

181565

by Jonathon Williams

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Presentation 1: Project Definition, Research and Quality Planning

Course:	BSc (Hons) Electrical & Electronic Engineering
Module:	SGEL6000 Independent Project
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Project Background, Problem Definition and Constraints

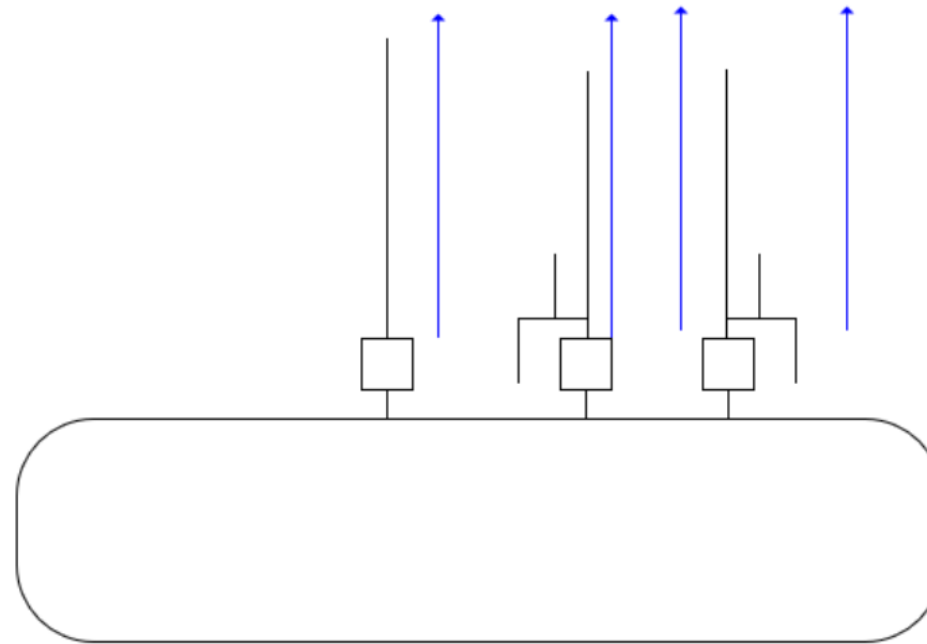
- Customer - major deliverer of online goods and services
- Location – Swansea Warehouse
- Orders – ‘Single-Medium’ (Singles) or ‘Multi-Medium’ (Multis)

Project Background, Problem Definition and Constraints

Current Layout

--- Packages out

--- Totes in



Peak 2020 (Weeks 40 – 53)

- Single Medium exceeded warehouse capacity.
- 46.9% of the total output volume – 11,975 units
- Capacity – 5,765 units/hour on 3 automated delivery lines
- Bridged using 8 indirect associates (4 days, 4 night) costing £1,327/day

Problem Definition

- Create a solution that will automate tote delivery to packing line 8

Functional Design Specification

- Agreed with the Customer
- Specific Deliverables:
 - Performance
 - Safety
 - Environmental
 - Aesthetics
 - Finance
 - Technical

FDS - Performance

Reference	Criteria
P1.1	Line must accept minimum of 500 totes per hour
P1.2	Work-out (Pack-line) will run at 80 ft/min with a ramp time of 0.5s
P2	System must highlight faults and be presented to the engineering team via pilot lights and/or the SCADA System.
P3.1	Start-up sequence must be as per other lines, work-out-line (top) to wake on start button or on positive edge of sensor
P3.2	Work-in-line (totes) must start automatically when work is detected
P4	System must be controllable from the current operations interface
P5	System must display faults locally on control panel
P6	Solution must be compatible with the warehouse's OEE system (Metrics dashboard measuring Overall Equipment Effectiveness)
P7	Tote conveyor is an accumulating conveyor, allowing the line to fill with totes and not stop when one tote reaches the end of the line.

FDS – Environmental, Safety & Finance

Reference	Criteria
E1	Conveyors must have an energy saving mode - after 30 minutes of inactivity, conveyor switches off
S1	Line must conform to SIL 2 reliability rating, stop category 0 (energy disconnect) according to BS EN IEC 62061
F1	Project must be within budget of £150,000
F2	Project must provide a return of investment within 2 years.

FDS - Aesthetics

Reference	Criteria
A1	Line must keep aesthetics, must match colours of other conveyance. RAL 7016 & 1023
A2	Line must have the same layout as other lines – work-in on the bottom, work-out on top.
A3	Tote-conveyor must be 0.75m high
A4	Pack-conveyor must be 1.42m high
A5	Tote-conveyor must be able to accept totes of the minimum and maximum size and weight as specified in Table 4
A6	Pack-conveyor must be able to fit packages of minimum and maximum size and weights as specified in Table 5

FDS - Technical

Reference	Criteria
T1	Parts used must be in line with the preferred suppliers list (Appendix 4)
T2	System must display and send healthy signal when system has no faults
T3	BOM, technical and operations manuals are provided

Project Risks

- Risk is an undesirable future event that could affect the project
- Consequences are used to for risk mitigation strategies

Risk	Mitigation
External Risks- changes in senior management decisions, customer needs and behaviour e.g. lack of understanding, customer requirement changes, supplier relations, subcontractors labour availability (Covid), material availability, project assumptions	• Link project goals and objectives to stakeholders needs, focusing on customer requirements • Develop team communication and management reporting procedures, job roles, project change procedures, and how project funding and invoicing will be undertaken • Agree functional design specifications (FDS) and test plans • Examination of available technology to achieve project objectives • Develop a list of alternative suppliers/manufacturers for approval in case shortage of labour/materials for preferred ones

Health and Safety

- Conform to current relevant UK regulations and standards
- UKCA rather than CE
- Declaration of conformity
- Machinery Directive 2006/42/EG
- The Supply of Machinery (Safety) Regulations 2008
 - Machines are designed safely
 - Operating instructions are produced in English.
 - Technical documentation is produced
 - A declaration of conformity is issued
 - The machine is labelled UKCA compliant displaying the UKCA mark.
- Provision and Use of Work Equipment Regulation (PUWER 78)
- Health & Safety at Work Act 1974 (HASWA 74)

Testing Plan

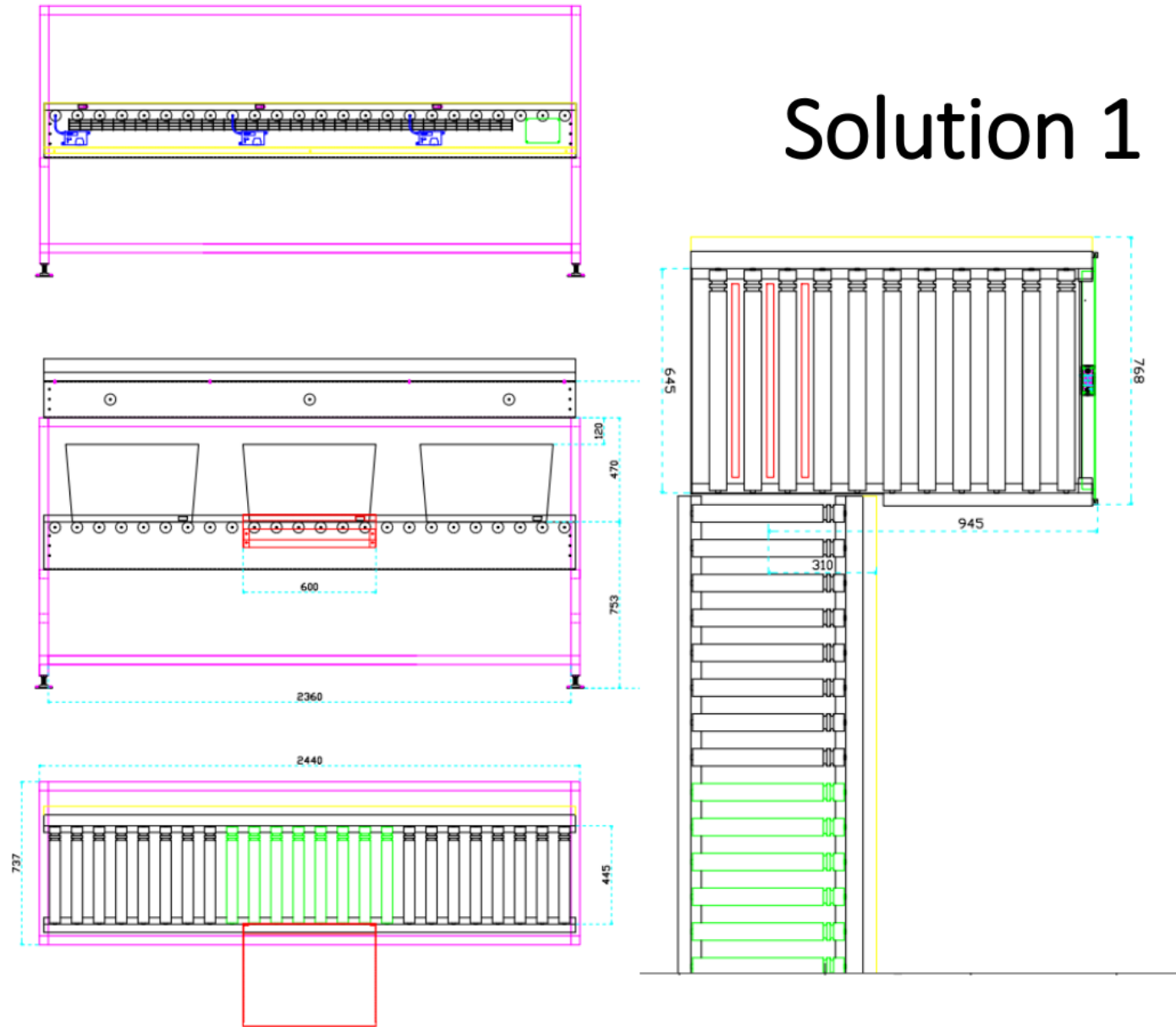
Test Number	FSD Reference	Test Description	Expected outcome
1	A1	Check colour of frame work	Colours match specification.
2	A2	Check layout of conveyors is as per FDS	Layout of conveyors is as per FDS
3	A3	Measure height of tote conveyor	Conveyor is 0.75m high
4	A4	Measure height pack-conveyor	Conveyor is 1.42m high
5	A5	Check tote-conveyor can accept totes of the minimum and maximum size and weight as specified in Table 4	Conveyor can accept material within set dimensions and weight (Appendix 5)
6	A6	Check pack-conveyor can fit packages of the minimum and maximum size and weights as specified in Table 5	Conveyor can accept material within set dimensions and weight
7	T2	With no faults on the tote line, check PLC01 receives system healthy signal	PLC01 gets healthy signal
8	P1.1	Load totes onto line for 1 hour, set up photocell on line to trigger a counter	After 1 hour, counter must be greater than 500 to accept line can cope with 500 totes per hour.
9	P1.2	Measure belt speed using tachometer	Speed is 80 ft/min
10	P1.2	Check ramp time of VFD controlling motor	Ramp time is 0.5s
11	P3.1	Press start button for line	Pack-line starts when start button is pressed
12	P3.2	Flag incoming tote sensor	Tote accumulation line starts

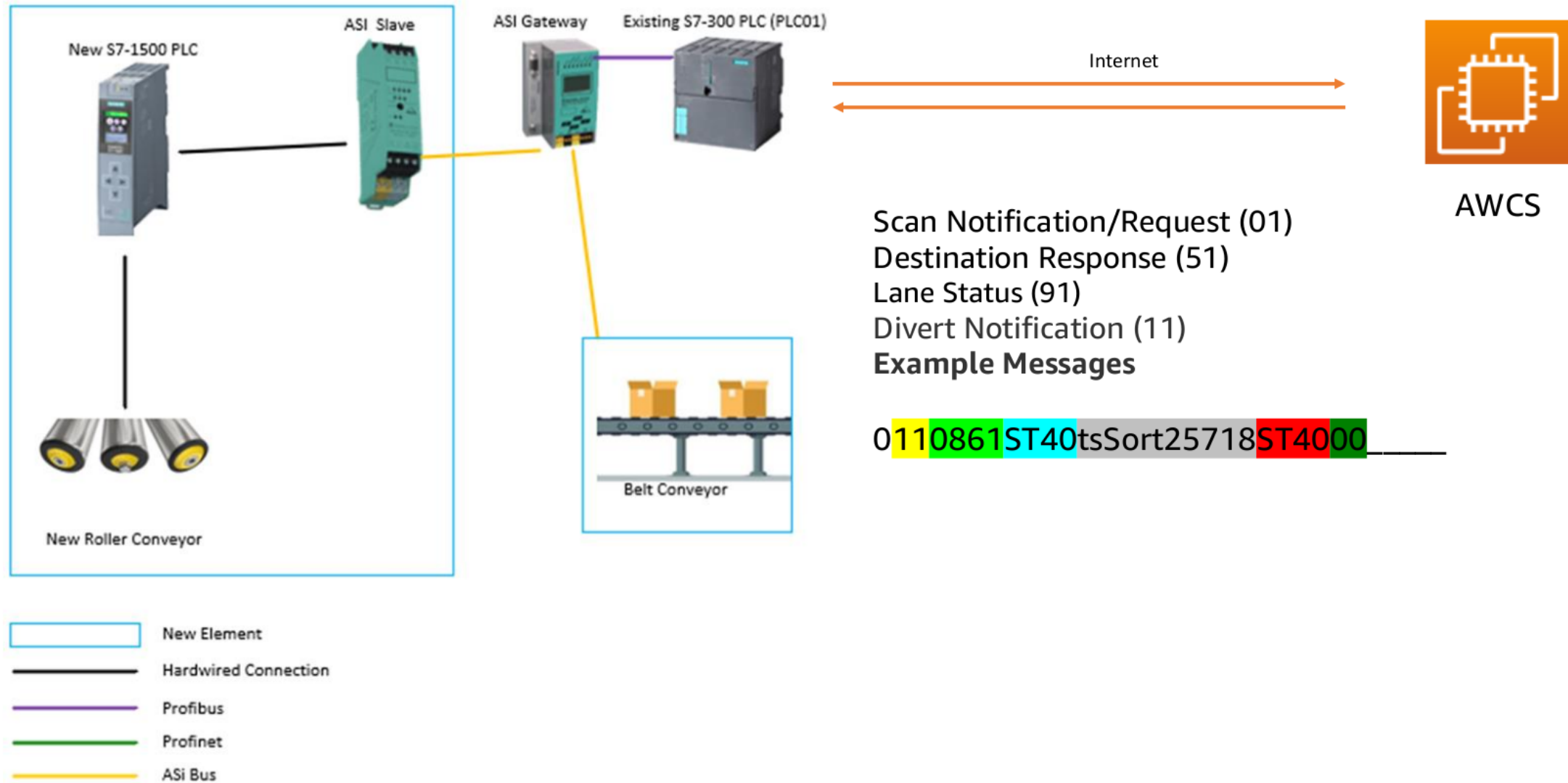
Test Number	FSD Reference	Test Description	Expected Outcome
13	E1	Leave the pack-line for 20 minut..1es.	When no photocells on the line have been triggered for 20 minutes, the conveyor will turn off.
14	S1	Activate emergency stop	On activation of E-stop, the line will stop and energy will disconnect.
15	P2/P5	Place fault on line by blocking sensors,	Fault light displays on panel and sends fault condition signal to PLC01
16	P4	Route tote to line using operations interface	Tote routes correctly
17	P6	Modification is able to be added to OEE platform	Modification added to OEE and performance can be measured
18	P7	Load line with totes	Totes accumulate correctly
19	T1	Check components used/BOM matches preferred suppliers	Parts used are preferred manufactures
20	T3	Check documentation list for required documents	All required documentation is present
21	F1	Project is within budget	Project is within budget
22	F2	Calculate ROI	Project will have an ROI <2 years

Solution Common Themes

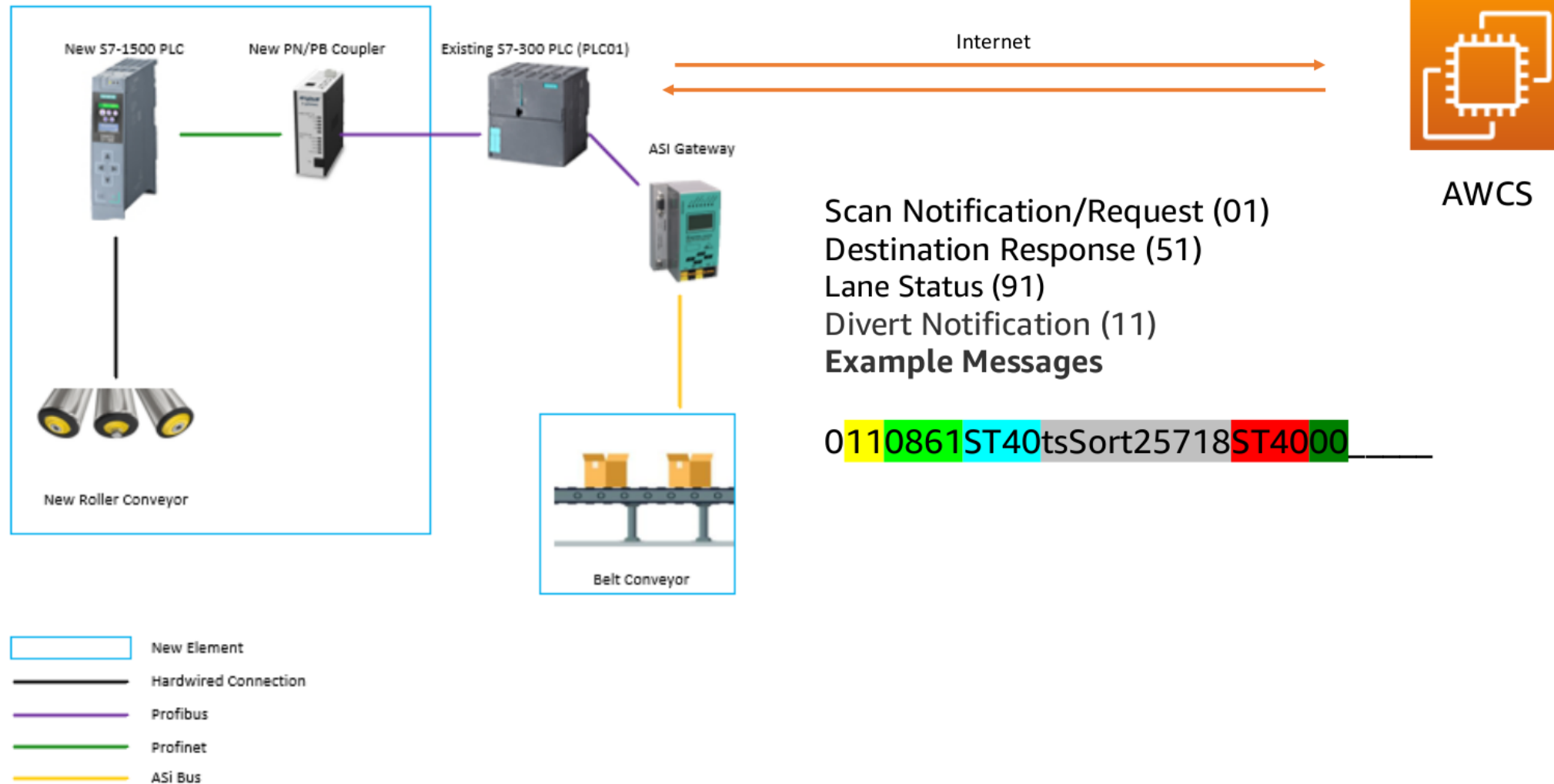
- All solutions must provide automated tote delivery to Packline 8.
- Pack line 8 must match the design of the other lines in terms of work in work out flow
- Tote accumulation

Solution 1

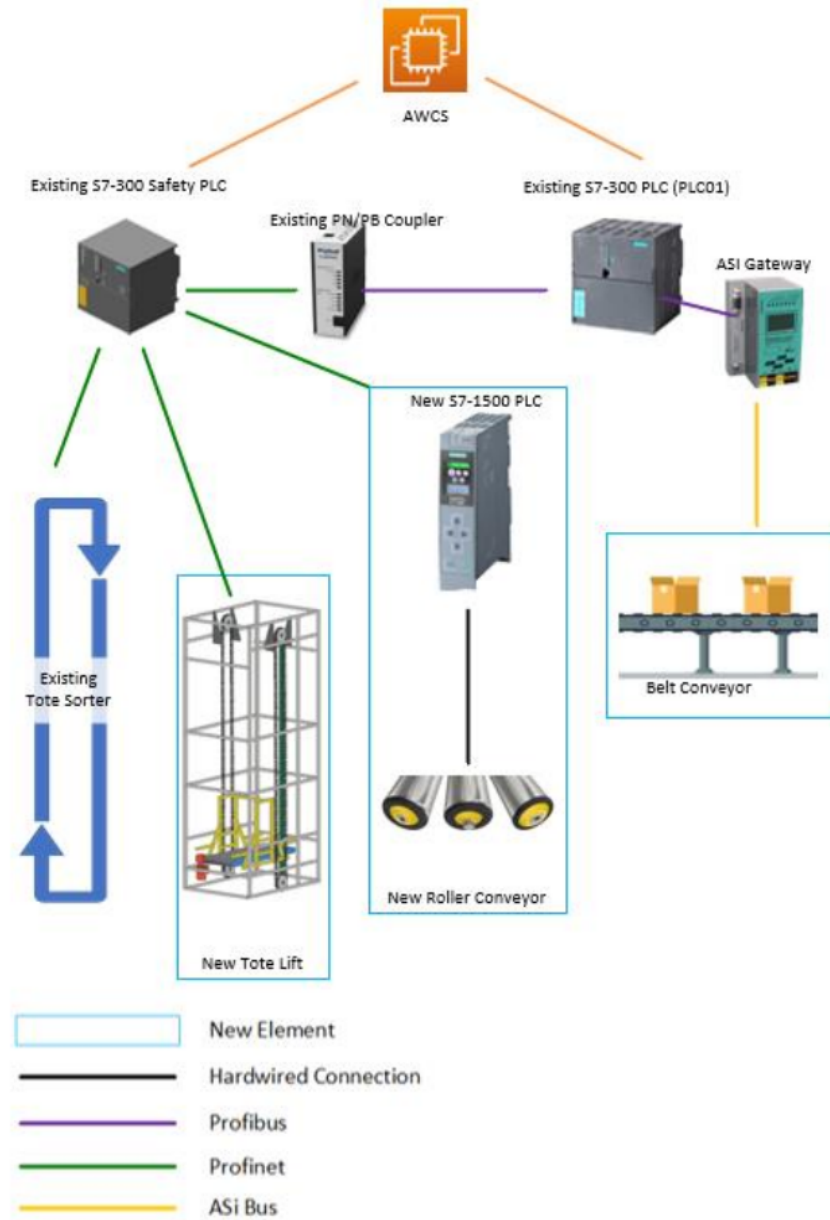




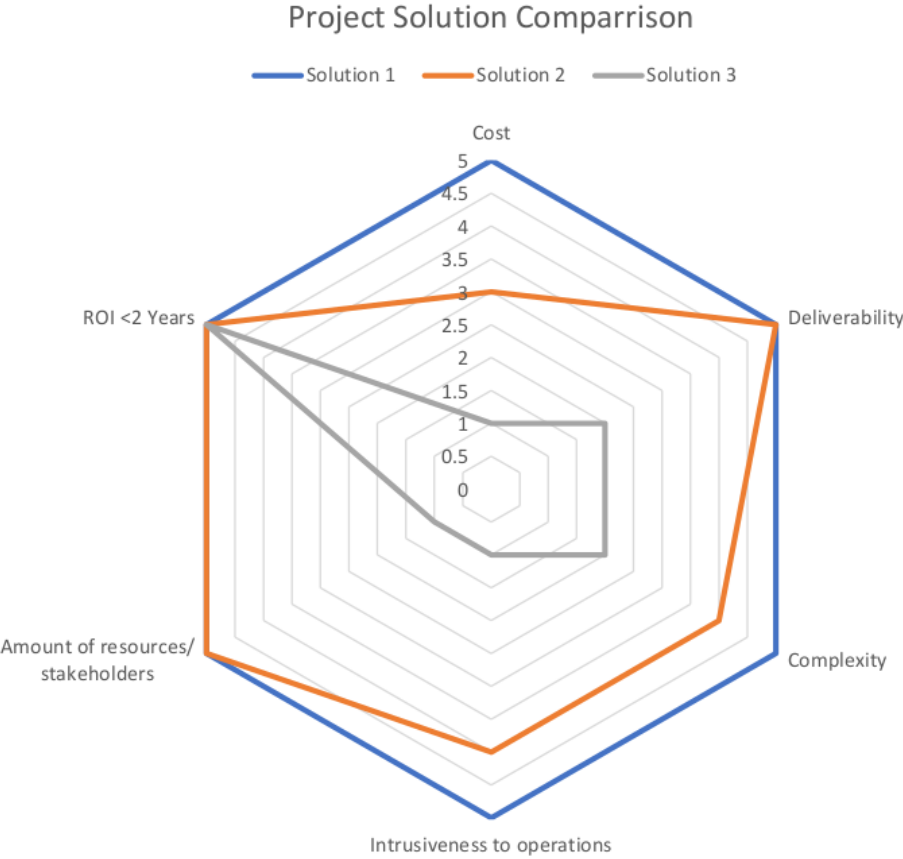
Solution 2



Solution 3



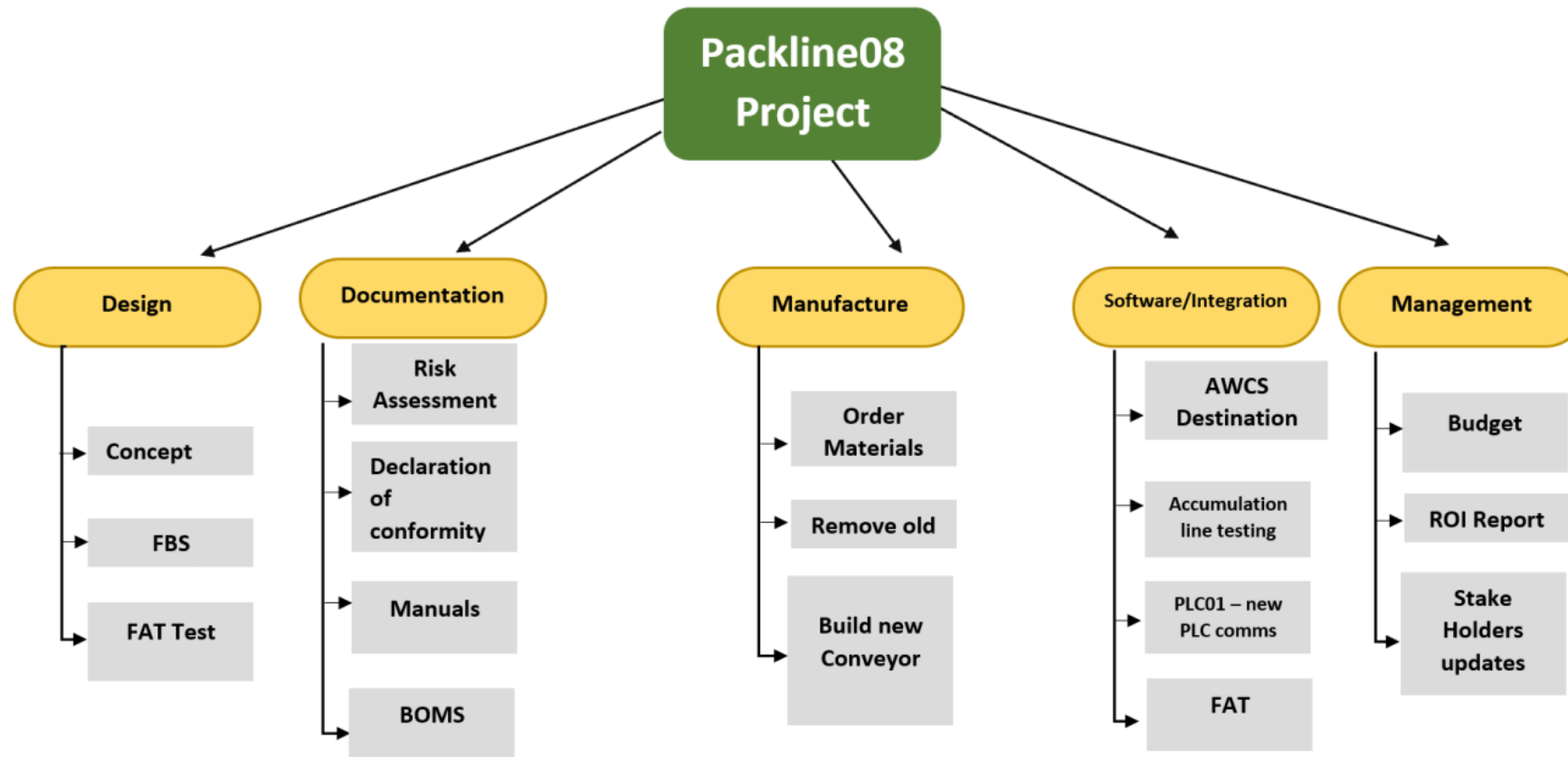
Solution Comparison



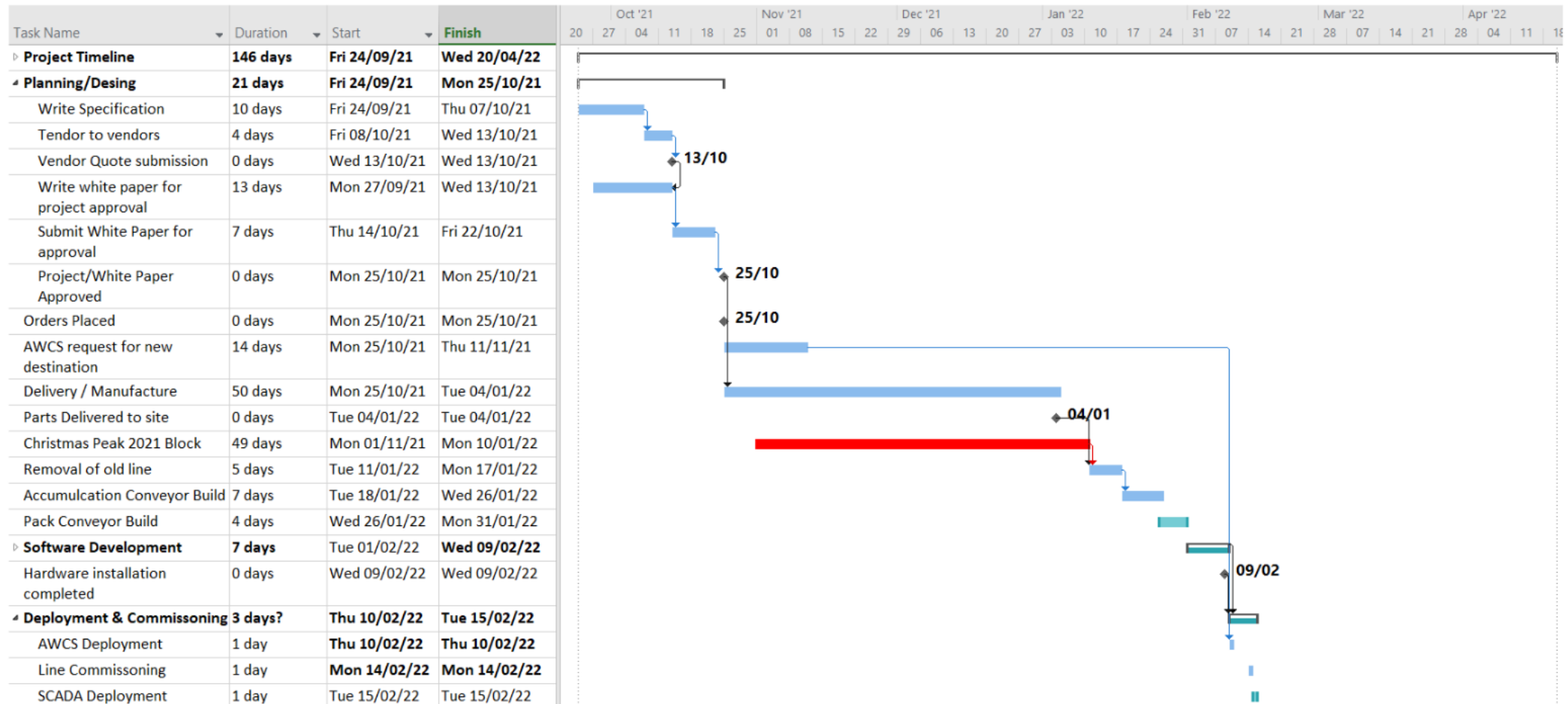
Criteria	Solution 1	Solution 2	Solution 3
Cost	5	3	1
Deliverability	5	5	2
Complexity	5	4	2
Intrusiveness to operations	5	4	1
Number of resources/stakeholders	5	5	1
Return on Investment <2 Years	5	5	5

	Solution 1	Solution 2	Solution 3
Hardware	£ 136,739	£ 139,000	£ 215,000
Software	£ 1,000	£ 1,000	£ 15,000
Total	£ 137,739	£ 140,000	£ 230,000

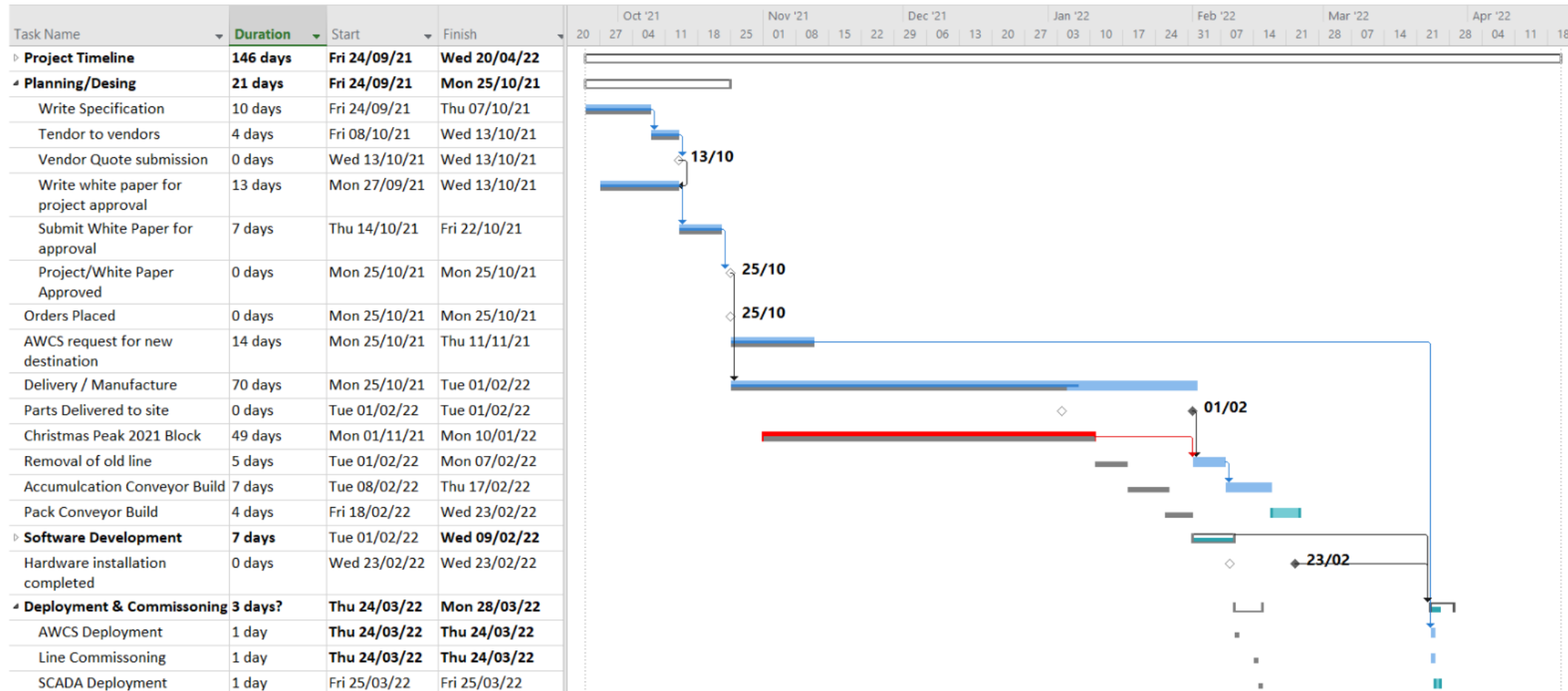
Work Breakdown Structure



Gantt Chart



Gantt Chart to date



Any Questions?

FINAL GRADE

GENERAL COMMENTS

Instructor

78/100

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15

PAGE 16

PAGE 17

PAGE 18

PAGE 19

PAGE 20

PAGE 21

PAGE 22

PAGE 23

GRADING FORM: NEW CSG-RUBRIC

JONATHON WILLIAMS

78

1. ENGAGEMENT WITH LITERATURE

 Section 1: Engagement in research, for project background Clear evidence provided. (RD) Section 5: Engagement in research, for review of solutions Solutions showed research had taken place. (RD) (8/10) **8**

2. KNOWLEDGE AND UNDERSTANDING

 Section 1: Project background Good explanation provided but one slide was unclear. (RD) Section 3: Project risks, health and safety etc Clearly identified and explained. (RD) Response to questions 1 and 4 Good answers provided. (RD) (15/20) **15**

3. COGNITIVE AND INTELLECTUAL

 Section 1: Problem Definition and constraints Good explanation given with limitation. (RD) Section 2: Functional Design Specification A clear set of specifications presented categorised in a helpful way. (RD) Section 4: Test planning Excellent planning for testing based on the FDS (RD) Response to questions 2 and 6 Good answers provided. (RD) (28/35) **28**

4. PRACTICAL APPLICATION

 Section 5: Critical choice and justification of final solution Good range of methods used including two types of scoring system. (RD) Section 6: Project Planning and working breakdown structure Well **20**

broken down and presented using the 40 hour rule. (RD) Response to questions 3 and 5 Good answers. (RD) (20/25)

5. TRANSFERABLE SKILLS

 All sections: Quality of the presentation slides Quite good but could have been more appealing. (RD)
All sections: Quality of the delivery style Good delivery, slight overrun on time. (RD) (7/10)

7