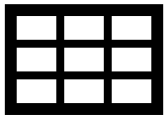
Danfoss - Aftermarket Workflow and Process Creation and Implementation



Team:504

Team Introductions

David Bishop
Manufacturing Engineer

Alex Wilson
Process Engineer

Kyle Youmans
Control Engineer

Julian Villamil
Test Engineer

Kyle Youmans

Sponsor and Advisor

Engineering Mentor
Shayne McConomy, Ph.D
Professor

Project Advisor
Yousuf Ali, Ph.D.
Professor

Engineering Mentor
Stephen Seymore
Operations Engineer Director

Kyle Youmans

Project Overview Following the “McConomy” Method

Project Scope

What the project is about?

- Project description
- Project background

Customer Needs

Gathering customer data:

- Tour of manufacturing facility
- Interviewed Operations Engineer at Danfoss

Functional Decomposition

Breaking down the functions our system must complete

- Flow chart

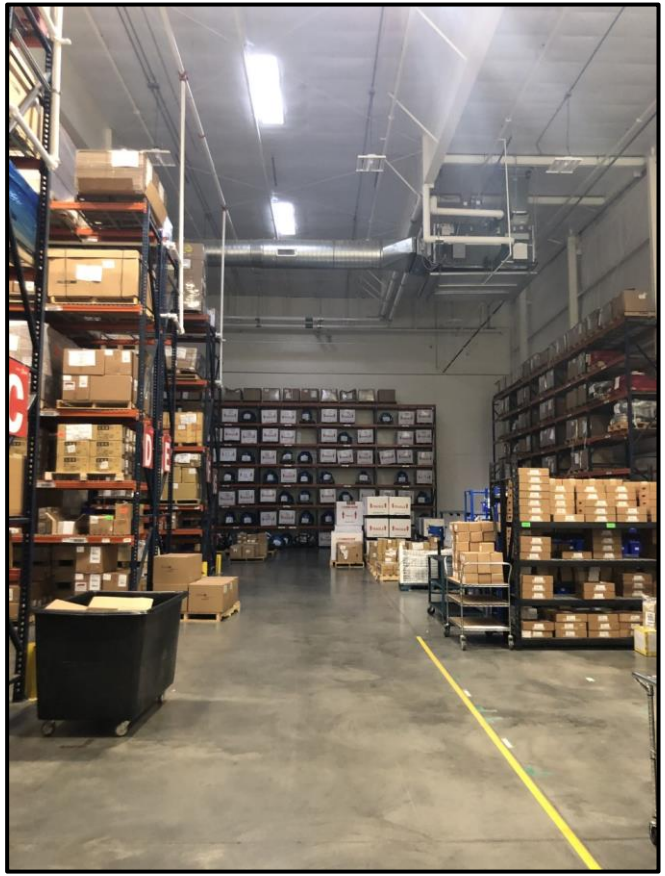
Kyle Youmans

Project Scope

Kyle Youmans

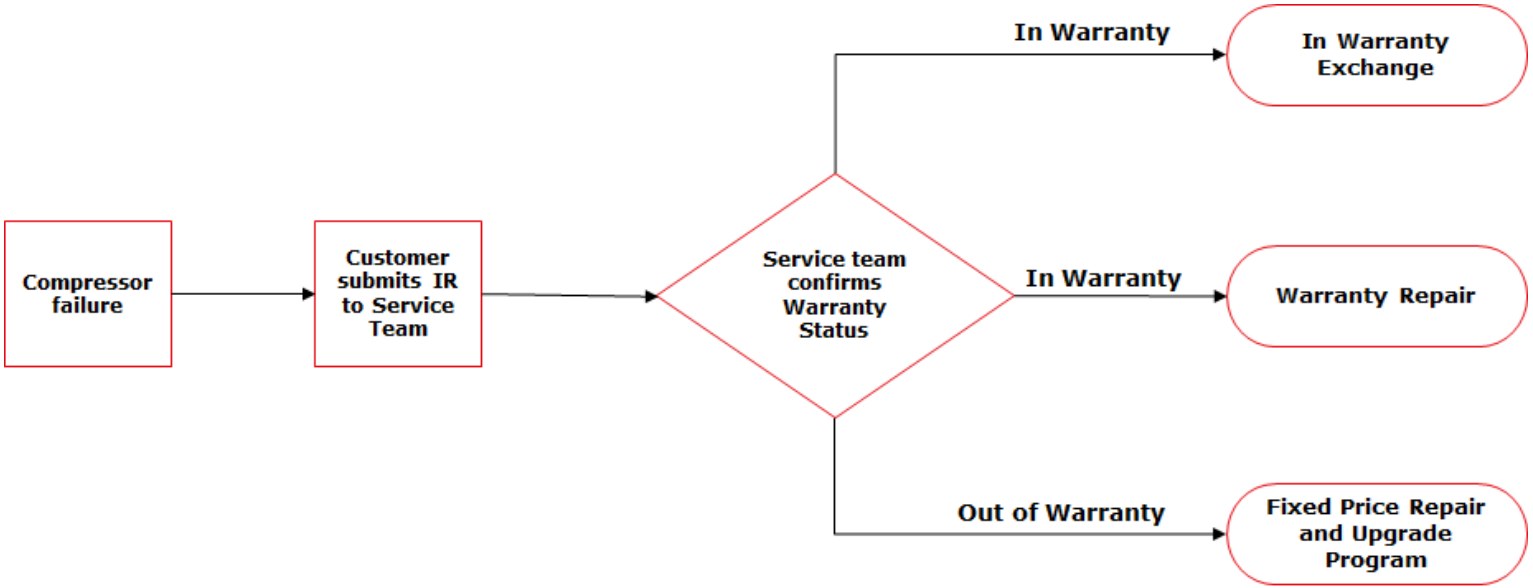
Problems caused by the old Aftermarket Repair Process

- Customers are not willing to pay the quota and they leave compressor in the warehouse.
- Losing valuable warehouse space for pointless storage.
- Danfoss plans to eliminate this problem with the flat-rate exchange program.



Kyle Youmans

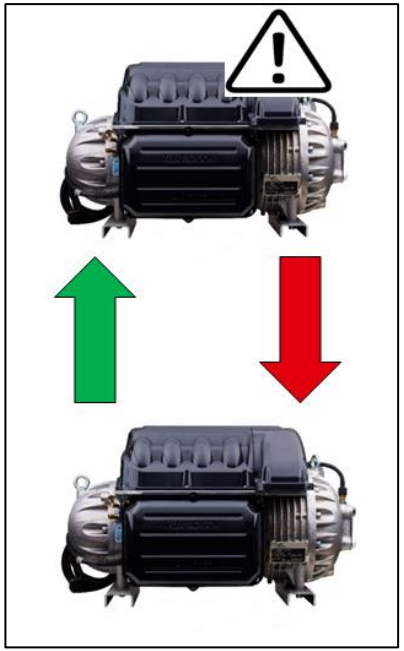
Future Aftermarket Repair Programs



Kyle Youmans

Project Background

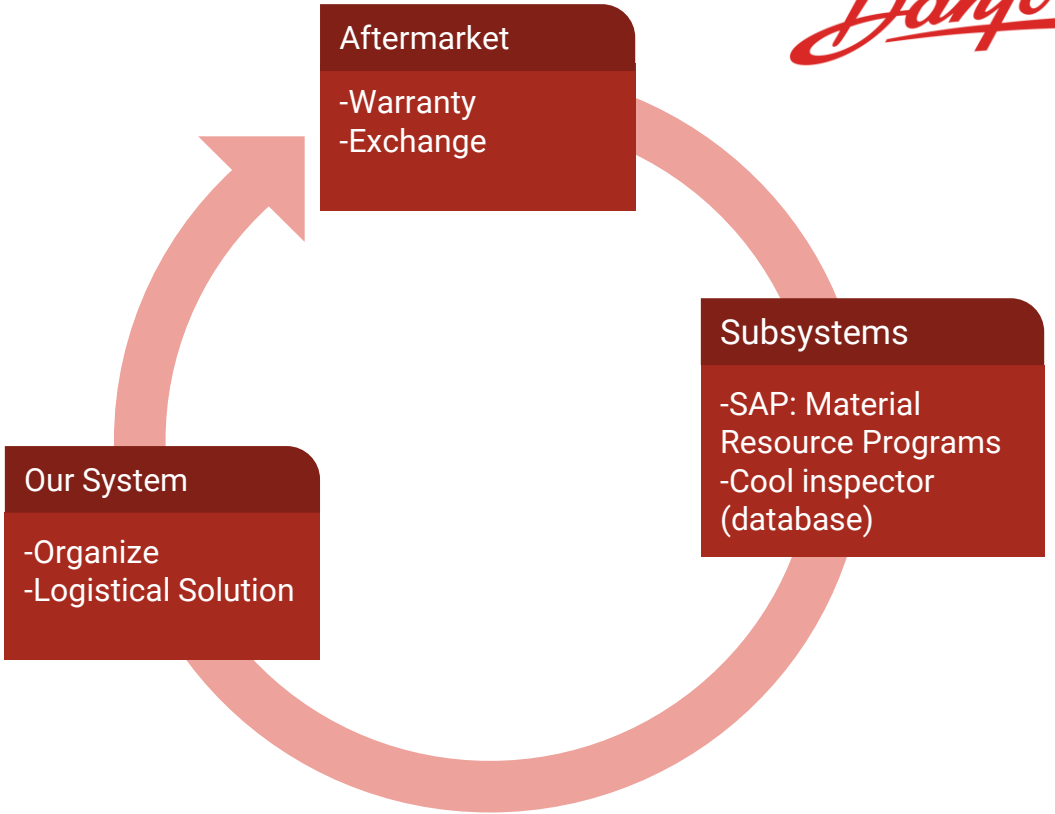
- By adding the “warranty repair” and the “fixed price repair and update program”
- Created a need for a system that can diligently manage the hardware of compressors going to and from the field.



Kyle Youmans

Project Description

"A system that coordinates existing record keeping subsystems to organize aftermarket production, preventing aftermarket parts from entering into new production. The system is automated and more effective than older subsystems."

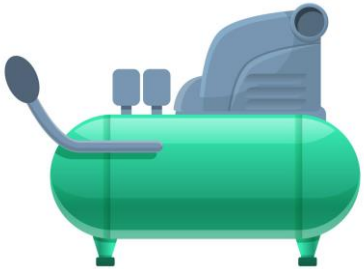


Kyle Youmans

What's the Process?

Where we come in

Receive Compressor | Inspection | Planning | Production | Pack & Ship

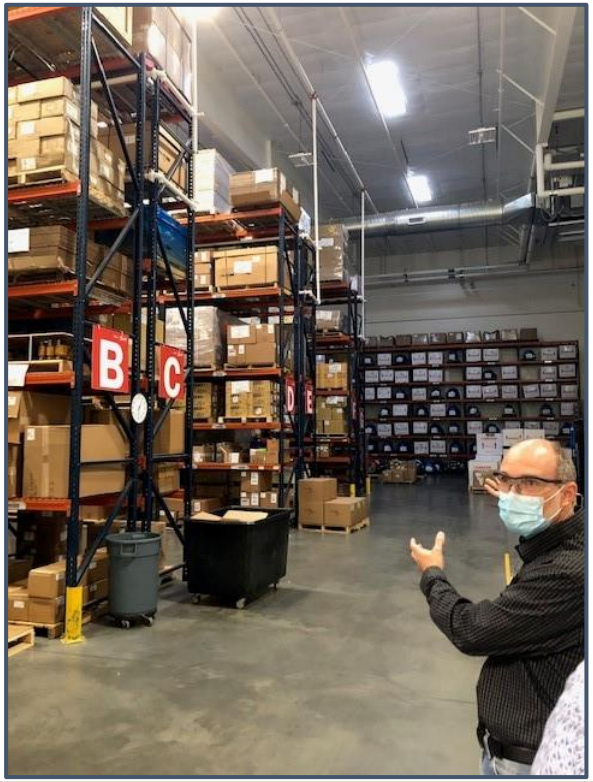


Kyle Youmans

Customer Needs

Alex Wilson

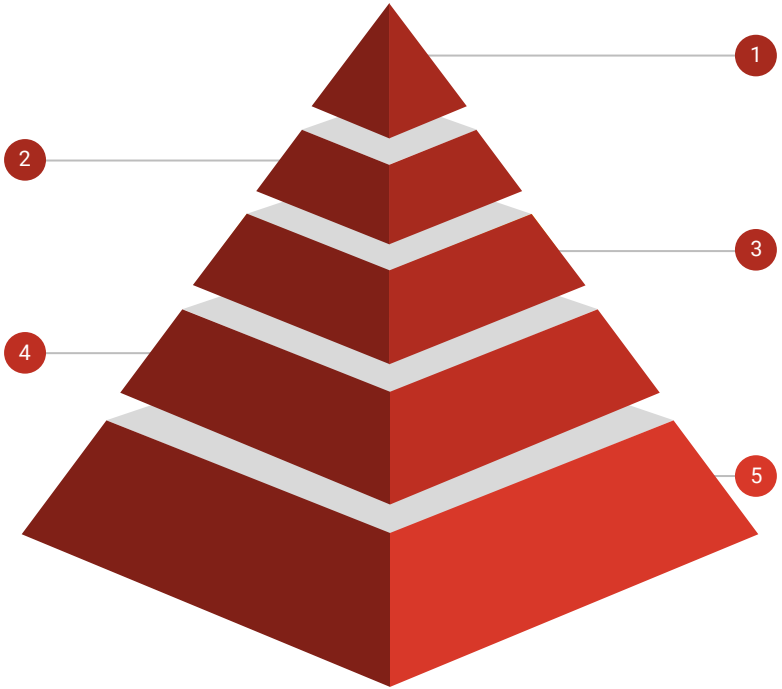
Interview with Stephen Seymore



Interpreted Needs

Automation
The system is more robust than the current process with fewer human errors due to an automated design.

User Experience
System is capable of providing its outputs in a format that is accessible and easily understood by a common audience.



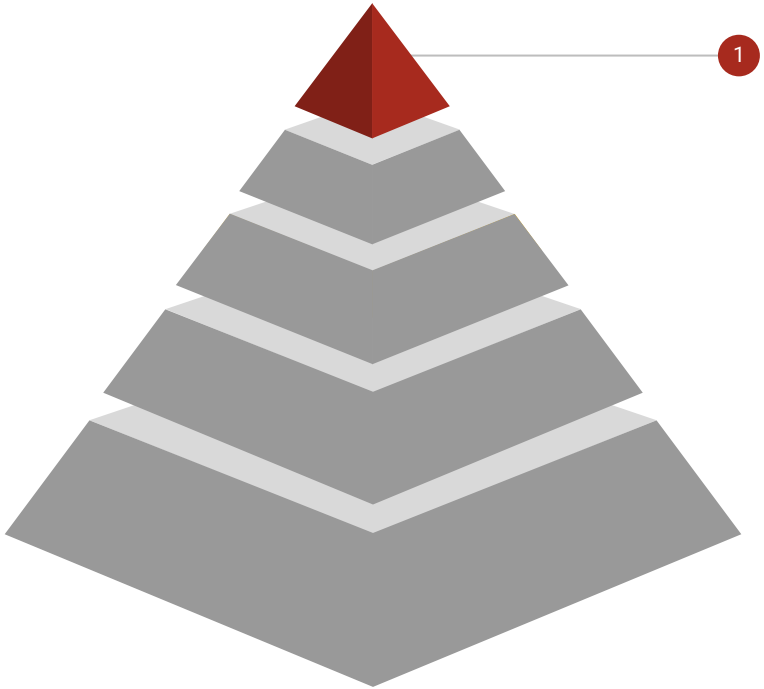
Organization
The system needs to catalog and store data in an organized way.

Quality
Aftermarket compressors are shipped back to their customers at the same level of performance or higher based on the bill of materials generated by the system

Adaptability
System is easily updated as software changes and input information changes

Alex Wilson

Interpreted Needs



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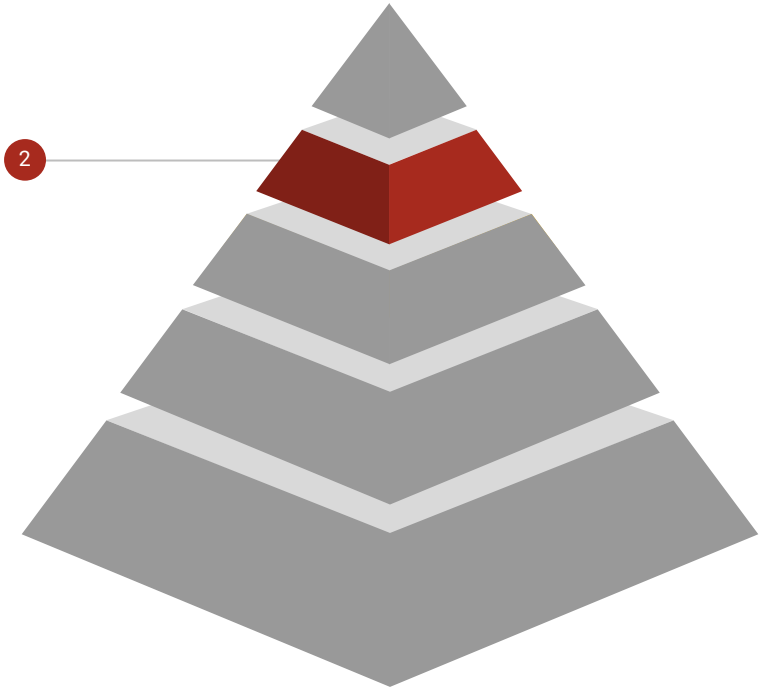
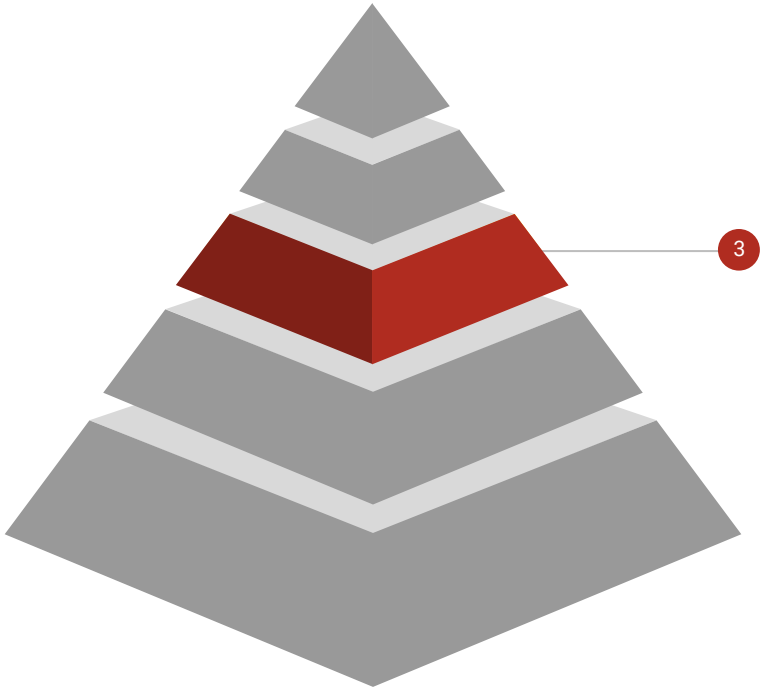


Alex Wilson

Interpreted Needs



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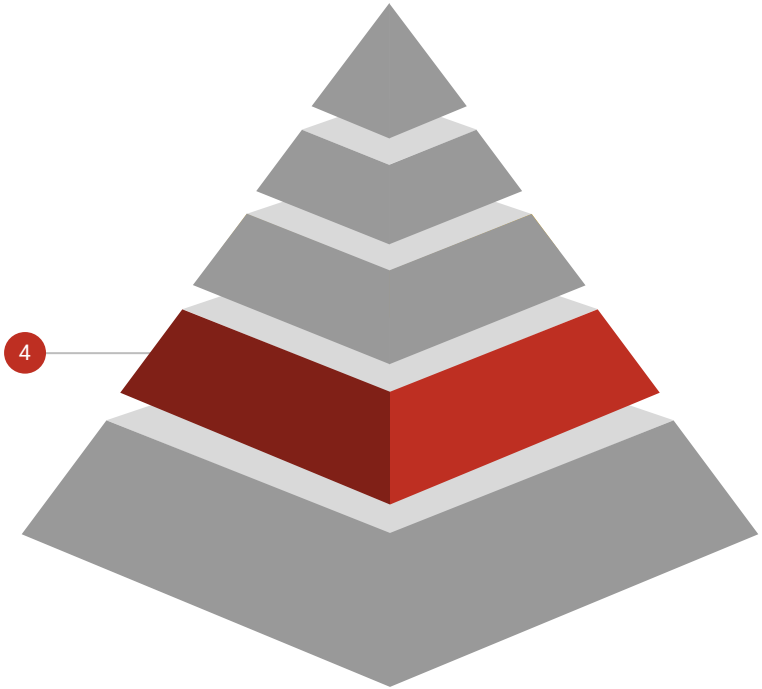
Quality

Aftermarket compressors are shipped back to their customers at the same level of performance or higher based on the bill of materials generated by the system

Alex Wilson

Interpreted Needs

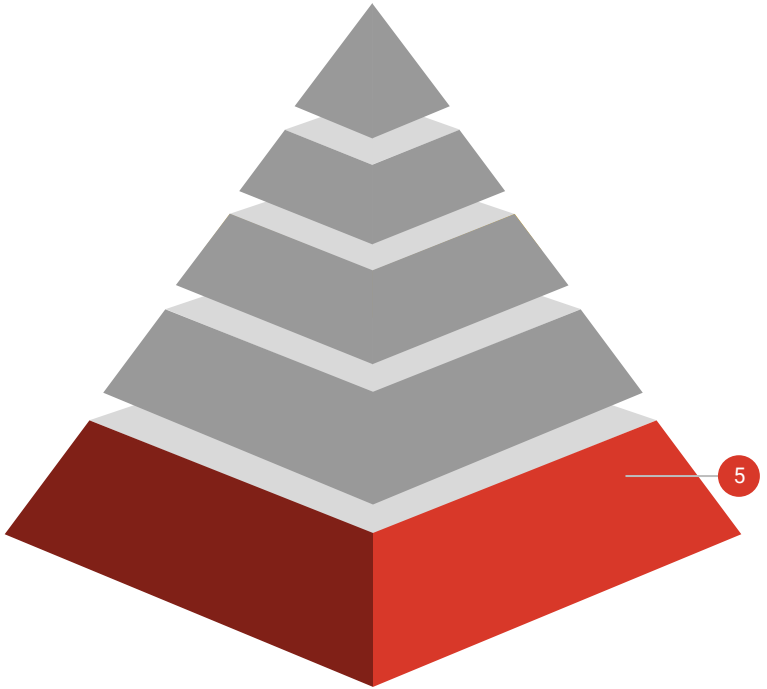


User Experience

System is capable of providing inputs and outputs in a format that is accessible and easily understood by a common audience.

Alex Wilson

Interpreted Needs



Adaptability

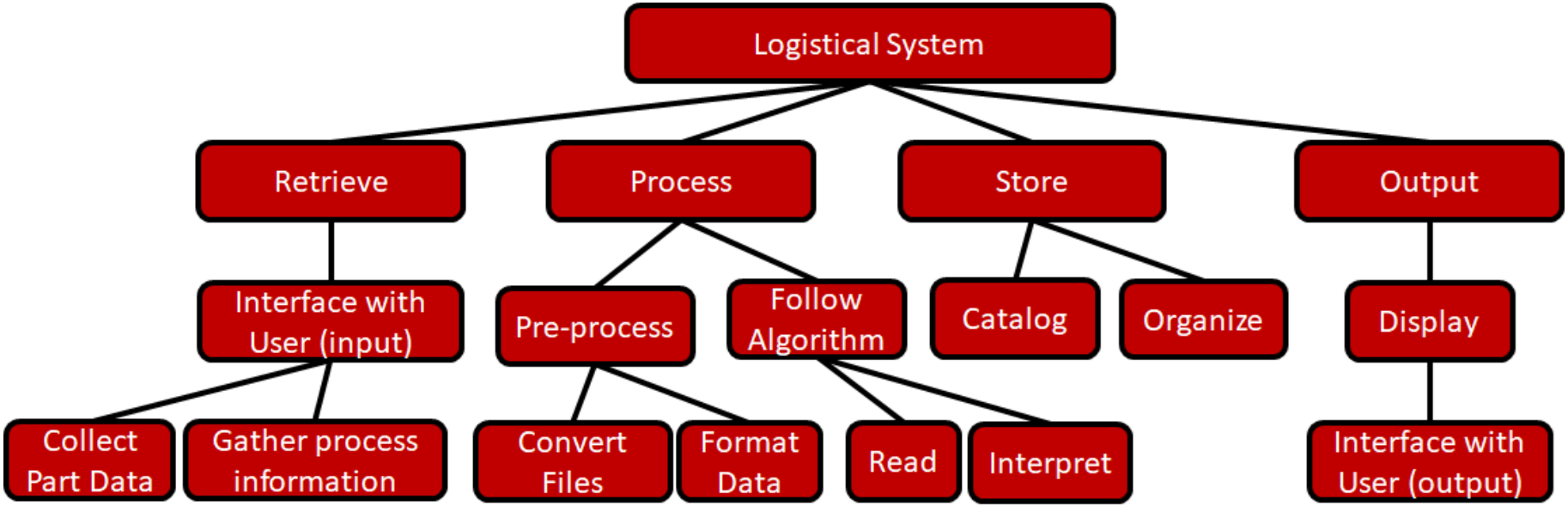
System is easily updated as software changes and input information changes

Alex Wilson

Functional Decomposition

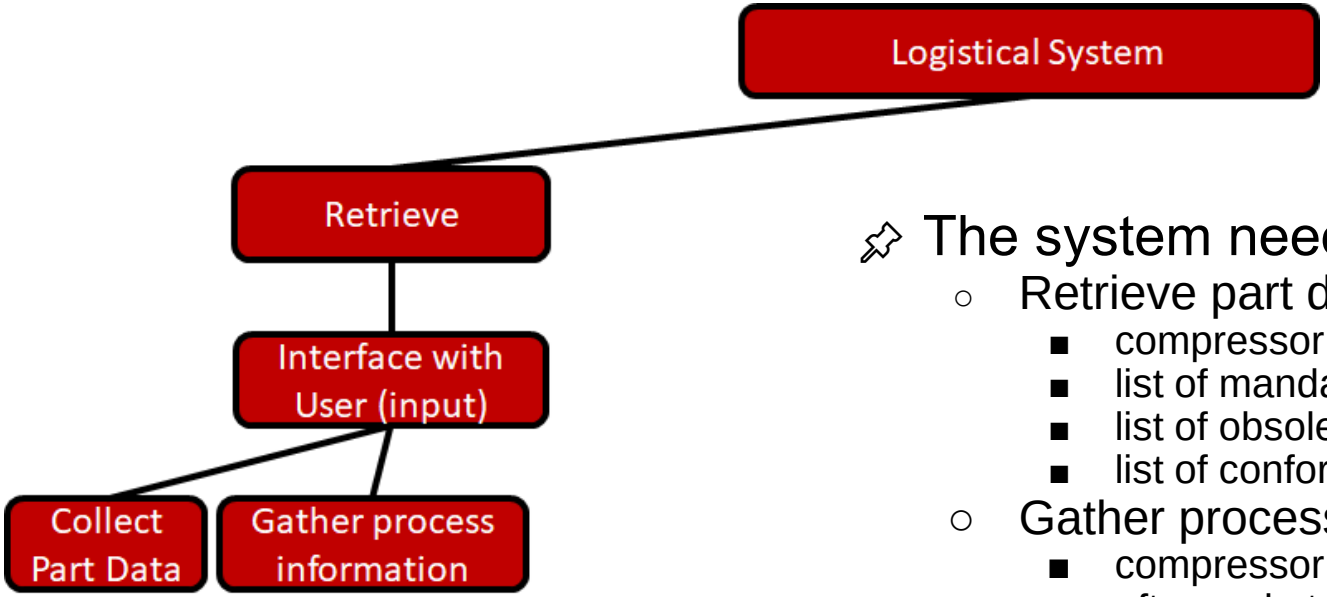
Alex Wilson

Functional Flow Chart



Alex Wilson

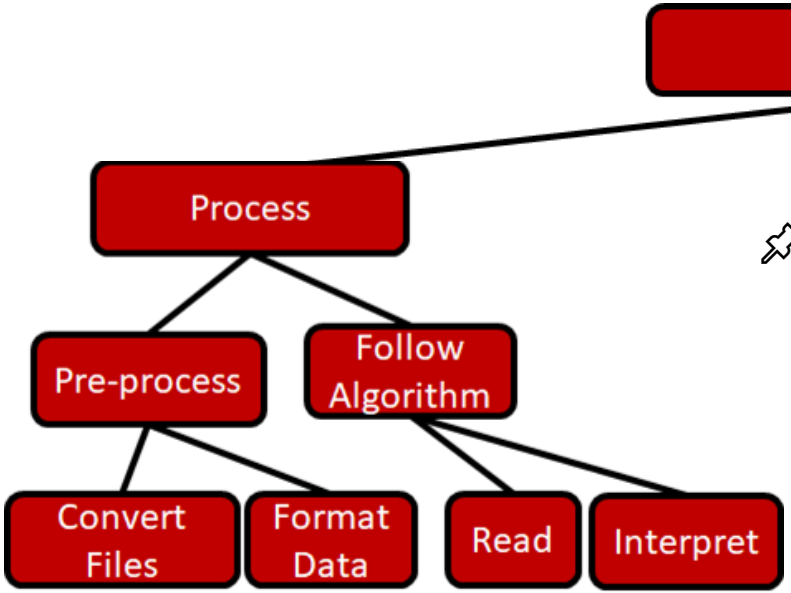
Functional Flow Chart



- The system needs to…
  - Retrieve part data from...
    - compressor failure reports
    - list of mandatory replacements
    - list of obsolete parts
    - list of conforming parts
  - Gather process information from
    - compressor as it moves through aftermarket repair process

Alex Wilson

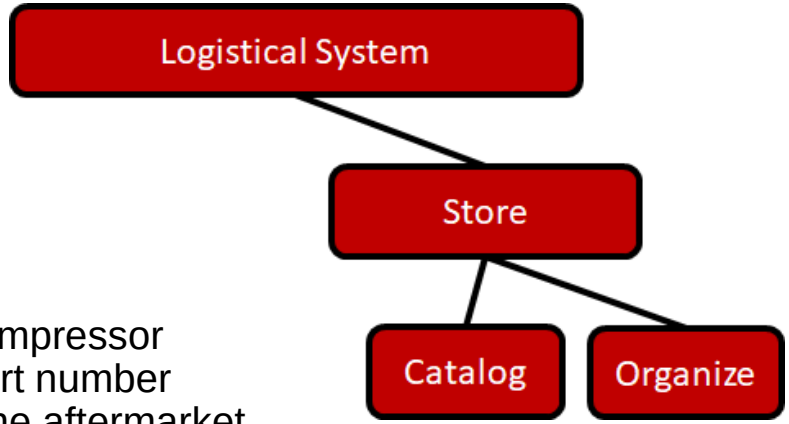
Functional Flow Chart



- The system needs to…
  - Pre-process
    - Converting files to correct format
    - Formatting data in a way that can be understood by a computer
  - Follow algorithm
    - Read in retrieved data
    - Interpret data

Alex Wilson

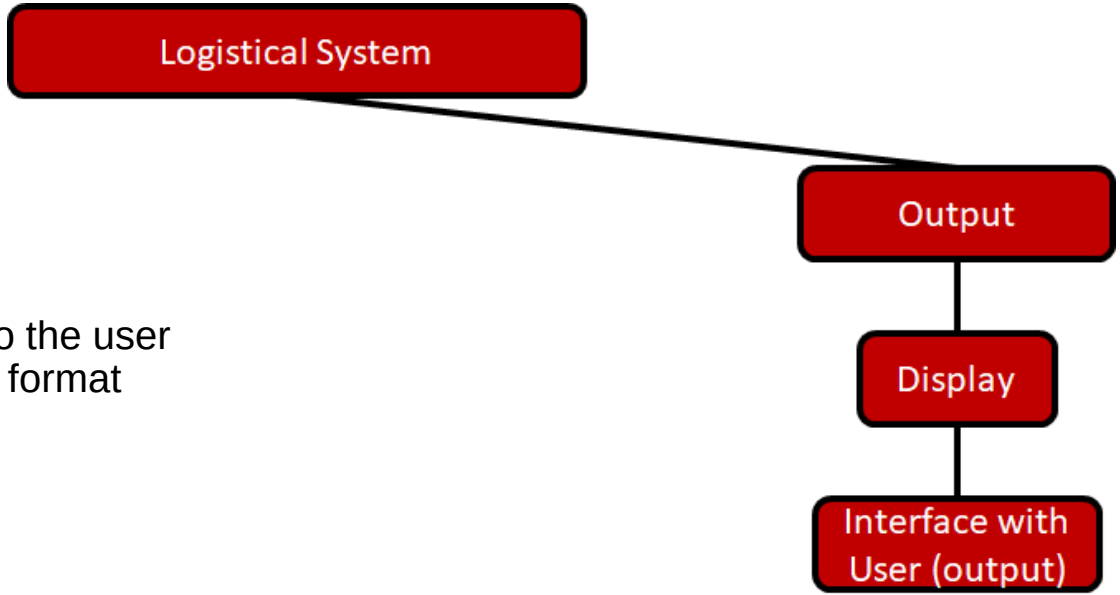
Functional Flow Chart



- The system needs to…
  - Store Data
    - Cataloging each of the compressor components by its part part number
    - Organizing each step of the aftermarket repair process
    - Form a database

Alex Wilson

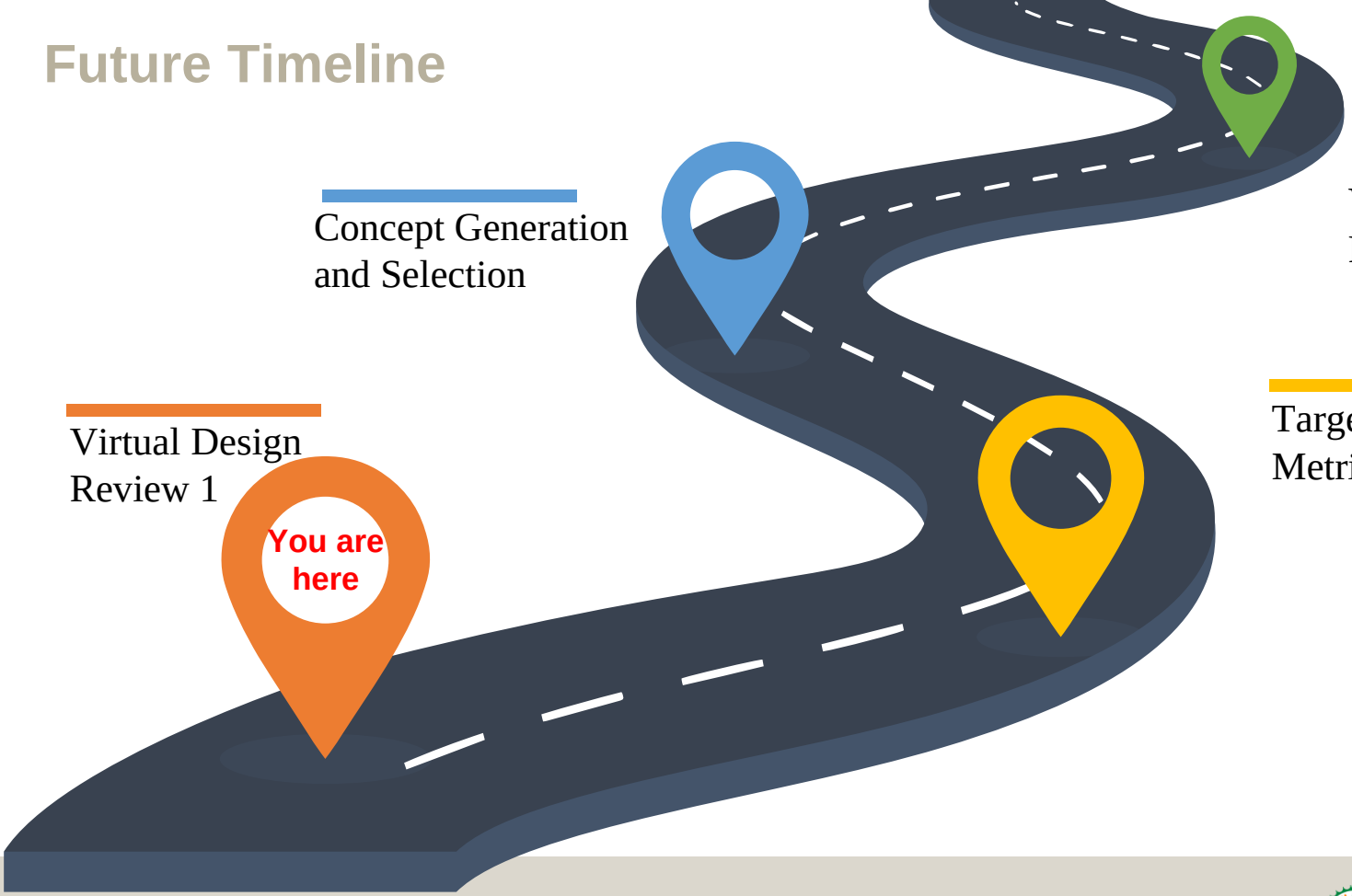
Functional Flow Chart



- The system needs to…
  - Output Data
    - Displaying relevant data to the user
    - Concise and easy to read format

Alex Wilson

Future Timeline

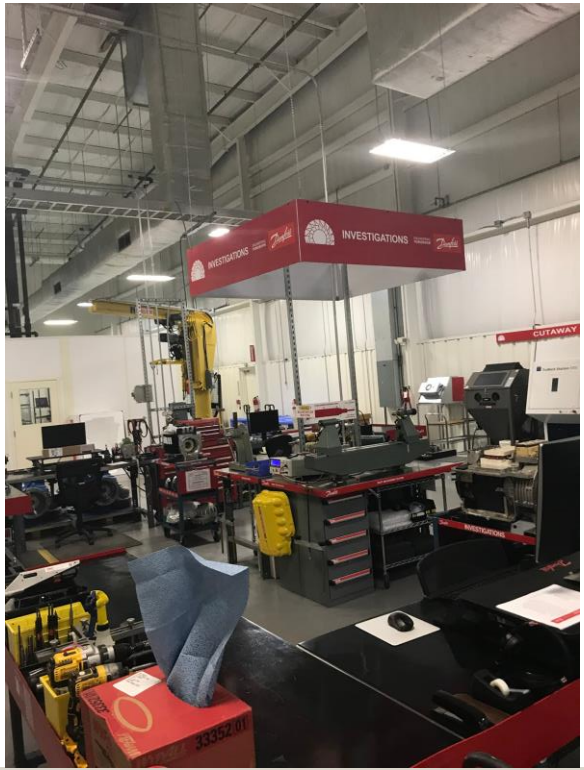


Alex Wilson

Tour of Danfoss

Tour of Danfoss

Tour of Danfoss



Tour of Danfoss

Reference

[1] Seymore, Stephen. (2020). Aftermarket Services Danfoss Turbocor® Compressors. [PowerPoint slides]. Retrieved from https://3.basecamp.com/3939307/buckets/18515621/uploads/3119943154

[2] McConomy, Shayne. (2020). Aftermarket Workflow Project 2020. [Word document]. Retrieved from https://3.basecamp.com/3939307/buckets/18515621/uploads/3078752695

[3] Bishop et al. (2020). SD T504 201023 Functional Decomposition. [Word document]. Retrieved from https://famu-fsu-eng.instructure.com/courses/4476/assignments/18861/submissions/102840000000061346

[4] Seymore, Stephen. (2020). Special Compressor Process. Danfoss Turbocor®. [PDF file]. Retrieved from https://3.basecamp.com/3939307/buckets/18515621/uploads/3119943196

Questions?

Backup Slides

Cross Reference Table

System				
Function	Retrieve	Process	Store	Output
Collect data from compressor failure reports	+			
Collect a list of mandatory replacements	+			
Collect list of obsolete parts	+			
Determine relevent vsnegligible parts to include in this analysis		+		
Determine how failed and obsolete parts are replaced	+	+		
Determine what conforming parts need to be replaced	+	+		
Determine what additional parts need replacing due to obsolete part changes		+		
Determine the age of the compressor and each individual part	+			
Record the experience and expertise of the engineers into the solution	+	+	+	+
Create a database to catelog the chronology of compressor repair		+	+	+
Adapt for future products	+	+	+	+
Memoize data		+	+	
Display Bill of Materials			+	+
Display list of recommended replacements based on historical data		+		+
Output all of the data to an executive summary		+	+	+
Organize and streamline the process such that it is replicable	+	+	+	+
Track part and serial numbers throughout each manufacturing stage	+	+	+	+