

1708174

by Jordan Gough

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Fired Heater Combustion Difficulty Monitoring

Jordan Gough

1708174

20/01/2023

Project Background, Problem Definition and Constraints

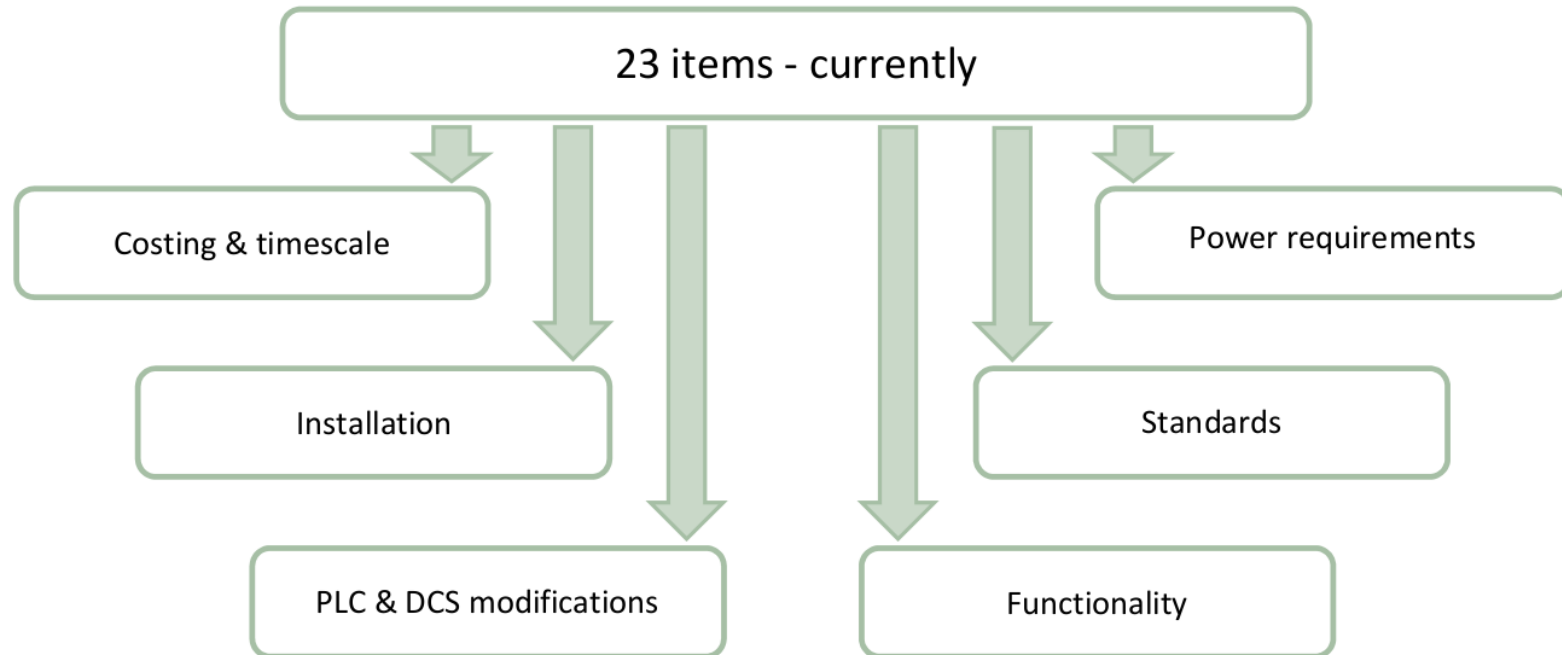
Project Background

- Incomplete combustion caused by rich air-to-fuel ratio (not enough air)
- Mixture can ignite
- HSE requirement
- 53 instances since August 2016
- Closes fuel gas XVs on high CO / CH₄

Constraints

- Lack of SIL rated measurement options, as per IEC 61508, on the market

Functional Design Specification



Project Risks and Health & Safety

Project Risks

- Supply chain issues
- Unplanned absence (vacation, sickness, etc.)
- Industrial strike action
- Unit shutdown events
- Unable to find suitable instrument

Health and Safety

- 17 industry standards to follow
- 10 company standards
- Management of change (MOC)

Test Planning

Tables

Testing Table

- 14 items, 9 tests
 - Configuration tests
 - Calibration & functions tests
 - Power tests
 - PLC & DCS tests
 - Alarm tests

Compliance Table

- 6 items, 6 verifications
 - Budget
 - Timescale
 - Standards

Solution Review

Yokogawa TDLS8100 & Neo Monitors LaserGas iQ2 Vulcan

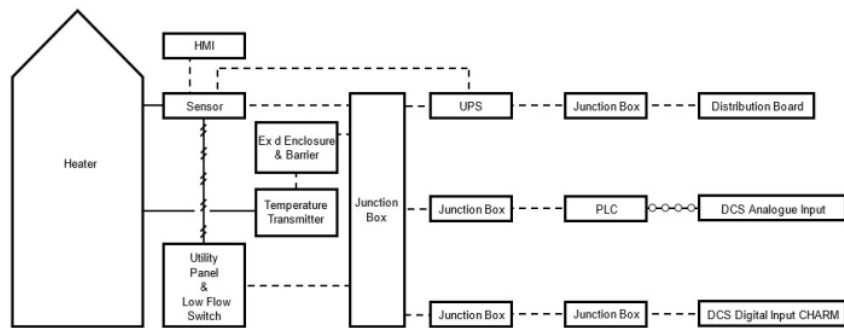
- Tuneable diode laser spectrometer
- Infrared adsorption
- Continuous monitoring
- Simultaneous CO & CH₄ measurement
- Probe type

Rosemount 700XA

- Gas chromatograph
- Sporadic measurement
- Simultaneous CO & CH₄ measurement
- Extraction type

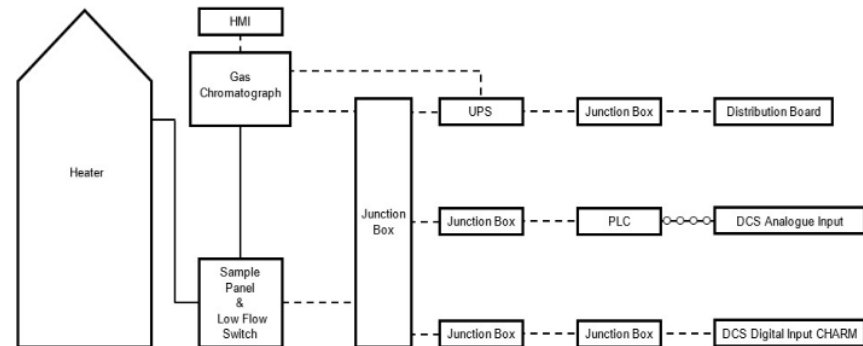
Solution Review

Tuneable Diode Laser Spectrometer



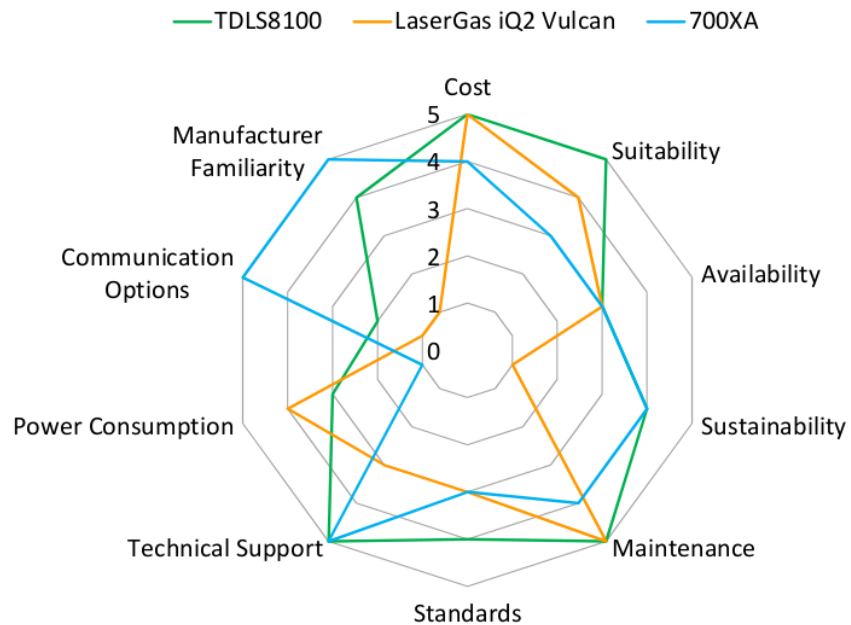
----- Electrical Connection
—— Process Connection
~~~~~ Pneumatic Connection  
○-○-○-○- Serial Link

## Gas Chromatography



----- Electrical Connection  
—— Process Connection  
○-○-○-○- Serial Link

# Solution Justification

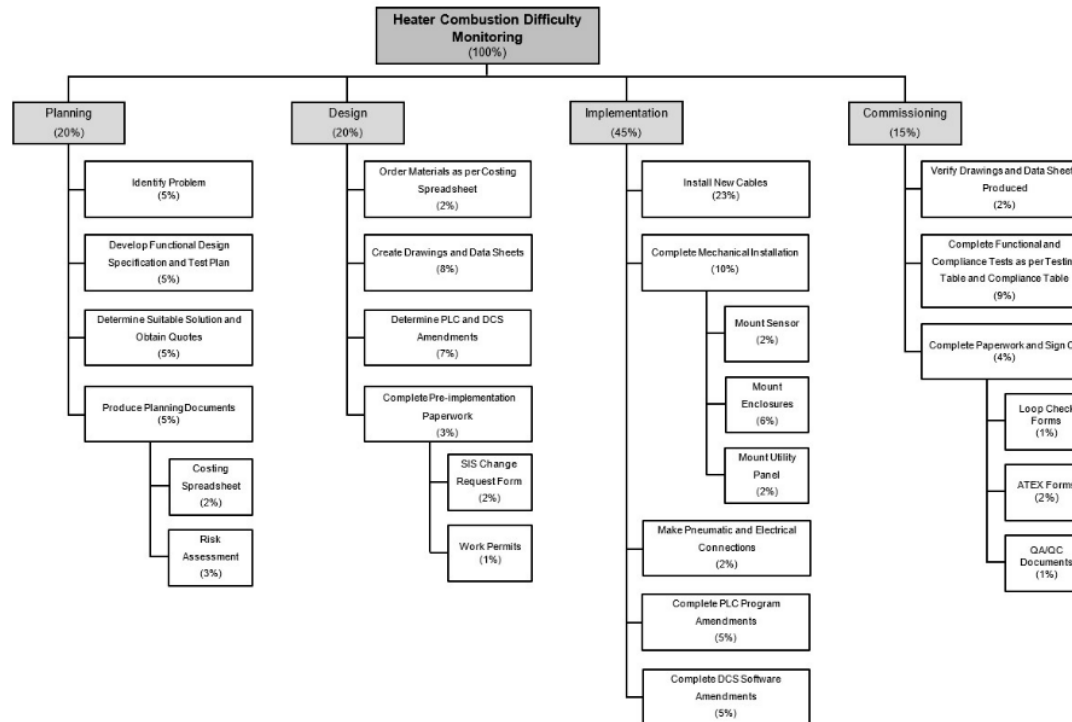


## Yokogawa TDLS8100

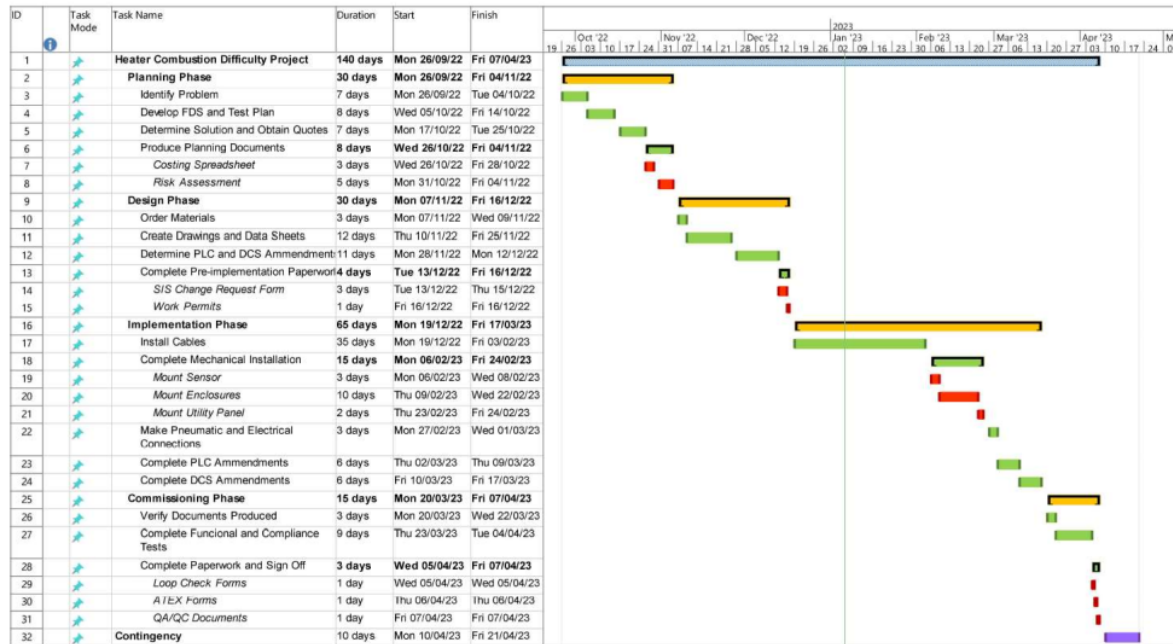
- Low cost - £45,039.18
- Real-time, simultaneous monitoring
- SIL rated (IEC 61508 compliant)
- Familiar manufacturer
- Good sustainability report
- Correct communications options (4-20ma, HART)
- Relatively low maintenance



# Project Planning



# Project Planning



- Budget - £250,000.00
- Current Spend - £187,792.56
- Remaining - £62,207.44
- Not factored –
  - Staff Wages
  - Stocked Materials

# Progress Made

| Name                                  | Start        | Finish       | % Complete |
|---------------------------------------|--------------|--------------|------------|
| Heater Combustion Difficulty Project  | Mon 26/09/22 | Fri 07/04/23 | 52%        |
| Planning Phase                        | Mon 26/09/22 | Fri 04/11/22 | 100%       |
| Identify Problem                      | Mon 26/09/22 | Tue 04/10/22 | 100%       |
| Develop FDS and Test Plan             | Wed 05/10/22 | Fri 14/10/22 | 100%       |
| Determine Solution and Obtain Quotes  | Mon 17/10/22 | Tue 25/10/22 | 100%       |
| Produce Planning Documents            | Wed 26/10/22 | Fri 04/11/22 | 100%       |
| Costing Spreadsheet                   | Wed 26/10/22 | Fri 28/10/22 | 100%       |
| Risk Assessment                       | Mon 31/10/22 | Fri 04/11/22 | 100%       |
| Design Phase                          | Mon 07/11/22 | Fri 16/12/22 | 100%       |
| Order Materials                       | Mon 07/11/22 | Wed 09/11/22 | 100%       |
| Create Drawings and Data Sheets       | Thu 10/11/22 | Fri 25/11/22 | 100%       |
| Determine PLC and DCS Amendments      | Mon 28/11/22 | Mon 12/12/22 | 100%       |
| Complete Pre-implementation Paperwork | Tue 13/12/22 | Fri 16/12/22 | 100%       |
| SIS Change Request Form               | Tue 13/12/22 | Thu 15/12/22 | 100%       |
| Work Permits                          | Fri 16/12/22 | Fri 16/12/22 | 100%       |

|                                           |              |              |     |
|-------------------------------------------|--------------|--------------|-----|
| Implementation Phase                      | Mon 19/12/22 | Fri 17/03/23 | 19% |
| Install Cables                            | Mon 19/12/22 | Fri 03/02/23 | 35% |
| Complete Mechanical Installation          | Mon 06/02/23 | Fri 24/02/23 | 0%  |
| Mount Sensor                              | Mon 06/02/23 | Wed 08/02/23 | 0%  |
| Mount Enclosures                          | Thu 09/02/23 | Wed 22/02/23 | 0%  |
| Mount Utility Panel                       | Thu 23/02/23 | Fri 24/02/23 | 0%  |
| Make Pneumatic and Electrical Connections | Mon 27/02/23 | Wed 01/03/23 | 0%  |
| Complete PLC Amendments                   | Thu 02/03/23 | Thu 09/03/23 | 0%  |
| Complete DCS Amendments                   | Fri 10/03/23 | Fri 17/03/23 | 0%  |
| Commissioning Phase                       | Mon 20/03/23 | Fri 07/04/23 | 0%  |
| Verify Documents Produced                 | Mon 20/03/23 | Wed 22/03/23 | 0%  |
| Complete Functional and Compliance Tests  | Thu 23/03/23 | Tue 04/04/23 | 0%  |
| Complete Paperwork and Sign Off           | Wed 05/04/23 | Fri 07/04/23 | 0%  |
| Loop Check Forms                          | Wed 05/04/23 | Wed 05/04/23 | 0%  |
| ATEX Forms                                | Thu 06/04/23 | Thu 06/04/23 | 0%  |
| QA/QC Documents                           | Fri 07/04/23 | Fri 07/04/23 | 0%  |
| Contingency                               | Mon 10/04/23 | Fri 21/04/23 | 0%  |

FINAL GRADE

GENERAL COMMENTS

Instructor

63/100

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

GRADING FORM: NEW CSG-RUBRIC

**JORDAN GOUGH****63****1. ENGAGEMENT WITH LITERATURE****2. KNOWLEDGE AND UNDERSTANDING**

Project background and problem definition (7/10) Project constraints, risks, health and safety (7/10) Response to questions (8/10) Total = 22/30

**22****3. COGNITIVE AND INTELLECTUAL**

Functional Design Specification (4/10) Test planning (5/10) Project Planning and management methods (7/10) Total = 16/30

**16****4. PRACTICAL APPLICATION**



Review of Solutions (6/10) Justification of final solution (7/10) Total 13/20

**13**

## 5. TRANSFERABLE SKILLS



Quality of the presentation slides (7/10) Quality of the delivery style (6/10)  
Total 12/20

**12**