# The minutes for Brainstorming (2/06/19 in the Building 327)

**Patrick**: He was impressed about the exaskelton tech. However, in order to handle heavier stuff, we need a mobile assist robot which has a fixture on the floor (or wall/ceiling). He is also impressed about the mixed-reality operator interface studied at ANL.

**Young**: It is called interaction control that includes with the admittance and impedance control.

**Sabri**: UIC has a great experience of the interaction control.

He proposed to form an organization among local universities and institutions in Illinois. In this category, students can go around in the group.

He asked a specific contract to collaborate with Fermilab and to work a student in the Fermilab program. (Need MOU?)

**Mayling**: Mike pointed out in the morning that the DOE initiated us to develop the robotic tech at Fermilab. (He suggests) We will have a resource for the R&D with students.

**Sabri**: He asked any time frame (to apply the support from the DOE).

**Paul**: There is a discussion in Washington DC about the budget 2021.

He also pointed out that we could have two beneficial aspects (with the collaboration); students can learn the different aspects to apply the robotic tech; Fermilab could have a man power (momentum) and fresh intelligence.

Patrick: He has an experience on the High Power Target R&D that the DOE provides us separate resources to collaborate with institutions (and university?). We can spend money to educate a student.

Fermilab has a Ph.D program which is applicable for not only an accelerator student, but also engineer, even MS and undergraduate students. We will have a resource to support the student via the DOE budget.

**Sabri**: The University can provide a student with two ways; they can send an undergraduate student with a cheap cost; For MS and Ph. D, professors in the university look the money flow, i.e. how much dollar flows into the their faculty.

**Mayling**: We need to understand more about the university business. We should move on the other topics. She asked Keith, Kyle, and John who actually built a robot at Fermilab what they are impressed from the workshop.

**Keith**: He saw a lot of advanced technologies at CERN. Especially, he was impressed about their robot arm system, which can be applied for our autopsy facility.

Paul: He talked about the recent incident of the MI collimator.

**Venu**: He commented about Patrick’s first comment. SNS has demonstrated about a mobile assist robot for assembling a payload to an aircraft. It was done in 2006 or 2007.

**Kyle**: He came late because of taking a training class. He does not have any strong opinion.

**John**: He is interested in applying the robotic technology for fixing the collimator.

**Venu**: He is also missing a big part of morning session because of his delay arrival. He asked our discussion in the morning session.

**Mayling**: She briefly explained about the morning session. She pointed out that we have various issues in the various conditions. We realize that there is no simple solution.

**Venu**: He asked that Fermilab could apply a diagnostic train (monorail) like CERN. Fermilab folks looks negative since there is no space to add a rail.

**Mario**: He talked about how he started forming the robotic facility in CERN. He started to buy a robot from a vendor. He realized that none of robot can survive after several operations. He comments that we need a person who has an envision and know how to adapt the robotic technology to the (accelerator) system for next couple of decades. They started the facility with seven people and now it grows with 70 people. He pointed out that we need an expertise to understand accelerators, issues, and robotic technologies.

He said that we need a strategy to develop the robot tech in the lab. We need a strong team-work to accomplish the project.

**Noah**: He asked how the CERN robotic group start.

**Mario**: He mentioned that he built the control system first (CERNTAURO framework?). Then, he adapted the existing robotic system with vendors. Then, he identified the issue and fixed it.

**Patrick**: We realize that we need to hire people. We should describe our statement to the DOE; if we do not have the robotic facility, we are not able to maintain the high power beam facility.

He brought out the analogy about the story for introducing a 3D printer to the lab. When engineers realized a function of the printer they made it useful. He believes that the robotic facility would be similar situation.

**Mayling**: She is wondering whether industries may or may not be interested in collaborating with us.

**Mario**: They need a profit to work together. They also need to know the practicality of the application.

**Venu**: He asked to spend money to build a mockup model. This is useful to find out what kind of functionality and what kind of robot we need.

**Mario & Patrick**: We have a mockup model.

**Patrick**: If we learned too much from the mockup model, we will stack.

We need a strategy to envision the project.

**Young**: ROS is useful. There are many ways to use it. ROS has a capability to integrate many functions.

**Mario**: He argued that ROS is not reliable. According to him, we need an expert to apply ROS.

**Jon**: He has an experience to work with company. He achieved to introduce 30 % automation system in three years. He also pointed out that engineer should understand an issue to work on. Visual inspection is one of the most effective way to understand.

**Katsuya**: Asked professors how they are interested in collaborating with us if we have resource.

**Sabri**: They are. We need a solid strategy to work together.

**Patrick**: Probably, it takes a year to get support from DOE. He prefers to start from a small working group that includes (at least?) one expert and a couple of young workers (engineers?). We will build a consensus plan. (I think we need to build a framework.)

**Don**: He proposes to form the robotic focus group. He suggests us to form a scholarship.

**Patrick**: During conversation with Jon, they consider to have a design contest for young people.

**Sabri**: There are more than 1000 students studying robotics. We should give them more opportunities to work at the national lab.

**Young**: We should provide a solid plan, object, and priority.

**Mario**: We also need to involve a technical aspect and management in the strategy.

**Patrick**: Not too strategic. We should specify the first issue and move on the next step.

**Paul**: AD proposed to form the robotic group but it should open for other dept.

Attendees:

Keith Anderson, Sabri Cetin, Cory Crowley, Noah Curfman, Paul Czarapata, Mario Castro, Kyle Hazelwood, Patrick Hurh, Gordon Koizumi, Jon Komperda, Simon Kudernatsch, Dennis Nicklaus, Young Soo Park, Donald Peterson, Jacob Reed, Eric Swanson, Venugopal Varma, Mayling Wong-Squires, and Katsuya Yonehara