Team 10: Climatic Camera

Design Review I

Nash Bonaventura
Diego Gonzalez
Bryce Shumaker

Team Introductions

Bryce Shumaker
Project Manager

Nash Bonaventura
Simulation Engineer

Diego Gonzalez
Design Engineer

Stakeholders

Engineering Mentor
Kourosh Shoele, Ph.D.
Assistant Professor
FAMU-FSU College of Engineering

Sponsor
Vinayak Hegde,
Reliability Engineering Manager
Danfoss Turbocor Compressors, Inc.

Objective

The objective of the project is to design a product that will maintain operation of a recording device at extreme temperatures (-70°C to 190°C)

Bryce Shumaker

Background

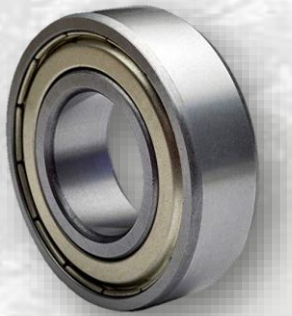
Turbocor® TG Series

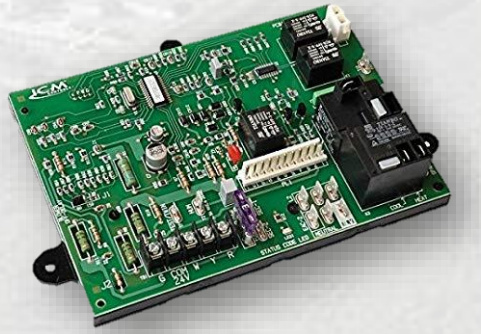
- Manufacturer of oil-free magnetic bearing compressor
  - Zero performance degradation
  - Variable Speed
- Manufactured in Tallahassee, Florida and Shanghai, China

Bryce Shumaker

Background

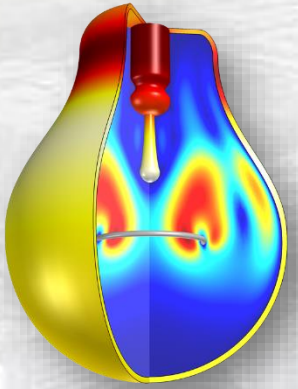
- All components are tested by reliability engineering Department
- Components are tested using cyclic temperature tests
- Tests go full duration or till visible LED failure

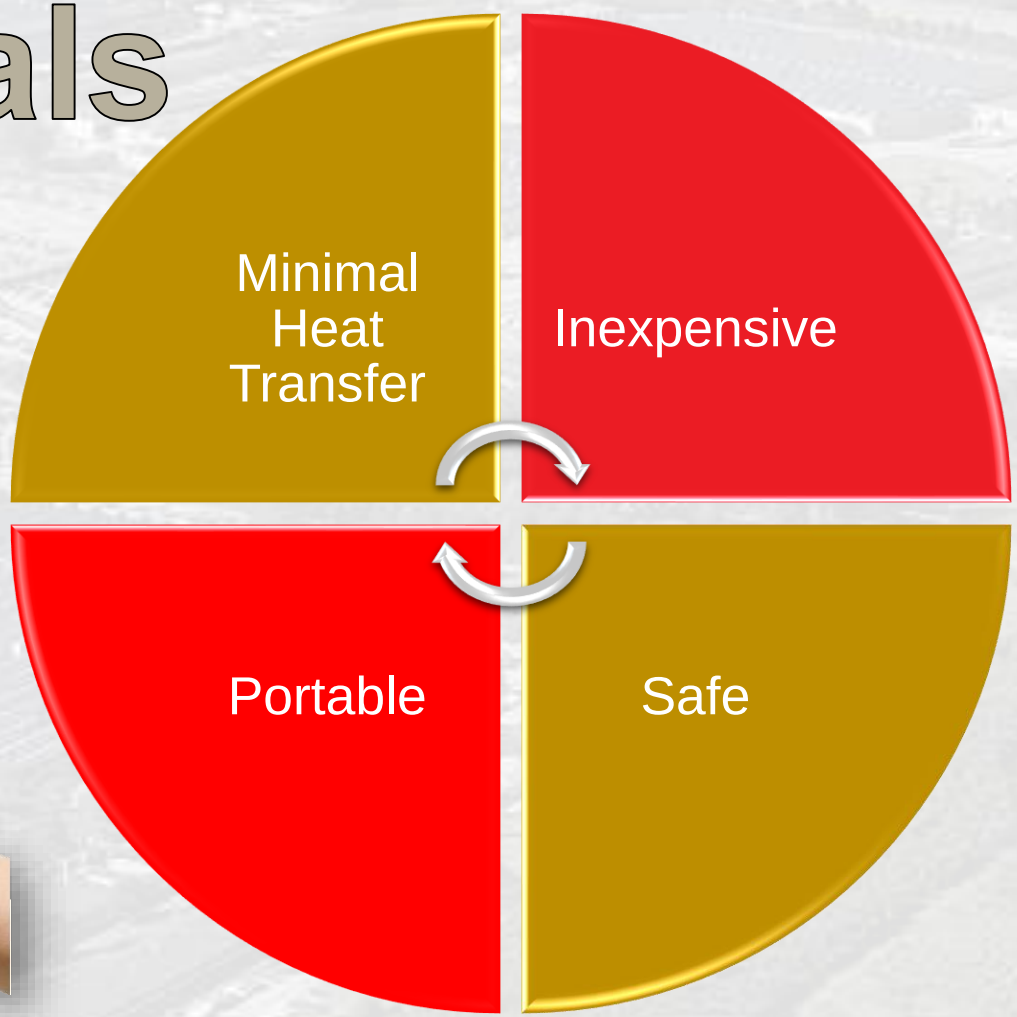




Bryce Shumaker

Key Goals





Bryce Shumaker

Markets

Primary Market

- Danfoss Turbocor Compressors, Inc.

Secondary Market

- Other Users/Manufacturers
- Aerospace
- Research
- Marine

NASA

NSF

MARINE EDUCATION & RESEARCH SOCIETY

Bryce Shumaker

Current Problems

- Physical presence is necessary to monitor to determine failure
- During cooling cycles window gets foggy and obstructs view

Bryce Shumaker

Technical Specs

CSZ ZPHS(HP)-32-12-ST2/WC

CSZ		Thermotron
97 x 97 x 97 cm	**Workspace Dimensions**	102 x 100 x 97 cm
-70°C to 190°C	**Temperature Range**	-70°C to 180°C
12.5°C/min	**Cooling Performance**	9.6°C/min
10-98% RH	**Humidity**	10-90% RH

Thermatron SE-1000-10-10

Diego Gonzalez

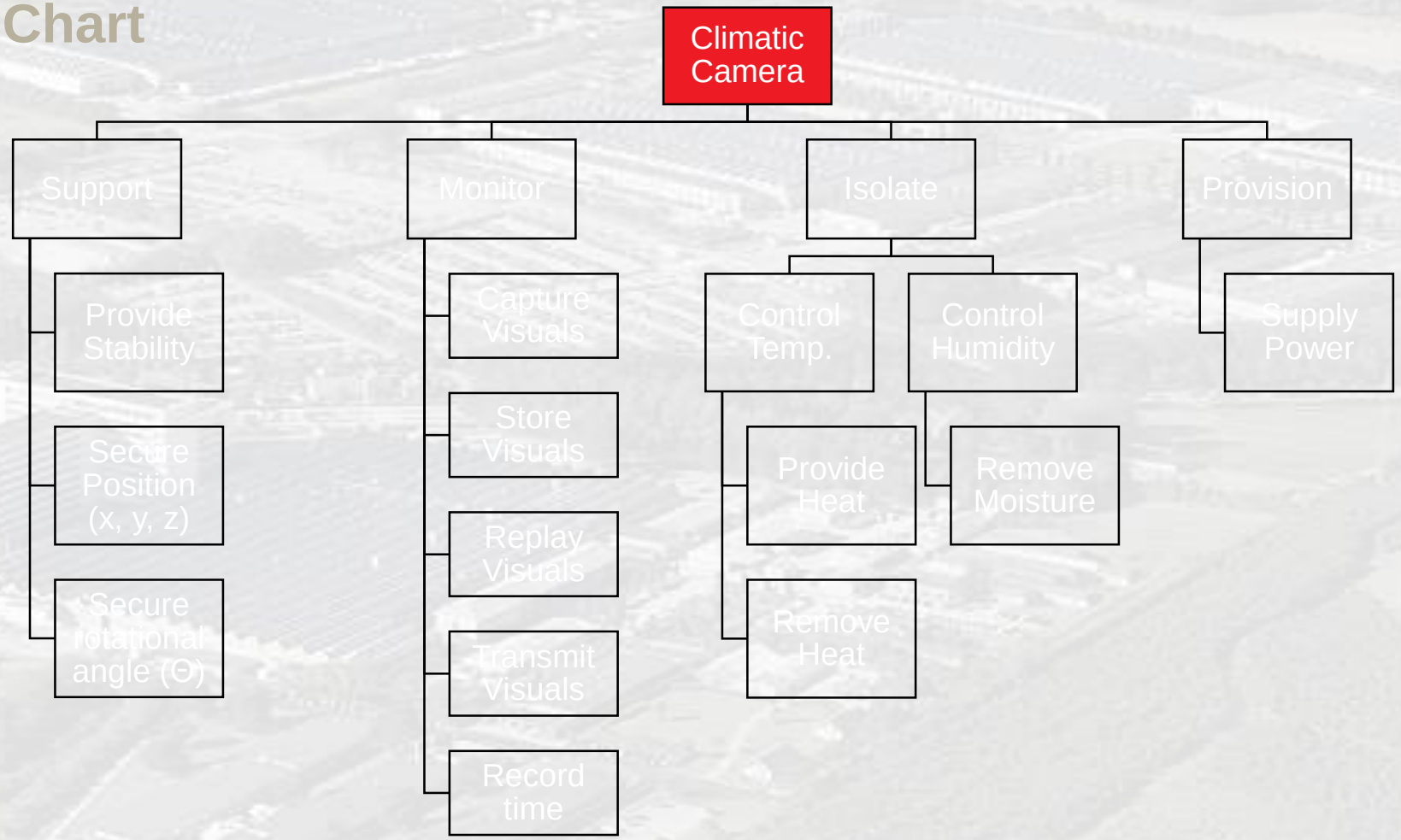
Customer Needs

Customer Statement	Interpreted Need
Test goes 24/7 until failure	The device provides continuous monitoring
Temperature ranges from -40 to 160 degrees Celsius. Relative Humidity ranges from 10 to 90%	The device operates within the parameters of the test
Would like the device to be adjustable to different positions	The device can be adjusted to different orientations
I want to use an existing camera and make it work under the test conditions	The device is isolated from the testing environment
USB connection preferably	The device has computer connection capabilities

Diego Gonzalez

Functional Decomposition

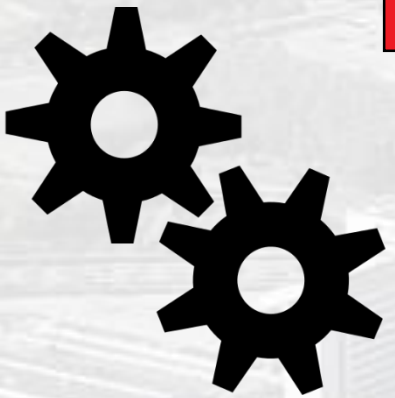
Hierarchy Chart

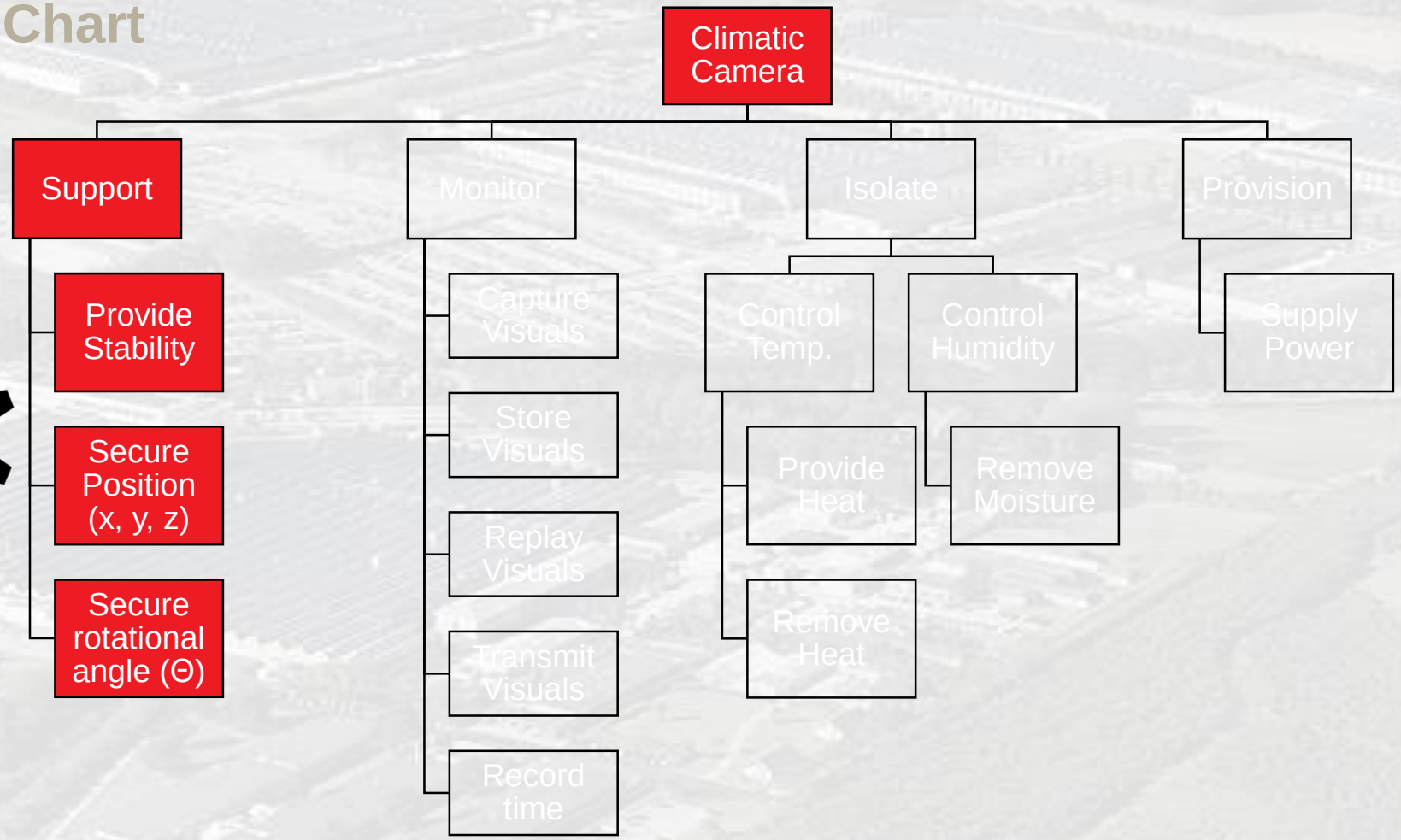


Diego Gonzalez

Functional Decomposition

Hierarchy Chart

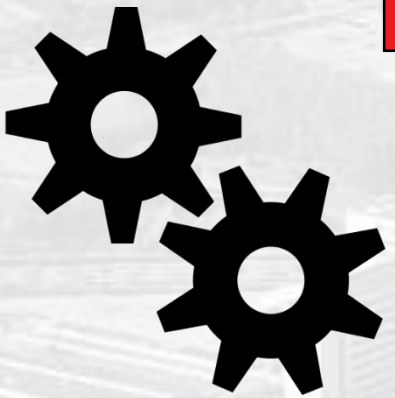




Diego Gonzalez

Functional Decomposition

Hierarchy Chart

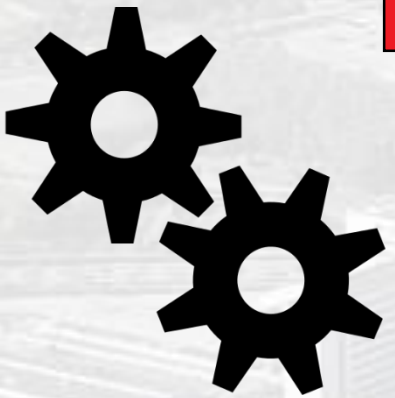


- Climatic Camera
  - Support
    - Provide Stability
    - Secure Position (x, y, z)
    - Secure rotational angle (Θ)
  - Monitor
    - Capture Visuals
    - Store Visuals
    - Replay Visuals
    - Transmit Visuals
    - Record time
  - Isolate
    - Control Temp.
      - Provide Heat
      - Remove Heat
    - Control Humidity
      - Remove Moisture
  - Provision
    - Supply Power

Diego Gonzalez

Functional Decomposition

Hierarchy Chart

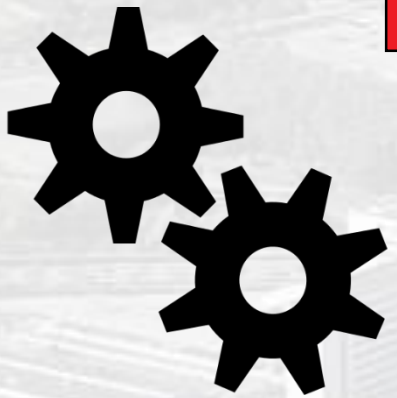


- Climatic Camera
  - Support
    - Provide Stability
    - Secure Position (x, y, z)
    - Secure rotational angle (Θ)
  - Monitor
    - Capture Visuals
    - Store Visuals
    - Replay Visuals
    - Transmit Visuals
    - Record time
  - Isolate
    - Control Temp.
      - Provide Heat
      - Remove Heat
    - Control Humidity
      - Remove Moisture
  - Provision
    - Supply Power

Diego Gonzalez

Functional Decomposition

Hierarchy Chart



- Climatic Camera
  - Support
    - Provide Stability
    - Secure Position (x, y, z)
    - Secure rotational angle (Θ)
  - Monitor
    - Capture Visuals
    - Store Visuals
    - Replay Visuals
    - Transmit Visuals
    - Record time
  - Isolate
    - Control Temp.
      - Provide Heat
      - Remove Heat
    - Control Humidity
      - Remove Moisture
  - Provision
    - Supply Power

Diego Gonzalez

Functional Decomposition

Cross-Reference Table

	Systems			
Functions	Support	Monitor	Isolate	Provision
Provide Stability	X	X	X	
Secure Position	X	X		
Secure Rotational Angle	X	X		
Capture Visuals		X		
Store Visuals		X		
Replay Visuals		X		
Transmit Visuals		X		
Record Time		X		
Control Temperature			X	
Control Humidity			X	
Supply Power		X		X

Diego Gonzalez

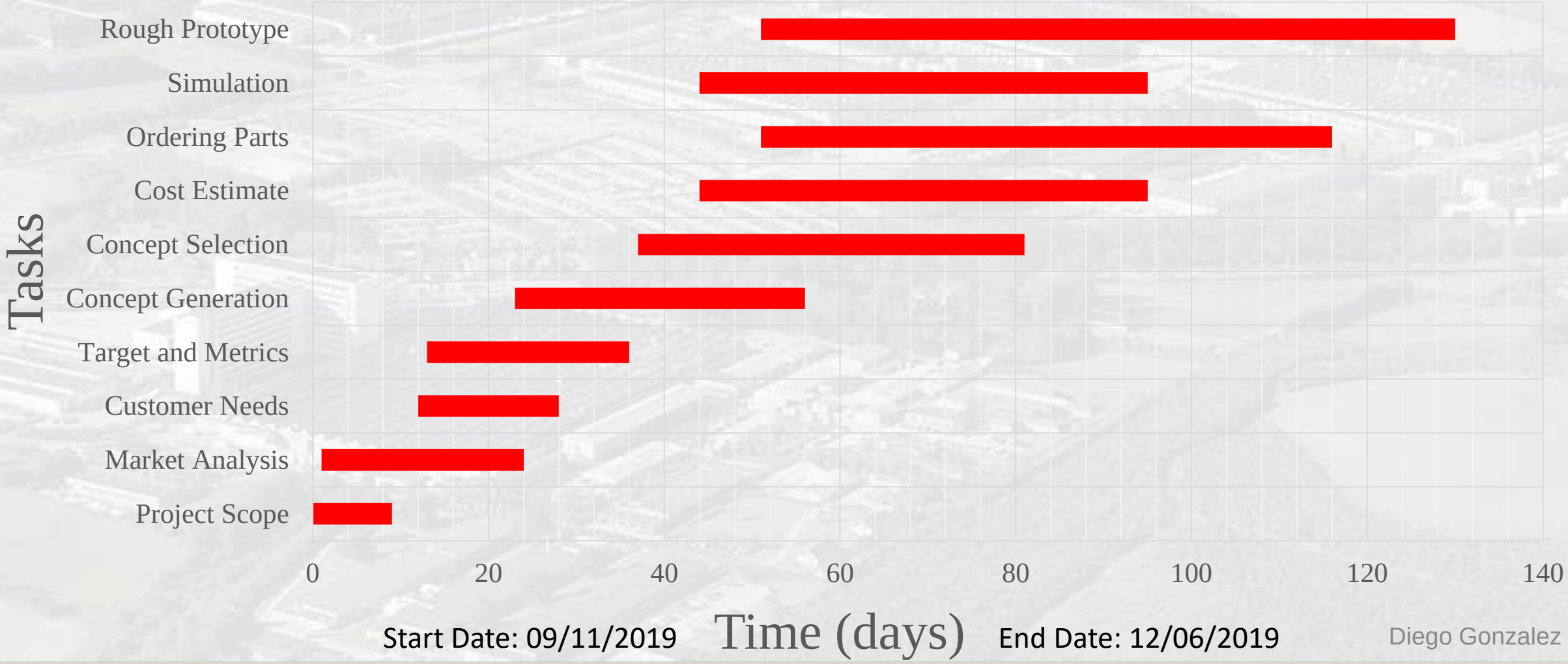
Possible Problems to think about

- Dew and Condensation
- Materials integrity
- Visibility inside the chamber
- Overheating of Camera

Diego Gonzalez

Time-Line

Climatic Camera Time- Line Report



Start Date: 09/11/2019

End Date: 12/06/2019

Diego Gonzalez

References

McConomy, S. (2019, February 2). Engineering Characteristics, Functions, Targets, and Metrics. FAMU-FSU College of Engineering.'

Industrial, C. S. Z. (2010). Z-Plus Temperature & Humidity Chambers. Retrieved October 1, 2019, from https://www.cszindustrial.com/Products/Temperature-Humidity-Chambers/Z-Plus.aspx.

SE-1000-10-10 Environmental Chamber. (2014). Retrieved October 1, 2019, from https://thermotron.com/equipment/se-series-detail/se-1000-10-10-environmental-chamber/.

"It's not a problem it's an opportunity"