20 November 2018

The document presented here is a Strategic Plan for Diversity, Inclusion, and Innovation, developed by the MIT Department of Aeronautics and Astronautics. The plan represents the renewed commitment of the department to creating and maintaining a culture of excellence in research and education. An integral part of this commitment is the growth of a community which is welcoming and nurturing to all its members – students, staff, and faculty. As a leading aerospace department, it is incumbent on us to step forward in this dimension, as we have in many other venues.

The Strategic Plan is the first step in our journey towards achieving these goals. The plan describes an assessment of the department’s current climate, and it recommends mechanisms and resource commitments needed to improve the diversity and inclusion of different groups within AeroAstro.

In presenting the Strategic Plan, we also pledge the commitment of the department leadership to a more welcoming and nurturing community; one that recognizes that a diversity of backgrounds and experiences enhances the quality of our research and teaching.

We look forward to feedback and suggestions on improving the plan. We also invite frank conversations about challenging issues as we progress together towards our shared goal of a more diverse and inclusive MIT AeroAstro community.

Sincerely,

Edward M. Greitzer     Daniel E. Hastings

Edward M. Greitzer     Daniel E. Hastings
H. N. Slater Professor     Cecil and Ida Green Education Professor
Interim Head     Head
Department of Aeronautics and Astronautics     Department of Aeronautics and Astronautics
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1 Executive Summary

The Department of Aeronautics and Astronautics at MIT considers diversity of all forms, be they physical, cultural, historical, or intellectual, to be a core value of our community. The scholarship of conceiving, designing, implementing and operating complex air and space engineering systems depends on a broad range of skills, experience and viewpoints. Furthermore, we recognize that our department has historically had an imperfect commitment to this value, with at best partial recognition of the importance of the different forms of diversity and the fundamental right of people to have access and be part of our intellectual pursuit. The following report represents the next steps of our department towards addressing this shortcoming and ensuring a community that is a welcoming home for all. Our specific goal is to generate immediate actions that will increase the number of underrepresented minorities and women in our department to match or surpass MIT numbers and eventually mirror the national population.

1.1 Recommendations

The following is an executive summary of the top line recommendations from the committee. Additional recommendations are contained within the specific sections as opportunities for improvement.

Community-wide

- **Continued and periodic evaluation of climate:** The Diversity Committee will collect and assess climate surveys (e.g., Student Quality of Life Surveys) segmented by demographic when possible in order to evaluate possible differences by population. Conduct annual town-hall style meetings with different groups in the AeroAstro community, to check-in on any issues, and to update them on any new developments. The committee further recommends setting specific targets for improving the climate as experienced by the entire community (especially as measured by the climate surveys), with a well-defined timeline to achieving these improvements.

- **Dedicated resources:** The Departmental Leadership is recommended to create a new staff position (for example, a “Departmental Diversity & Development Officer”) to plan, assess, fundraise, and coordinate activities between groups within and external to the Department, and examine the physical spaces available to the AeroAstro community to encourage a more inclusive environment.

- **Social engagement:** The Department is recommended to identify and promote social engagement opportunities across all levels of the Department, within the scope of diversity and inclusion.

- **Strategic plan implementation:** The Diversity Committee will issue an annual departmental report specifically on progress towards the goals of the committee and the status of the recommendations in this strategic plan.

Undergraduate

- **Recruiting:** The Diversity Committee will work with the Office of the Provost and MIT Admissions to create a list of actions that allows us to better identify the pool of first-year students who are interested in AeroAstro, with a particular aim to improve the diversity of the undergraduate population in the department.
- **Outreach**: The Diversity & Development Officer is recommended to work with existing K-12 outreach programs at the Office of Engineering Outreach Programs such as MITES or Seed Academy to identify specific scheduled activities that describes how and when to coordinate with these programs to attract more diverse students to MIT with the intention of declaring for AeroAstro.

- **Exploratory first year subjects**: The Departmental Leadership is recommended to create a complementary exploratory offering for first year students that addresses the fundamentals of problem solving in aerospace, alongside 16.00.

**Graduate**

- **Recruiting and outreach**: The Departmental Leadership is recommended to increase the use of Departmental Fellowships as a strategic recruiting tool, especially for outstanding women and URM candidates. The committee recommends that each diversity fellowship be transitioned into named fellowship that carry similar prestige to other named Departmental Fellowships, which may require additional fundraising. Develop a concrete plan to advertise MIT AeroAstro among undergraduates from other related fields, both within the Institute and outside.

- **Climate**: The Departmental Leadership is recommended to implement [power-diffusion mechanisms](#) (including the use of departmental funding) in order to reduce the risk of harassment\(^1\).

- **Advising and Mentoring**: The Department is recommended to address graduate student concerns about low frequency of meetings with some research advisors by communicating issue to faculty, raising expectations, and sharing the OGE’s Best Advising Practices handbook.

**Faculty**

- **Department Service**: The Departmental Leadership is recommended to appoint *ex officio* a member of the diversity committee to every standing committee to represent minority populations, to prioritize diversity at every level. The committee also recommends that diversity statistics for each faculty member be collected during the annual reviews.

- **Faculty Scholars**: The Department is recommended to establish and nurture a MIT AeroAstro Future Faculty Scholars Program to identify and support undergraduate and graduate women and URM students who have interest and potential to become faculty members.

- **Inter-institutional leadership**: The Department is recommended to form and maintain a larger consortium with sister AeroAstro departments to pool resources to identify and develop a pipeline of future faculty members who are URM and women, following our success with the Women in Aerospace Symposium.

- **Recruiting and outreach**: The Faculty are recommended to plan recruiting visits to targeted HBCUs, HSIs, and other institutions with a track record of producing outstanding women and URM faculty. This committee recommends that a standing budget be established and

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\(^1\) This is recommendation 5 of the NASEM report “Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine,” 2018. However, following MIT’s definition of harassment ([https://handbook.mit.edu/harassment](https://handbook.mit.edu/harassment)), we refer to harassment as unwelcome conduct for any reason, not just on the basis of gender, race or ethnicity.
faculty be incentivized to visit these schools, which produce large numbers of highly qualified and diverse candidates, to talk about our graduate program.

Staff

- **Hiring equity**: The Departmental Administration is recommended to eliminate ‘Waiver of Search’ in hiring. The committee recommends that the requirements on requesting a waiver of search be increased in order to achieve a broader pool of applicants.
- **Incentivize diversity hiring**: The Departmental Administration is recommended to offer a program of financial incentives (either direct compensation or in discretionary funds) to hiring managers\(^2\) who make successful hires that increase diversity.
- **Mentoring and inducing new employees**: The Departmental Administration is recommended to revamp our onboarding process, to include enhanced mentoring, a comprehensive tour across the department’s space engaging a broad range of staff, and an introductory presentation of the department’s website and other informational resources.

\(^2\) This document uses the term Hiring manager following the MIT definition: http://web.mit.edu/ist-train/atc/story_content/external_files/ATS-JobRequisitionRequiredFieldsV2.pdf
2 Diversity, Inclusion and Innovation Strategic Plan: Overview

It is a common practice to consider diversity along measurable axes, such as gender and ethnicity. The intent of the Diversity, Inclusion and Innovation Committee is to look beyond these traditional axes to consider how to broaden the spectrum of history, experience and viewpoints in our community. As will be described in later sections, the department, and the AeroAstro industry as a whole, is far from reflecting the US or global demographics along any conceivable axes and has had an imperfect commitment to valuing all members of our greater community. Although we have admittedly lacked dedication to diversity in the past, it is clear that a more diverse and heterogeneous AeroAstro department at MIT would benefit us all.

2.1 Value Proposition

Over the many decades of aeronautics and astronautics at MIT, the change in national demographics and societal needs, both national and international, have served -- and will continue to serve -- as a dominant forcing function of whom and how we teach, as well as the research areas we investigate. The interplay of past, present, and future national demographics define a pool of students, who later become faculty and staff and form the intellectual and cultural foundation of our community of educators and researchers. Responding actively and creatively to the opportunities embodied in our national demographic profile is critical to our productive future.

We have been a consistent leader in excellence and leadership in education and research in Aeronautics and Astronautics the world over. Human diversity is a reliable and available source of new ideas, ingenuity and creativity in general and supports and nurtures our core pillars of education and research. For these reasons, it must be a core value of the AeroAstro department to be an inclusive home for people of all races, genders, religions, ethnicities and backgrounds.

2.2 Charge to the Committee

In May 2017, the department head, Prof. J. Peraire, charged the committee with the following:

“Respect for, and full engagement of, all races, genders, religions, ethnicities, and sexual orientation form the foundation of our behavior and commitment to diversity and inclusion. The AeroAstro Faculty, Student, and Staff Standing Committee on Race and Diversity is charged with developing action plans to protect and nurture the mental and physical well-being of each member of our community, to increase the inclusion of underrepresented minorities and women, and to address other such opportunities as appropriate.”

Additionally, the committee adopted the following goal of developing a prioritized DI&I Strategic Plan to:

a. increase AeroAstro numbers to surpass MIT numbers at the undergraduate, graduate, faculty and staff level in 5 years and to at least match the national population numbers in 10 years,
b. identify opportunities to improve the inclusivity of all aspects of the MIT AeroAstro community.
2.3 **Definitions**

**Diversity**

In the context of the DI&I Committee, diversity connotes awareness and acceptance of the value and strength derived from engaging the richness of multiple cultures including race, disabilities, gender, national origin, religion, sexual orientation, and skin color, among other attributes, as a core value of the Department.

The data in this report were collected by the Office of the Provost, and must therefore follow their specific demographic model of diversity, which primarily relies on self-reported membership in a specific set of ethnicities, and is restricted to US citizens. It is not the intent of this committee to restrict our efforts to this demographic model or definition of diversity, and as part of strategic plan we will investigate alternate sources of data to better represent the diversity in our department.

**Inclusion**

Inclusion is the intentional, successful effort to invite, cultivate, and apply the values and strengths inherent in diversity for the common good of the Department.

**Innovation**

Innovation refers to the transformative products, ideas, systems, environment, etc., developed and maintained by the Department for the common good, based upon the effective and efficient application of diversity and inclusion.

2.4 **Historical context**

MIT AeroAstro has the distinction of being the oldest graduate program in Aeronautics, having established a graduate degree in 1914. The first master’s (M.S.) degree was awarded to H. K. Chow in 1915, and the first doctorate degree (D.Eng.) was awarded to Jerome Hunsaker in 1916. As the field expanded, the department grew gradually more diverse. The first woman to receive a graduate degree (M.S.) in Aeronautical Engineering was **Hilda Lyon** in 1932, for her thesis on a topic very much relevant today, titled *The Effect of Turbulence on the Drag of Airship Models*. Lyon’s appears to have been only the tenth MS awarded by the department. After graduating from MIT, Hilda Lyon worked with Ludwig Prandtl in Germany, and later became the head of the Stability Section at the Royal Aircraft Establishment in Farnborough. She devised the Lyon Shape, which has been used for numerous submarines since the USS Albacore. It is worth noting that during that same year, **Isabel Ebel** became the first woman to receive an SB in Aeronautical Engineering. Abel is believed to have helped Amelia Earhart plan her transcontinental flight in 1932. She was a mathematics teacher at the Brooklyn Technical High School from 1932-1938, after which she joined the Grumman Aircraft Corporation in 1939. In 1942, she became a research engineer at United Airlines.

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3 [http://library.mit.edu/F/DRV3GP8FFQAK98DKALPDTPBQVPP1N1ED6E3LDS2JC6M6RGI3P-05093?func=find-acc&acc_sequence=017844292](http://library.mit.edu/F/DRV3GP8FFQAK98DKALPDTPBQVPP1N1ED6E3LDS2JC6M6RGI3P-05093?func=find-acc&acc_sequence=017844292)


Joseph Samuel Dunning was awarded his SB in Aeronautical Engineering in 1937, becoming the first black aeronautical engineer in the US\textsuperscript{11}. He went on to have an illustrious career in the Douglas Aircraft Company (founded by Donald Douglas, SB 1914), retiring as its Vice President of Administration. In the 1940s, MIT in general, and AeroAstro in particular, contributed to the training and education of several African-American military pilots (known as the Tuskegee Airmen). These included AeroAstro alumni Yenwith Whitney (SB 1949) and Louis Young (SB 1950)\textsuperscript{12}. Wesley L. Harris (Princeton University, PhD, 1968) became the first African-American faculty member in the department in 1972. He served as head of department (2003-2008), associate provost (2008-2013), and was founding director of the Office of Minority Education (1976-1979).

While several women in the post-war years received SB and MS degrees, it was only in 1960 that Beverly J. Beane (married name: Beverly Graham) became the first woman to receive a PhD degree in the department for her thesis titled *Supersonic drag characteristics of partial-ring wings*, supervised by Professor Leon Trilling. She had previously received her MS degree in 1951 for a thesis titled *Theoretical study of flutter analysis and oscillatory air force evaluation for a*
rectangular wing in supersonic flow, under Professor Holt Ashley’s guidance. Like several other women graduates of the department at the time, Dr. Beane began her aeronautics career at the Douglas Aircraft Company, before founding a technical consulting company (Graham Associates).

Figure 3. (Left) Beverley (Beane) Graham (PhD 1960); (Center) Sheila Widnall (SB 1960, MS 1961, ScD 1964); (Right) Isaiah Blankson (SB 1969, MS 1970, PhD 1973) with Professor Larry Bucciarelli in 1967.

In 1964, **Sheila Widnall** became the second woman to receive a doctorate from the department, and the first woman faculty in the MIT School of Engineering. Professor Widnall was also the first woman to serve as Secretary of the U.S. Air Force. Although Victor Claude Smith (Chemical Engineering: SB 1924, SM 1926, ScD 1930) was the first black student to receive a doctorate from MIT (Thesis: *A Study of Homogeneous Combustion in Gases*), it appears to have been only in 1973 that **Isaiah M. Blankson** (SB 1969, MS 1970, PhD 1973) became the first black PhD from AeroAstro, for his thesis titled *Flow induced oscillations of a flexible circular cylinder* under the guidance of Professor Morton Finston. After graduating from MIT, Dr. Blankson went on to have a successful career at NASA.

The historical background described above shows that although women and other minorities were underrepresented in the early days of the department, they contributed significantly to MIT AeroAstro and the aerospace community as a whole, and went on to have a wide range of noteworthy careers. It is therefore evident that a more diverse and inclusive environment will make our Department stronger, and will help us maintain our position of leadership amongst our peers.

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14 [http://library.mit.edu/F/BQGEJKM9XX51TSTP89U4LTG99GALIPD1TTTP5DKKPAGVQJEXI3-12203?func=full-set-set&set_number=044867&set_entry=000009&format=999](http://library.mit.edu/F/BQGEJKM9XX51TSTP89U4LTG99GALIPD1TTTP5DKKPAGVQJEXI3-12203?func=full-set-set&set_number=044867&set_entry=000009&format=999)
16 [https://sipt.org/in-memoriam/beverly-graham/](https://sipt.org/in-memoriam/beverly-graham/)
20 [https://dspace.mit.edu/handle/1721.1/60749](https://dspace.mit.edu/handle/1721.1/60749)
3 Planning Process Used

The Diversity committee as initially established in May 2017 was composed of

- Co-Chair: Prof. W. Harris
- Co-Chair: Prof. D. Newman
- Ex-officio: Prof. J. Peraire
- Ex-officio: Prof. E. Modiano
- Prof. N. Roy
- Prof. H. Balakrishnan

Subsequently, the committee added:

- Communications Director: Mr. W. Litant
- Graduate Program Administrator: Ms. B. Marois
- Administrative Officer: Mr. B. O’Conaill
- Academic Program Administrator: Ms. M. Stupard
- Staff member: Ms. B. Shuster
- Ex-officio: Prof. E. Greitzer
- Prof. P. Lozano
- Graduate student: Cadence Payne
- Graduate student: Cory Frontin
- Graduate student: Stewart Isaacs
- Undergraduate student: Maddie Garcia

With the change and department leadership in June 2018, Prof. J. Peraire and E. Modiano retired from their ex-officio positions on the committee.

The process for writing this Strategic plan consisted of the following:

- The committee held weekly meetings beginning in September 2017. The initial focus was on learning about existing efforts in diversity, inclusion and innovation within the department and across the institute.

- The committee met with Institute officials, including the Institute Diversity Officer\textsuperscript{21}, and the Director of Institutional Research\textsuperscript{22}. The Institute Diversity Officer briefed the faculty in April 2018, to reinforce specific messages about how to address the issues of diversity and inclusion. A subset of the committee also met with the Director of the Office of Minority Education\textsuperscript{23}.

- The committee held a series of individual meetings with departmental faculty, to identify ongoing efforts to address diversity, inclusion and innovation, solicit suggestions for improvement and identify areas of concern.

\textsuperscript{21} Dr. J.J. Jackson, meeting 12/5/17
\textsuperscript{22} Ms. Lydia Snover, meeting 6/19/2018
\textsuperscript{23} Associate Dean DiOnetta Jones Crayton, 9/17
• The committee held town hall meetings with the undergraduate and graduate student bodies and with the administrative and research staff. Feedback from these groups was collected in the meetings.
• The committee also identified increasing the diversity of applicants to the graduate program. The reasoning for this activity as the first-year goal was that the graduate program is one area where we have the most direct control. We were able to reach out to other institutions to encourage applicants, and were not directly competing with other departments for the same applicants.

3.1 Recommended process for maintaining the strategic plan

The committee will be responsible to issuing an annual report specifically on progress towards the goals described in this strategic plan and tracking of the recommendations. Part of this annual reporting will be regular assessment of the recommendations to the department, collecting feedback from the community and modifying the recommendations as necessary.

The DI&I Committee shall be in direct contact with the Graduate Association of Aeronautics and Astronautics during development of the Departmental Student Life Survey. Collaboration between the committee and this organization will work to ensure that questions delivered to the department’s graduate student body remain consistent through survey iterations to enable continuity in data collection. Continuity of data collection is crucial to the will allow the placement of metrics on the surveyed areas that are of particular interest, allowing the committee to properly assess how the plan is or is not working as indicated by student feedback.

4 Assessment and Findings

4.1 Undergraduate Student Body

4.1.1 Demographic composition of the undergraduate student body

The following table describes the demographics of our undergraduate student body. In AY2017, there were 153 undergraduate students in AeroAstro in both 16 and 16-ENG. In AY2018-19, the department had 166 undergraduate students in 16 and 16-ENG.

<table>
<thead>
<tr>
<th></th>
<th>AeroAstro24</th>
<th>School of Engineering</th>
<th>MIT-wide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>URM</td>
<td>Women</td>
</tr>
<tr>
<td>AY2017</td>
<td>30%</td>
<td>29%</td>
<td>46%</td>
</tr>
<tr>
<td>AY2018</td>
<td>34%</td>
<td>28%</td>
<td>46%</td>
</tr>
</tbody>
</table>

In AY2018-19, the sophomore class (64 students) includes 41% women and 19% US URMs. The percentage of women in the AeroAstro undergraduate program is the lowest in the MIT School of Engineering (SoE), slightly below Nuclear Science and Engineering. The percentage of URMs in

24 MIT Office of the Provost, Institutional Research, accessed 9/18
the AeroAstro undergraduate program ranks fourth in SoE, behind Chemical Engineering, Mechanical Engineering and Biological Engineering. Figures 4 depicts the historical trends in our undergraduate population in terms of female and URM demographics.

![Graph showing recent trends of the departmental undergraduate demographics.](image)

Figure 4. Recent trends of the departmental undergraduate demographics.

### 4.1.2 Climate Survey

The assessment of the climate within the undergraduate student body is based on the survey on Student Quality of Life that was conducted by the Dean of Student Life in February 2017. We obtained the report for AeroAstro upon request. This survey is conducted every four years, and the survey instrument is available. We recommend that it may be used for a periodic assessment of the general climate within the department.

### 4.1.3 Demographics of Climate Survey Respondents

All current undergraduate students in AeroAstro were invited to participate in the survey. 49% of those invited (73 students) answered the survey at least partially, which was higher than the MIT-wide participation rate. Most individual questions had between 63 and 73 responses. The gender decomposition of the responses was 62% male and 37% female and 2% chose to self-identify. 28% of the respondents identified as racial/ethnic minorities (1.5% American Indian or Alaska Native; 11% Black or African American; and 15% Hispanic or Latino).

While these numbers are higher than the composition of URMs in the graduate student body (11%), we note that they include students who may not be US citizens or US Permanent Residents. At a high level, we believe that the results are likely to be reasonably reflective of the general climate within the department. Finally, 78% of the survey respondents identified their sexual orientation as Straight/Heterosexual, while 5% identified as Gay or Lesbian, 9% as Bisexual, and 8% stated that they prefer to self-describe.
4.1.4 Diversity and Inclusion in the Climate Survey

The full results of the climate survey for undergraduate students are in Appendix A.2.1. There do not appear to be substantial differences between how AeroAstro undergraduates assess the climate at MIT and how all undergraduates assess the climate at MIT. For example, AeroAstro undergraduates appear to feel the department is more collegial and supportive than the general MIT undergraduates (81% at least somewhat agree in AeroAstro, vs 72% across the Institute), and the differences in assessment of student respect is relatively minor. However, the specific percentages of the student who experience bias, discrimination or bigotry are disturbing:

- 37% of responses indicate bias, discrimination and/or unfairness as sources of stress during the previous year.
- 45% of responses indicate that they have experienced at least occasional small acts of bigotry or disrespect based on their social identity in academic spaces during the previous year.
- 15% of responders do not see themselves as part of the MIT community and 30% do not agree (or feel neutral) about MIT AeroAstro currently being a diverse community.

4.1.5 Departmental Activities to Promote Diversity and Inclusion among Undergraduates

The department has a number of activities and student groups designed to promote diversity and inclusion. The majority of these are described in the Student group section of this document. Our primary activities to promote diversity and inclusion are focused on engaging with first-year students. These activities include:

- **First-year Pre-Orientation Program, “Discover Aerospace.”**
  Our FPOP program is four days long, and is one of the larger FPOP programs, with space for 30 first-years. It is however the shortest of the FPOP programs at four days. The FPOP program is a significant driver of first-years declaring for Course 16. The FPOP applications that departments receive from the First-Year Office include student gender and nationality, but not student race and ethnicity. Therefore, when selecting incoming first-years for Discover Aerospace the department currently balances the program for gender but not for other forms of diversity.

- **First-year Exploration class, 16.00 “Introduction to Aerospace Engineering and Design.”**
  While 16.00 is not explicitly a vehicle for increasing diversity within the department, it is an important component of connecting to the first-year population. It is the only subject that we offer without a substantial list of prerequisites, and is therefore our only course that can be used by first-years to explore the AeroAstro domain. In previous years, 16.68, “Modern Space Science and Engineering Seminar” was a second exploratory class that was available to first-years but it has not been offered in some time. Unlike the exploratory courses of other departments, 16.00 does not satisfy any of our degree requirements. Additionally, no other department offers a single exploratory class. Increasing our exploratory offerings (or reducing prerequisites for upper-year classes) may create additional on-ramps to the degree and increase our inclusivity.
First-year UROPs

The departmental UROP program has been a successful component of the educational experience in AeroAstro for many years. In any given year we average approximately 200 UROP positions, filled by Course 16 as well as non-Course 16 majors and first-year students. In AY2017-18, the department hired 258 UROPs, 60 of whom (23%) were first-year students, including 22 women (37%). Ninety (90) of our 151 undergraduates (60%) had UROPs in our department, including 30 women (33%) and 18 URMs (20%). Of the 258 UROPs offered by our faculty, a further 168 were outside the department. During that same period, thirty-five (35) Course 16 students UROPed outside of AeroAstro, including 17 women and 10 URMs. This suggests a very robust UROP program both for our own undergraduate students and also undergraduates from other departments. Recent efforts to improve our UROP program include establishing a UROP officer on the undergraduate committee and working to identify a UROP point-of-contact in the major AeroAstro labs. Additionally, as of Fall 2015, AeroAstro HQ will contribute $1K in discretionary funds to faculty advising first-year UROPs and provide $1K towards the stipend of each first-year UROP.

Taken together, these three activities are significantly correlated with first-year students declaring for AeroAstro. For the sophomore class entering Course 16 in the fall of 2018, 51% of these students had participated in the 2017 FPOP program, 53% had at least one UROP in Course 16; and 71% had been enrolled in 16.00.

4.1.6 Advising and Mentoring

First-year advising

AeroAstro has been particularly active in first-year advising. In 2018-2019, three of our faculty are involved in first year seminars, and seven faculty are traditional advisors, representing a disproportionately high level of engagement as nearly 30% of the faculty interact with first years in advising capacities.

Upper-year advising

According to the 2018 Senior Survey, AeroAstro places second across the Institute by satisfaction with advising in a ranking of departments with 15 or more respondents to the senior survey, sorted by the proportion of students who are generally or very satisfied, with relatively little turnover from year-to-year, suggesting our upper-year advising meets student expectations. Nevertheless, there are additional opportunities for advisors to engage with upper-year students beyond registration day meetings, such as career advising and counseling for graduate school.

4.1.7 Major Selection

Incoming sophomores who attended the department’s sophomore orientation on registration day of the Fall 2018 term were asked to fill out a short survey indicating which of the department’s outreach programs might have influenced their decision to declare Course 16. 42 of our 63 new sophomores were at the orientation and filled out the survey. The students were asked to select all of the programs which might have influenced their decision to select Course 16 as their major. The results are as follows (totals exceed 100% since students could choose multiple options):
<table>
<thead>
<tr>
<th>Program</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>UROP</td>
<td>38%</td>
</tr>
<tr>
<td>16.00 Intro to Aerospace and Design</td>
<td>33%</td>
</tr>
<tr>
<td>Discover Aerospace FPOP</td>
<td>26%</td>
</tr>
<tr>
<td>First-year advising / mentoring</td>
<td>29%</td>
</tr>
<tr>
<td>The Unified West Coast Trip</td>
<td>17%</td>
</tr>
<tr>
<td>Other (e.g., decided in high school)</td>
<td>29%</td>
</tr>
</tbody>
</table>

We also asked the 42 respondents to tell us in which of the AeroAstro student groups they might have had membership or participation. Two were in AIAA, 1 in DBF, 1 in Flying Club, 9 in Rocket Team, and 7 in WAE.

The department has had a strong UROP program for many years including funding first-year UROPs, and it is satisfying that this is the primary draw in recruiting students to our department.

4.1.8 Curriculum

Unified Engineering carries a reputation of being difficult. This can serve as a barrier to joining the department for URM students whose high school experiences may make them feel less prepared than their peers. Serious consideration should be placed on the systems of support available in Unified Engineering, as well as the department communications surrounding the class.

Additionally, increased diversity adds challenges in reconciling differences in background, opinions and political views. Students in team-based classes in the department have highlighted issues of emotionally charged conversations between teammates that have negatively impacted their class experience and overall project outcomes. Learning how to effectively navigate differences to create high-functioning teams will be a critical skill for future leaders in aerospace. The department should support learning these skills.

Finally, URM students often cite their motivation for joining engineering as a means to better serve their underserved communities. When challenging subjects are disconnected from the social context that students are from, it can serve to magnify the difficulty of the subject. Adding social context to engineering problems and including opportunities for meaningful engagement with underserved communities in the curriculum could help URM students feel validated in their major selection and improve their sense of belonging in the department.

4.1.9 Opportunities for improvement

- The MIT first-year student population is highly diverse, but the Office of the Provost does not share the demographics of the first-year population that applied to MIT with the intention of declaring for AeroAstro. As a result, we currently do not know if the first year experience is increasing the diversity of the population declaring for AeroAstro relative to the incoming first years, or if the first year experience is depressing the diversity of the
AeroAstro population. We may be competing for female, URM and other diverse first-year students who enrolled at MIT with the stated intention of declaring for another major. While we cannot discover the names of specific first year students who enrolled with an intention to declare for AeroAstro, the committee recommends working with Office of the Provost to explore actions that can provide more information such as adding questions to the different surveys to discover more information.

- The MIT Student Quality of Life survey results are not broken out by gender or minority status. It is important to understand if the departmental climate differs significantly across genders or minority status. The committee recommends working with the Office of the Provost to collect this data, or offer an alternate survey.

- We have no official and standing departmental activities designed to improve the pipeline of female and URM high school students applying to MIT with the intention of studying Aeronautics and Astronautics. One aspect of this is to make aerospace more accessible, and to raise awareness of the history of aerospace among high school students. The interviews with faculty revealed only ad hoc outreach activities at the high school level, either locally in Boston or nationally. This represents a missed opportunity to increase the diversity of our department by attracting exceptional talent to MIT with the goal of a degree in AeroAstro. It is not necessary that we start a new program, but the committee recommends working with existing outreach programs at OEOP such as MITES or Seed Academy to identify a schedule of actions to attract more diverse students to apply to MIT with the intention of declaring for AeroAstro. Additionally, the committee recommends that AeroAstro students who participate in these outreach activities (currently on a voluntary basis) be compensated for their time and effort.

- The aerospace industry has a reputation of having high barriers to entry for international students, and the undergraduate student organizations reported that this barrier, whether real or perceived, deters some students from declaring for AeroAstro. The committee recommends that the Department assist international students with career planning, finding internships in the aerospace industry, etc. and publicize these efforts.

- The resolution of the above issues will be labor-intensive and cannot be assigned to the Academic Program Administrator or Graduate Program Administrator, or individual faculty. The committee recommends identifying a staff member (likely the departmental development officer) to collect data, manage first year engagement and to work with OEOP programs.

- The undergraduate student organizations reported that the department has a reputation of being intimidating, and having a steep learning curve. The undergraduate students strongly supported the introduction of a second exploratory offering for first year students, alongside 16.00. The purpose of this class is for students to develop intuition and problem-solving techniques in preparation for success in Unified Engineering. Additionally, the students recommended more outreach in making AIAA, GWAE and AeroAfro well-known and accessible, possible through an AeroAstro club fair.

- The undergraduate student organizations reported that the recent changes to Unified Engineering have had a positive effect on the department’s reputation, but one additional change that could boost overall enrollment would be to simply move Unified from a 9 am start to a 10 am start.
The committee recommends including cross-cultural dialogue education in coordination with greater department effort on enhancing effective teamwork at the student, faculty and staff level. In addition, the committee recommends creating incentives for faculty to include meaningful social context within class content and opportunities for applications to problems in underserved communities.

4.2 Graduate Student Body

4.2.1 Demographic composition of the graduate student body

<table>
<thead>
<tr>
<th></th>
<th>AeroAstro</th>
<th>School of Engineering</th>
<th>MIT-wide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>URM</td>
<td>Women</td>
</tr>
<tr>
<td>AY2017</td>
<td>17%</td>
<td>11%</td>
<td>29%</td>
</tr>
<tr>
<td>AY2018</td>
<td>20%</td>
<td>15%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Figure 5. Recent trends of the departmental graduate student demographics.

There are currently 228 graduate students in AeroAstro, 45 (20%) of whom are women, and 20 (9%) of whom are US underrepresented minorities (URMs) in STEM fields. It is worth noting that the percentage of women in AeroAstro is currently lower than in the School of Engineering (30%) and MIT as a whole (35%). Indeed, the percentage of women in the AeroAstro graduate program

25 MIT Office of the Provost, Institutional Research, accessed 9/21/18
is among the lowest in the MIT School of Engineering (SoE). Nationwide, NSF estimates that women received 15%, and URMs received 7% of doctorates in Aerospace, Aeronautical and Astronautical Engineering in 2016. The percentage of URMs in the AeroAstro graduate student body is slightly better than the SoE (7%) and MIT (8%). However, it is still considerably less than in the general US population (30%), suggesting the need to improve on that front.

4.2.2 Climate Survey

The full results of the climate survey for undergraduate students are in Appendix A.2.2. The assessment of the climate within the graduate student body is based on a town hall style meeting with the Graduate Association of Aeronautics and Astronautics (GA3), and the survey on student quality of life that was conducted by the Dean of Student Life in February 2017. We obtained the report for AeroAstro upon request. This survey is conducted every 4 years, and the survey instrument is available. We recommend that it may be used for a periodic assessment of the general climate within the department.

4.2.3 Demographics of Climate Survey respondents

All current graduate students in AeroAstro were invited to participate in the survey. 47% of those invited (i.e., 102 students) answered the survey at least partially, which was higher than the MIT-wide participation rate. Most individual questions had approximately 100 responses. The gender decomposition of the responses was 75% male and 25% female – a slightly higher response rate from the graduate women students, who composed 21% of the student body at the time. 10% of the respondents identified as racial/ethnic minorities (1% American Indian or Alaska Native; 1% Black or African American; and 8% Hispanic or Latino). While these numbers are slightly higher than the composition of URMs in the graduate student body (9%), we note that they include students who may not be US citizens or US Permanent Residents. At a high level, we believe that the results are likely to be reasonably reflective of the general climate within the department. Finally, 91% of the survey respondents identified their sexual orientation as Straight/Heterosexual, while 6% identified as Gay or Lesbian, 2% as Bisexual, and 1% stated that they prefer to self-describe. Therefore, the diversity and inclusion efforts in the department should consider the climate and opportunities for LGBTQ identified students as well.

4.2.4 Diversity and Inclusion in the Climate Survey

When we focus on the survey questions that could relate to issues surrounding diversity and inclusion, the percentage of the graduate students who experience bias, discrimination or bigotry is disturbingly similar to the undergraduate population:

- 25% of responses indicate bias, discrimination and/or unfairness as sources of stress during the previous year.
- 45% of responses indicate that they have experienced at least occasional small acts of bigotry or disrespect based on their social identity in academic spaces during the previous year.
- More than 20% of responders do not see themselves as part of the MIT community; a similar fraction does not agree (or feels neutral) about MIT AeroAstro currently being a diverse community.
4.2.5 GA³ Climate Survey

In addition to the Office of the Provost, the GA³ organization carried out a climate survey of their own. The full results are in Appendix A.3, but the following key issues were identified:

- Diversity
- Advisor relations
- Harassment and inappropriate behavior within the general community
- Financial support, especially for international students
- Departmental support for professional development
- Promotion of departmental resources

Diversity in particular elicited positive and negative comments, including that the formation of this committee was viewed as a positive step for the department. However, approximately 20% of students reported being subjected to inappropriate/hateful language and almost 25% students have been treated differently due to race, culture, religion, sexual orientation etc. This is consistent with the institute-wide climate survey.

Additionally, the unevenness of student experience in working with their research advisor was identified as a concern (see Sec 4.2.8 below), and a “general dissatisfaction with the physical space available to the graduate students” was identified as an important issue, which is consistent with the results of the Institute’s Climate Survey.

A diverse group of graduate students represent a multitude of communities with unique and complex needs. The GA³ survey revealed a desire for academic research that confers benefit to the communities they represent by addressing these complex needs. A commitment to diversity and inclusion in the department must include a critical examination of the type of problems considered for research, and the intended and actual beneficiaries of this research.

4.2.6 Departmental Activities to promote Diversity and Inclusion among Graduate Students

The primary departmental activities to promote diversity and inclusion among graduate students involve the student groups (see Section 3.3). Additionally, the diversity committee has recognized that a diverse graduate student population requires a diverse set of graduate student applicants. To this end, in Fall 2017 the diversity committee began the following efforts:

- The committee worked with Department HQ to establish a set of fellowships that could be used to ensure funding for female and minority students who would be admissible but had not been able to find an RA.
- The committee began offering funding for current female and minority graduate students to travel to their undergraduate institutions and give talks advertising the AeroAstro graduate program.
- Faculty members of the committee reached out to colleagues at other institutions to identify strong female and minority undergraduates and encourage them to apply to the department. The committee also investigated the use of the Name databases\(^{26}\) to identify and contact potential female and minority undergraduates. It is too early to tell whether or not these efforts have been successful.

\(^{26}\) https://apps.grad.uw.edu/nne/
\(^{27}\) https://engine.eng.ufl.edu/
• The Graduate Program Office maintains a presence at the NSBE, SACNAS, SHPE and SWE conferences. However, we have limited engagement with existing programs on campus to recruit diverse graduate students, such as CONVERGE\textsuperscript{28} and the MIT Summer Research Program (MSRP)\textsuperscript{29}. As with the undergraduates, this represents a missed opportunity to increase the diversity of our department by attracting exceptional talent to MIT. The committee recommends that a schedule of engagement with these programs such as advising students or meeting with students during visit days, be established and reported to the department. This activity is primarily a recruitment activity and requires strong faculty involvement.

4.2.7 Advising and Mentoring

Advising and mentoring of graduate students is largely a function of the individual research labs. However, the department has two formal mechanisms for ensuring some baseline level of advising.

• In 2007, the department established a formal end-of-semester review process for each graduate student with their advisor, to ensure each student received an opportunity to discuss their progress with their advisor, and to receive written feedback. This was in response to comments from the graduate students that many did not receive regular (or any) feedback from their advisor.

• The department was also involved in the pilot of X.THG evaluations, which uses the course evaluation process to allow graduate students to provide anonymous feedback on their research experience. The anonymous nature of the feedback precludes us from identifying specific advisors or research groups, but it allows us to identify any systemic issues. However, the X.THG evaluations indicate that:
  ○ 25% of our students meet their advisor at least once per month, but not weekly.
  ○ 12% of our students meet their advisor at least once per semester, but not monthly.
  ○ 7% of our students only meet their advisor in group settings, and never one-on-one.
  ○ 2% of our students report that they do not ever meet their advisor.

• In 2017, the department replaced the research qualifying exam with a formal practicum in research communication, the Doctoral Research and Communication Seminar (16.995). In this practicum, the graduate students receive both lectures from technical instructors and individual instruction from instructors from the WRAP program in how to craft a research narrative and deliver a talk.

4.2.8 Opportunities for Improvement

• NSF estimates that only 75% of the doctorates in Aerospace, Aeronautical and Astronautical Engineering in 2016 had a bachelor’s degree in the same field. We can improve the pipeline to our graduate school by attracting undergraduates from other related fields. The committee recommends a sustained publicity program to non-AeroAstro but related departments in the September of each year, such as Mechanical Engineering,

\textsuperscript{28} https://oge.mit.edu/undergraduate/converge/
\textsuperscript{29} https://oge.mit.edu/undergraduate/msrp/
Computer Science and Physics departments at top-tier schools including our sibling departments at MIT.

- Name databases\(^{30,31}\) of juniors nationwide from under-represented populations have not been historically used for recruiting. The committee recommends that the Graduate Program Administrator contact students in the Name databases who have declared an interest in AeroAstro with a recruiting email each September.

- Feedback from the 16.THG course evaluations indicates concerns about the low frequency of their meetings with research advisors. It is strongly recommended that research advisors be made aware of this concern and share the OGE’s Best Advising Practices handbook.

- Finances or money are significant sources of stress for graduate students, with 53% of the responses indicating some level of related stress, and over 30% indicating “moderately stressful” or “very stressful.” This strongly motivates the use of Departmental Fellowships as a recruiting tool, especially for outstanding women and URM candidates. The committee recommends that the members of the diversity committee who are on the Graduate Admissions Committee select the awardees based on merit. Additionally, the committee recommends that each diversity fellowship be identified as a named fellowship that can be advertised, which may require additional fundraising.

- The committee recommends an effort to implement power-diffusion mechanisms (including the use of departmental funding) in order to reduce the risk of harassment\(^ {32}\), such as making the funding of a student’s graduate research independent from the advisor-advisee relationship. Doing so will also alleviate some of the concerns raised in graduate student surveys around the difficulty of changing labs or research advisers due to the coupling of advisors and funding.

- A typical metric tracked for graduate students (especially PhD candidates) is the 10-year graduation rate (i.e., the percentage of students who receive their PhDs in 10 years). The Department currently tracks these attrition rates in the PhD program, in addition to the times to meet different milestones (field exams, thesis proposal defenses, thesis defenses, etc.) but does not report the broader trend. The committee recommends that the milestone achievement and attrition rates be reported annually in order to capture unaddressed problems.

- The visits of current graduate students to their undergraduate institutions need to be planned better, in terms of repeated visits and identifying institutions that are targets of opportunity, including planning yearly visits to targeted HBCUs, HSIs, and other institutions with a track record of producing outstanding women and URM faculty. The committee recommends that the general faculty be incentivized to participate in more strongly in the program. Care for the career implications that are posed by having early-career graduate students give academic talks at other universities must be considered, as

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\(^{30}\)https://apps.grad.uw.edu/nne/

\(^{31}\)https://engine.eng.ufl.edu/

\(^{32}\)As noted previously, this is recommendation 5 of the NASEM report “Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine,” 2018. However, we continue to follow MIT’s broader definition of harassment (https://handbook.mit.edu/harassment).
well as the extra burden imposed on minority-status faculty. For these reasons, full faculty participation is essential. This committee recommends that a standing budget be established and faculty be incentivized to visit these schools, which produce large numbers of highly qualified and diverse candidates, to talk about our graduate program. Additionally, using these opportunities to highlight specific topics of research related to social benefit may be useful in attracting diverse graduate student applicants.

- Invited talks signify the academic pursuits the department sees as valuable as well as the researchers the department acknowledges as leaders in the field. Inviting diverse scholars that are innovating in topics particularly relevant to women and URMs in aerospace would signal that the department sees value in these topics and scholars. The committee recommends extending invitations for department talks to scholars and leaders both from diverse backgrounds and who are innovating in issues relevant to women and URMs in aerospace.

4.3 Student groups

There are several student groups focused on diversity and inclusion.

- **AeroAfro**: AeroAfro is a department-recognized community of black graduate students. The group aims to provide a network of students who can understand the particularities of being both a graduate student in Aeronautics and Astronautics and a member of the African Diasporic community. In particular, AeroAfro exists to provide a place where our shared heritage is celebrated, and a place where we can parse racially charged experiences in the department, at MIT, and in the greater aerospace industry. This mission is put into practice by facilitating communication between the black graduate students and department faculty, by fostering connections with AeroAstro alumni, and by having organic gatherings a few times per semester. For example, AeroAfro invited three high school students from D.C. for a department and Institute visit on August 3-4. It is worth noting that AeroAfro is the only student group focused on building a community for URM students -- no similar group exists for Hispanic or Native American students.

- **AIAA**: The American Institute of Aeronautics and Astronautics (AIAA) is a world-recognized professional organization for aerospace engineering. Across the United States, student chapters support collegiate students develop skills and resources to succeed both in college and in the workforce. These student chapters support teams like Design, Build, Fly (DBF) and Rocket Team, funding them to compete in national events. The group hosts events catered to careers in aerospace, such as the Career Fair Networking Dinner and organizes resume review sessions in association with the Women in Aerospace Engineering (WAE) to improve students’ professional profiles. Other activities include a UROP Fair, the Student Faculty Dinner, hosting guests of honor, and the Life After Psets event where students connect with faculty in an informal setting. The group also maintains a fund to support students with up to $400 to attend conferences.

- **Departmental Resources for Easing Friction and Stress**: As part of the institute-wide REFS (Resources for Easing Friction and Stress) program for peer support, AeroAstro established a dREFS program for our department in Fall 2017. AeroAstro dREFS are trained AeroAstro graduate student mediators who specifically support the AeroAstro community. These students offer low-barrier, confidential services to graduate student
peers in the form of support, coaching, listening, de-escalation, and informal mentoring and mediation. Faculty mentors provide additional support as needed.

- **Women in Aerospace Engineering:** Women in Aerospace Engineering (WAE) aims to create a supportive community for women interested in aerospace in MIT’s Department of Aeronautics and Astronautics. Our primary goals include promoting women in aerospace through (1) community development, (2) peer mentorship, (3) professional development, and (4) outreach to MIT women and the greater Boston community. We achieve these goals by hosting study breaks and dinners with members of the Graduate Women of Aerospace Engineering (GWAE) to build a sense of community, hosting group forums to discuss experiences of women in STEM, organizing a mentor-mentee program between upper and underclassmen for support and advice, encouraging members to participate in Lightning Talks on their research to practice public speaking, hosting guest speakers from industry, and organizing resume reviews and internship informational panels during Career Week. We engage in a wide range of outreach activities by collaborating with other women's groups at MIT for a joint Women in STEM week, planning freshman outreach events for new students each year, organizing a High School Aerospace Day each fall to host ~30 high school girls on campus to learn about opportunities in STEM, visiting local schools, and hosting activities for STEM events at the MIT Museum.

- **Graduate Women in Aerospace Engineering:** The purpose of Graduate Women in Aerospace Engineering (GWAE), is to represent and support the women in the MIT Department of Aeronautics and Astronautics. The organization will: (1) foster a strong community among AeroAstro graduate women, (2) recruit women and underrepresented minorities and advocate for diversity in collaboration with the MIT AeroAstro Diversity, Inclusion, and Innovation Committee, (3) support the personal, academic, and professional development of AeroAstro graduate women, (4) enhance ties with AeroAstro undergraduate women through sponsorship of a graduate-undergraduate mentor program, (5) participate in STEM outreach events, (6) maintain a relationship between AeroAstro women faculty and graduate women, and (7) serve as a liaison for communication between the AeroAstro department and the graduate women body. These objectives are accomplished through the formation of 4 organizational pillars: Outreach, Professional Development, Mentorship, and Community Building wherein purpose and goals manifest into executable programs. The group also organizes events such as Tea Time, a casual recurring weekly meeting for women in the department, organize and participate in Alma Mater Outreach and the MIT Splash program, host a Women in STEM Speaker series, and coordinate undergraduate/graduate mentoring with WAE.

It is worth noting that we do not have any student groups focused on URM students other than AeroAfro. We also note that these student groups are not widely known outside the department (or in some cases, even within the department). We recommend publicizing the activities of these groups during FPOP, open houses, etc.
4.4 Faculty

4.4.1 Demographic Composition of the Faculty

<table>
<thead>
<tr>
<th></th>
<th>AeroAstro(^\text{33})</th>
<th>School of Engineering</th>
<th>MIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>URM</td>
<td>Women</td>
</tr>
<tr>
<td>FY2017</td>
<td>22%</td>
<td>14%</td>
<td>19%</td>
</tr>
<tr>
<td>FY2018</td>
<td>24%</td>
<td>15%</td>
<td>20%</td>
</tr>
<tr>
<td>FY2019</td>
<td>22%(^\text{34})</td>
<td>19%(^\text{35})</td>
<td>Data not yet available</td>
</tr>
</tbody>
</table>

4.4.2 Climate Survey

The full results of the climate survey for undergraduate students are in Appendix A.2.3. The assessment of the climate within the faculty is based on the Faculty and Staff Quality of Life Survey that was conducted in 2016.

4.4.3 Demographics of the Climate Survey Respondents

All faculty in AeroAstro were invited to participate in the survey. 60% of those invited (i.e., 22 faculty) answered the survey at least partially, which was marginally lower than the MIT-wide faculty participation rate (64%). The gender decomposition of the responses was 86% male and 14% female. 20% of the respondents identified as racial/ethnic minorities, specifically Black or African American or Hispanic. Finally, 100% of the survey respondents identified their sexual orientation as Straight/Heterosexual.

4.4.4 Diversity and Inclusion in the Climate Survey Responses

The questions asked of faculty and staff in the Climate Survey were not identical to the questions asked of the undergraduate and graduate students. But as before, we focus on the survey questions that could relate to issues surrounding diversity and inclusion. In each case, we also consider the MIT-wide responses.

Overall, AeroAstro faculty feel less recognized for their contributions than the MIT faculty overall, and strongly feel they are not recognized at nearly twice the rate of the rest of the institute, and strongly feel they are not treated fairly at more than twice the rate of the rest of the institute. Nevertheless, AeroAstro faculty generally feel the workplace is free from bias and discrimination to a greater degree than the faculty across the institute, but feel that opportunities are not as good for female faculty as the faculty across the institute.

There is not a significant difference in the percentage of AeroAstro faculty who feel that minority faculty are at a significant disadvantage relative to the faculty across the institute, and in fact many

\(^{33}\) MIT Office of the Provost, Institutional Research, accessed 9/21/18

\(^{34}\) Preliminary

\(^{35}\) Preliminary
more feel that the opportunities are just as good. However, the AeroAstro faculty feel much more strongly than the general faculty that not everyone is treated with respect.

Several faculty commented in one-on-one interviews on a general lack of inclusiveness in the department. The atmosphere at faculty lunch was a very common concern. The faculty lunches are perceived as not inclusive, and in some instances constitute a hostile environment, underlining their very purpose of creating a shared community among the faculty and staff. More generally, the faculty expressed a concern that Aerospace is perceived as being a “guys” sport, and is not perceived as addressing broad social problems, a comment with strong echoes from the GA³ climate survey. An additional concern was that the primary community for many in the department is the research group, which is definitionally narrow. The committee does not have specific actions but recommends that there be awareness around these issues of lack of inclusiveness and perceived hostile environment.

4.4.5 Departmental Activities to Promote Diversity and Inclusion among Faculty

The Women in Aerospace Symposium, started by MIT and Stanford in 2009, has been a driver of both diversity and inclusion. The symposium was hosted by MIT for the first seven instances (with non-uniform frequency), but has rotated to the University of Colorado and Stanford in recent years. The symposium is designed to identify strong female Aerospace doctoral students and post-doctoral fellows who would be potential faculty hires. In the last ten years, 145 women have participated and 23 are faculty around the world. It is worth noting however that no similar event exists for URM students.

While impactful, the Women in Aerospace Symposium represents one of the very few official activities to promote diversity and inclusion among the faculty. In contrast, in interviews with the faculty, several indicated engagement in individual efforts to improve diversity, including recruiting female and minority students, acting as heads of house and promoting the department externally, although these are generally not focused on improving the faculty diversity or the inclusiveness of the faculty community.

There is no formal program for faculty recruiting diverse graduate students. The graduate student organizations have been charged with visiting alma mater campuses, but the graduate student body does not have good connectivity to many HBCU and HSIs, including but not limited to Georgia Tech, Arizona State University and others. It is imperative to involve faculty if the department is to establish relationships with these institutions. The committee recommends that faculty be asked and incentivized to visit HBCUs and HSIs, promote the department and recruit students, including annual reporting of recruiting activities.

In 2010, the Institute released a Report on the Initiative for Faculty Race and Diversity³⁶, co-authored in part by Prof. Wes Harris in his capacity as Associate Provost for Faculty Equity. The report echoes several of the recommendations in this report, however, several of them are not currently implemented. One of the recommendations was to establish a “Faculty Race and Diversity Initiative Committee”, which is now the “Committee on Race and Diversity” and is part of the Institute Community and Equity office. This committee does not issue an annual comprehensive report on the institute, but instead collates reports issued by different organizations across the institute and creates report cards to assess progress. This suggests that a lack of reliable

reporting and accountability tied to a central body has limited the impact of the 2010 report, and the committee recommends that the department commit to gathering and publishing an annual report on the progress of this committee and the department as a whole. Several other relevant points can be emphasized from the 2010 report:

- The importance of top-down leadership is emphasized in related institute reports including the 2010 report. The individual interviews with faculty for this AeroAstro Strategic Plan also indicated that the faculty follow the lead of the department in prioritizing service, and that the lack of diversity in the department was a result of a lack of action in Headquarters on this issue. Several AeroAstro faculty stated that initiative to establish a diversity committee was a very positive step, but the Department Head needs to continue this attention at every level.

- The 2010 report identified a number of existing programs and models that could benefit our Department, such as the Pappalardo Fellows Program in Physics, a postdoctoral fellowship program that identifies, recruits and supports the most talented and promising young physicists at an early stage of their careers. This program has been a key part of increasing the gender diversity in the Physics department. Additionally, the Biology department hired a full-time staff person to coordinate new outreach programs and efforts. Over a five-year period, the fraction of students from underrepresented minorities almost tripled, with a steady increase from 5.2% in 2004 to 14.4% in 2009.

- Another opportunity was identified to reduce “hidden bias”. During the 2008-2009 academic year, the School of Science (SoS) Dean’s Office sponsored discussions for faculty in each SoS department to facilitate conversations about concepts surrounding such bias (“schemas”), opening the way for further consideration of bias present in a department that may impact recruitment and retention.

4.4.6 Advising and Mentoring

One positive sign of the survey is that the AeroAstro faculty feel more strongly that they have received adequate mentoring than the faculty across the institute (82% compared to 71%). However, this finding might be biased towards senior faculty members. In interviews, faculty identified that some important mentoring activities had received less attention recently, including regular meetings between the untenured faculty and the departmental leadership and the strong encouragement to give research talks at the faculty lunches.

4.4.7 Opportunities for Improvement

- The committee recommends that the department consult with our peer institutions and establish a national initiative around diversity where resources similar to the Name Exchange databases are pooled to identify and develop a pipeline of future URM and women faculty members. The committee recommends this initiative include extending our success with the Women in Aerospace Symposium (or creating a similar event) to include URM students.

- The committee recommends that the department establish a postdoctoral Future Faculty Scholars program that identifies, recruits and supports the most talented and promising young engineers at an early stage of their careers. Such a program will require significant resources, and the committee recommends that fundraising for such a program be a departmental commitment.
● In order to demonstrate the commitment of the departmental leadership to diversity at every level, the committee recommends that a member of the diversity committee be appointed *ex officio* to every standing committee (Graduate Admissions, Graduate, Undergraduate and Faculty Search Committees) to ensure fairness in the processes. The committee also recommends that diversity statistics for each faculty member be collected during the annual reviews.

● The committee recommends that a standing budget be established and faculty be incentivized by the Department Head to visit targeted schools that produce large numbers of highly qualified and diverse candidates, to advertise the graduate program and recruit students. Additionally, following previous recommendations in this Strategic Plan (see Section 4.2.7) the committee recommends that faculty be encouraged to participate in undergraduate and graduate recruitment activities such as, but not limited to, MITES, CONVERGE and MSRP.

● The committee recommends resuming departmental mentoring activities, including regular meetings between the untenured faculty and the departmental leadership, and the strong encouragement to give research talks at the faculty lunches.

● The committee recommends that the department commit to gathering and publishing an annual report on the progress of this committee and the department as a whole.

4.5 Staff

Staff at MIT are broadly classified into Administrative Staff (including Academic Administrators), Research Staff (including Principal Research Scientists/Engineers and Research Scientists/Engineers), Support Staff, and Other Academic Staff (including Senior Research Scientists/Engineers, Technical Instructors, and Postdoctoral Associates). We note that the Postdoctoral Associates, whom AeroAstro has 20-25 of at any time, tend to be short-term appointments of 1-2 years.

4.5.1 Demographic composition of the Staff

The Departmental staff is under-represented both with female and URM staff across all classifications. And the under-representation becomes generally more pronounced, particularly on gender lines, among the higher-compensated staff classifications.

Furthermore, not only are URMs and females under-represented in the Department in comparison to the School and the Institute, but -- among staff -- the females employed in AeroAstro have the least representation among the best compensated (research staff). Women are concentrated among the 2nd lowest paid contingent (support staff), when one accounts for years of experience.
### Climate Survey

The assessment of the climate within the staff is based on the Staff Quality of Life Survey which is sponsored by the Council on Family and Work, Office of the Provost, and Chair of the Faculty. The Surveys are administered periodically to examine the work-life environment for faculty, other instructional staff, researchers, postdoctoral scholars, administrative staff, support staff, service staff, and students at MIT. We obtained the report for AeroAstro upon request. We recommend that it may be used for a periodic assessment of the general climate within the department.

### Demographics of the Climate Survey Respondents

All current AeroAstro staff were invited to participate in the survey. Among research staff 73% of those invited (16 individuals) answered the survey at least partially. Among non-research staff the number was 86% (24 individuals). The individual questions had between 11 and 13 responses among the research staff; and generally between 21 and 24 for non-research staff. The gender decomposition of the responses among research staff was 92% male and 8% female; among the non-research staff the composition was 25% male, and 75% female. 41% of the research staff respondents identified as racial/ethnic minorities (33% Asian; and 8% Hispanic or Latino). 25% of the non-research respondents identified as racial/ethnic minorities (12.5% Asian; 12.5% Black or African American).

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37 MIT Office of the Provost, Institutional Research, accessed 9/21/18
4.5.4 Diversity and Inclusion in the Climate Survey: Research Staff

In this document, we focus on the survey questions that could relate to issues surrounding diversity and inclusion. In each case, we also consider the MIT-wide responses. Responses are broken out by research staff/non-research staff but the questions considered were identical.

Among the research staff, it is noteworthy that no responses were received indicating the respondents disagreed with the statements that they felt recognized and that employees are treated fairly. Across MIT around 20% of staff hold these negative sentiments. Similarly the responses for AeroAstro were more positive than for MIT in general in response to these questions. There was a lack of disagreement with either of these sentiments, though it is worth noting that the proportion of research staff across MIT who feel strongly that minority employees enjoy equal opportunities is greater than it is in AeroAstro. AeroAstro research staff report adequate mentoring at about a 20% greater rate than Institute research staff in general.

4.5.5 Diversity and Inclusion in the Climate Survey: Non-research Staff

For non-research AeroAstro staff, negative responses on perceived recognition are 10% higher than for MIT in general. Though the proportion of positive responses on fairness is comparable, about 15% more MIT staff strongly perceive fairness than in AeroAstro (37% of MIT staff strongly perceive fairness, while 22% of Aero staff have that perception). On both questions on whether the department is free from bias and discrimination, and whether opportunities for female staff exist, the AeroAstro responses are somewhat less positive than at MIT in general.

On opportunities for minority staff, the AeroAstro response is comparable, even slightly better than MIT in general. On being treated with respect the AeroAstro response is notably worse with ~20% fewer of AeroAstro employees agreeing or strongly agreeing than everyone here is treated with respect. In contrast to research staff, non-research staff in AeroAstro have a more negative (~15%) perception of personal mentoring that at MIT in general.

4.5.6 Departmental Activities to Promote Diversity and Inclusion among Staff

The department has a range of activities to promote inclusion. Among these are monthly staff lunches and/or coffees, department picnics, ice cream socials, our annual holiday season traditional lunch and gift swap and student dinners. For at least the past ten years the administrative, support, and research staff annually have been presented with a gift to demonstrate the department’s appreciation of their work and dedication. The gift expenditure and acquisition is annually approved by the administrative officer and has been managed by the communications director. Finally, an annual Administrative Professionals’ Day, usually held during the last week of April, in which the AeroAstro department head and associate head send administrative/support staff gift cards in recognition of their contributions throughout the year.

However, there are no formal activities to promote diversity among the staff. Diversity is not currently tracked in hiring and a waiver of search mechanism allows the hiring manager to close off the open posting of jobs to the general populace. Such waivers allow rapid hiring of people already known to the department, but limits our reach to diverse candidates. The committee

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38 This document uses the term ‘Hiring Manager’ following the MIT definition: http://web.mit.edu/ist-train/atscr/story_content/external_files/ATS-JobRequisitionRequiredFieldsV2.pdf
recommends that waiver of search mechanisms be eliminated from hiring, even at the expense of slower hiring processes.

Furthermore, there are no departmental incentives to reward diversity. Organizations such as Facebook and Intel have identified financial incentives as an effective driver of increased diversity in hiring. In the department, financial incentives (either direct compensation or in discretionary funds) could be offered to hiring managers who made successful hires that increased diversity. Similarly, referral bonuses could be offered to employees in general who are integral in bringing a W/URM candidate onto the staff.

4.5.7 Mentoring for Staff

Over a period of many years, new staff have informally voiced frustration with the department’s onboarding process. For many, it involved little more than providing a computer and showing them to their desk. A more structured, welcoming process could do much to make employees feel welcome and included from the start. Some elements of improvement might include:

- **Mentors**: Pairing new employees with a peer mentor of whom they could ask questions, seek advice, and be made comfortable as members of the staff. This process currently exists for non-HQ administrative assistants, but could be extended to all.
- **Tour**: While new employees are currently brought around to meet people, and some have joined the regularly scheduled department tours, a personal tour that includes labs, classrooms, lecture rooms, etc. would do much to assist employees in performing their jobs, and it would help them become more comfortable in the new/unfamiliar environment.
- **Presentation**: An introduction presentation by appropriate staff including a tour of the department website and other informational resources.

Staff Rewards and Recognition Programs, such as the High Five, the Above and Beyond, the **Wings Award** and the **Spirit of XVI Award**, could be given throughout the year and promoted for greater visibility and significance. These are relevant instruments that contribute to the climate in the Department and there is an opportunity to use and extend them to support our goals on diversity and inclusion.

4.5.8 Opportunities for improvement

- The committee recommends eliminating the use of waivers of search, in order to ensure that a broad pool of applicants is considered for all staff positions in the department.
- The committee recommends that specific monetary incentives be offered to employees who refer candidates who both increase the departmental diversity and are ultimately hired.
- The committee recommends the establishment of a formal mentoring process for staff, starting with a revamp of our onboarding process to include enhanced mentoring, a comprehensive tour across the department’s space engaging a broad range of staff, and an introductory presentation of the department’s website and other informational resources.
- It is recommended that the department reinstates a staff-centric Awards and Recognition Committee that will revive the High Five, and Above and Beyond awards, manage the

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Wings and Spirit of XVI awards, promote the awards, encourage nominations, and otherwise return the program to a staff endeavor.

4.6 Community-wide Concerns

A common concern in the community relates to the quality of the physical space in the Space in the Department. For example, the GA³ climate survey identified space for graduate student gatherings as a concern around inclusiveness. While significant improvements have been made in recent years, the community perceives that the quality of space is hurting our own ability to attract women and URMs.

In addition to the specific recommendations made above, opportunities for empathetic social engagement across all levels of the department are rare but extremely good for the well-being of the department both within the scope of diversity and inclusion as well as transcendent of it. It should be promoted as much as possible by the department.
1 Appendix

2 A 1. Data from climate surveys

3 A.1.1 Undergraduate climate surveys

In this report, we focused on the survey questions that could relate to issues surrounding diversity and inclusion. In some cases, we also considered the MIT-wide responses. The specific questions considered were the following:

- Based on your experience and observation, rate the general climate at MIT [based on] Intolerant of diversity (1) to Embracing diversity (6).
- I feel that a diversified student body is important for MIT’s continued academic excellence.
- I feel that the climate and opportunities for female students at MIT are at least as good as those for male students.
- I feel that the climate and opportunities for students of a racial minority at MIT are at least as good as those for non-minority students.
- I feel that the climate and opportunities for LBGTQ identified students at MIT are at least as good as those for non-LGBTQ identified students.
- I feel that the climate and opportunities for international students at MIT are at least as good as those for non-international students.

- My department creates a collegial and supportive environment.
- Students at MIT treat one another with respect.

- I feel that I belong at MIT.
- I believe that others think I do not belong at MIT.
• Sources of stress that have affected you during the current academic year. (Only AeroAstro responses presented.)
  o Bias/discrimination/unfairness
  o Being able to practice my faith
  o Being able to express my political views

• During the current academic year, how often have you felt excluded from informal networks in academic spaces? (Only AeroAstro responses presented.)
• How often have you felt part of a community in academic spaces? (Only AeroAstro responses presented.)
- How often have you experienced small acts of bigotry or disrespect based on your social identity (e.g., sex, race, national origin, sexual orientation, or values) in academic spaces?
  - In reference to the acts described in question above: in general, do you think the other person is aware of the effect that their acts had on you? (Only AeroAstro responses presented.)

- When walking down the Infinite Corridor, to what extent do you see yourself as part of the MIT community?
- The community in my major is a diverse place. (Only AeroAstro responses shown)
4 A.2.1 Graduate climate surveys

The specific questions considered were the following:

- Based on your experience and observation, rate the general climate at MIT [based on] Intolerant of diversity (1) to Embracing diversity (6).
- I feel that a diversified student body is important for MIT’s continued academic excellence.
- I feel that the climate and opportunities for female students at MIT are at least as good as those for male students.
- I feel that the climate and opportunities for students of a racial minority at MIT are at least as good as those for non-minority students.
- I feel that the climate and opportunities for LBGTQ identified students at MIT are at least as good as those for non-LBGTQ identified students.
- I feel that the climate and opportunities for international students at MIT are at least as good as those for non-international students.

![Graphs showing responses to climate and opportunities questions.]

- My department creates a collegial and supportive environment.
- Students at MIT treat one another with respect.

![Graphs showing responses to department environment and respect questions.]

- I feel that I belong at MIT.
- I believe that others think I do not belong at MIT.

![Graphs showing responses to belonging and non-belonging questions.]
- Sources of stress that have affected you during the current academic year. (Only AeroAstro responses presented.)
  - Bias/discrimination/unfairness
  - Being able to practice my faith
  - Being able to express my political views

- During the current academic year, how often have you felt excluded from informal networks in academic spaces? (Only AeroAstro responses presented.)
- How often have you felt part of a community in academic spaces? (Only AeroAstro responses presented.)
● How often have you experienced small acts of bigotry or disrespect based on your social identity (e.g., sex, race, national origin, sexual orientation, or values) in academic spaces?
  ○ In reference to the acts described in question above: in general, do you think the other person is aware of the effect that their acts had on you? (Only AeroAstro responses presented.)

![Bar chart showing the frequency of experiencing small acts of bigotry or disrespect in academic spaces.]

![Bar chart showing the awareness of the effect of acts on the respondent.]

● When walking down the Infinite Corridor, to what extent do you see yourself as part of the MIT community?
● The community in my major is a diverse place. (Only AeroAstro responses shown)

![Bar chart showing the extent of self-identification with the MIT community.]

![Bar chart showing the perception of diversity in the major.]

5 A.3.1 Faculty climate surveys

The specific questions considered were the following:

- I feel recognized for my contribution to MIT.
- Employees in my unit are treated fairly.
- My workplace is free from bias and discrimination.
- In my workplace everyone is treated with respect.
- I feel that the climate and opportunities for female staff\textsuperscript{40} in my unit are at least as good as those for male staff.
- I feel that the climate and opportunities for minority staff in my unit are at least as good as those for non-minority staff.

- While at MIT, do you feel as though you have received adequate mentoring?

\textsuperscript{40} The wording of the questionnaire used “staff” for all non-student employees, but the data presented here are for the respondents who identified as faculty.
A.1.4 Research Staff climate surveys

- I feel recognized for my contribution to MIT.
- Employees in my [organizational unit] are treated fairly.
- My workplace is free from bias and discrimination.
- I feel that the climate and opportunities for female staff in my [organizational unit] are at least as good as those for male staff.
- I feel that the climate and opportunities for minority staff in my [organizational unit] are at least as good as those for non-minority staff.
- In my workplace everyone is treated with respect.
While at MIT, do you feel as though you have received adequate mentoring?

7 A.1.5 Non-Research Staff climate surveys

- I feel recognized for my contribution to MIT.
- Employees in my [organizational unit] are treated fairly.

- My workplace is free from bias and discrimination.
- I feel that the climate and opportunities for female staff in my [organizational unit] are at least as good as those for male staff.

![Graphs showing responses to survey questions.](image-url)
- I feel that the climate and opportunities for minority staff in my [organizational unit] are at least as good as those for non-minority staff.
- In my workplace everyone is treated with respect.

![Chart showing climate and opportunities comparison between AeroAstro and MIT]

- While at MIT, do you feel as though you have received adequate mentoring?

![Chart showing mentoring satisfaction at AeroAstro and MIT]

8 A 2. AeroAstro Alma Mater Visit Process

The Graduate Women in Aerospace Engineering group (GWAE) arranges for 4-6 women AeroAstro graduate students to visit their alma maters each fall and spring. In August/September each year a call is made by the group’s leadership to all graduate women in the department, asking them to fill out an online application form if they are interested in this opportunity. The form asks these women about which school/department they’ll visit and when, who their main contacts are at the school who can help them coordinate the visit (advertise well in their home department and school wide, set up rooms/refreshments, etc.), what their research topic is, and has them submit a proposal with more details about how they envision their visit.
GWAE then selects a reasonable number of women to put forth to the DI&I Committee for approval. At this time (2018) we are only considering visits to schools within the US. Once these visits are approved by DI&I, the women begin scheduling, and work with members of GWAE who have done visits in the past to prepare. They are asked to keep the Graduate Administrator informed as the visits are planned, and are reimbursed for reasonable travel expenses post visit. DI&I requests the women making these visits to write up a report once the visit is complete, and to collect names and emails of participants in their sessions for further outreach.
A3. GA³ & GWAE AEROSTRO GRADUATE SURVEY RESULTS

SURVEY OVERVIEW
- Questions based on similar survey conducted by IECS
- Created by GWAE and GA³ (2017-2018)
- Questions cover:
  - Inter- and Academic Experience and Community
  - Research Advisory and Mentorship Relationship
  - Professional Development
  - Financial Support
  - Overall
- Survey conducted June-July 2018
- 43 respondents

Q1. HOW WOULD YOU RATE THE FOLLOWING

Q2. RATE HOW WELL YOU FEEL AEROSTRO SUPPORTS THE FOLLOWING

Q3. RATE HOW WELL YOU FEEL AEROSTRO SUPPORTS THE FOLLOWING
Q6. WHAT IS AEROSTRAT DOING WELL?

- Community building
  - QA&O, CME, and other departments funded for these purposes
  - Social events outside of lab
- Growing efforts for diversity and inclusion
- Students feel supported by staff members like the Dean
- Opportunities for networking
- Student-department relationship
  - Asking for student feedback e.g. Departmental Head selection process

COMMENTS - Advisors

- “Some Descriptions of faculty members and their advising exist; additional details exist. Faculty members should be more involved in student recruitment for continued success.”
- “There are no advisors and a lack of diversity.”
- “I don’t know how you can assess if the research is not followed.”
- “Your advise of what the advisor is in the department is important.”
- “Need more input for managing good communication relationship.”
- “More interactions with students and feedback sessions are important.”
- “Students support is great for their academic and other divisions.”
- “We are pleased here to work with all students in different roles. Students and faculty members are very open and positive.”
- “Need more feedback from students that we are doing right things.”
- “Less addressing these problems, doing better.”

COMMENTS - Diversity

- “It seems a recognition of content work that is good for the future work.”
- “The discussions regarding diversity and inclusion have led to new initiatives.”
- “The wonderful diversity in the department; it is great to work with different students.”
- “The diversity in the department is strong. It is being added by social direction for students.”
- “More interactions with students; networking opportunities, leadership opportunities; finding a mentor.”
- “Support students in research opportunities to ensure diversity and inclusion.”

COMMENTS - International Students

- “More representation of international students in training opportunities; more input in advising opportunities.”
- “The department could provide more help to international students in finding jobs and networking opportunities.”
- “Need to be more explicit for international students and their advisors.”
- “Same as above but make it more explicit for international students.”
- “International students are very important for the department.”
- “International students can improve.”
- “Helping international students get involved in projects.”
COMMENTS – Financial Support

- "There seems to be no doubt that financial aid to students is vital to the success of any program. Many institutions are known to be expensive and have limited resources for all students. The University of Illinois at Urbana-Champaign has some financial aid programs but they may not be enough.".

- "There are more guarantees of funding to good students. This is fair. It is important to be transparent and ensure that all students have an equal opportunity to learn and grow. However, if we want to improve our student recruitment, we need to consider how we can attract and support students from diverse backgrounds.".

COMMENTS – Resources

- "The distance between students and professors is a major issue. Faculty members should be more accessible and approachable. They should be available for students to reach out to and discuss their concerns.".

- "Faculty members should be encouraged to reach out to students and provide guidance. This can help students feel more connected to the academic community and support their success.".

COMMENTS – Other

- "There are some concerns about the lack of diversity in our student body. This is concerning because it limits the range of perspectives and experiences that are brought to the classroom.".

- "It is important to consider the impact of diversity on our programs. How can we ensure that our programs are inclusive and welcoming to all students?".

CONCLUSION

- "Key points of concern:
  - Teaching
  - Research
  - Curriculum
  - Assessment
  - Opportunities to learn
  - Personal support
  - International students
  - Enrollment
  - Student recruitment
  - Future research
  - Department support should extend beyond student group funding."