

NOTES FOR TEACHERS & FACILITATORS

1. PRIOR TO THE WORKSHOP

Go to [this page](#) on the CFPA website.

Download and print the documentation listed below in the quantities indicated. The *Team Registration* and *Student Media Consent Forms* must be completed and submitted at the Workshop.

1. Team registration form (1)
2. Student media consent form (1 per student)
3. Notes for teacher-facilitators (1)
4. Fluid power fundamentals (1 per student + teacher copy)
5. Lifter instructions (2)
6. Rotating platform instructions (2)
7. Design process cube sides (legal) (1)
8. Design process cube instructions (1)
9. Portfolio checklist (1)
10. Portfolio notebook template (1)
11. Examples of good design portfolio contents (1)
12. Iso-Ortho views illustrated (1)
13. 2019 Challenge scenario (1 per student + teacher copy)
14. Challenge rules (1)
15. Local Challenge rubric – short (1 for students + teacher copy)
16. Local Challenge rubric – detailed (1)
17. Hints for overall success (1)
18. Hints for device design & construction (1)
19. Pre-test (1 per student)
20. Post-test (for Challenge Day) (1 per student)

Note there are two versions of the *Local Challenge Rubric*, a *short version* and a *detailed version*, so choose the most appropriate version – we recommend the short version for the students and a copy of the detailed *Local Challenge Rubric* (which is used by the judges) for each teacher.

Three things to have your students do before they attend the Workshop Day:

- A. Have the students complete the *Pre-Test* before they do either B or C below. Please bring the completed *Pre-Tests* to the Workshop Day.
- B. Watch one or both of the following *videos*:
<https://www.youtube.com/watch?v=vnMWhuAT3ZI>
Seven minutes long. More careers based.
<https://www.youtube.com/watch?v=7kfDvxH2bcw>
27 minutes long: More applications based.
- C. Review the *Fluid Power Fundamentals* file.

2. WORKSHOP DAY

In addition to the forms and documents mentioned in part 1, please bring a cheque for \$125 made out to the *Canadian Fluid Power Association* to the Workshop. (You will be getting an invoice and instructions by email prior to the Workshop.)

At the Workshop, students will:

- a) Explore the materials and tools
- b) (Introductory activity): Make a design process cube
- c) Build the *Lifter* and the *Rotating Platform* devices
- d) Be introduced to the *Challenge Scenario*
- e) Seek clarification of the *Challenge Scenario* through questions & answers
- f) Be made aware of the importance of the *Design Portfolio* and the design process
- g) Know what to bring to the Challenge Day
- h) Review the *Hints for Success* and *Hints for Device Design and Construction* files

A. Explore the materials and tools

Introducing the use of tools

Demonstrate how to use a saw and mitre box safely by cutting two wood strips 10cm long using a piece from the materials kit. Show how two green cardboard corners secure the wood at 90 degrees using a SMALL amount of wood glue. The sheet from which gusset corners are cut can be used as a 90° template.

Dispensing wood glue

In the kits there are small plastic cups. These are used to hold a small amount of wood glue. Each team of four needs a bottle of wood glue and there are stirring sticks to apply the glue to the wood and cardboard when assembling a device. Emphasize that only a small amount of glue is required to secure the pieces.

B. Make a design process cube

Note: the steps in the design process are discussed in detail in step E below.

Ask each pair of students (2 per team) to make a square with external dimensions of 10cm using one long piece and using a ruler, pair of scissors, mitre box and small saw. Do not tell the students how to do it, let them make mistakes and discover that the thickness of the wood matters.

There are three ways to make the square: (2 X 10 cm) + (2 X 8 cm) or (4 X 9 cm) or (4 X 10 cm using 45 degree mitre cuts), demonstrating that there are different ways of assembling the same thing.

The two 10 cm squares can be combined to create a cube with the addition of four 8 cm pieces and then covered with the Process Cube Sides. The sides will identify the six steps of a Design Process.

C. Build the Lifter and Rotating Platform devices

Draw attention to the *Lifter* and *Rotating Platform Instructions*.

Open the two kits. Notice that in the Lifter Kit the axle holders (white) are pre-cut and have a hole punched in them for the dowel to rotate in and that one of the syringes is pre-drilled in both kits.

The Lifter comes together after a fair amount of construction. The Rotating Platform is less “glamorous” than the Lifter and easier to make.

Both models demonstrate important techniques. The plunger can be used for linear movement directly, but where linear-to-rotary movement is required, the syringe must pivot or turn – hence, the syringe platforms. This is important as undue stress, particularly torque, will apply sufficient pressure to the clip for it to tear away from wood. It is recommended that the white clips be placed firmly on cardboard glued to wood and allowed to dry before the clip being pressed firmly on. Both the white clips and the more accommodating, gray clips with a larger sticky pad, are included in the Workshop and the Challenge kits.

At some point during the construction demonstrate how to drill a hole in the plunger of a 20ml syringe using the mitre box or vice. It is best to have 2 pairs of hands available for this operation. This demonstration is for when students explore prototypes for the Challenge and need to attach syringes as actuators.

D. Be introduced to the Challenge Scenario

Read through the *Challenge Scenario* and review the isometric drawing in the *Challenge Scenario* with the students. Make it clear that all movements of the device **MUST** be controlled using fluid power. (*This is explained in more detail in Section 3C below.*)

Go over the *Challenge Rules* emphasizing safety requirements.

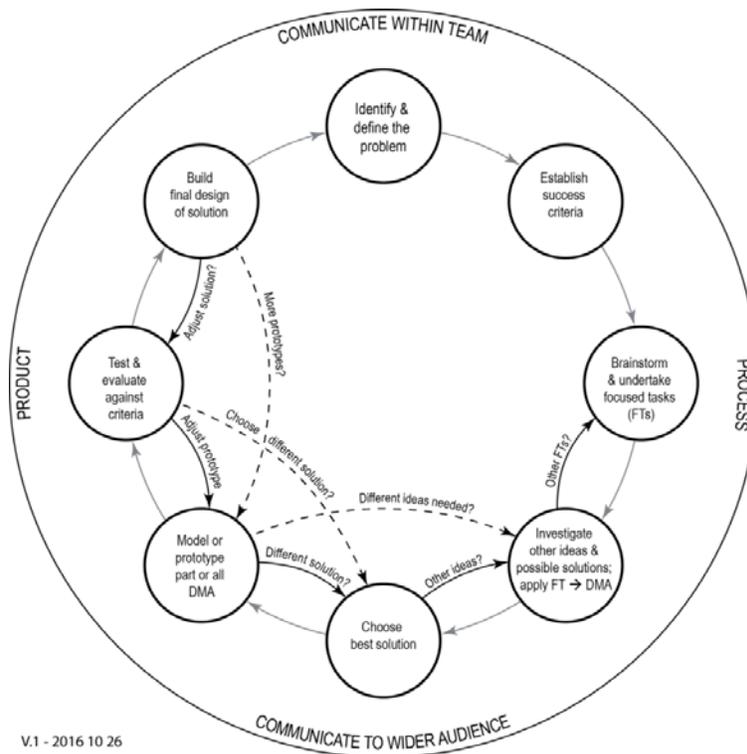
Go through the *Local Challenge Rubric* which will tell the students how their efforts will be graded.

During the four weeks between the Workshop and the Challenge Days, each team will:

- Design, build, test and fine-tune one or more prototypes of a device to meet the requirement of the Challenge Scenario
- Produce a *Design Portfolio* that comprehensively documents their design process.

E. Be made aware of the importance of the Design Portfolio and the design process

The diagram of a detailed *Design Process* below illustrates the iterative procedures involved with an advanced process



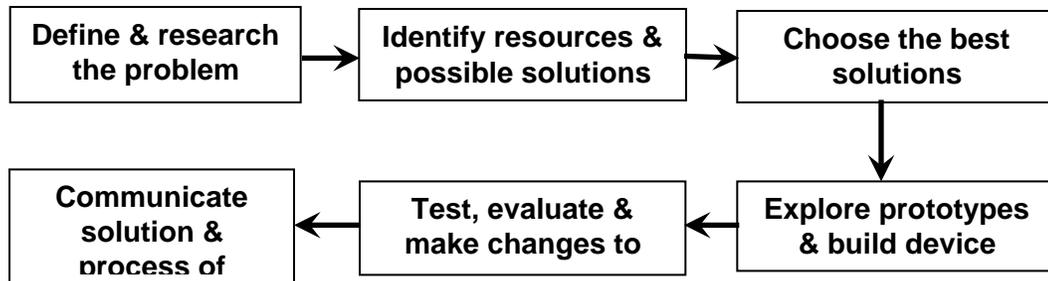
V.1 - 2016 10 26

Note: The Design Process diagram refers to FTs (focused tasks) and DMA (design and make activity).

A focused task is the exploration and investigation of a sub-system of the planned device. For example, the students will need to design a mechanism for picking up an object and this may involve an understanding of levers. The FTs here will be understanding the three classes of levers and incorporating that knowledge into the design of the pick-up sub-system.

The design and make activity (DMA) is the overall design and making of the prototype device.

This is a simplified version for students (using text from the Design Process Cube sides):



Stress the importance of the *Design Portfolio* and refer to the *Portfolio Checklist* and *Portfolio Notebook Template* and the *Iso-Ortho Diagram*.

Refer to *Samples from Successful Portfolios* to get a better idea of what a good Design Portfolio looks like.

Emphasize the need to explore different designs! Usually the first idea is **not** the best!

F. Seek clarification of the Challenge Scenario through questions and answers

At the Workshop we will go through the *Challenge Scenario* paragraph-by-paragraph, accepting questions.

Typical questions are “What happens if the object is dropped or falls over outside the boundary of the destination area?” or “Can we clamp our device to the footprint wall?”

The students must understand that they will be limited to using the materials that are in the kit that they are being provided at the end of the Workshop for constructing their Challenge Scenario prototype(s).

G. Know what to bring to the Challenge Day

Each team will bring only two copies of the *Design Portfolio* and their tools to the event. One of the Portfolio copies must be a print out that can be submitted for review by the judges. The other copy, to be used by the team to guide the construction of its device, can be another print out or an electronic version on a tablet or laptop computer.

H. Review the Hints for Overall Success and Hints for Device Design and Construction files

At the end of the Workshop Day, these files will provide additional tips that, if followed, will improve each team’s chances of success.

3. CHALLENGE DAY

A. Challenge Day schedule

9:00 – 9:30 am	Registration
9:30 – 11:30	Construction (with no involvement by teachers) Judges circulate among teams
11:30 – Noon	Construction (with involvement by teachers if necessary)
Noon – 12:30	Lunch
12:30 – 1:30	Completion of construction and testing (no teacher involvement)
1:30 – 2:30	Two-minute demonstrations of devices
2:30 – 3:00	Judges’ deliberations; presentation of awards
3:00	Departure

B. Basis of evaluation

The *Local Challenge Rubric* is used to evaluate each team’s performance. Attached to this rubric are these interview questions (which the judges will ask as they circulate among the teams):

1. What alternative designs did you look at before selecting the design you are building today?
2. Why did you select this design to use for the Challenge scenario?
3. What other materials might be useful to have?
4. How did you decide who on your team would be responsible for which parts of the project?

C. Point deductions for use of hands and dropped objects

There are specific rules about the use of hands:

- ***All movements*** of the device **MUST** be controlled ***using fluid power***.
- If your team manufactures ***a device that only works when it is stabilized by hand(s)*** then ***only 50% of the ‘moving object’ score will count***.
- ***If your team breaks the device*** during the allocated 2 minutes, then your team can repair it during the 2 minutes but ***subsequent ‘moving object’ scores will only count 50%***.
(Sometimes, in the excitement of the Challenge a team member will pull too much on a plunger and lose its operation. Hence the proviso that a quick repair may be untaken.)
- ***If your device is touched by hand IN ANY OTHER WAY, then the ‘moving object’ score will be zero for the pick and place cycle during which the touching occurs***.

In addition:

If an object is **dropped in transit** from the pick-up point to one of the drop-off zones, the object is returned to the pick-up point and the next attempt is made. No penalty is assessed.