

# Debris in Space Autonomous Removal Mechanism (DISARM)

## Milestone Two

### Team Members

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Project Manager: Kyle Watkins

Project Systems Engineer: Luca Rizza

Electronics System Lead: Michael Leard

Electronics System Supporting Engineers: Nouraldean El-Chariti, Ali Lebbar

Grappling System Lead: Daniel Soto

Grappling System Supporting Engineers: Laura Guziczek, Ali Lebbar, Davey Renoid

Control System Lead: Nouraldean El-Chariti

Control System Supporting Engineers: Laura Guziczek, Matthew Intriago, Michael Leard

Structure System Lead: Vincent Panichelli

Structure System Supporting Engineers: Davey Renoid, Ali Lebbar, Daniel Soto

Client: Dr. Markus Wilde (mwilde@fit.edu)

Faculty Advisor: Dr. Silaghi (msilaghi@fit.edu)

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## Current Milestone Progress

Task	Completion %	To do
1) Develop models for 27 cubesat unit and 10 cubesat unit debris	100%	none
2) Export 3D Debris and DISARM prototype models into Gazebo	100%	none
3) Develop algorithm pseudocode	20%	continue sensor research
4) Implement pseudocode on Gazebo models	10%	upon completion of algorithm research

## Discussion

Task 1: Developing the 3D models for the cubesat was challenging. To make it easier for myself, I decided to design them using Solidworks, since it is better for making CAD designs instead of Gazebo. To have a base case, I designed a 1 unit cubesat model, and from that model scaled it to a 10 unit cubesat and a 27 unit cubesat. Since a cubesat is simply the representation of a potential debris, extrusions of different designs and widths were placed on the cubesat to test the algorithm's potential to adjust to welding on different debris depths.

Task 2: Gazebo models run on URDF and SDF files which is not compatible with Solidworks. Exporting these files and keeping the designed meshes and extrusions was as challenging as designing them. In order to this, the files had to be exported using a plugin to convert Solidworks files to URDF. During this export, all the CAD details were lost and had to be fixed. To fix the files, I had to convert all the STL files (each individual part of the model is converted to STL which is packaged by the URDF) to collada using FreeCad. Then once I had the collada files of each part, I edited the textures using Blender. From Blender I exported the files as separate collada files. Once this was done, all that was needed was to convert the URDF file into an SDF file using the Linux terminal, and make sure that the files were in order for the model. I followed this same process for all 3 debris models as well as our current DISARM prototype model which was designed through a team effort.

Task 3: Before I could develop the pseudocode, I wanted to have the 3D models I would need for the simulation ready before anything. This way it be easier to code each individual model on gazebo and learn as I go. With the models on Gazebo, my next steps are learning how to implement

the sensors on the DISARM model and as well code each individual part to show the prototype welding each debris type. Since the designing the models took longer than expected, the pseudocode has been delayed. Additionally, we currently have one possible sensor that we could use but have not decided if it is the most efficient.

Task 4: Since the implementation of the pseudocode was delayed, so was the implementation of it on Gazebo. However, this will hopefully be completed for the next milestone.

### Plan for next Milestone

Task	Matthew
Continue development of algorithm pseudocode	Developing the pseudocode should be clearer now with model designs
Implement pseudocode on Gazebo	Learn through tutorials online

### Discussion

Task 1 and 2: Both these tasks go hand in hand since to design the pseudocode I had to first understand how Gazebo links models to code, and from code to the simulation. Now with the completed models, I can continue learning how to implement the simulation on Gazebo, design an outline (pseudocode), and then carry on implementing the pseudocode into actual code on the simulation.

### Date(s) of meeting(s) with Client during the current milestone

#### Client Meeting Log

September 30, 2020

Second PDR Meeting

October 7, 2020

PDR Presentation

October 23, 2020

Progress Evaluation Meeting

## Client feedback on the current milestone

- DISARM should not use non-static shielding.
  - Focus on thermal and EM shielding.
    - Protect equipment from heat of weld.
    - Protect electronics from EM of large current wires.
- Use both camera vision and range sensors instead of just range sensors.
  - Linear sensors would work for design specifications.
  - Lidar sensors are too intricate and supplemental for project.
- Power source voltage needs to be distributed to each electrically dependent element depending on its supply voltage.
  - Example: Sensor requires 5V, so voltage from power source needs to be adjusted to achieve this voltage
- Discuss with team whether the dampening system is the optimal design (Currently using springs as dampening)
  - Need to justify whether the dynamics of the model will carry out its task without failure.

## Date(s) of meeting(s) with Faculty Advisor during the current milestone

### Faculty Advisor Meeting Log

October 26, 2020

Meeting to discuss milestone 2  
progress

## Faculty Advisor feedback on each task for the current Milestone

Model designs look well and now that we have those need to look at what are the next steps. Step one could be researching how to calculate the position of objects in Gazebo and implementing it into the DISARM model. Once that is done next steps could be figuring out how to simulate the weld or even begin the weld with the now calculated welding locations.

Faculty Advisor Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Matthew Intriago	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
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Faculty Advisor Signature: \_\_\_\_\_ Date: \_\_\_\_\_