



1. You're on the Team

Think Tank!!!

Congratulations! You have been selected for an internship at Cogitate ([koj-i-teyt]). Cogitate is a leading-edge professional think tank organization that provides consulting and research services to a variety of government and commercial Customers in various scientific and engineering domains. As part of Cogitate, you will be required to work with your fellow interns to address the needs of your Customers in an innovative, high quality, timely, and cost-efficient manner. Show us what you've got!

Learning Points:

- Participation, communication and cooperation by all team members are essential to attain team and individual goals.
- Understand and leverage the strengths of your team members.
- It is critical to understand Customer requirements to ensure that what you produce will meet them.
- There are many solutions which can support a Customer's mission. Prioritization must be done based upon Customer requirements, cost, schedule constraints, etc.
- Problem solving requires that team members keep an open mind to a variety of potential solutions.

Customer Deliverables:

Program plan

- 🍏 Organizational Chart
- 🍏 Role Descriptions
- 🍏 Schedule / Plan Questions
- 🍏 Brainstorm Ideas
- 🍏 Risks
- 🍏 Prototype

Leadership Skills

Teaming

- For an individual to be successful, the team needs to be successful.
- In a team environment, each person needs to be aware of others' needs.
- Consider the strengths and weaknesses of all team members.
- Examine the individual roles people play within the team.

Teaming is an important aspect of the Raytheon culture. Programs are generally too large for one person to complete and require a team from only a few to over several hundred. Successful teams are open, encourage creative thought, are inclusive, and move toward a common goal. Successful teams can move together toward their goal. They also find a way to capitalize on the talents and abilities that individual members bring to the team.

Teams are made up of people with different strengths and weaknesses. The best leaders know and understand the team dynamics and put their people in roles that utilize their strengths.

Communication

- There are many ways to communicate (verbal, non-verbal, visual, etc).
- Each team member needs to clearly and precisely deliver his or her message.
- Each team member must ensure that his or her message was heard and understood.
- If you don't understand, ask questions.

Communication is a tool used to obtain shared understanding through the transfer of knowledge. Communication between people can be verbal or nonverbal.

Verbal communication, such as speaking, is a common form of communication. When communicating verbally, we should be clear and concise in our statements to ensure that our message is heard.

Nonverbal communication is essential but is more likely to be overlooked or deemed secondary to verbal communication. Examples of nonverbal communication include touch, eye contact, gestures, body language, and writing.

To ensure proper communication, you make sure that you are heard and that you listen. If you are the receiver of an idea, it can be helpful to repeat in your own words what the sender is saying. This encourages further discussion and ensures you are both on the same page.

Can you think of some examples of communication behaviors (good and bad) that you have observed?

Example - While in a conversation with someone, what message are you conveying if you stand with your arms crossed?

Diversity

- Diversity is the inclusion of different types of people in a group or organization.
- Diverse teams provide a variety of perspectives and more creative and innovative solutions. Diverse teams are made up of people with different backgrounds such as education, religion, job experience, recreational activities, cultural background, gender, personality, etc.
- Each team member has something valuable to contribute.
- For improved success, the team must ensure that everyone contributes.
- When real constraints, such as time or cost are present, the team is still required to get the job done.
- Diversity is a fundamental part of Raytheon's culture and is considered a key to Raytheon's success. At Raytheon, everyone's contribution is valued. If everyone on a team is the "same," the "same" type of ideas will be generated.

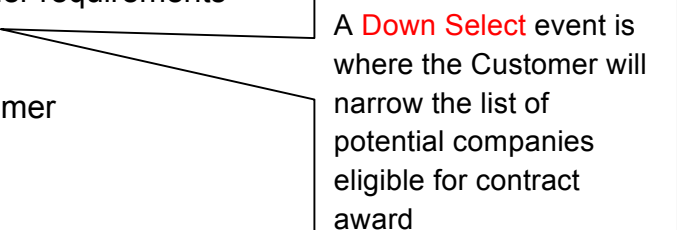
The Mission

An increase in natural disasters and hostile environments has driven a need in the public sector for a search and rescue vehicle. The vehicles need to be able to deliver supplies to isolated individuals as well as rescue injured people and carry them back to a safe location. In addition, due to the hostile environments, it must be demonstrated that the vehicle can withstand high impact forces. The Customer has broken the deliverables down to two subassemblies that will be bid separately. The first is the rescue/delivery apparatus and the second is the vehicle.

The Customer will be viewing demonstrations of potential suppliers for the two sub-assemblies in March 2015 with Customer Presentations in April 2015.

Key to a successful contract award includes:

- Demonstrate compliance with Customer requirements
- Complete by down select event date
- Minimize sub-assembly cost
- Present product package to the Customer



A **Down Select** event is where the Customer will narrow the list of potential companies eligible for contract award

The Challenge

You have been assigned to your first program at Cogitate. The RACE (Rescue And reCon Enabler) Program is a multi-million dollar program whose scope is to build a prototype of a device that can quickly extract people from hazardous, remote areas inaccessible by normal means of travel. In the first phase of the program, the Customer is requesting a prototype of the extraction design method. Currently, the program is in the requirements stage. At this critical step of the engineering lifecycle, you need to ensure that you understand the Customer's requirements. Safety and cost are key Customer care-about in this phase.

Spending more time up front to ensure understanding will save you time and money later on. Once you understand the Customer's requirements, you can begin brainstorming solutions and analyze which are the best fit for the requirements.

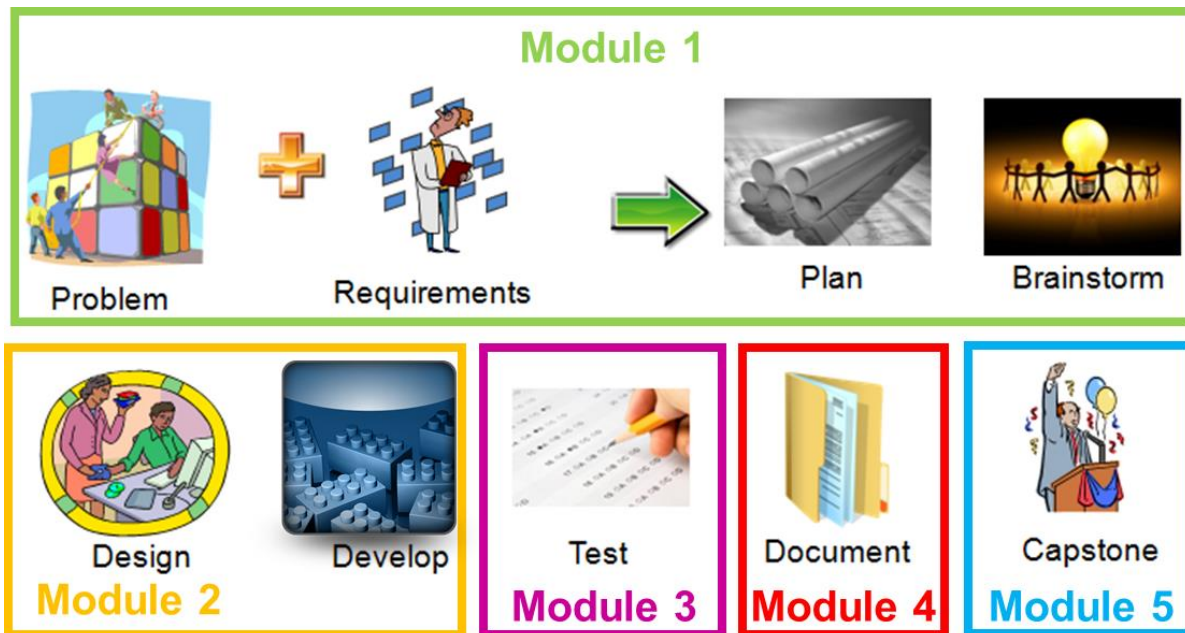
Engineering Lifecycle

The Engineering Lifecycle includes the tasks executed to realize a marketable product. Initially, a Customer problem or need is identified. There are typically two ways that requirements are then developed:

1. Discussion between the Customer and the Engineering company
2. Customer dictated

Once the requirements are understood, a program plan for execution needs to be defined and solutions are brainstormed and prioritized. Then, the design phase tackles the problem through a detailed definition for the technical solution. During development, the design will be implemented. To ensure the product meets the Customer's needs, it must be tested against the requirements. Finally, the program will demonstrate the proof of concept to the Customer, who will decide which company will be awarded the contract.

In Module 1, the focus will be on setting up the program, understanding the problem to be solved plus the requirements, creating a plan for the program, and brainstorming ideas.



Eggstraction Activity

A **prototype** is an original model on which something is patterned. It is a functional form of a type or design of construction.

Objective

To design a prototype device operated by one person that will extract a Grade A Medium egg from the middle of a 4.25 meter radius circle without breaking or cracking the egg.

Technical Terms

Circular motion is the movement of an object along the circumference of a circle or rotation along a circular path. Examples of circular motion include a satellite orbiting the Earth at constant height, a car turning through a curve at a race track, and a gear turning inside a mechanism.

Requirements are the guidelines a program must follow and are provided by the Customer. They help in understanding Customer needs and expectations.

Requirements

- 1) Each team will construct the device before the day of the competition.
- 2) Each team will be responsible for the secrecy of their design.
- 3) The eggs will be provided and they will be raw.
- 4) The device may be constructed of any kind of material.
- 5) Participants can use pulleys, motors, carts, remote control vehicles, etc. to move the egg outside of the circle.
- 6) The operator cannot touch the pavement within the 4.25 meter radius circle and cannot enter the space above the circle (an imaginary vertical cylinder).
- 7) The cost of the apparatus must be recorded.

Event

- 1) The circle will be outside on a rough concrete pavement in a street between two curbs, or, on a gym floor covered with plastic if it is raining outside.
- 2) The egg will be inspected by the judge within one minute of the extraction.
- 3) Only one extraction will be made with each team's device.
- 4) Each team will have 5 minutes to set up the device before the clock starts.
- 5) No part of the device may be inside the imaginary cylinder before the clock starts.
- 6) If the egg has not been extracted after 4 minutes, the clock will be stopped and the task considered incomplete.

Scores

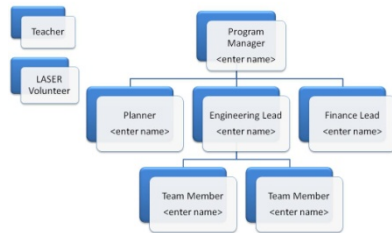
Scoring will be based on time to complete the task and the cost of the device. The egg must not be cracked or broken. Tie-breakers will be based on creativity.

A success factor = time (seconds) x Cost (\$) should be report by each team.

Program Information

As a program is formed, several decisions need to be made early on pertaining to the structure of the program and how tasks will be executed on the program. Organizational tools used to accomplish definition of the program structure are an organizational chart and job descriptions table.

RACE Organizational Chart



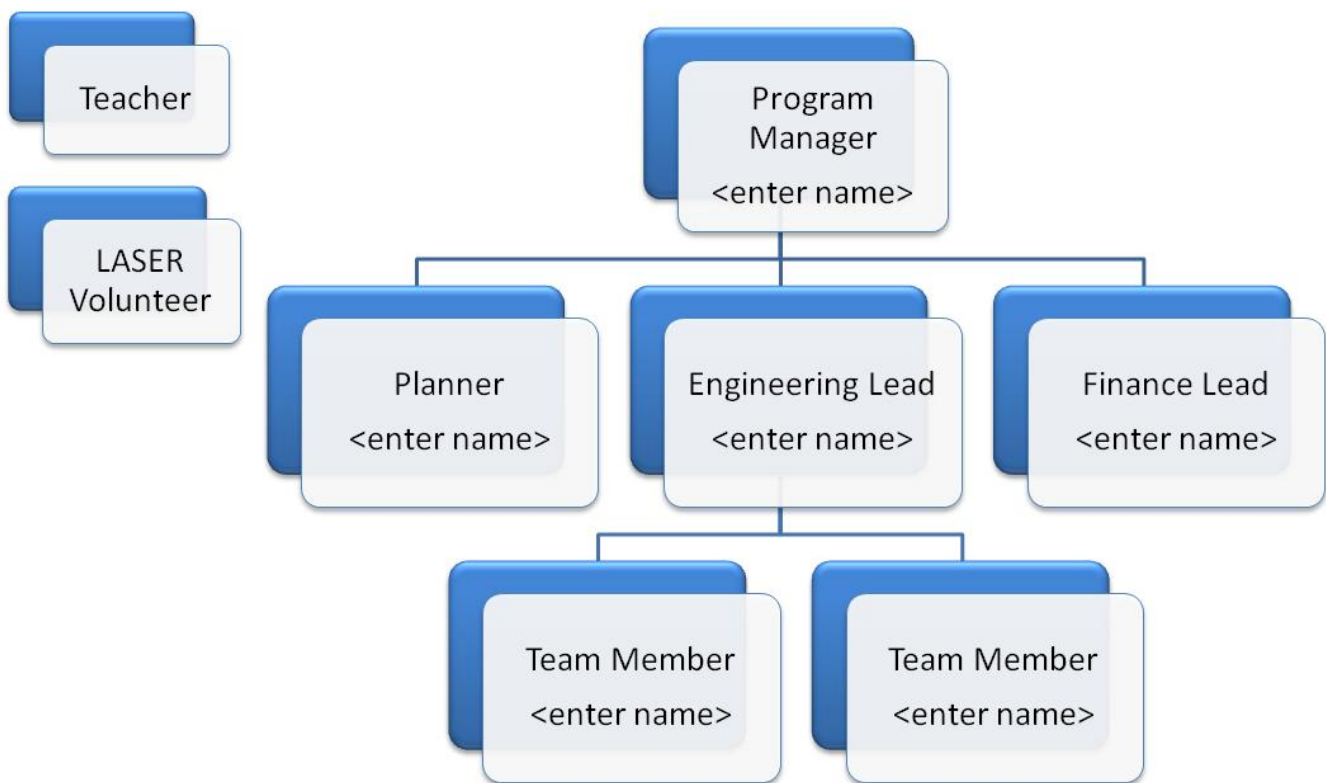
Teacher	The teacher is the real classroom teacher. The teacher may also act as the Customer.
LASER Volunteer	The LASER Volunteer is the person from Raytheon in the classroom, is the team mentor, and may also act as the Customer.
Program Manager	The Program Manager is the person ultimately responsible for the team's decisions. The program manager must be knowledgeable in all critical decisions, and provide clear leadership to the team. The Program Manager is responsible for assuring all class pre-work is completed.
Finance Lead	The Finance Lead is responsible for keeping track of the budget, actual and estimated. The Finance Lead should provide regular updates on the state of the budget to the Program Manager.
Engineering Lead	The Engineering Lead is responsible for all engineering decisions, and must get approval from Finance before purchases, and must provide regular updates on critical decisions to the Program Manager.
Planner	The Planner takes input from the Program Manager and the other leads and puts together a schedule for completing all tasks. The planner must keep the schedule up-to-date to report progress (or lack thereof) to the Program Manager and Leads. The Planner is responsible for rubric maintenance, and bringing it to each class working session.
Team Member	Each team member will have tasks he/she is responsible for. The team member must support the lead, and helps provide creative solutions to the overall project.

Organizational Chart

An Organizational Chart is a tool that enables a program to identify the roles on the program, identify team members, and assign responsibilities. Once the roles are identified, then resources (people) can be assigned to a role on the Program which is shown in an organizational chart. The picture below is an example of an organizational chart.

Instructions: Using the RACE Organizational Chart below, assign and record the team member names.

RACE Organizational Chart



The Organizational Chart enabler is included in the Curriculum Enablers that will be provided by your teacher. Your team may choose to update the chart in the book or in the enabler.

Job Descriptions Table

Job descriptions define the specific tasks that are executed on the program by a resource in a specific role.

Instructions: Review the job descriptions below and edit the descriptions, if needed, to document what each role will be doing on the program.

This process will communicate expectations regarding actions to be done on the program. An example of editing a job description is shifting maintenance of the rubric from the Planner to the Finance Lead.

Note: Teacher and LASER volunteer roles are not allowed to be edited.

Teacher	The teacher is the real classroom teacher. The teacher may also act as the Customer.
LASER Volunteer	The LASER Volunteer is the person from Raytheon in the classroom, is the team mentor, and may also act as the Customer.
Program Manager	The Program Manager is the person ultimately responsible for the team's decisions. The program manager must be knowledgeable in all critical decisions, and provide clear leadership to the team. The Program Manager is responsible for assuring all class pre-work is completed. The program manager is responsible for the program plan. This role is also responsible for coordinating the development of presentation materials.
Finance Lead	The Finance Lead is responsible for keeping track of the budget, actual and estimated. The Finance Lead should provide regular updates on the state of the budget to the Program Manager.
Engineering Lead	The Engineering Lead is responsible for all engineering decisions, and must get approval from Finance before purchases, and must provide regular updates on critical decisions to the Program Manager. The Engineering Lead is also responsible for understanding, designing and developing to the project requirements as well as coordinating the design review. Integration is also the responsibility of the Engineering Lead. This role is responsible for creating the test plan.
Planner	The Planner takes input from the Program Manager and the other leads and puts together a schedule for completing all tasks. The planner must keep the schedule up-to-date to report progress (or lack thereof) to the Program Manager and Leads. The Planner is responsible for rubric maintenance, and bringing it to each class working session.
Team Member	Each team member will have tasks he/she is responsible for. The team member must support the lead, and helps provide creative solutions to the overall project. A team member is responsible for the Engineering notebook as well as recording and posting team minutes. This role will also carry out the test plan and record the data.

Schedule

A schedule is an enabler that defines major milestones for a program and the high level tasks needed to achieve the milestones. Resources and hours needed to complete the tasks are assigned per tasks. The schedule serves as the baseline for tracking progress.

Instructions: Using the enabler and dates provided for Customer reviews, fill in the schedule with Task ID, Task Name, Duration, Dates and Resources. The tasks should include all actions to be taken to successfully complete deliverables.

Team Member Name, Phone, Availability

LASER Module Dates: Oct. 17, Nov 21, Jan 16, Feb 20, Mar 20

Top 15 Winning Teams Capstone Date: April 17

Top 6 Winning Teams Raytheon Tour Date: May 1

Schedule		
Team Name		
Team Member Name	Phone #	Day and Time Available to Meet/Work on Project

Task ID	Task Name	Duration	Planned Start Date	Planned Finish Date	Actual Start Date	Actual Finish Date	Resource Name(s)
1							
2							
3							
4							
5							
6							
9							
10							



What is your plan if.....

Someone is sick on days the artifacts are due?

The person responsible for the device/project is not in class the day of the test?

Someone is not able to meet when the rest of team is available to work on the project outside of class?

On presentation day, someone on your team is absent?

Brainstorming

Included below are basic rules for brainstorming.

- No criticism of ideas – one idea can lead to another solution
- Think outside the box – be creative and think big
- Do not be constrained by the current situation, rules or resources

The goal of this step is to get ideas that could lead to other solutions.

Round Robin Brainstorming. (Other methods are available.)

- 1) All team members participate in turn.
- 2) Only one idea per person per turn.
- 3) If you are out of ideas, say pass.
- 4) Facilitator records all ideas.
- 5) Accept all ideas at face value... don't discuss, edit, evaluate or criticize during collection.
- 6) Wild, "blue sky" ideas are encouraged.
- 7) Brainstorming is fun... humor is okay.
- 8) Continue in rotation until all team members say "pass".

After the team has documented the ideas for the egg drop activity, critical thinking should be used to identify potential risks to the solution. A risk is something that could go wrong. This risk list, should be used to avoid potential problems with your design that will increase cost and schedule if realized.

Instructions:

Capture brainstorming ideas on the space below. After brainstorming for the egg drop activity, brainstorm a list of risks associated to your selected design.

Raytheon volunteers will be available to help with the brainstorming process.

Brainstorming Ideas

Risks

Next Class

Prior to the next class:

If your program team members change, update the program org chart, roles and schedule plan.

Brainstorm ideas for the Eggstraction re-design activity.

Module 1 Rubric

Due	Due Date	High School – Module 1 Rubric	Pts
During Mod 1 LASER class	Oct. 17, 2014	Team Organizational Chart	13
During Mod 1 LASER class	Oct. 17, 2014	Role Assignments	10
During Mod 1 LASER class	Oct. 17, 2014	Schedule	13
During Mod 1 LASER class	Oct. 17, 2014	Plan Questions	12
During Mod 1 LASER class	Oct. 17, 2014	Brainstorm Ideas	13
During Mod 1 LASER class	Oct. 17, 2014	Risks	13
During Mod 1 LASER class	Oct. 17, 2014	Discussion and Career Questions	13
1 week after Mod 1 LASER class	Oct. 24, 2014	Prototype	13
			100

Discussion

1. What are the strengths of your teammates?
2. Present to the class, your program, team member roles, schedule, and plan if schedule can't be met.
3. How did you refrain from self-editing or critiquing others during brainstorming?
4. How did the diversity of your team impact the selected solution?

Outbrief Instructions

For the outbrief, each team will have the opportunity to discuss their answer to one of the discussion questions. Remember what you learned in the pre-work about presentations.

As time allows, feedback will be provided on the outbrief.

Real Life Applications

Skills

Communication, teaming, adapting to team differences, leveraging diversity, adapting personal leadership style, program planning, requirements analysis, cost analysis, Customer relations, sciences that contribute to propulsion analysis

Applications

Teacher, Systems Engineer, Architect, Research Scientist, Psychologist, Mechanical Engineer, Environmental Engineer, Business Manager, Accountant, Aerospace Engineer, Customer Relations

Career–Summary Questions

1. I found that I have the following skills that helped me complete Module 1.
2. I discovered I have a gap in the following areas that can be a focus for future development.
3. List the aspects of Module 1 you enjoyed the most.
4. With the answer to Question 3 in mind, describe the types of career in which you might excel. **(Note, you are not limited to those listed above.)**

References

1. Reprinted with permission from IEEE at <http://tryengineering.org/> (The Sloan Career Cornerstone Center has provided engineering and engineering technology degree profiles to TryEngineering.)
2. Photos <http://www.nasa.gov/home/index.html>
3. Discussions [Wikipedia](#)
4. Definitions <http://www.merriam-webster.com/dictionary/>