STEM Works check-list for STEM learning

STEM space design should be driven by the intended learning that would like to take place.

Considerations:

Will the STEM learning require......

• wet areas, sinks arranged in pods in the centre at one end only to allow for flexibility. These can suit a range of tasks that depend on water, such as titrations, use of chemicals, water turbines, using data plotters in enzyme controlled experiments.

• Access to computers that can run CAD programs. To support the development of special skills and to support the design process, students will need to have access to CAD and opportunities to access just in time tutorials on how to use it. Students engage best once they have established a need to use the software. Often student teams can identify one CAD expert.

• an open space to test robots and other large projects. Students may use a range of commercially available robots or may design and build their own. They will need access to computers to program the devices and space on the floor to test their code. Often students will need to program robots to solve a challenge, which may be in the form of an obstacle course. This will need a large area to work.

• a durable floor surface which will accommodate robots or other devices (hard floor which will resist chemical and water spills).

• access to a 3D printer (need power points and provision for possible ducting or ventilation). 3D printers can be used to support the design and appraise process where students can redesign

• access to a laser cutter (power considerations and venting). A laser cutter can be used to design and produce a range of precision cut artefacts from a range of materials (wood, metal, plastic) or it can etch glass and engrave. Students can use this technology to create a range of products which can integrate into other materials. A design could be created in CAD which can be made using the laser cutter for some parts and the 3D printer for others. Students can then assemble the artefact.

• Access to a computer operated mill (eg. CNC Mill, consider power, working space, ventilation). Mills allow students to create very interesting 3D carved prototypes and engraving in timber and other materials. Mills can also be used to create moulds out of high density foam which can then in turn be used to vacuum form plastic products. Examples include the hull of a boat or a catamaran. In this case a student could create a design of a hull in CAD and create a small 3D model using the 3D printer. This could be tested in a water bath before creating an actual real life foam model. This can then be vacuum formed to create several identical hulls which can be used to make a solar boat, barge, and so on.

• Students to use some hand tools, such as files, screw drivers, spanners, hammers, pliers, wire cutters. Will they need access to a small drill press, hand saw, vice or
clamps? Effective storage space of tools will be needed to allow the easy collection and access to tools and accountability. Appropriate bench space would be needed to house a vice, small drill press, and other similar tools. Example of the Concept 2 Creation (C2C) model car racing build program. In this example students build a model slot car from scratch using parts provided through C2C. Student need access to files, screw drivers, a vice, soldering iron, pliers, metal cutters, sand paper and a space to work in a team. A small drill press can be useful if students want to re-engineer the car by making new wheels, redesigning the chassis and making it using the 3D printer.

• Students to solder, as this will require appropriate space and power point access. Soldering irons are a great tool to allow students to engage with basic electronics. Connecting globes to a series circuit and placing it into a small project made using the laser cutter can demonstrate the integration of multidiscipline. Students designing circuits and ensuring that the integration works well is key.

• Access to technology such as wireless projectors so that students can present to the class easily from their own device. Small group access to larger monitors to enable greater collaboration space. Students collaborating on solving a problem can then present their predicted solution to the class, this process of deliberating and sharing ideas will benefit the class as a whole as they push towards the most effective and productive solution prior to engaging in the next phase of researching and creating their prototype.

• Comfortable furniture to allow for students to work together and move tables and chairs easily

• Storage space to allow for student artefacts to be stored and in some cases have these displayed as works in progress. The lack of space can cause critical issues with some projects, eg. Students who building environmentally energy efficient models of houses take up a lot of storage space.

• Space for students to move around

• Access to printers

• Easy access to a dedicated secure preparation and storage area where specialised equipment and tools can be securely stored (space for robots, sensors, electronic equipment, materials, model racing cars and tracks, planes, remote controls,.. This space is critical because the number of projects which may be occurring across all classes at any given time could be very large if the STEM space is going to be used effectively.