Format for the Operational Readiness Review (ORR) Report (Spring2017)

At an ORR the focus is on Phase D results, i.e. System Assembly, Integration and Test. The ORR report is built from your CDR/PDR report from last semester. You will edit your CDR/PDR report by updating the old material and adding new material. This mostly includes:

- *Updating of mechanical drawings, bill of materials, interfaces, text and analysis as necessary.*
- *Adding your test results of the subsystems and the system, and instructions on safe operation which can be put in the ConOps sections.*

You are to 1) make the number of hardcopies of this report as requested by the industrial sponsor and your instructor (Dr. Beale will certainly need one), 2) load a pdf of the report onto the CANVAS assignment, 3) deliver to the TA your design notebook, 4) include your CODs + deliverables with your hardcopy of the report for Dr. Beale, separate from the report and held together with a binder clip. Hardcopying costs will be covered by the sponsor in some cases, so see Dr. Beale or the TA when ready to make hardcopy reports.

This semester has been spent on Phase D, which, from the course material, involves:

Phase D - System Assembly, Integration, Test and Launch (SAITL)

Purpose: To assemble parts and components to create the subsystems, integrate subsystems to make the entire system, to test the subsystems and system to be able to meet requirements, and finally to launch the system.

Activities: The Systems Engineer is very involved in evaluating and qualifying the system based on verification and validation test procedures for components, subsystems and system. Perform testing under conditions close to the expected environment, if possible. Resolve any discrepancy of performance with requirements. Prepare an operator's manual and, if needed, include maintenance, storage and shipping procedures. Demonstrate the system at the Operational Readiness Review (ORR).

Systems Engineer's Reporting: In your final report, discuss the test results, including ability of the system to meet requirements, mission and functional performance. If there are any changes in the 11 SE functions and the baseline (CDR/PDR) design, remember to update the documentation to track the changes.

Below is a format for your report. The changes and additions to the CDR/PDR report are in red and underlined. And document your answers to the Programmatic Questions in blue letter below.

TITLE PAGE – Include a descriptive project title with "Operational Readiness Review" in the title, name of "corporation", members, semester, date, course ("MECH4250"), instructor, technical advisor, corporate sponsor.

SUMMARY or **ABSTRACT** (1 page of text, about 200 words). This is a short summary of what the problem is, what you have accomplished and your conclusions. It gives the reader a clue of what are the most important contributions of the work. Updated from CDR/PDR, with emphasis on the test results and product features on both the subsystems and system.

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INTRODUCTION

Introduce the assignment, state and identify the design problem. Discuss previous work. In one or

two added paragraphs, discuss any comments of the sponsor from CDR/PDR, and your response/actions taken and documented in the rest of the report.

MAIN BODY

SYSTEMS ENGINEERING (by Systems Engineering team members)

1. Mission Objective – present a clear statement of the mission objective that all stakeholders have agreed upon and accepted. Hopefully this remains the same from the PDR/CDR. Also attach MPCOD here (which, in a sense, is your mission objective for this semester)
2. Architectural Design Development. This section should change little if at all from the PDR/CDR. Simply present the chosen architectural design, with any changes in response to the sponsors comments from the PDR/CDR.
    a. NOT REQUIRED IF SUCCESSFUL AT CDR/PDR: a review of your feasible alternatives – perhaps shown as hand sketches.
    b. NOT REQUIRED IF SUCCESSFUL AT CDR/PDR: Presentation of any or all of the following – logical arguments, analyses, mock-ups, test results, risk analysis, cost analysis, etc. - that argue for or against each feasible alternative, leading to a single recommended alternative.
    c. REPEATED AND UPDATED AS NECESSARY FROM CDR/PDR: Inclusion of enough design detail to complete a conceptual design – this is an architecture proposed through the subsystem level, which includes:
        i. *Undimensioned* CAD drawings - 3-D rendered CAD assembly drawings (Solid Works) of design concept(s) – dimensions are not required yet, show the entire device, subassemblies and views of areas critical to understanding the concept.
        ii. Product hierarchy - A description of the subsystems and components, their interfaces, their logical and physical layout appropriate for a conceptual design.
        iii. Detailed CDR Economic Analysis - Include a Bill of Materials, such as a parts list, part costs and total cost, and your cost to manufacture.
    d. A course requirement is that each team demonstrate in either a, b or c:
        - Usage of modern engineering tools – e.g. commercial software such as FEA, Working Model and other simulation software, spreadsheets, data acquisition, CAD, etc. Update from PDR/CDR if changed.
        - Application of fundamental engineering analysis methods, based on simplified analytical models with calculations. Choose your calculation carefully, only do what is appropriate and necessary to your project. Discuss with your instructor or technical advisor what you plan on presenting here. Put calculations details in the appendix. Update from PDR/CDR if changed.
3. Requirements - List requirements that are derived and those that have originated from the sponsor or other stakeholders. Place these in outline form, the first outline level is the system level, followed by the subsystem level requirements, and component requirements if any at this time. Consider also requirements that are based upon economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political factors. Update from PDR/CDR if changed.
4. Concept of Operations (ConOps) – Describe how the system will operate. Add safe

operating instructions here for the system.

5. Validate and Verify – Formulate a test plan, to be performed in Phase D to test the system to show that each measurable system requirement is met (this is System Verification). Present brief, preliminary test plan that will demonstrate that the system will function according to the ConOps and satisfy the mission objective (this is System Validation). Document your test results. Did your subsystems' test results satisfy requirements? If not, what action did you take to meet requirements? Did your system testing satisfy system-level requirements, can it perform the ConOps, and does it satisfy the mission objective?
6. Interfaces and ICD – List the mechanical, electrical, thermal and operational boundaries at this point in time, if any. Update from PDR/CDR if changed.
7. Mission Environment – Describe the mission environment and its effect, if any, on the design. Update from PDR/CDR if changed.
8. Technical Resource Budget Tracking – identify and estimate technical resource budgets if relevant and necessary - such as mass, volume, power, battery, fuel, memory, etc. *Do not put your final bill of materials (BOM) here, that should be in the management section below.* Update from PDR/CDR if changed.
9. Risk Management – The systems engineer will be able to identify risks to safety, performance and program. Perform Failure Mode Analysis if called for. Update from PDR/CDR if changed.
10. Configuration Management and Documentation. Update the team drive and baseline the CDR documents. Summarize how the configuration is managed. Update from PDR/CDR.

SUBSYSTEMS DESIGN ENGINEERING –
Include 3-view orthographic projections, fully dimensioned, of all parts that must be manufactured (Refer to the website if guidance and drawing standards). Drawings must be approved by the designer, drawer, and technical advisor. Include assembly drawings, schematics of hydraulic, pneumatic and electrical systems if needed. Complete the parts list, which could be in a bill of materials table. Update and refine 3-D solid models, engineering analyses, economic analyses. Answer any concerns of industrial sponsor. Update the design details of each subsystem based on any changes you made since the CDR, including dimensioned drawings (drafts) sufficient so that parts can be made, completed/updated analyses, complete bill of materials for each subsystem can be included here or in the Project Management section, assembly drawings and any schematics (e.g. hydraulic, electrical, etc.). Include safe operating instructions for the subsystem(s) if appropriate, or present safe operating instructions of the system as a whole in the ConOps section.

PROJECT MANAGEMENT – Show project management structure (show how tasks are assigned on the basis of multifunctional areas), actual project costs on a Bill of Materials, any Gantt Charts [5] or Work Breakdown Structure used during the semester. Updated for this semester. Total updated project costs need to be complete at presentation time.

PROGRAMMATIC QUESTIONS – Answer each of the following questions, in a single paragraph for each question. It is permissible and recommended that you discuss your proposed responses with your technical advisor or instructor before the report is due.

- (f) Discuss any professional and ethical responsibilities that came up in your project (if any), and what your team did to address them and why.
- (c)Discuss any economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints related to your design, and how your team chose to address them.

- (i)Discuss the important of lifelong learning, and present at least one new area and topics that your team had to learn in order to complete your project, and what methods you used to become educated on the things you did not know before.
- (j) Discuss any contemporary issues related to your project and design, (such as energy, environment, water quality, medical, job creation, etc.)

CONCLUSIONS

Restate the primary information and results. Update. Add your overall observations and list of suggested tasks for future work.

REFERENCES

A list of reference citations (e.g. textbooks, technical articles). For a format for a reference list, see the example below.

APPENDIX

▪ Pages from catalogs and technical description for important parts and components that were purchased.
▪ Information from suppliers, price quotes.
▪ Details of calculations described in report.

An ORR Power Point Presentation is not Required, but Prepare a Demonstration

Demonstrate your prototype. In Systems Engineering parlance, this demonstration is a "System Validation" exercise. Perhaps demonstrate the system by operating in an environment that is as close to the operational environment as possible. Operate in a scenario to emulate the Concept of Operations as best you can, without performing the actual mission. Demonstrate as best you can that the system meets the mission objective.

At the ORR demonstration to your sponsor, turn in:

- *The ORR report hardcopies – the number of copies the sponsor requires, with 1 copy with CODs attached for Dr. Beale.*
- *Your design notebook.*
- *Upload pdf of ORR report onto CANVAS assignment.*

References

[1] MECH 4240-50 Class Web page: http://www.eng.auburn.edu/users/bealedg/MECH4240-50/
[2] Introduction to Communication: http://www.eng.auburn.edu/users/bealedg/MECH4240-50/#Q13
[3] Machine Drawing Format http://www.eng.auburn.edu/users/bealedg/MECH4240-50/#Q15
[4] Online Ethics Center for Engineering and Science: http://onlineethics.org/eng/cases.html
[5] Gant Chart online: http://www.ganttchart.com/