The Student Space Systems Fabrication Laboratory: An Approach to Space Systems Engineering Education

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What is S3FL?

S3FL is a student-led organization at the University of Michigan dedicated to providing students with practical space systems design and fabrication experience not readily available through the usual academic curriculum. S3FL’s approach is to enhance education by coupling classroom knowledge with practical experience involving real engineering design, analysis, test, fabrication, integration, and operation of actual flight vehicles and space payloads.

Organization

All S3FL day-to-day activities are student-run with leadership roles (team leads and chief engineer) filled by the more experienced students. Administrative support is provided by the student Executive Committee (Excom) and faculty advisors. S3FL students are divided among the various projects based upon prior experience, field of study, and the students’ interest. Occasional cross-disciplinary meetings ensure that systems-level issues are addressed by the entire team.

Number of student participants

<table>
<thead>
<tr>
<th>Number of Students Participating</th>
<th>Spring</th>
<th>Fall</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>30</td>
<td>24</td>
<td>54</td>
</tr>
<tr>
<td>2020</td>
<td>32</td>
<td>26</td>
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<tr>
<td>2021</td>
<td>35</td>
<td>28</td>
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<tr>
<td>2022</td>
<td>38</td>
<td>31</td>
<td>69</td>
</tr>
<tr>
<td>2023</td>
<td>40</td>
<td>33</td>
<td>73</td>
</tr>
</tbody>
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Student demographics

- 60% aerospace engineering
- 18% mechanical engineering
- 16% electrical engineering
- 6% computer science
- 4% other

69% undergrads

Our Philosophy

Students are attracted to S3FL by exciting and challenging projects. Unlike paper design exercises offered in a classroom setting, S3FL projects face real constraints imposed by limited funds, external deadlines, and shifting requirements. The inter-disciplinary nature of these projects also requires communication between teams. This motivated, S3FL students to become team players and think of the systems level impact of their designs. Along with technical skills development, S3FL projects thus better prepare students for the real tasks and problems they are likely to face upon entering the workforce.

S3FL provides:

- Hands-on projects to apply classroom knowledge in real-world, interdisciplinary settings
- Experience working through a complete design cycle
- Development and foundation of systems engineering mindset

Also, by participating in the end-to-end development of complete space systems, students acquire knowledge and expertise during all steps of the process from requirements definition to design and test to operations and launch.

Finally, the active leadership of upper-level students as mentors and team leads enables the transfer of knowledge to incoming students while reinforcing basic principles to the mentors. This “see one, do one, teach one” paradigm benefits all students in the program.

These methods combined are what make graduating S3FL students wiser engineers!

Past & Present Projects:

- Vortex 1996 - 1998
- ICARUS 1998 - 2001
- FEGI 2002 - 2005
- BalloonSat 2003-2004
- TSATT / C9 2005-2006
- Climber 2005-2006
- AND MORE!!