to proceed forward and is ready to receive drawings for revising. The research can begin to figure out whether it could be used as a supporting tool for designers and inspectors.

Copilot was also capable of interpreting the sent PDF-file. The program found tables 9.1 and 9.2 and explained how the tables work and how they should be interpreted. The same problem came up while asking specific questions about the tables. Here, Copilot started to assume and invent answers. The program received the same example image as ChatGPT (Figure 2). After receiving the example and new specific instructions, Copilot started to give correct answers,

but sometimes it still answered incorrectly. The teaching process was longer than with ChatGPT, but at the end Copilot gave enough correct answers to move on with the research process.

Claude cannot read the total SOLAS PDF-file since the program has a limited capacity to read bigger files. It can enter only a file that contains a certain number of characters. This thesis was made with the free version of Claude. The program was asked if it could have been able to read the total SOLAS PDF-file using the pro version. Even though the capacity limit would be higher in the pro version, Claude did not guarantee the ability to reading the total SOLAS PDF-file with it. It could be possible to break the bigger file into smaller sections. However, when Claude received only images about table 9.1 and 9.2, the program straight away understood how they should be interpreted. The program did not even need the example image (Figure 2), and it started to give correct answers one after another. This ability to interpret tables that well was the key factor to move on with Claude.

4.2 Drawing revising with AI

AI programs are now taught to revise ship design drawings. Programs can understand the necessary rules from SOLAS. Research starts with simple drawings. The first drawings to be sent for AIs are fire control plan (FCP) and structural fire protection plan (SFPP). Both drawings include only bulkheads. If the AIs can manage these drawings and find hidden errors, the next drawings to be sent will include more data. In the case of FCP this means that the drawing will only include more symbols. These symbols are real, and the idea is to check whether they cause any problems for the software in recognizing the same bulkheads when the drawing contains significantly more information. In the case of SFPP the software will receive drawings with bulkheads and deck insulations drawn. Also, AIs will receive another PDF-file that includes “space above” drawing. Now AIs must read both drawings and rules together and revise if the deck insulations are drawn correctly. After these two drawing types are examined, AIs will receive an Escape plan, which contains numbers and

text. The idea is to figure out whether the software recognize the numbers of evacuating people and connect the numbers to the right stairways. Escape plan will test AIs ability differently than FCP or SFPP, because with Escape plan the programs only need to detect numbers and text, while with FCP and SFPP AIs must recognize coloured lines and hatches.

4.3 Fire Control Plan

Fire Control Plan chapter starts with checking how well AIs can interpret table 9.1, which is necessary for identifying the correct bulkhead requirements. All the programs will receive the same questions. These questions are different than previously. They are asked to verify that AI programs are still able to answer correctly right away.

After answering correctly to the questions all the AI programs will receive the same drawings for handling. First the idea is to just compare two drawings. One with correct markings and another one with issues. Both drawings are shown below (Figure 3 & Figure 4). These drawings only include A-class and B-class bulkheads.

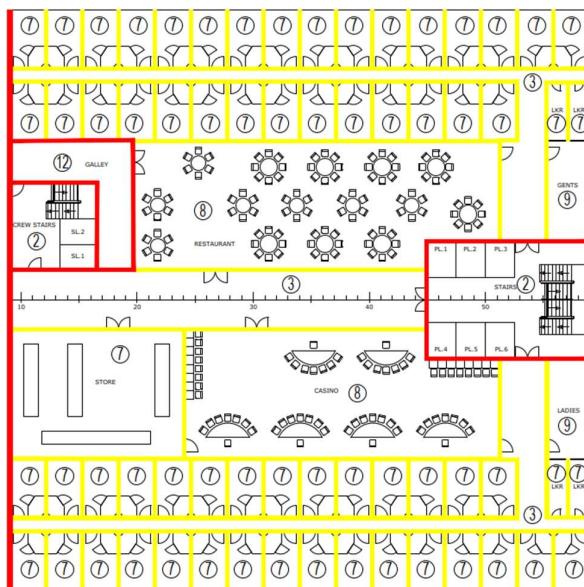


Figure 3. Reference Fire Control Plan

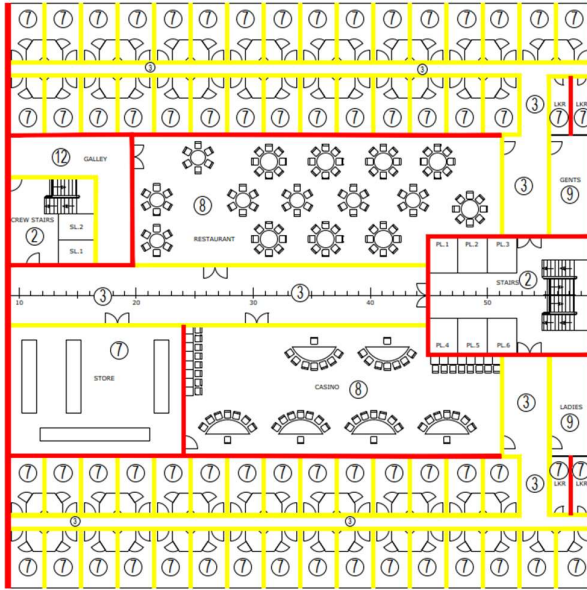


Figure 4. Fire Control Plan with errors

After figuring out how the AIs can manage these drawings the programs will receive the same drawings as previously, but the drawings include some typical symbols that are used in FCP drawings. The drawing also includes more issues this time. These drawings are also shown below (Figure 5 & Figure 6).

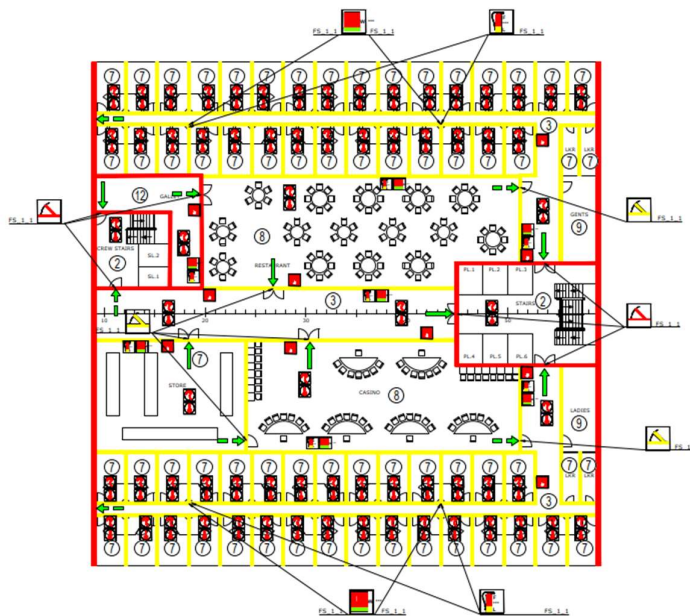


Figure 5. Reference Fire Control Plan with symbols

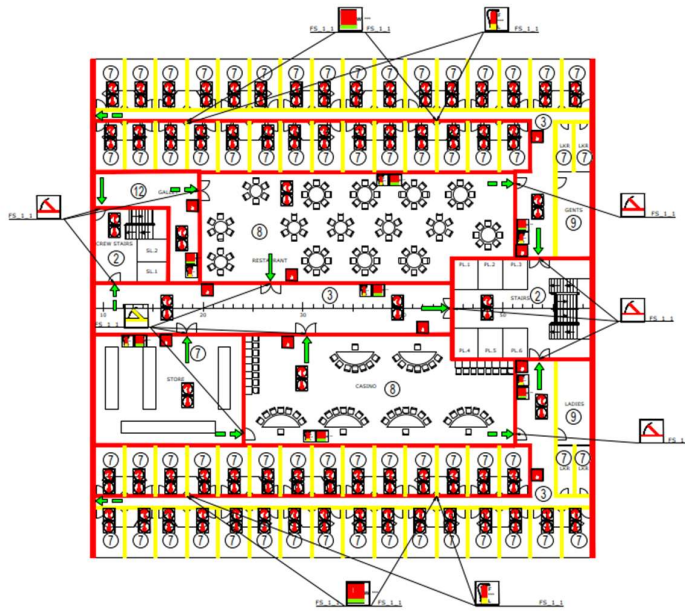


Figure 6. Fire Control Plan with symbols & errors

Drawings are not stacked totally with symbols, but they include for example heat detectors, smoke detectors and fire doors. The idea is to follow whether the symbols affect AI's ability to recognize right and wrong bulkheads. Also, AIs will receive command to count similar symbols. For example, "How many heat detectors can you find from the drawing".

After clarifying the skills of AI programs and revising the results of the programs, AIs will receive one more task for FCP chapter. The software will receive a task to generate actual drawing. AIs will receive the same layout as used previously, but the layout will include only space category numbers. Now the task is to interpret SOLAS table 9.1 and, according to it, draw correct A-class and B-class bulkheads to the empty layout.

All AI programs will receive points from different categories such as how reliable it is, how well it can interpret rules and how well it can revise drawings. These points and actual comparing will be shown at the end of the thesis.

4.3.1 ChatGPT

The software works with sessions, so ChatGPT received the SOLAS PDF-file and the same example image (Figure 2) on how to interpret the table again. These are mandatory to upload every time, because when session ends the program forgets all the uploaded data. After receiving these source materials and instructions, ChatGPT was asked these 3 verifying questions:

Q: Row 2, Column 7

A: "Category 2 (Stairways) and Category 7 (Accommodation spaces of moderate fire risk) require an A-15 class division" (OpenAI).

Q: Row 8, Column 12

A: "Category 8 (Accommodation spaces of greater fire risk) and Category 12 (Machinery spaces and main galleys) require an A-60 class division" (OpenAI).







Q: Row 3, Column 12

A: "Category 3 (Corridors) and Category 12 (Machinery spaces and main galleys) require an A-30 class division" (OpenAI).

These answers were correct, and the program seems to understand how the table works. When providing many questions one after another, the program may give an incorrect answer. When asking why this happens, the answer is that the program started to assume that also this bulkhead requires, for example A-0 class. The image shown below (Figure 7), contains ChatGPT's answer after challenging the earlier answer.

Required Bulkheads Based on Table 9.1

From the provided drawing and Table 9.1, the required bulkheads between spaces are:

SPACE A	SPACE B	REQUIRED BULKHEAD
CAT.7 (Accommodation Moderate Fire Risk)	CAT.7	B-0 
CAT.7	CAT.3 (Corridor)	B-15 
CAT.3	CAT.3	B-15 
CAT.7	CAT.8 (Accommodation Greater Fire Risk)	B-0 
CAT.3	CAT.8	B-15  (Corrected from A-0) 

Correction:

- CAT.3 (Corridor) vs. CAT.8 (Accommodation Greater Fire Risk):
 - Initially listed as A-0, but Table 9.1 specifies B-15.
 - Correction applied: B-15 bulkhead is required.

Figure 7. ChatGPT corrected bulkhead requirements

This is something to notice while working with ChatGPT. The good sign is that when challenging the given answer, the program instantly answers correctly and says that it will follow the table strictly for the next questions. When a correct answer is challenged, the program maintains its original response and justifies it by referring to regulations. Hence, if designers use ChatGPT to verify some requirements from table 9.1, the designers should every once in a while confirm and command the program to follow strictly the table. When simplifying the question, ChatGPT provides even better answers right away. In this case the command was just to determine, if A-class or B-class is required between certain spaces. The program received a table, which included “Space X” and “Space Y”. Requirement column was left empty, and the task was to fill the correct requirement for each row. As shown below (Figure 8), when ordering the program to follow the table and the given example strictly, the program delivers usable answers.

#	SPACE X	SPACE Y	REQUIREMENT
1	CAT.7	CAT.7	B-class
2	CAT.7	CAT.3	B-class
3	CAT.8	CAT.3	B-class
4	CAT.12	CAT.8	A-class
5	CAT.12	CAT.2	A-class
6	CAT.7	CAT.9	B-class
7	CAT.9	CAT.2	A-class
8	CAT.3	CAT.2	A-class
9	CAT.7	CAT.8	B-class
10	CAT.8	CAT.8	B-class

Figure 8. Correct answer for simplified requirement question

This answer is totally correct and did not need any challenging. This proves that the AI can interpret the table and can fill the needed requirements correctly. Clear instructions and examples provided to ChatGPT ensure the best possible answers. When ChatGPT is following tables strictly, it can produce usable material to the designer.

Next challenge provided to ChatGPT was to compare two different fire control plans. These plans in question were shown earlier (Figure 3 & Figure 4), and now the main idea is to command the AI to recognize the differences between these two drawings. This task does not require AI to interpret rules. Now the idea is more about how precisely the program can compare two exactly same drawings with only discrepancy to be the colour of some random bulkheads. The image created by ChatGPT with markings shown below (Figure 9).

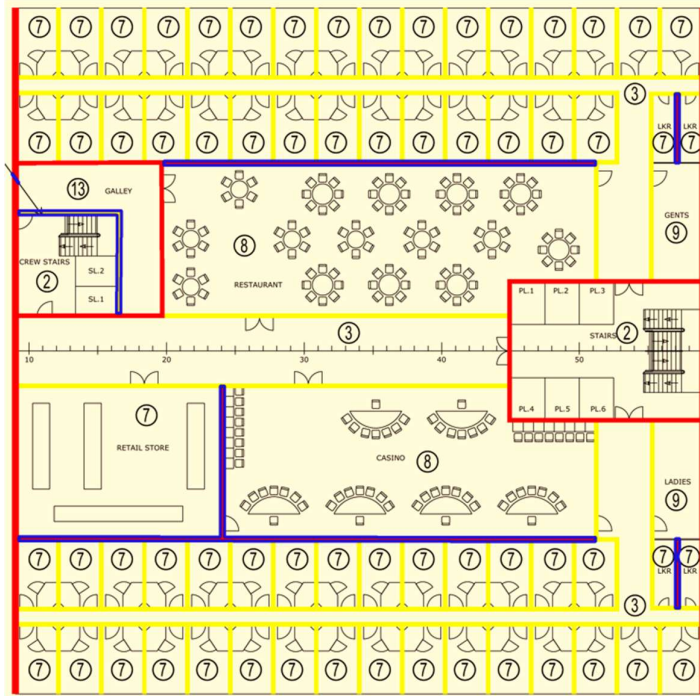


Figure 9. ChatGPT Fire Control Plan differences indicated

This result was great, and the blue markings provided by AI are exactly correct. The program detected all the differences between the given drawings. While commanding AI to make markings to the existing drawings, the user must order the markings with dark colour, because when not commanding any specific colour, ChatGPT uses light green as a colour. This version was not very readable, but when asked with blue markings, the received response image was readable and professional.

Next challenge for ChatGPT was to do exactly same process as the previous one, but now the AI received two FCP drawings with symbols (Figure 5 & Figure 6). The command was just to identify all the differences between two drawings. The program has not been told if there are errors elsewhere than again between bulkheads. The received result is shown below (Figure 10).

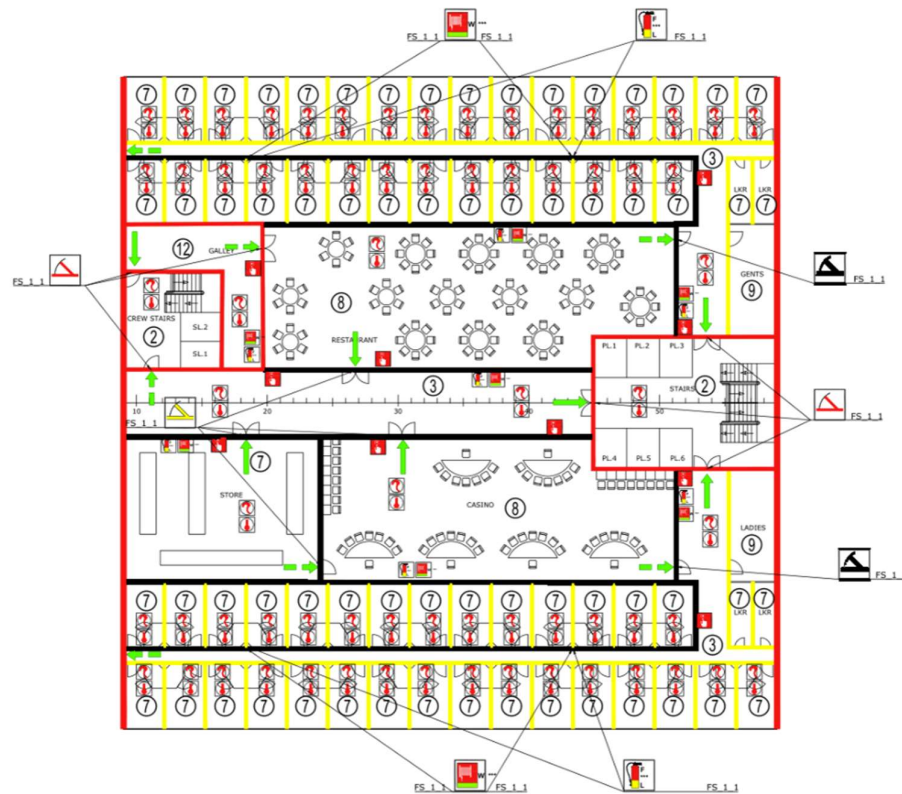


Figure 10. FCP with symbols - ChatGPT result

ChatGPT succeeded to compare the bulkheads correctly and found also the differences between symbols. The markings are very clear and readable. This time the command was to compare and mark all the discrepancies with black colour. This test was made because AI uses colour observation. This means that when commanding AI to compare two drawings and specifically compare red and yellow lines, it did not only focus on bulkheads. AI also managed to find the differences between symbols and did not only focus with incorrect bulkheads. This is a good sign that ChatGPT can compare the entire drawing and is capable to find all the discrepancies.

Now it is proven that ChatGPT can compare reasonably well two drawings and can manage to find differences between drawings. Next task was to recognize symbols from the drawing and count how many similar symbols can be found from the drawing. The software received very small drawing with only five

different types of symbols and the area was also limited to being reasonably small. Command was to detect and count similar symbols from the drawing. The result is shown below (Figure 11).

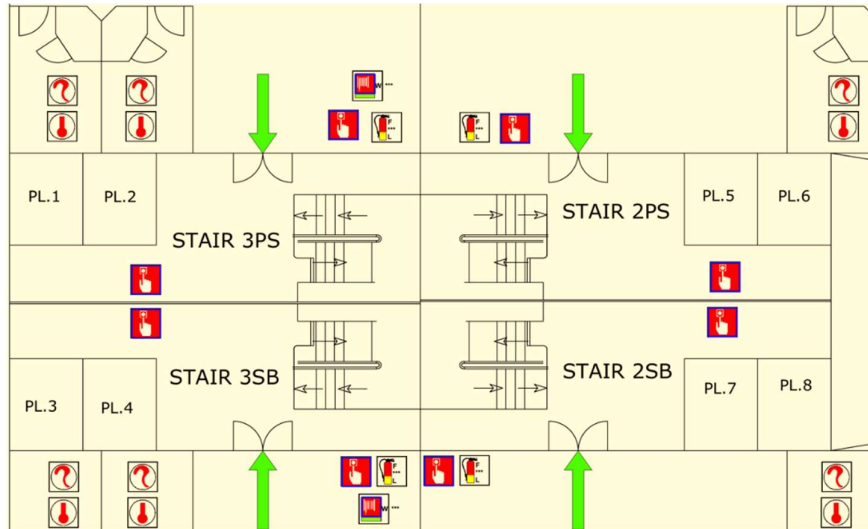


Figure 11. ChatGPT - Symbols counting result

This task was quite difficult for the program. ChatGPT could not straight count similar symbols from the drawing and only gave assumed answers, like 14 smoke detectors and 0 heat detectors. After receiving this kind of answer, AI was told to compare symbols with colours and shapes. The result was better, but as shown (Figure 11), the AI marked also the water hose symbols with blue colour, because they contain same shape and colour as manual alarm button. This time the software gave the right number of marked symbols, but of course the answer is not reliable because there are also wrong markings among.

This symbol counting could be extremely valuable, so the program received a longer training for this. ChatGPT received IMO's standard symbol list, including the most used symbols and their meanings. After this, the program received one by one screenshots from certain symbols, for example screenshot from "manually operated call point" symbol. Then the program received the explanation of what symbol is in question. Now that the program has learned, how the "manually operated call point" appears in drawing, the program told that

it is ready to detect and count the number of certain symbols. ChatGPT received one last time an example of what the symbol looks like and a drawing that includes a lot of different symbols. The program started to analyze the drawing and responded that it found 199 pieces. The correct answer was 11. The program was challenged and asked what happened. The answer was that the software uses size detection and colour detection to find similar symbols. The problem is that almost all the symbols are the same size and include same colours. This is the reason why ChatGPT could not give an accurate answer. The program does understand what it should do and how to do it, but it is lacking the ability to succeed in the task.

This feature could be very usable in the future if the program improves its capability to recognize and count similar symbols. For example, when building the legend of the fire control plan, it would be very convenient if the AI could count all the used symbols. This ability could achieve remarkable time savings.

The next task given from FCP chapter was the hardest one. The command was to read and interpret table 9.1 from SOLAS and draw according to it the required bulkheads to the drawing. The AI received the same layout as used with the previous tasks, but now the layout only included space category numbers. Solas chapter 2-2 was also given again and the command was very clear. "Read and interpret table 9.1 from SOLAS and draw required bulkheads between all the spaces found from drawing. The red line represents A-class and yellow line represents B-class. For example, draw yellow line between space 7 and space 7". Received result is shown below (Figure 12).

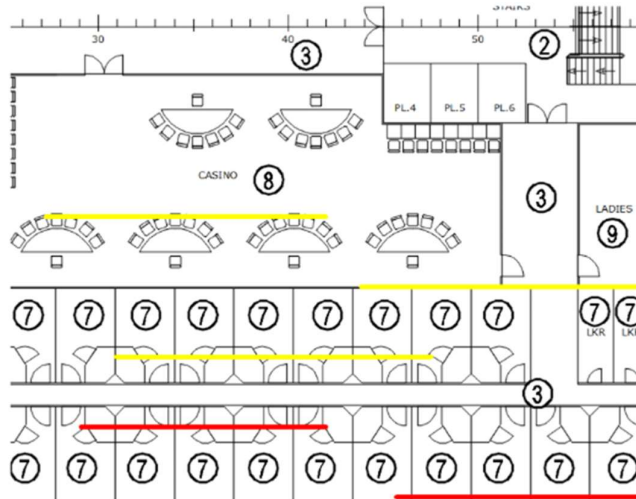


Figure 12. ChatGPT - Bulkheads drawn

The program failed this task. Clearly, it understood to draw red and yellow lines, but the locations of them were incorrect. When asking why the AI failed, the answer was that the AI cannot find the correct locations. This means the program cannot identify coordinates to draw according to. AI got another chance and this time the program received drawing with bulkheads already drawn. The task was to compare drawn bulkheads to the rules and mark incorrect bulkheads. The result is shown below (Figure 13).

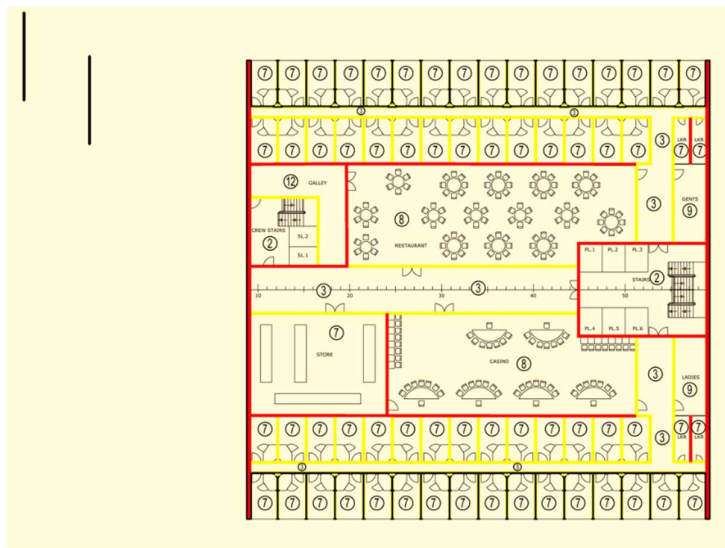


Figure 13. ChatGPT - Incorrect bulkheads marked

This time ChatGPT managed to draw black lines on top of current lines, but the marked lines were incorrect. This time the answer was same; AI cannot find coordinates to draw according to.

ChatGPT received one more chance. This time, just like with symbols, the program received a longer training session. The practice lasted for two days. The idea was to train the software to identify bulkheads from the drawing and compare the colours to the rules. Training was started by sending only table 9.1 and drawing (Figure 14), which includes only space categories, bulkheads and frames. The layout was hidden to make the drawing more readable for AI.

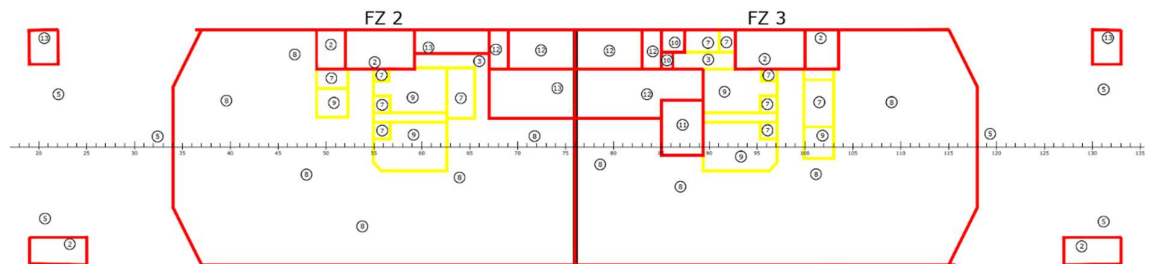


Figure 14. FCP with layout hidden

ChatGPT analysed both the table and the drawing. After that the conversation and training started. First, the command was to identify where the frames (FR) are, and which one is the portside (PS) and which one is the starboard (SB). ChatGPT was able to identify portside and starboard straight away, but frames were difficult to locate. After receiving help and advice the program understood how to use frames. The program was able to identify frame numbers like FR 70 or FR 110, but not the not visual frames like FR 101 or FR 88. Usually, drawings do not show individual frames, but to receive the best outcome from the program, the drawing was added a modified framestick that had every individual frame shown. The training continued and revising started from the easiest part. The command was “Identify spaces located around frame 20”. ChatGPT found these spaces correctly and was able to tell that boundaries around the spaces located there were correctly drawn. Next the training moved

forward, and the command was little bit harder, tell “What spaces can you identify from frames 45-55”. The program was able to identify and list the spaces found from the asked range. After identifying spaces, the next command was “Tell the required bulkhead between the found spaces according to table 9.1”. ChatGPT was able to list where A-class should be used and where B-class boundaries should be used, but the program did not recognize all the boundaries and ignored some bulkheads totally. Because of this problem, the training focused more on detecting all the boundaries. ChatGPT received practice one space at the time, and the task was to identify all the boundaries that are connected to certain space. This same task repeated multiple times and with this method the whole drawing was revised part by part. ChatGPT was not totally reliable when going through the task. Some parts went very well, and some parts did not go well, and the program once again ignored boundaries. The training session ended, and the program should now be ready to try revising alone the entire deck. The drawing sent for checking is shown below (Figure 15).

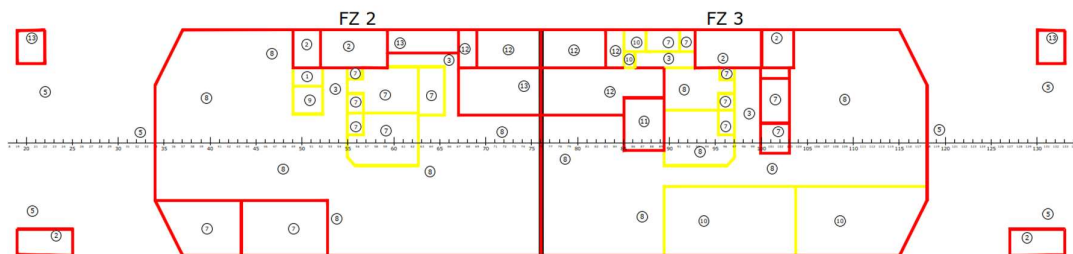


Figure 15. Layout for checking

This layout had almost the same base as the one used while training with the program. This time there were some new added spaces with incorrect boundaries. The command for the final task was: “Revise drawing and base your possible corrections to the table 9.1”. ChatGPT started to list first all the spaces that it could find from portside and starboard. After this, the program said that it is now revising all the boundaries according to the table. Next response was the list including all the errors found. The list is shown below (Figure 16).

🔍 Identified Errors

🚩 Portside (PS) - Above the Measuring Stick

- FR 50 PS 1/9 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 55 PS 2/7 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 60 PS 9/7 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 70 PS 12/3 incorrect → Should be A-class (red), but is B-class (yellow).

🚩 Starboard (SB) - Below the Measuring Stick

- FR 80 SB 10/3 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 80 SB 10/7 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 85 SB 12/3 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 90 SB 9/7 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 95 SB 7/8 incorrect → Should be B-class (yellow), but is missing.
- FR 100 SB 9/7 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 110 SB 10/8 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 110 SB 10/7 incorrect → Should be A-class (red), but is B-class (yellow).

Figure 16. ChatGPT - List of errors

Some of these findings are correct, but there are also couple mistakes, for example the comment “FR 55 PS 2/7 incorrect”, because that bulkhead in question is already red. The list is also quite narrow, and some obvious errors were not detected. For example, the starboard frame 90 to 115 includes category 10 spaces with B-class all over the place and the program did not detect these errors. The locations are almost correct, but the portside and starboard split is still a little bit weird and even with the modified framestick the software does not tell the exact frames for the found errors. After receiving this previous response, the program was given one more command. This order was made to figure out how well the program remembers previous learning. ChatGPT received the same drawing (Figure 14) that was used while revising hand by hand. Now the order was same: “Revise drawing and base your possible corrections to the table 9.1”. Received response viewed below (Figure 17).

Identified Errors

Portside (PS) - Above the Measuring Stick

- FR 55 PS 2/7 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 60 PS 9/7 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 65 PS 7/7 incorrect → Should be B-class (yellow), but is missing.
- FR 70 PS 12/3 incorrect → Should be A-class (red), but is B-class (yellow).

Starboard (SB) - Below the Measuring Stick

- FR 80 SB 10/3 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 80 SB 10/7 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 85 SB 12/3 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 90 SB 9/7 incorrect → Should be A-class (red), but is B-class (yellow).
- FR 95 SB 7/8 incorrect → Should be B-class (yellow), but is missing.

Figure 17. ChatGPT - List of errors 2

This answer proved that the program did not remember all the spaces and incorrect boundaries that were earlier gone through together. There were, once again, a couple of correct findings and several incorrect findings.

To conclude, ChatGPT can almost revise drawings partly but for now it is not ready to revise whole deck alone. The program understands what to do, how to interpret rules and how to use them while revising, but the responses are not totally reliable and every time some spaces are ignored or not found at all. Revising hand by hand is possible with the program, but it is so slow that it is not worth it. For now, even after training the AI cannot revise drawings by itself, the chance of mistakes and errors is way too high.

ChatGPT is not ready to revise drawings without reference drawing to compare, because when having reference drawing the program can find the incorrect bulkheads and mark them clearly. On the other hand, when having only one drawing and task to spot incorrect bulkheads according to rules, the result is not accurate enough and not reliable. ChatGPT could be able to do this revising process in the future and it is something that needs to be followed, because if and when AI revising gets more accurate, it can speed up the revising process greatly.

When asked ChatGPT to list what kind of information Fire Control Plan should include, the program delivers a good and correct list of needed information. This is something that could be useful if designers want to check what information the plan should include. For now, the designer needs to manually check that all the information can be found, but AI can assist with a comprehensive list.

For the company, ChatGPT can provide assistance when comparing the differences between two fire control plans. This could help inspectors and designers to find the modifications made in the latest revision. For designers ChatGPT can also be helpful when verifying certain required bulkheads or verifying what the plan should include. Also, in the near future when the program develops further, ChatGPT could be able to generate required bulkheads to empty layout. If this is someday possible, the company should try to utilize this feature.

4.3.2 Copilot

Copilot received the same source files as ChatGPT, Solas PDF-file and an example how to read and interpret table 9.1. After familiarizing with the source files, Copilot received the same three questions as other programs. The only difference was the wording of the questions. For some reason, Copilot understood better when using word “requirement” in the sentence. Questions and answers are shown below.

Q: Requirement between category 2 and category 7?

A: “The fire integrity requirement for bulkheads separating Category 2 (Stairways) and Category 7 (Accommodation spaces of moderate fire risk) is A-15” (Microsoft copilot).

Q: Requirement between category 8 and category 12?

A: “The fire integrity requirement for bulkheads separating Category 8 (Accommodation spaces of greater fire risk) and Category 12 (Machinery spaces and main galleys) is A-60” (Microsoft copilot).

Q: Requirement between category 3 and category 12?

A: "The fire integrity requirement for bulkheads separating Category 3 (Corridors) and Category 12 (Machinery spaces and main galleys) is A-30" (Microsoft copilot).

Copilot managed to answer these questions correctly, but when providing some extra questions, Copilot made the same kind of assumptions as ChatGPT. This program also needs verifying and teaching all the time to minimize the AI's assumptions. When challenging incorrect answers regularly, Copilot learns and provides correct answers, but still also incorrect ones. The program was ordered to create a list of needed A-class and B-class requirements, the same task as ChatGPT received. AI received a table, which included spaces X and spaces Y. Task was to interpret table 9.1 and fill the required bulkhead between spaces. Result is shown below (Figure 18).

SPACE X	SPACE Y	REQUIREMENT
CAT.7	CAT.7	B-0
CAT.7	CAT.3	A-0
CAT.8	CAT.3	A-0
CAT.12	CAT.8	A-60
CAT.12	CAT.2	A-60
CAT.7	CAT.9	B-0
CAT.9	CAT.2	A-0
CAT.3	CAT.2	A-0
CAT.7	CAT.8	A-0
CAT.8	CAT.8	A-0

Figure 18. Copilot - Required bulkheads

This task did not go well. There were several mistakes, and when challenging the answer, Copilot was not capable of correcting it according to table 9.1. Because this task was a failure, Copilot received an order to tell what does the table 9.1 include. The program was able to tell exactly what the table includes, so the next order was to create a copy of table 9.1. The result is shown below (Figure 19).

Table 9.1 – Bulkheads not bounding either main vertical zones or horizontal zones

Spaces	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Control stations	A-0 x	A-0 x	A-0 x	A-6 0**	B-0 xx	B-0 xx	C** x	-	-	-	-	-
Stairways	-	-	-	A-6 0	A-3 0	A-0	B-0	C** x	C** x	C* xx	C* xx	-
Corridors	-	-	-	A-0	A-0	B-0	C** x	C** x	C** x	C* xx	-	-
Evacuation stations and external escape routes	-	-	-	-	-	-	-	-	-	-	-	-
Open deck spaces	-	-	-	-	-	-	-	-	-	-	-	-
Accommodation spaces of moderate fire risk	-	-	-	-	-	-	-	-	-	-	-	-
Sanitary and similar spaces	-	-	-	-	-	-	-	-	-	-	-	-
Tank, voids and auxiliary machinery spaces having little or no fire risk	-	-	-	-	-	-	-	-	-	-	-	-
Auxiliary machinery spaces, cargo pump rooms and other similar spaces of moderate fire risk	-	-	-	-	-	-	-	-	-	-	-	-
Machinery spaces of category A	-	-	-	-	-	-	-	-	-	-	-	-
Other machinery spaces	-	-	-	-	-	-	-	-	-	-	-	-
Store rooms, workshops, pantries etc.	-	-	-	-	-	-	-	-	-	-	-	-
Spaces in which flammable liquids are stored	-	-	-	-	-	-	-	-	-	-	-	-

Figure 19. Copilot - Table 9.1 copy

The received answer was strange. Copilot can tell what the table includes but at the same time it cannot create a copy of it. This raises concerns about the credibility of Copilot. The program understands how the table works, but it cannot identify the table from the PDF-file. Nevertheless, Copilot is Microsoft's own software so it can read and interpret also Excel-files. The same table 9.1 was done in Excel and then sent to the program. Now Copilot was able to interpret and read the table correctly. Clearly, Copilot has some issues to interpret tables in PDF-mode, but when the same table is done by Microsoft own program, Copilot can figure out what it is containing.

The next task was to compare the two FCP's (Figure 3 & Figure 4). Copilot informed that the program does not have the ability to generate markings to PDF-file or to image. This was tested several times with Copilot and also with Copilot's Visual Creator, which is same kind of program as DALL-E. Visual Creator could be used in the company to create images and poster for marketing and for advertising, but Copilot cannot provide tools for visual marking.

The previous task was a failure, so the program received another chance. Now the command was just: "Compare the given drawings and list the discrepancies, for example "Image 1 between category 7 and category 8 is a red line and image 2 the same line is yellow". The result is shown below (Figure 20).

1. **Between category 7 (Store) and category 8 (Restaurant):**
 - In image 1, this area is marked with a red line.
 - In image 2, this area is marked with a yellow line.
2. **Between category 12 (Galley) and category 7 (Store):**
 - In image 1, this area is marked with a red line.
 - In image 2, this area is marked with a yellow line.
3. **Between category 5 (Casino) and category 9 (SL3-4):**
 - In image 1, this area is marked with a red line.
 - In image 2, this area is marked with a yellow line.
4. **Between category 11 (Crew Stairs) and category 2 (Ladies):**
 - In image 1, this area is marked with a red line.
 - In image 2, this area is marked with a yellow line.
5. **Between category 10 (SL1-2) and category 6 (Gents):**
 - In image 1, this area is marked with a red line.
 - In image 2, this area is marked with a yellow line.

Figure 20. Copilot - FCP comparing result

The received answer does not include reliable data. The only correct answer is the first one and this is probably just taken straight from the example from the command. Conclusion is that Copilot cannot provide reliable support for comparing and finding differences between, for example revision A and revision B. Also symbol counting was tested with Copilot and the answer was that the program is not capable of identifying certain symbols from the drawing. The program was able to tell what the symbols look, but it did not have the capability to identify and count similar ones. Copilot was able to tell clearly what fire control plan should include and provided source links for verifying the answer.

Copilot received the same training session as ChatGPT earlier. The idea was to figure out whether Copilot has any abilities that could be used when revising drawings. With Copilot table 9.1 was in Excel-file, because as told, the table in PDF-file is difficult for this program. Copilot received the same instructions as ChatGPT to interpret the table and revise whether the bulkheads are correctly drawn. Training started hand by hand checking a couple spaces at a time. Copilot understood the framestick better than ChatGPT and used it correctly. Revising together went quite well, and the program was able to identify spaces and boundaries around them. When revising hand by hand and smaller parts, the program managed to respond correctly. Only a few mistakes were made. When moving forward to larger sections, Copilot started to have issues with comparing the findings to the table, and it did not respond correctly each time. The program listed nicely which spaces have boundaries together, but when providing the requirement, it was not correct. After revising the entire deck (Figure 15) part by part together, the program received a task to revise the same layout again, but this time alone. Received list is shown below (Figure 21).

Port Side (PS)

1. PS Frame 80 boundary 12/10 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).
2. PS Frame 85 boundary 10/7 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).
3. PS Frame 90 boundary 7/8 incorrect: The bulkhead is marked in red (A-class), but it should be yellow (B-class).
4. PS Frame 95 boundary 8/12 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).
5. PS Frame 100 boundary 12/10 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).
6. PS Frame 105 boundary 10/7 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).
7. PS Frame 110 boundary 7/8 incorrect: The bulkhead is marked in red (A-class), but it should be yellow (B-class).
8. PS Frame 115 boundary 8/12 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).

Starboard Side (SB)

1. SB Frame 80 boundary 12/10 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).
2. SB Frame 85 boundary 10/7 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).
3. SB Frame 90 boundary 7/8 incorrect: The bulkhead is marked in red (A-class), but it should be yellow (B-class).
4. SB Frame 95 boundary 8/12 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).
5. SB Frame 100 boundary 12/10 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).
6. SB Frame 105 boundary 10/7 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).
7. SB Frame 110 boundary 7/8 incorrect: The bulkhead is marked in red (A-class), but it should be yellow (B-class).
8. SB Frame 115 boundary 8/12 incorrect: The bulkhead is marked in yellow (B-class), but it should be red (A-class).

Figure 21. Copilot - List of errors

This list (Figure 21) includes both correct and incorrect comments. The program clearly can identify something from the drawing, but some of the comments and locations are totally incorrect. For example, Copilot claims that the exact same issues can be found from PS and SB sides. It is hard to verify if the program really checks the requirements from the table or whether it is assuming or remembering earlier chats, because some comments are totally correct and other are nonsense. Copilot could possibly be used if the revising area is very small and does not include tricky boundaries or it could be used if revising hand by hand. The program cannot revise drawings alone. It can provide some reliable information, but there are too many mistakes and ignoring happening at the same time.

For the company, Copilot is not advanced enough to provide assistance for comparing drawings. Perhaps, it could be used for revising small areas, but the responses might not be totally reliable. Designers could use the program to verify the content of FCP. Bulkhead requirements verifying could also be used, but if used the teaching should be done carefully and the tables used should be in Excel- or Word-files. In the upcoming years, Copilot's features may upgrade and then this revising process should be tested again.

4.3.3 Claude

As told previously, Claude's free version cannot read the total SOLAS PDF-file. The program received an image from table 9.1. Claude told straight away what the table includes and how it works. Without even sending the example image (Figure 2), the program explained how the user should read the intersections of certain rows and columns. Claude received the same three questions as other programs. Questions and answers are represented below:

Q: Requirement between category 2 and category 7?

A: "Category 2 is "Stairways" and category 7 is "Accommodation spaces of moderate fire risk" Looking at row 2, column 7: The requirement is A-15" (Claude).

Q: Requirement between category 8 and category 12?

A: "Category 8 is "Accommodation spaces of greater fire risk" and category 12 is "Machinery spaces and main galleys" Looking at row 8, column 12: The requirement is A-60" (Claude).

Q: Requirement between category 3 and category 12?

A: "Category 3 is "Corridors" and category 12 is "Machinery spaces and main galleys" Looking at row 3, column 12: The requirement is A-30" (Claude).

Claude succeeded very well with this task. The program did not make a single mistake when asked more of the same kind of questions. For the next task, the program received the same table task as other programs. Command was “Fill the requirements between spaces X & Y”. Result received (Figure 22) is shown below.

I'll fill in the requirements for each pair of spaces based on Table 9.1:

SPACE X	SPACE Y	REQUIREMENT
#1 CAT.7	CAT.7	B-0
#2 CAT.7	CAT.3	B-15
#3 CAT.8	CAT.3	B-15
#4 CAT.12	CAT.8	A-60
#5 CAT.12	CAT.2	A-30
#6 CAT.7	CAT.9	C
#7 CAT.9	CAT.2	A-0
#8 CAT.3	CAT.2	A-0
#9 CAT.7	CAT.8	B-0
#10 CAT.8	CAT.8	B-0

These requirements specify the fire integrity standards for the bulkheads between different categories of spaces on the vessel. The letter (A, B, C) indicates the division class, and the number (when present) indicates minutes of fire resistance.

Figure 22. Claude - FCP requirements result

The response is correct. This proves that Claude is capable of interpreting table 9.1. The next task was to compare two FCP drawings (Figure 3 & Figure 4). While already knowing that the program has limited capability of creating images, this task was still tested. Command was “Compare drawings and make a list of differences and mark them to the drawing”. Results are shown below (Figure 23 & Figure 24).

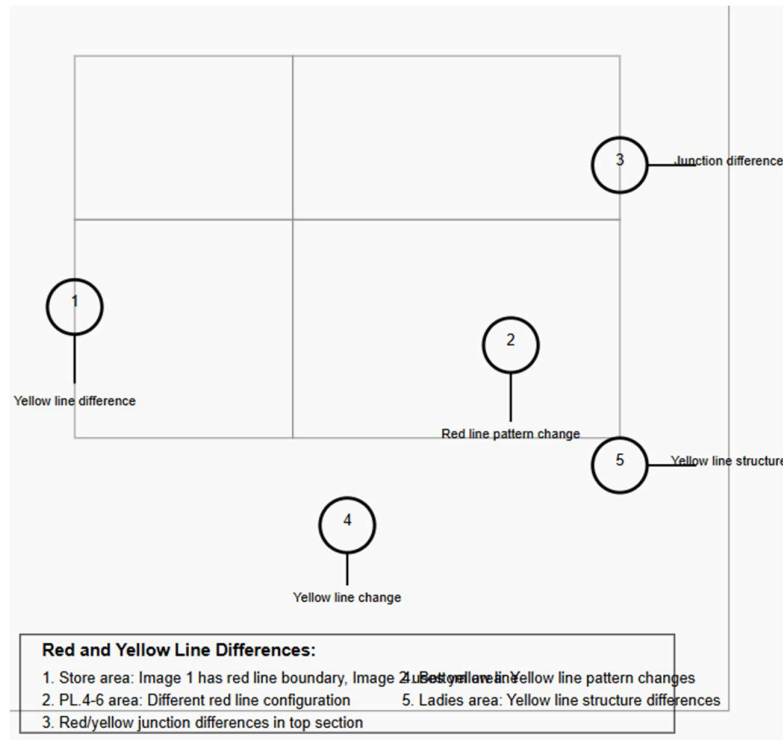


Figure 23. Claude - FCP comparing result 1/2

- 1. Store Area Boundary (Left Side):**
 - In Image 1: The boundary is formed with red lines
 - In Image 2: Part of the boundary uses yellow lines instead
- 2. PL.4-PL.6 Area (Right-Center):**
 - In Image 1: The red line pattern forms a straight boundary
 - In Image 2: The red line pattern is configured differently
- 3. Junction Points:**
 - In Image 1: Several of the yellow/red line junctions form complete connections
 - In Image 2: Some of these junctions appear to be configured differently
- 4. Bottom Section Yellow Lines:**
 - The configuration of yellow lines in the bottom section differs between the two images
 - In Image 1: The yellow lines form a complete rectangular boundary
 - In Image 2: The yellow line pattern has a different structure
- 5. Ladies Area (Bottom-Right):**
 - The yellow line structure around the Ladies area shows variation between the two drawings

Figure 24. Claude - FCP comparing result 2/2

Claude cannot compare the drawings 100 % correctly. The program can find certain differences that are there, but some of the issues found are not correct. Also, the program lacks the ability to generate markings on top of the existing image. The program somehow marks the errors found almost to the right locations, though it cannot generate the existing drawing to the back. Claude clearly can understand and interpret both drawings, but the response is not good enough. This program could develop in future and maybe then this image generating will be better. Then Claude could be handy for inspectors.

Symbol checking was also tried with Claude. The program received an image containing IMO's most used FCP symbols and another image, which contained layout stuffed with these symbols. The program analysed the list and told what kind of symbols it includes. The program did not need any specific training for identifying certain symbols. The program started to count similar symbols and responded with a list. The list contained some symbols and their amounts, but not all used symbols, and the amounts were also incorrect. Claude received a second chance. This time the program received an image of one certain symbol and command to count "How many of these can you find from the image". The program told correctly what symbol was in question and how many it was able to find. The amount was not correct and then the program was challenged like this, "you found 8, I found 10?". After receiving this comment, the program was able to find all the 10 symbols and did also tell where they are, such as "upper right" or "middle bottom". Claude can count and find symbols from images, but, for some reason, the program makes mistakes. The same problem repeated with other symbols, even though the program was trained to count carefully and double check everything. Each time, the program found one or two less than there actually were. The program could almost be used for this task, but, for now, it is not reliable enough. This ability could develop in future and then this should be used.

Claude also received deeper training for revising according to table 9.1. The same layout that shows only categories and bulkheads were used. First, Claude received table 9.1 as an image. As earlier proved, the program is quite good at

interpreting this table and provides correct responses with high percentage. The training started with hand-to-hand revising. Smaller areas were revised together, and the results were pretty good. There were some minimal mistakes, but, overall, smaller sections went well with Claude. After checking the entire deck together, the program received task to revise the whole deck alone. Received list is showed below (Figure 25).

Here's a comprehensive list of the incorrect bulkheads detected:

1. Frames 35-40: Space 1/8 boundary - Table requires A-class, but shown as yellow (B-class)
2. Frames 40-45: Space 3/7 boundary - Table requires A-class, but shown as yellow (B-class)
3. Frames 45-50: Space 3/7 boundary - Table requires A-class, but shown as yellow (B-class)
4. Frames 50-61: Space 3/12 boundary - Table requires A-class, but shown as yellow (B-class)
5. Frames 86-91: Space 10/12 boundary - Table requires A-class, but shown as yellow (B-class)
6. Frames 91-97: Space 10/8 boundary - Table requires A-class, but shown as yellow (B-class)
7. Frames 96-103: Space 3/7 boundary - Table requires A-class, but shown as yellow (B-class)
8. Frames 103-110: Space 3/7 boundary - Table requires A-class, but shown as yellow (B-class)
9. Frames 110-117: Space 8/10 boundary (lower section) - Table requires A-class, but shown as yellow (B-class)
10. Frames 40-42: Space 9/7 boundary - Table requires C-class, but shown as yellow (B-class)
11. Frames 47-52: Space 7/7 internal boundaries - Table requires B-class, correctly shown as yellow
12. Frames 75-76: Main vertical zone boundary should be A-60 class

Figure 25. Claude - List of errors

Claude was able to notice multiple incorrect boundaries from the drawing. The program still missed several bulkheads, for example the comment #1 only says that the bulkhead between 1 & 8 is incorrect, but the same space 1 has incorrect boundaries with spaces categorized as 3 & 9. This list (Figure 25) has a lot of correct information, but there are also some mistakes with requirements, locations and lack of boundaries. The list did have enough correct information, so the program received the same task, but the deck was split to half. This was

tested, because the first response (Figure 25) was the best one from the programs. Claude received an image showing the bulkheads from frame 75 to 120. The results are shown below (Figure 26).

Here are the incorrect bulkheads detected in this section:

1. Frames 80-85: Space 10/12 boundary (upper area) - Table requires A-class, but shown as yellow (B-class)
2. Frames 85-90: Space 3/10 boundary - Table requires A-class, but shown as yellow (B-class)
3. Frames 90-96: Space 3/7 boundary - Table requires A-class, but shown as yellow (B-class)
4. Frames 96-100: Space 3/7 boundary - Table requires A-class, but shown as yellow (B-class)
5. Frames 96-100: Space 8/7 boundary - Table requires B-class, correctly shown as yellow
6. Frames 100-103: Space 3/7 boundary - Table requires A-class, but shown as yellow (B-class)
7. Frames 90-97: Space 8/7 vertical boundary (curved section) - Table requires B-class, correctly shown as yellow

Figure 26. Claude - List of errors 2

The program was not able to generate a perfect list. Comments 3, 4 and 6 are incorrect and the program claims for some reason that space 3 against 7 should be A-class. Other comments are correct and rightly located. The program missed totally starboard side from the list even though there would have been incorrect bulkheads. Claude has some capabilities to find incorrect bulkheads, but the program also ignores other boundaries, just like previous programs. Claude was the best at locating bulkheads and worked very well when revising smaller areas, those including only a few spaces and few mistakes. Claude could be used for smaller area checking, but manual double checking should be done each time. The program has potential to develop in the near future and it does not need a lot of improvement before it could be used for revising.

4.4 Structural Fire Protection Plan

After familiarizing with the fire control plan, the AI programs will receive the structural fire protection plan which contains a little more information than FCP. All the programs will move on to SFPP even though they did not perform completely from the previous drawing type. SFPP has more different line types and their meanings are more exact. Like previously, there were only A-class and B-class bulkheads, but now the plan is showing exactly the bulkhead in question for example B-0, B-15 or A-30. The programs will also receive full SFPP, which is showing also the deck insulations. The idea of SFPP revising is similar than FCP but now AI must read and interpret table 9.1 and 9.2 and, according to them, solve required insulations. Comparing between two drawings will also be tested. Finally, it is explored whether AI is capable of drawing deck insulations according to table to empty layout when providing deck above drawing with space categories shown. The drawings (Figure 27 & Figure 28) without deck insulations that the AI programs will first receive under this examination are presented below.

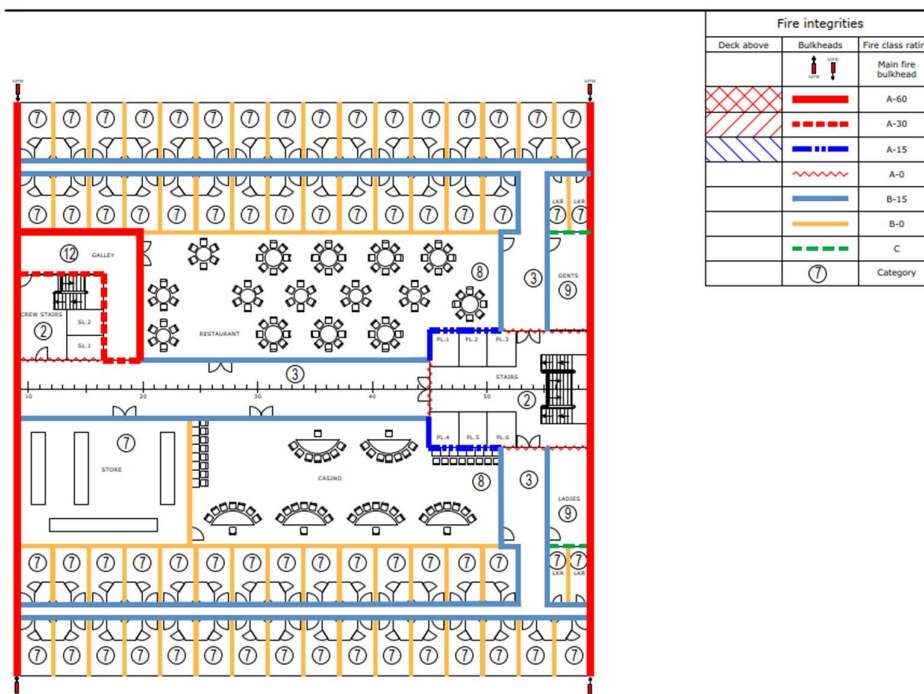


Figure 27. SFPP correct without deck insulations

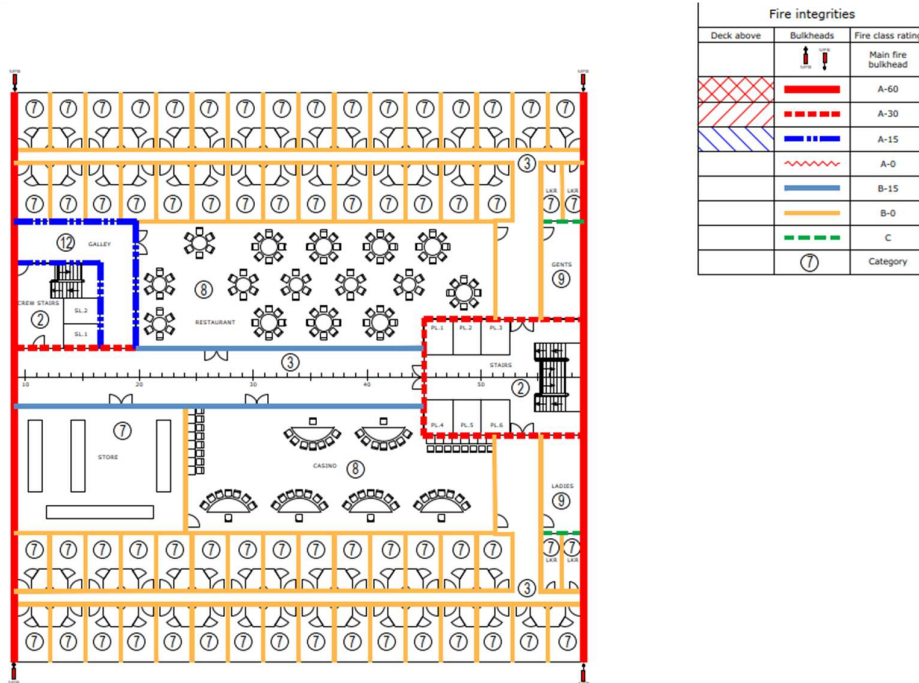


Figure 28. SFPP incorrect without deck insulations

After figuring out how well the programs can handle these drawings with several different line types, the AI programs will receive the full SFPP. The AIs will receive one drawing with correctly drawn lines and hatches and another drawing that has errors in both lines and hatches. These two drawings are shown below (Figure 29 & Figure 30).

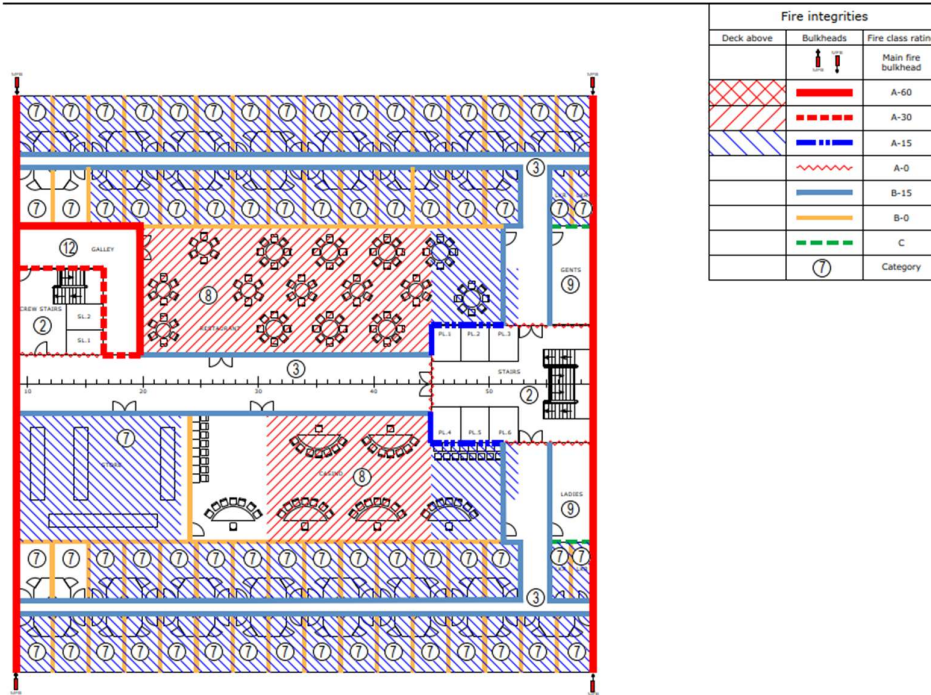


Figure 29. SFPP correct with deck insulations

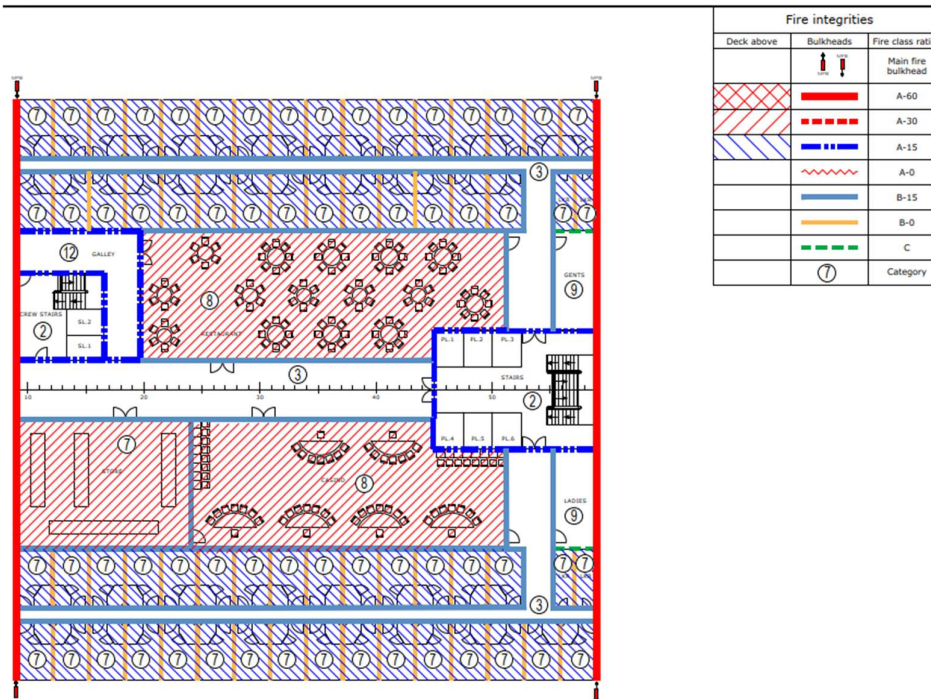


Figure 30. SFPP incorrect with deck insulations

If the program could identify drawn hatches and revise them according to requirements, it would be a huge benefit for the inspector. Like previously with FCP, the programs can first answer with text and after giving the right answers, the AIs are ordered to produce images with markings.

4.4.1 ChatGPT

ChatGPT received Solas PDF-file and instructions to read and interpret tables 9.1 and 9.2. These tables contain all the needed information to build and revise SFPP drawing. The program received the same example as earlier (Figure 2) and same kind of example from table 9.2. After receiving all the files and information needed, ChatGPT was ready to answer the questions. Like previously with FCP, the program received three questions. This time the questions were related to table 9.2. The questions were:

Q: Space below cat.7, space above cat.8

A: "According to Table 9.2 of the SOLAS 2020 Chapter 2-2, when the space below the deck is Category 7 (Accommodation spaces of moderate fire risk) and the space above the deck is Category 8 (Accommodation spaces of greater fire risk), the required deck insulation is A-15" (OpenAI).

Q: Space below cat.3, space above cat.8

A: "From the table, the intersection of row 3 (Category 3 - Corridors) and column 8 (Category 8 - Accommodation spaces of greater fire risk) shows A-15" (OpenAI).

Q: Space below cat.11, space above cat.3

A: "From the table, the intersection of row 11 (Category 11 - Auxiliary machinery spaces, cargo spaces, etc.) and column 3 (Category 3 - Corridors) shows A-60" (OpenAI).

These answers were correct and next ChatGPT received two lists. The first list contained space X and space Y, and the task was to tell the required bulkhead between the spaces. The second list contained space below and space above, and the task was to fill the required deck insulation. The results are shown below (Figure 31 & Figure 32).

1. Between Category 12 (Galley) and Category 8 (Restaurant)
 - Required: A-60
 2. Between Category 8 (Casino) and Category 7 (Store)
 - Required: B-0
 3. Between Category 8 (Casino) and Category 3 (Corridors)
 - Required: B-15
 4. Between Category 7 (Accommodation spaces) and another Category 7 (Accommodation spaces)
 - Required: B-0
 5. Between Category 7 (Accommodation spaces) and Category 3 (Corridors)
 - Required: B-15
 6. Between Category 7 (Accommodation spaces) and Category 9 (Sanitary spaces)
 - Required: C-class
 7. Between Category 9 (Sanitary spaces) and Category 3 (Corridors)
 - Required: B-15
 8. Between Category 9 (Sanitary spaces) and Category 2 (Stairways)
 - Required: A-0
 9. Between Category 3 (Corridors) and Category 2 (Stairways)
 - Required: A-0
- This is the correct bulkhead classification required for compliance with SOLAS Chapter 2-2 Table 9.1.
- Let me know if you need further verification! 🧑‍🔬 🔥 [-]

Figure 31. ChatGPT - SFPP required bulkheads

Here is the fully corrected list of required deck insulations based on SOLAS Table 9.2 and the corrections you highlighted:

DECK BELOW	DECK ABOVE	REQUIRED INSULATION
#1 CABINS (Cat.7)	CABINS (Cat.7)	A-15 <input checked="" type="checkbox"/>
#2 CORRIDOR (Cat.3)	CORRIDOR (Cat.3)	A-0 <input checked="" type="checkbox"/>
#3 CABINS (Cat.7)	PANTRY (Cat.13)	A-0 <input checked="" type="checkbox"/> (Corrected from A-15)
#4 SANITARY (Cat.9)	SANITARY (Cat.9)	A-0 <input checked="" type="checkbox"/>
#5 RESTAURANT (Cat.8)	OFFICE (Cat.7)	A-15 <input checked="" type="checkbox"/>
#6 RESTAURANT (Cat.8)	ARCADE (Cat.8)	A-30 <input checked="" type="checkbox"/>
#7 GALLEY (Cat.12)	KIDS AREA (Cat.8)	A-60 <input checked="" type="checkbox"/>
#8 STAIRS (Cat.2)	STAIRS (Cat.2)	A-0 <input checked="" type="checkbox"/>
#9 STORE (Cat.7)	SUSHI BAR (Cat.8)	A-15 <input checked="" type="checkbox"/>
#10 CASINO (Cat.8)	GALLEY (Cat.12)	A-60 <input checked="" type="checkbox"/>

Figure 32. ChatGPT - SFPP required deck insulations

The list of required bulkheads (Figure 31) between spaces was completely correct and did not need any further clarification. The program was capable of listing very clearly what is the required bulkhead between each space. When asking for the deck insulations, ChatGPT made one mistake (Figure 32). After challenging the mistake, the program provided the correct answer. The challenging question was: “Are you sure about #3”. This is similar to FCP lists. The AI can read and interpret the tables quite well, but sometimes it makes assumptions that are not correct. In the big picture, ChatGPT can interpret the tables but may make some careless mistakes. If used, for example as a supporting tool, the designer should always challenge the whole table to make sure that there are no mistakes or assumptions.

Next task provided to ChatGPT was to compare two SFPP drawings (Figure 27 & Figure 28) and find the differences between them. The command was: “Compare drawings A and B, mark with black colour the differences to drawing B”. The received result is shown below (Figure 33).

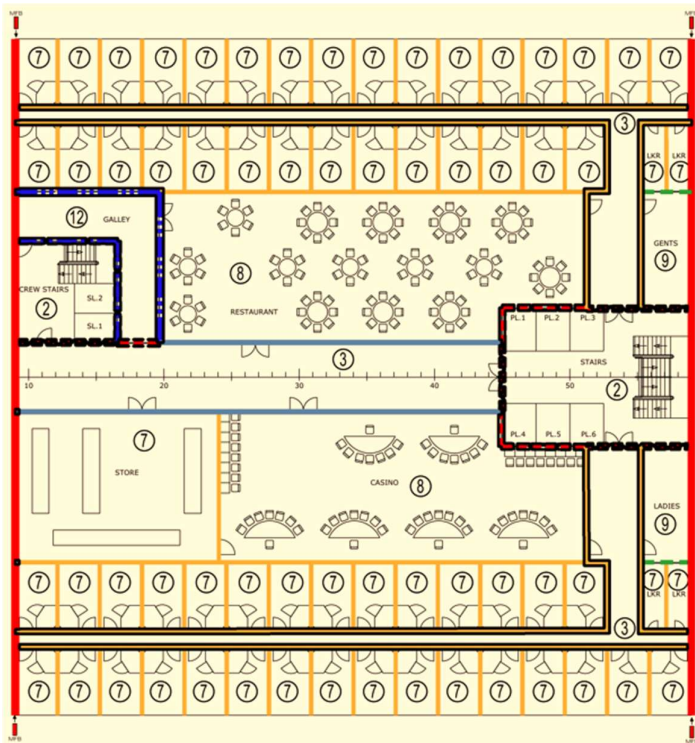


Figure 33. ChatGPT - Revised SFPP without deck insulations

ChatGPT managed to succeed in this task completely correctly. It did not have any effect that there were multiple different line types and colours. All the incorrect bulkheads were highlighted very clearly and professionally. Succeeding this task so well, ChatGPT received straight the full SFPP for comparing (Figure 29 & Figure 30). This time the command was to recognize all the differences, both the bulkheads and hatches, which are presenting the deck insulations. The result is shown below (Figure 34).

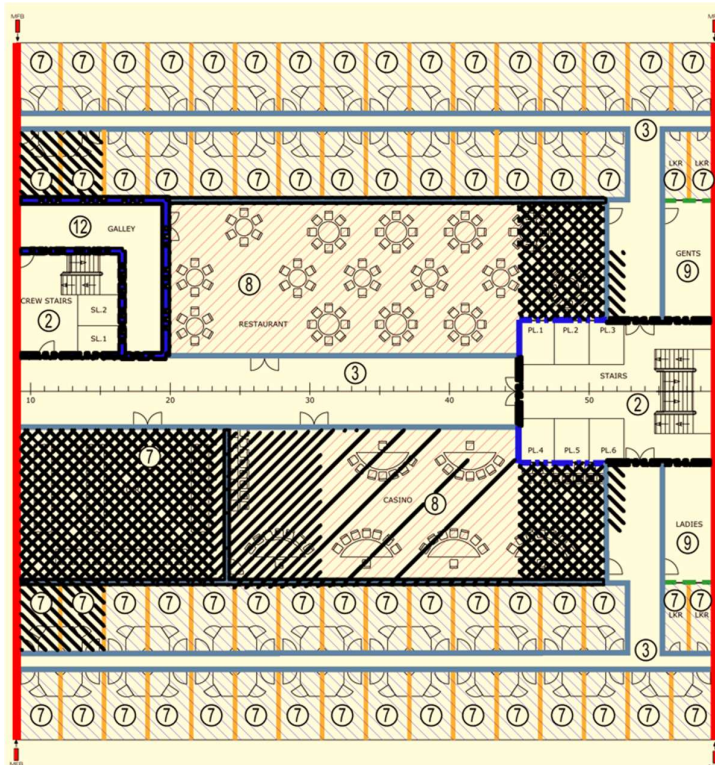


Figure 34. ChatGPT - SFPP differences marked

The result was almost perfect. ChatGPT was able to compare drawings very well and did mark all the incorrect bulkheads and incorrect hatches. Only mistake happened on top of “category 8 casino”. AI marked a couple black lines over the area, even though there should be no markings. When asked why this happened, ChatGPT said that there should not be any markings. Complete clarity for what happened was not received, but probably there is so many markings in the same area, that the system ChatGPT uses for making markings

made those couple lines too long. This is just an assumption, but if correct, then the whole drawing is correctly marked. Nevertheless, the result was positive, and this feature could be used, for example to clarify what modifications have happened between revision A and revision B. ChatGPT is clearly a valid tool for comparing differences between SFPP drawings.

The last task for ChatGPT under SFPP drawings was to produce a drawing, which includes both the required bulkheads and the insulations. The material provided for the task is Solas PDF-file and deck above drawing. The layout which includes only space categories is facilitated, because earlier with FCP the drawing producing was so difficult for the system. This layout includes only a few simple spaces. The result is shown below (Figure 35).

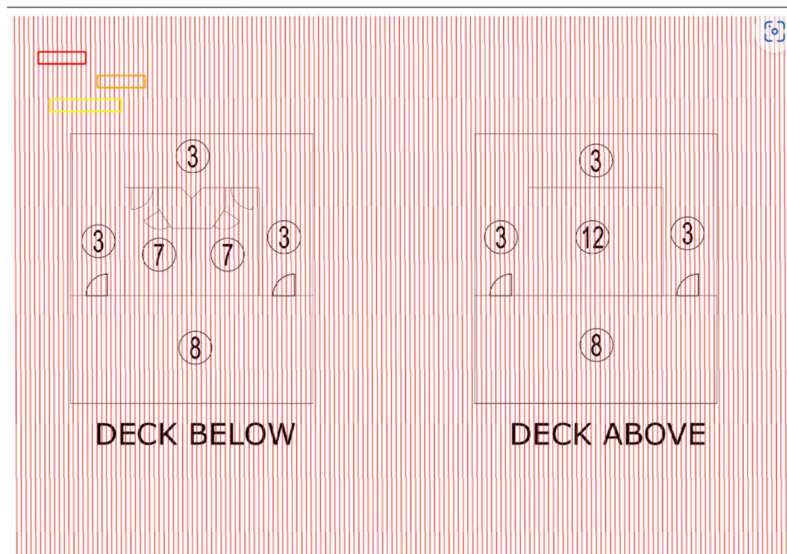


Figure 35. ChatGPT - Produced SFPP

The program ran into the same problem as when working with FCP. It cannot find coordinates to draw according to. ChatGPT received very clear instructions and styles on what should represent each insulation. It managed to tell by text, which spaces it can find and what insulations there should be. The program can produce reliable text data, but the drawing process is too difficult.

The conclusion is the same as with FCP. The program is not yet ready to produce drawings by itself even though it has all the information and material needed to do so. For now, ChatGPT can only be used when comparing and figuring out the differences between SFPP drawings.

4.4.2 Copilot

Copilot failed with FCP, but the program will still be challenged with SFPP drawings. After the basic teaching process, Copilot received more verifying questions, because the program had some issues with table 9.1 earlier. After receiving correct answers. The program received the same three questions as ChatGPT. The questions and the answers are shown below:

Q: Space below category 7, space above category 8?

A: "When the space below is categorized as 7 and the space above is categorized as 8, the required deck insulation is A-15. This information can be found at the intersection of row 7 and column 8 in Table 9.2 of the SOLAS 2020 CHAPTER 2-2 document" (Microsoft copilot).

Q: Space below category 3, space above category 8?

A: "When the space below is categorized as 3 and the space above is categorized as 8, the required deck insulation is A-15. This information can be found at the intersection of row 3 and column 8 in Table 9.2 of the SOLAS 2020 CHAPTER 2-2 document" (Microsoft copilot).

Q: Space below category 11, space above category 3?

A: "When the space below is categorized as 11 and the space above is categorized as 3, the required deck insulation is A-60. This information can be found at the intersection of row 11 and column 3 in Table 9.2 of the SOLAS 2020 CHAPTER 2-2 document" (Microsoft copilot).

Copilot answered immediately correctly to questions 1 & 3, but, for some reason, the correct answer to question 2 was difficult to find. The program

needed to be challenged twice before receiving the correct answer. This is alarming, because when asked what the table includes and how does it work, Copilot can tell exactly the correct answers. Also, when asking how many rows and columns the table includes, Copilot can answer correctly. The problem is with interpreting the intersections of certain columns. The program refused to answer when asked why certain intersections are so difficult to find. Thus, when challenging the program, it is hard to verify whether the program just guesses or assumes another response when the first one has been incorrect. The next command was to create copy of table 9.2 to figure out what does the program identify from the PDF-file. Copilot provided two different responses, which are shown below (Figure 36 & Figure 37).

- **Control stations:** A-30, A-30, A-15, A-0, A-0, A-0, A-15, A-30, A-0, A-0, A-0, A-60, A-0, A-60
- **Stairways:** A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-30, A-0, A-30
- **Corridors:** A-15, A-0, A-0, A-60, A-0, A-0, A-15, A-15, A-0, A-0, A-0, A-30, A-0, A-30
- **Evacuation stations and external escape routes:** A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0
- **Open deck spaces:** A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0
- **Accommodation spaces of minor fire risk:** A-60, A-15, A-0, A-60, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0
- **Accommodation spaces of moderate fire risk:** A-60, A-15, A-15, A-60, A-0, A-0, A-15, A-15, A-0, A-0, A-0, A-0, A-0
- **Accommodation spaces of greater fire risk:** A-60, A-15, A-15, A-60, A-0, A-15, A-15, A-30, A-0, A-0, A-0, A-0, A-0, A-0
- **Sanitary and similar spaces:** A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0
- **Tanks, voids and auxiliary machinery spaces having little or no fire risk:** A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0, A-0
- **Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk:** A-60, A-60, A-60, A-60, A-0, A-15, A-30, A-0, A-0, A-0, A-0, A-0, A-30
- **Machinery spaces and main galleys:** A-60, A-60, A-60, A-60, A-0, A-60, A-60, A-60, A-0, A-0, A-30, A-30, A-0, A-60
- **Store-rooms, workshops, pantries, etc.:** A-60, A-30, A-15, A-60, A-0, A-15, A-30, A-30, A-0, A-0, A-0, A-0, A-0, A-0
- **Other spaces in which flammable liquids are stowed:** A-60, A-60, A-60, A-60, A-0, A-30, A-60, A-60, A-0, A-0, A-0, A-0, A-0

Figure 36. Copilot table 9.2 copy version 1

Tilat alla	Tilat yllä	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	A-30	A-30	A-15	A-0	A-0	A-0	A-15	A-30	A-0	A-0	A-0	A-60
(2)	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-30
(3)	A-15	A-0	A-0	A-60	A-0	A-0	A-15	A-15	A-0	A-0	A-0	A-30
(4)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0	A-0	A-0	A-0	A-30
(5)	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
(6)	A-60	A-15	A-0	A-60	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
(7)	A-60	A-15	A-15	A-60	A-0	A-0	A-0	A-0	A-0	A-0	A-0	

Figure 37. Copilot table 9.2 copy version 2

Clearly, Copilot is having some issues identifying the total table 9.2 correctly. In the first response (Figure 36) the program clearly can find all the categories but cannot identify them as columns and rows. The second response (Figure 37) is a little better, but for some reason the program cannot identify all the 14 rows and 14 columns. This was challenged to identify all the rows and columns the same way as previous response. The program was not able to modify the response any further. Copilot can read and interpret the rules, but it is not capable of interpreting PDF-file tables reliably. This same problem was with table 9.1, so table 9.2 was also done in Excel form. Now Copilot was able to read and interpret it more reliably. The program was now capable to answer correctly straight away to those three questions presented earlier. The research continued, and the next task was to compare SFPP drawings. The sent drawings were presented previously (Figure 27 & Figure 28). Copilot responded with a list of differences. The received list is shown below (Figure 38).

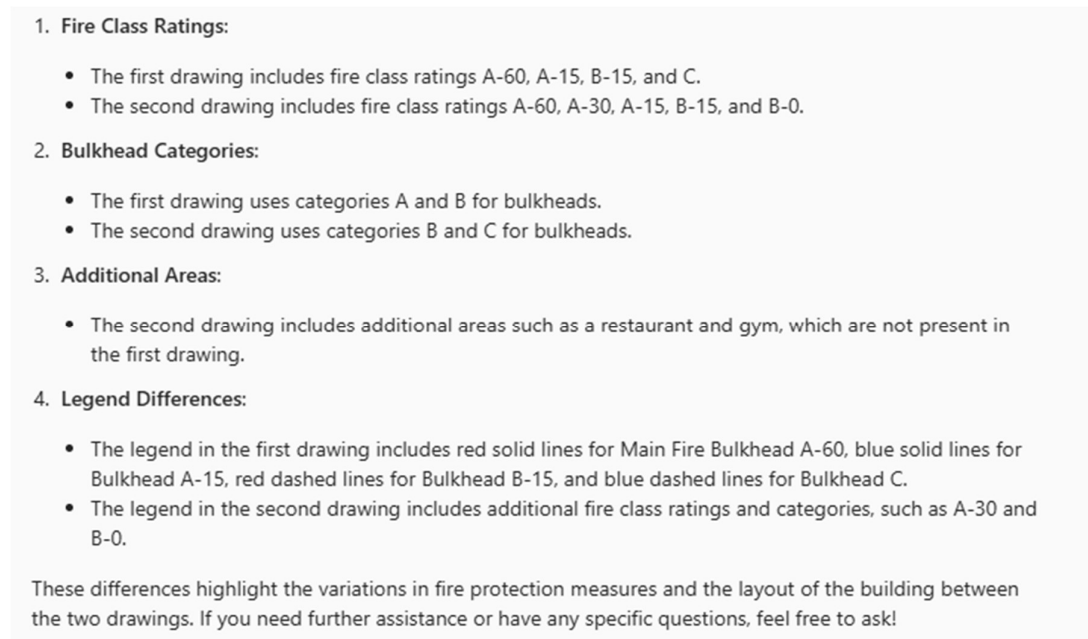


Figure 38. Copilot SFPP respond

This received response is totally incorrect. All the notices are wrong. After this list, the program received another command to create an image which shows the differences between drawings. Copilot used Visual Creator to upload the

response. The program provided an image which does not have anything to do with the given command. Visual Creator cannot make markings to already existing drawing, the software just creates imaginary images that include the words used in the command. The received images are shown below (Figure 39), just to show that Visual Creator cannot be used for revising.

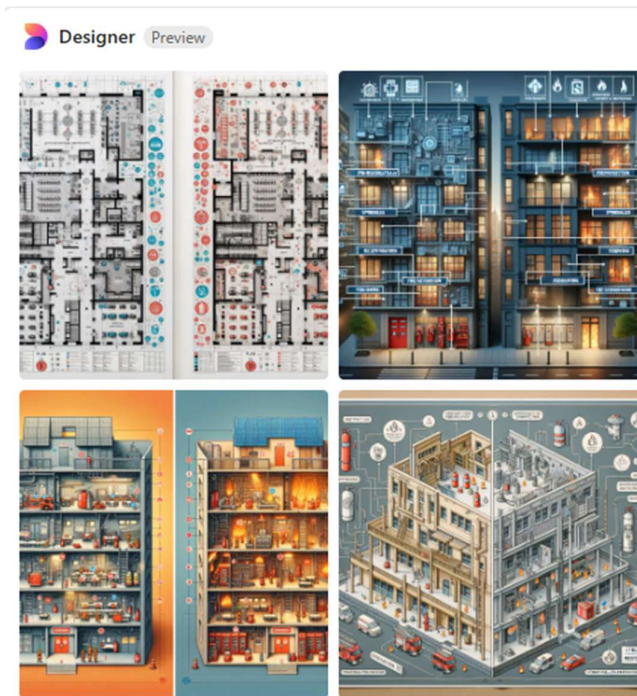


Figure 39. Copilot visual SFPP response

The last task was to determine the required bulkheads and draw them to the empty layout. Copilot received SOLAS PDF-file and an empty layout which included only space categories. The program could not provide a visual response. The text response only included instructions to read the table and draw bulkheads, for example with PDF-editor program.

Copilot is not advanced enough to provide assistance for revising SFPP drawings. Also, the program cannot provide reliable support for designers. The only useable ability is clear text reading and text interpreting. Copilot requires significant upgrades before it can become a useful tool for SFPP design within the company.

4.4.3 Claude

With Claude, SFPP part began with the same three questions that were asked from every program. Claude received only an image of table 9.1 and 9.2, because, as told previously, the free version cannot handle the whole PDF-file. Claude did not need any examples. The questions and received responses are presented below.

Q: Requirement, space below cat. 7 and space above cat.8?

A: "Category 7 is "Accommodation spaces of moderate fire risk", Category 8 is "Accommodation spaces of greater fire risk", Looking at the intersection of row 7 and column 8: The requirement is A-15" (Claude).

Q: Requirement, space below cat. 3 and space above cat.8?

A: "Category 3 is "Corridors", Category 8 is "Accommodation spaces of greater fire risk", Looking at the intersection of row 3 and column 8: The requirement is A-15" (Claude).

Q: Requirement, space below cat. 11 and space above cat.3?

A: "Category 11 is "Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk", Category 3 is "Corridors", Looking at the intersection of row 11 and column 3: The requirement is A-60" (Claude).

The programs responses were all correct. Claude can observe the tables found from images very well. The next task was to fill the required insulations to the given table according to the table 9.1 and 9.2. The sent tables were the same as used with other programs. The received filled tables are shown below (Figure 40 & Figure 41).

SPACE X	SPACE Y	REQUIRED INSULATION
#1 CABINS CAT.7	CABINS CAT.7	B-0
#2 CORRIDOR CAT.3	CORRIDOR CAT.3	B-15
#3 CABINS CAT.7	PANTRY CAT.13	A-15
#4 SANITARY CAT.9	SANITARY CAT.9	C
#5 RESTAURANT CAT.8	OFFICE CAT.7	B-0
#6 RESTAURANT CAT.8	ARCADE CAT.8	B-0
#7 GALLEY CAT.12	KIDS AREA CAT.8	A-60
#8 STAIRS CAT.2	STAIRS CAT.2	A-0 ^a
#9 STORE CAT.7	SUSHI BAR CAT.8	B-0
#10 CASINO CAT.8	GALLEY CAT.12	A-60

Note: The superscript "a" in item #8 refers to the note indicating that a bulkhead between such spaces need not be fitted if deemed unnecessary by the Administration.

Figure 40. Claude - SFPP bulkhead table

1. DECK BELOW: CABINS CAT.7 / DECK ABOVE: CABINS CAT.7 Required insulation: A-15 (Intersection of row 7 and column 7)
2. DECK BELOW: CORRIDOR CAT.3 / DECK ABOVE: CORRIDOR CAT.3 Required insulation: A-0^a (Intersection of row 3 and column 3, with note "a")
3. DECK BELOW: CABINS CAT.7 / DECK ABOVE: PANTRY CAT.13 Required insulation: A-0 (Intersection of row 7 and column 13)
4. DECK BELOW: SANITARY CAT.9 / DECK ABOVE: SANITARY CAT.9 Required insulation: A-0 (Intersection of row 9 and column 9)
5. DECK BELOW: RESTAURANT CAT.8 / DECK ABOVE: OFFICE CAT.7 Required insulation: A-15 (Intersection of row 8 and column 7)
6. DECK BELOW: RESTAURANT CAT.8 / DECK ABOVE: ARCADE CAT.8 Required insulation: A-30 (Intersection of row 8 and column 8)
7. DECK BELOW: GALLEY CAT.12 / DECK ABOVE: KIDS AREA CAT.8 Required insulation: A-60 (Intersection of row 12 and column 8)
8. DECK BELOW: STAIRS CAT.2 / DECK ABOVE: STAIRS CAT.2 Required insulation: A-0 (Intersection of row 2 and column 2)
9. DECK BELOW: STORE CAT.7 / DECK ABOVE: SUSHI BAR CAT.8 Required insulation: A-15 (Intersection of row 7 and column 8)
10. DECK BELOW: CASINO CAT.8 / DECK ABOVE: GALLEY CAT.12 Required insulation: A-0 (Intersection of row 8 and column 12)

Note: The superscript "a" in item #2 refers to the first note below the table, which indicates that a bulkhead or deck between such spaces need not be fitted if deemed unnecessary by the Administration.

Figure 41. Claude - SFPP Deck insulation table

Clearly, Claude can answer very accurately the asked questions. Both tables were filled correctly without any notices. Hence, it can be assumed that the program is not guessing the responses. After succeeding in this task so well, Claude was ready to receive SFPP drawings. Same drawings (Figure 27 & Figure 28) were sent to the program, and command was to make a list of differences and mark them to the existing drawing. The results are shown below (Figure 42 & Figure 43).

Blue Lines:

1. Cat. 2 (Stairs):

- Image 1: Blue line extends partially along the stairs
- Image 2: Blue line is more concentrated near the crew stairs

2. Cat. 3 (Corridors):

- Image 1: Blue line passes through corridors more extensively
- Image 2: Blue line is more limited in corridor coverage

3. Cat. 7 (Moderate Fire Risk Spaces):

- Image 1: Blue line crosses through several Cat. 7 areas
- Image 2: Blue line is significantly reduced in Cat. 7 spaces

Red Lines:

1. Cat. 7 (Moderate Fire Risk Spaces):

- Image 1: Red line forms a complete boundary
- Image 2: Red line shows slight variations in positioning

2. Cat. 8 (Greater Fire Risk Spaces):

- Image 1: Red line clearly defines Cat. 8 areas
- Image 2: Red line has subtle shifts in its boundary

Yellow Lines:

1. Around Cat. 7 and Cat. 8 areas:

- Image 1: Yellow lines form a consistent outer boundary
- Image 2: Yellow lines have minor positional variations

Figure 42. Claude - SFPP difference list

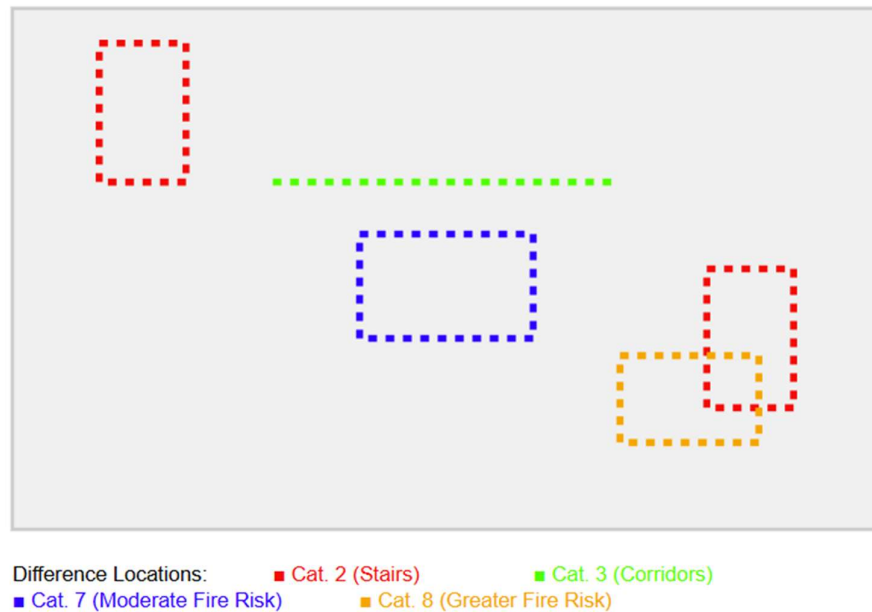


Figure 43. Claude - SFPP differences, visual

The program was not capable of handling SFPP drawings. Claude listed a couple of right notices, but the received explanations are hard to understand. The program was not able to locate the differences and explain clearly where they appear. The program was not able to produce the markings on top of existing drawing. The markings are located almost correctly, but the program failed to find all the errors. With Claude SFPP drawings with deck insulations were not tested, because the program failed with this easier version of SFPP.

Claude could work as a supporting tool for designers and inspectors while working with SFPP, but only for clarifying insulations or bulkheads. The program is not ready to provide visual responses and does not have the ability to compare drawings reliably. On the other hand, Claude did succeed very well with the requirements and therefore it can provide assistance when focusing on the text data or image, which includes text and numbers.

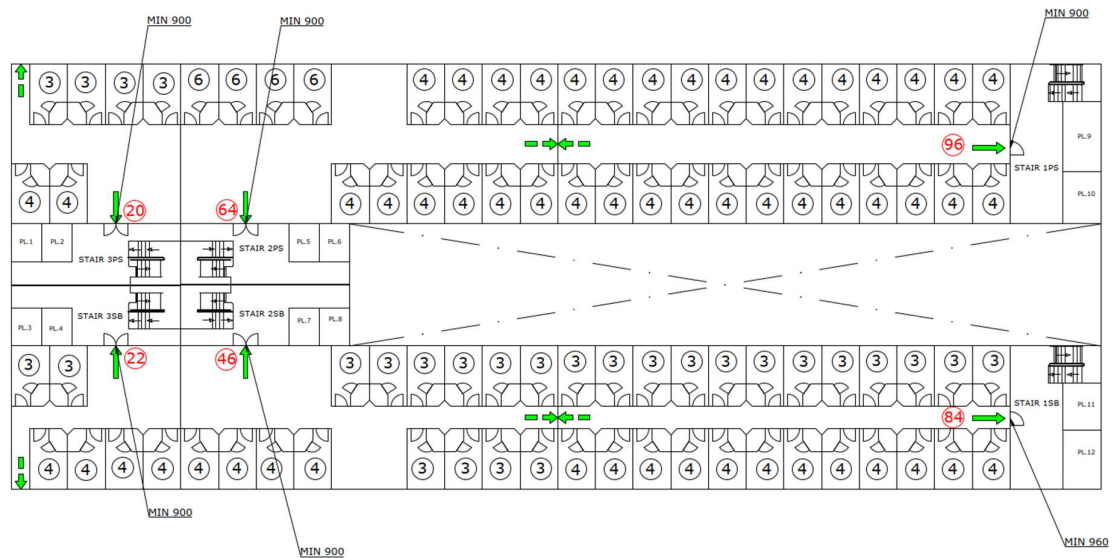


Figure 45. Escape plan - Situation B

The evacuating people are marked with red colour and the stairs are named with normal text font. All the cabin capacities are also shown, just to make it more realistic and provide more challenge to the programs. After figuring out how the programs manage to succeed with these drawings (Figure 44 & Figure 45), the programs will receive other drawings that include stair tables for each stairway. To make it a little more difficult for the programs, the stair naming's are in different order than in previous drawings. These drawings are shown below (Figure 46 & Figure 47).

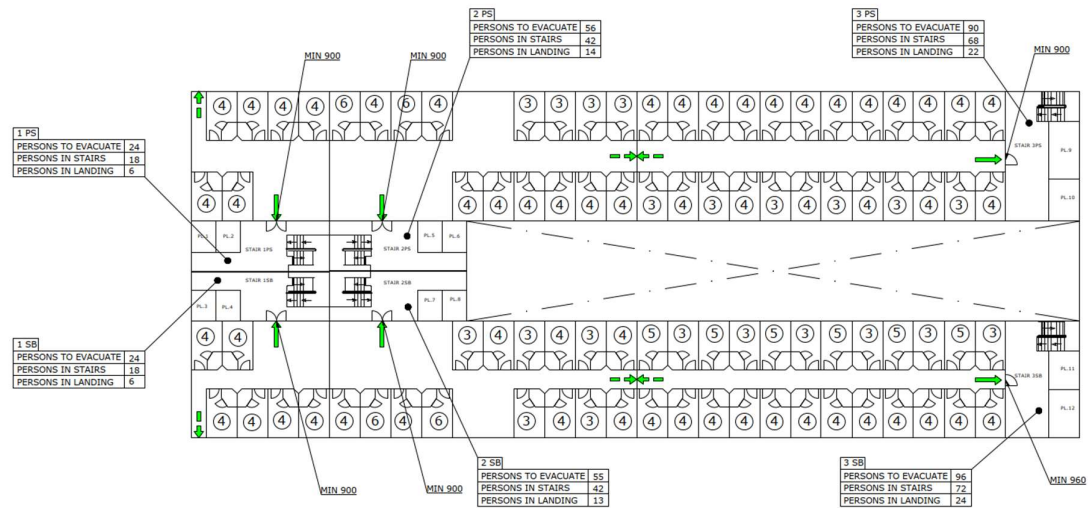


Figure 46. Escape plan - Situation C

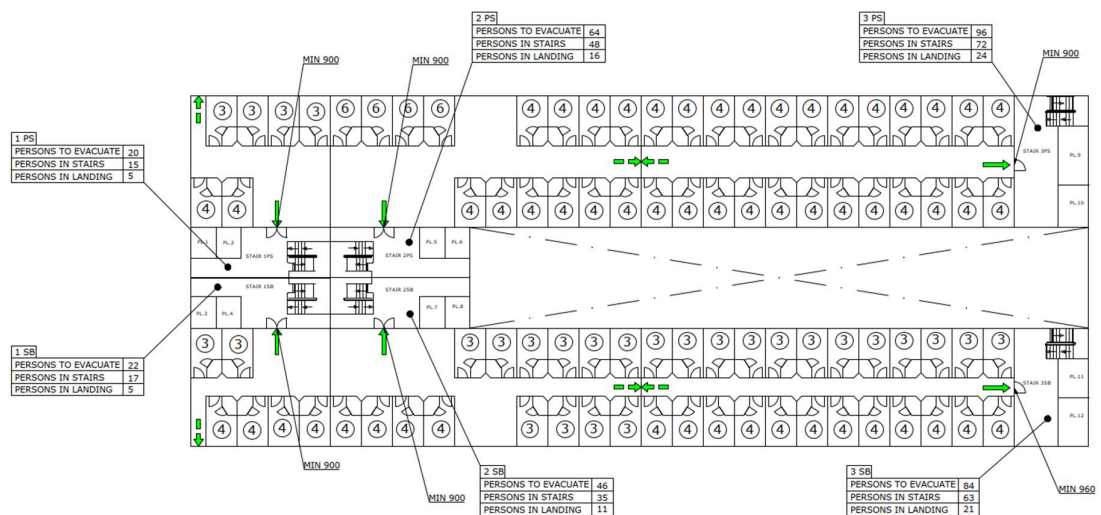


Figure 47. Escape plan - Situation D

These two drawings do not include red colour to point the total amount of escaping people. With these drawings the programs need to read and interpret the tables on the drawing. Tables also include other relevant information. Thus, the AIs cannot just pick the one number that is shown. They need to read, interpret and detect all the modified numbers.

4.5.1 ChatGPT

Escape plan revising could be easier to ChatGPT than FCP or SFPP, because the program is based on generating and observing text. In this task the command was as simple as possible, “Compare drawings and represent the discrepancies”. First the program received Figures 44 & 45. The received result is presented below (Figure 48).

Stairway	ESCAPE 7 (Total Persons Entering Stairway)	ESCAPE 8 (Total Persons Entering Stairway)	Difference
1PS	90	96	+6 persons
1SB	96	84	-12 persons
2PS	56	64	+8 persons
2SB	55	46	-9 persons
3PS	24	20	-4 persons
3SB	24	22	-2 persons

Figure 48. ChatGPT - Result to situation A versus B

ChatGPT gave this table to chat page and did not create an image to show these differences. That could also be done, but this table is clearer and shows exactly what is asked. The program succeeded in comparing only the red numbers without even ordering it to do that. Other numbers representing cabin capacities did not confuse the software. The program also managed to count the differences between the two drawings.

The previous task went well, so next ChatGPT received the drawings including tables (Figure 46 & Figure 47). The command was: “Compare drawings and create a table that shows the made modifications”. The result is shown below (Figure 49).

🚒 Differences Between Escape Plans (ESCAPE 3.pdf vs. ESCAPE 4.pdf) 🚒

Below is a detailed table comparing the evacuation numbers for stairs 1PS, 1SB, 2PS, 2SB, 3PS, and 3SB between the two escape plans.

Stair	ESCAPE 3 (Persons to Evacuate / In Stairs / In Landing)	ESCAPE 4 (Persons to Evacuate / In Stairs / In Landing)	Difference
1PS	24 / 18 / 6	20 / 15 / 5	-4 / -3 / -1
1SB	24 / 18 / 6	22 / 17 / 5	-2 / -1 / -1
2PS	56 / 42 / 14	64 / 48 / 16	+8 / +6 / +2
2SB	55 / 42 / 13	46 / 35 / 11	-9 / -7 / -2
3PS	90 / 68 / 22	96 / 72 / 24	+6 / +4 / +2
3SB	96 / 72 / 24	84 / 63 / 21	-12 / -9 / -3

Figure 49. ChatGPT - Result to situation C versus D

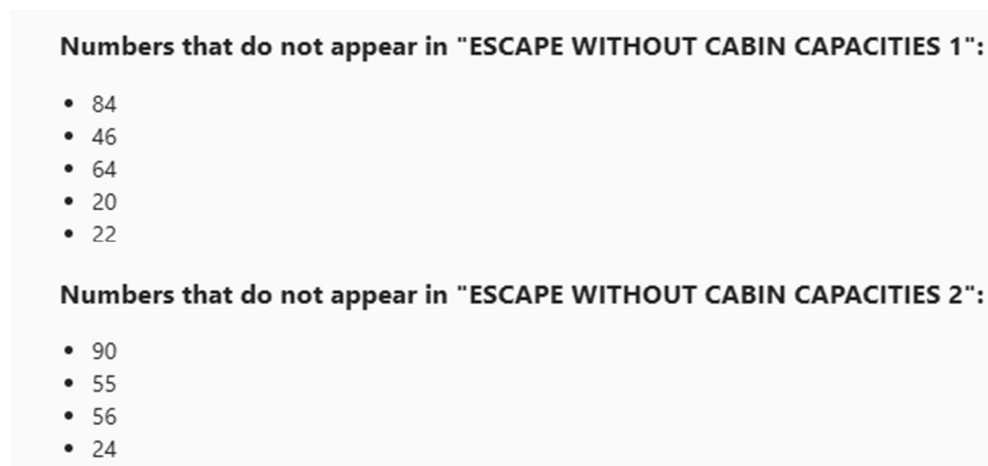
ChatGPT managed to compare the two given drawings totally correctly and the result was very clear and professional. This result shows all the data needed: the total amount of evacuating people, people entering the stairs and people at the landing area. The table clearly shows what the situation was before and what it is after the modifications. The differences from all three categories are also represented well.

ChatGPT succeeded very well in this task and this is something that could really be used to lighten up the inspector's workload. Of course, when talking about an entire deck of cruise ship, there will be much more data and numbers. Still, ChatGPT seems to work very well with texts and numbers, so maybe when using first time, the inspector should check the result manually just to be sure that the AI interprets and calculates correctly. This opportunity to use ChatGPT to support escape plan revising is real, but one thing came up while providing escape plans to the program. The escape plans must be done correctly. This means that all the numbers and text should be done with text tool, because when providing escape plan with numbers and text drawn with polyline, the AI cannot recognize them as a text. So, for example escape plans that are

converted from PDF to DWG, cannot be revised with ChatGPT. When the drawings are correct and professionally done, the program can work as a supporting tool. This is something that should be tested for real documents and that way the company could possibly gain valuable time savings from inspector's workload.

4.5.2 Copilot

Copilot first received the same source files as ChatGPT for this chapter. Copilot can identify numbers and text from PDF-file. The first task was to compare drawings that included only the total number of evacuating people (Figure 44 & Figure 45). The command was to compare only red numbers and list the differences between drawings. This task was a failure, because the program could not identify the red colour. Copilot listed also the differences between cabin capacities. This feature could also be valuable, but for this task the focus was the total number of evacuating people, so the given drawings were modified in AutoCAD and the next sent drawings did not include any cabin capacities. Copilot compared the drawings and gave the following response (Figure 50).



```
Numbers that do not appear in "ESCAPE WITHOUT CABIN CAPACITIES 1":  
• 84  
• 46  
• 64  
• 20  
• 22  
  
Numbers that do not appear in "ESCAPE WITHOUT CABIN CAPACITIES 2":  
• 90  
• 55  
• 56  
• 24
```

Figure 50. Copilot - Result for situation A versus B

Copilot can list the differences between drawings but cannot connect or show which number relates to certain stairway. This feature is not so usable, because in this case the designer or inspector must manually connect the numbers to the right stairways. The next task was to compare drawings that include tables (Figure 47 & 48). The received response is shown below (Figures 51 & 52)

ESCAPE TABLES WITHOUT CABIN CAPACITIES 1	ESCAPE TABLES WITHOUT CABIN CAPACITIES 2
<ul style="list-style-type: none"> STAIR 1PS: <ul style="list-style-type: none"> Persons to Evacuate: 24 Persons in Stairs: 18 Persons in Landing: 6 STAIR 1SB: <ul style="list-style-type: none"> Persons to Evacuate: 24 Persons in Stairs: 18 Persons in Landing: 6 STAIR 2PS: <ul style="list-style-type: none"> Persons to Evacuate: 56 Persons in Stairs: 42 Persons in Landing: 14 STAIR 2SB: <ul style="list-style-type: none"> Persons to Evacuate: 55 Persons in Stairs: 42 Persons in Landing: 13 STAIR 3PS: <ul style="list-style-type: none"> Persons to Evacuate: 90 Persons in Stairs: 68 Persons in Landing: 22 STAIR 3SB: <ul style="list-style-type: none"> Persons to Evacuate: 96 Persons in Stairs: 72 Persons in Landing: 24 	<ul style="list-style-type: none"> STAIR 1PS: <ul style="list-style-type: none"> Persons to Evacuate: 20 Persons in Stairs: 15 Persons in Landing: 5 STAIR 1SB: <ul style="list-style-type: none"> Persons to Evacuate: 22 Persons in Stairs: 17 Persons in Landing: 5 STAIR 2PS: <ul style="list-style-type: none"> Persons to Evacuate: 64 Persons in Stairs: 48 Persons in Landing: 16 STAIR 2SB: <ul style="list-style-type: none"> Persons to Evacuate: 46 Persons in Stairs: 35 Persons in Landing: 11 STAIR 3PS: <ul style="list-style-type: none"> Persons to Evacuate: 96 Persons in Stairs: 72 Persons in Landing: 24 STAIR 3SB: <ul style="list-style-type: none"> Persons to Evacuate: 84 Persons in Stairs: 63 Persons in Landing: 21

Figure 51. Copilot - Result for situation C versus D

Differences:

STAIR 1PS:	ESCAPE TABLES WITHOUT CABIN CAPACITIES 1: 24 (Persons to Evacuate), 18 (Persons in Stairs), 6 (Persons in Landing)	ESCAPE TABLES WITHOUT CABIN CAPACITIES 2: 20 (Persons to Evacuate), 15 (Persons in Stairs), 5 (Persons in Landing)
STAIR 1SB:	ESCAPE TABLES WITHOUT CABIN CAPACITIES 1: 24 (Persons to Evacuate), 18 (Persons in Stairs), 6 (Persons in Landing)	ESCAPE TABLES WITHOUT CABIN CAPACITIES 2: 22 (Persons to Evacuate), 17 (Persons in Stairs), 5 (Persons in Landing)
STAIR 2PS:	ESCAPE TABLES WITHOUT CABIN CAPACITIES 1: 56 (Persons to Evacuate), 42 (Persons in Stairs), 14 (Persons in Landing)	ESCAPE TABLES WITHOUT CABIN CAPACITIES 2: 64 (Persons to Evacuate), 48 (Persons in Stairs), 16 (Persons in Landing)
STAIR 2SB:	ESCAPE TABLES WITHOUT CABIN CAPACITIES 1: 55 (Persons to Evacuate), 42 (Persons in Stairs), 13 (Persons in Landing)	ESCAPE TABLES WITHOUT CABIN CAPACITIES 2: 46 (Persons to Evacuate), 35 (Persons in Stairs), 11 (Persons in Landing)
STAIR 3PS:	ESCAPE TABLES WITHOUT CABIN CAPACITIES 1: 90 (Persons to Evacuate), 68 (Persons in Stairs), 22 (Persons in Landing)	ESCAPE TABLES WITHOUT CABIN CAPACITIES 2: 96 (Persons to Evacuate), 72 (Persons in Stairs), 24 (Persons in Landing)
STAIR 3SB:	ESCAPE TABLES WITHOUT CABIN CAPACITIES 1: 96 (Persons to Evacuate), 72 (Persons in Stairs), 24 (Persons in Landing)	ESCAPE TABLES WITHOUT CABIN CAPACITIES 2: 84 (Persons to Evacuate), 63 (Persons in Stairs), 21 (Persons in Landing)

Figure 52. Copilot - Differences between situations C & D

When the data is marked in tables and the table leaders are pointing to the stairway in question, Copilot can connect the numbers to the stairways. This received response is correct and easily readable.

The program succeeded quite well from this chapter. Clearly the program cannot connect the numbers to the stairways without leaders. Usually Escape plans display only red and blue numbers, which are located next to the stairway in question. Thus, Copilot needs to have an upgrade before having the ability to connect numbers without leaders. However, when the numbers are shown in tables and leaders are pointing to the right stairway, Copilot can connect them and create a professional list which displays all the modifications between drawings.

For the company, Copilot could work as a supporting tool while comparing revisions and detecting modifications, but, for now, only with drawings that use tables to display the evacuating numbers. The same issues were found than with ChatGPT. The drawings must be done correctly, and all the data should be done with text tool not with polylines. Copilot did manage to identify some numbers done with polyline from converted drawing, but not all the numbers that were displayed. Like with ChatGPT, to receive the most usable and reliable response, the drawings should be done with text tool and if the source material is converted, the included numbers should be converted to text before checking the drawing with AI.

4.5.3 Claude

Claude received first the drawings including only the total number of evacuating people on each stairway (Figure 45 & Figure 46). The program was able to read and interpret the drawings. Cabin capacity numbers did not affect the program. The clear command to focus only on the red number was enough for Claude. The received response (Figure 53) is shown below.

```

## Pattern of Changes

# Comparison of Red Numbers Between Evacuation Drawings

## Document 1 vs Document 2 Values

| Stair Location | Document 1 Value | Document 2 Value | Difference |
|-----|-----|-----|-----|
| STAIR 1PS | 24 | 22 | -2 |
| STAIR 1SB | 24 | 20 | -4 |
| STAIR 2PS | 56 | 64 | +8 |
| STAIR 2SB | 55 | 46 | -9 |
| STAIR 3PS | 90 | 96 | +6 |
| STAIR 3SB | 96 | 84 | -12 |

## Summary of Changes

- **Total in Document 1**: 345 persons
- **Total in Document 2**: 332 persons
- **Net Change**: -13 persons (-3.8%)

1. **Port Side (PS) Stairs**:
- STAIR 1PS: Decreased by 2 persons
- STAIR 2PS: Increased by 8 persons
- STAIR 3PS: Increased by 6 persons
- **Net change to Port Side**: +12 persons

2. **Starboard Side (SB) Stairs**:
- STAIR 1SB: Decreased by 4 persons
- STAIR 2SB: Decreased by 9 persons
- STAIR 3SB: Decreased by 12 persons
- **Net change to Starboard Side**: -25 persons

3. **By Stair Number**:
- STAIR 1 (PS+SB): Decreased by 6 persons
- STAIR 2 (PS+SB): Increased by 1 person
- STAIR 3 (PS+SB): Decreased by 6 persons

```

Figure 53. Claude - Escape result situation A versus B

The response matches the sent source drawings. Claude produced very clear and professional response. The new feature, which is not seen with other programs, was that Claude calculated percentual net change without even asking for it. After this task, the program received drawings including tables for each stairway (Figure 47 & Figure 48). The result is shown below (Figure 54).

```

## Stair 1PS
| Measurement | Drawing 1 | Drawing 2 | Difference |
|-----|-----|-----|-----|
| Persons to evacuate | 24 | 20 | -4 |
| Persons in stairs | 18 | 15 | -3 |
| Persons in landing | 6 | 5 | -1 |

## Stair 1SB
| Measurement | Drawing 1 | Drawing 2 | Difference |
|-----|-----|-----|-----|
| Persons to evacuate | 24 | 22 | -2 |
| Persons in stairs | 18 | 17 | -1 |
| Persons in landing | 6 | 5 | -1 |

## Stair 2PS
| Measurement | Drawing 1 | Drawing 2 | Difference |
|-----|-----|-----|-----|
| Persons to evacuate | 56 | 64 | +8 |
| Persons in stairs | 42 | 48 | +6 |
| Persons in landing | 14 | 16 | +2 |

## Stair 2SB
| Measurement | Drawing 1 | Drawing 2 | Difference |
|-----|-----|-----|-----|
| Persons to evacuate | 55 | 46 | -9 |
| Persons in stairs | 42 | 35 | -7 |
| Persons in landing | 13 | 11 | -2 |

## Stair 3PS
| Measurement | Drawing 1 | Drawing 2 | Difference |
|-----|-----|-----|-----|
| Persons to evacuate | 90 | 96 | +6 |
| Persons in stairs | 68 | 72 | +4 |
| Persons in landing | 22 | 24 | +2 |

## Stair 3SB
| Measurement | Drawing 1 | Drawing 2 | Difference |
|-----|-----|-----|-----|
| Persons to evacuate | 96 | 84 | -12 |
| Persons in stairs | 72 | 63 | -9 |
| Persons in landing | 24 | 21 | -3 |

## Total Evacuation Numbers
| Measurement | Drawing 1 | Drawing 2 | Difference |
|-----|-----|-----|-----|
| Total persons to evacuate | 345 | 332 | -13 |
| Total persons in stairs | 260 | 250 | -10 |
| Total persons in landing | 85 | 82 | -3 |

## Minimum Width Requirements
Both drawings maintain identical minimum width requirements:
- One stair (likely main) at MIN 960
- Five stairs at MIN 900

```

Figure 54. Claude - Escape result situation C versus D

The program succeeded also well from this task. The response is clear and correct. Claude provides very good answers when comparing text and numeral data. The program does not even need any examples or teaching, which is a great sign. In addition, the program does other, not asked, tasks at the same time. For example, it compares door widths at the same time while calculating evacuating people. It looks like Claude is trying to produce as much information as possible from the drawing and not just focusing on the one thing that was asked from it.

For the company, Claude could easily work as a supporting tool for designers and inspectors when focusing on drawings that include numbers or text. Claude's responses are reliable, clear and professional. If proceeding with Claude, the premium version should be used to receive the ability of unlimited number of answers.

5 CONCLUSION & FINAL WORDS

All the AI programs have their own strengths and weaknesses. All the three programs succeeded quite well when analysing text data or numbers. All the programs were capable of following SOLAS. This was assumed, because all the programs are based on LLM and NLP. However, the responses were different, and the programs delivered different kinds of answers. Some responses were, for example more professional and more readable.

ChatGPT is the most capable in producing visual responses, and the responses are very clear and readable. Its ability to add markings on top of existing drawing is a very good feature that separates ChatGPT from other examined programs. On the other hand, Microsoft Copilot has the capability to work with other Microsoft applications, and in that way, it can help while interpreting, for example, Excel- or Word-files. The third program, Claude, has the best interpreting skills. The program can read and interpret tables with a minimal error rate.

All the examined programs also have their weaknesses. The biggest limitation is the inability to revise drawings independently. The programs are not yet advanced enough to revise drawings while simultaneously checking whether the boundaries are drawn correctly according to rules and regulations. A common problem with all the programs is that, while the AIs are revising the drawings, they do not check them carefully enough and therefore fail to identify all the spaces and possible boundaries.

All the programs can serve as supporting tools for designers and inspectors. Each program offers its own strengths and features that can help reduce the workload and achieve time savings. These three programs received points from 7 different categories along the research process. The categories are divided into two major parts. The first includes the capabilities on whether the program can read and interpret rules, revise drawings and produce visual responses. The second category includes the quality of the responses, such as their

readability or reliability. The points and categories are presented below (Table 1).

	PROGRAMS	ChatGPT	Microsoft Copilot	Claude
FEATURES				
INTERPRETTING SOLAS	YES/NO	YES	YES	YES (LIMITED CAPACITY)
GENERATING VISUAL RESPONSES	YES/NO	YES	NO	YES (LIMITED CAPACITY)
DRAWING REVISING	1-10p.	5	4	6
RELIABILITY	1-10p.	8	6	9
ACCURACY	1-10p.	9	7	9
PROFESSIONALISM	1-10p.	8	7	9
VISUAL RESPONSES	1-10p.	8	0	4
TOTAL	0-50p.	38	24	37

Table 1. Final points

The maximum number of points a program could achieve was 50. None of the programs came close to that score, mainly because the revising part of this thesis was such a difficult task for all the programs. For example, this is why Copilot received over 10 points less than other programs. It did not succeed from revising, and it does not have the capability to generate usable visual responses. Additionally, Copilot was the most unreliable when interpreting rules and regulations. The competition for the top spot was between ChatGPT and Claude. These two programs are quite equal to each other. Claude provides the most accurate and reliable answers when it comes to interpreting the rules and tables. However, the problem with Claude is the limited capacity of reading PDF-files and generating visual responses. ChatGPT, on the other hand, has the most features. It can, for example, browse the Internet, handle as large files as wanted and generate useful and readable markings on top of existing drawings. The downside of ChatGPT is that it occasionally makes mistakes, because it starts to guess and assume things. These two programs are so equal that it is almost impossible to say which one would be recommended to use. Each has some features that the other lack. However, for the company, ChatGPT would be the recommended option. The main reason is its ability to

compare drawings and make markings so well. This ability is something that could be used already and result in time savings. ChatGPT can also process large PDF-files and does not have any limitations regarding that. ChatGPT also provides the access to Dall-E 3 and Sona, both of which could be valuable tools for the company's marketing operations.

The problem with these AI programs available on the Internet is data and privacy security. The company works with major companies that are rivals to each other, meaning none of the clients' drawings could be submitted to these programs. All the programs claim not to store the information they receive, but this is something that should be interpreted very critically. No one wants to take such a big risk that clients drawing could be found from common AI programs. If the company wishes to move forward with AI programs, the best option would be to invest and order a custom-made AI program. This software could be taught to do whatever and revise whatever the company wants. This would also be strictly closed, so privacy security and data security would not be threatened. If designers and inspectors use these common AI programs instead, they must recognize the possible risks. When used carefully and deleting everything that could connect the drawing to the ship or to the owner, these programs can be used, and they can work as a supporting tool for inspectors and designers.

The results of this thesis were positive and awakening. The company gained valuable information about how the different AI programs currently function and what features they can provide for inspectors and designers. AI programs are constantly evolving and are making their way into the ship design industry. These results can now be analysed and after that, it is time to decide how and when the company should proceed with AI tools.

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