

# Cover Sheet: Request 13071

## Change Critical Tracking Criteria for Aerospace Engineering

### Info

Process	Major Curriculum Modify Ugrad/Pro
Status	Pending at PV - University Curriculum Committee (UCC)
Submitter	Bruce Carroll bfc@ufl.edu
Created	9/19/2018 7:52:30 AM
Updated	3/13/2019 3:04:30 PM
Description of request	Requested change of critical tracking criteria for undergraduate aerospace engineering degree. Raise minimum critical tracking gpa from 2.5 to 2.8 and replace "approved science elective" with "EML2023 Computer Aided Graphics and Design" as a required critical tracking course.

### Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	ENG - Mechanical and Aerospace Engineering 011902000	Bruce Carroll		9/19/2018
AEROSPACE ENGINEERING - catalog markup - critical tracking changes.docx					9/19/2018
College	Approved	ENG - College of Engineering	Heidi Dublin	Approved by the HWCOE Curriculum Committee and Faculty Council	10/23/2018
No document changes					
Associate Provost for Undergraduate Affairs	Approved	PV - APUG Review	Casey Griffith		1/22/2019
No document changes					
University Curriculum Committee	Commented	PV - University Curriculum Committee (UCC)	Lee Morrison	Added to February agenda.	2/13/2019
No document changes					
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			2/13/2019
No document changes					
Office of the Registrar					
No document changes					
Student Academic Support System					
No document changes					
Catalog					
No document changes					
Academic Assessment Committee Notified					
No document changes					
College Notified					
No document changes					

# Major|Modify\_Curriculum for request 13071

## Info

**Request:** Change Critical Tracking Criteria for Aerospace Engineering

**Description of request:** Requested change of critical tracking criteria for undergraduate aerospace engineering degree. Raise minimum critical tracking gpa from 2.5 to 2.8 and replace "approved science elective" with "EML2023 Computer Aided Graphics and Design" as a required critical tracking course.

**Submitter:** Bruce Carroll bfc@ufl.edu

**Created:** 3/1/2019 3:58:01 PM

**Form version:** 5

## Responses

**Major Name** Aerospace Engineering

**Major Code** ASE

**Degree Program Name** Aerospace Engineering

**Undergraduate Innovation Academy Program** No

**Effective Term** Fall

**Effective Year** 2019

**Current Curriculum for Major** Current Critical Tracking Requirements

A) Students must complete the following courses with a minimum grade of C within two attempts:

1. CHM2045 General Chemistry or CHM2095 Chemistry for Engineers 1
2. Approved Science Elective (AST3018, AST3019, BSC2010, CHM2046, CHM2096, or PHY3101)
3. MAC2311 Analytical Geometry and Calculus 1
4. MAC2312 Analytical Geometry and Calculus 2
5. MAC2313 Analytical Geometry and Calculus 3
6. MAP2302 Elementary Differential Equations
7. PHY2048 Physics with Calculus 1
8. PHY2049 Physics with Calculus 2

B) Students must maintain a minimum critical tracking GPA of 2.5 (based on best attempt in each tracking course)

**Proposed Curriculum Changes** Proposed Curriculum Changes: (Changes in Bold and Underlined)

The proposed curriculum change includes two parts. First is to replace the critical tracking course "science elective" with the course "EML2023 Computer Aided Graphics and Design". Second is to raise the minimum Critical Tracking GPA from 2.5 to 2.8.

A) Students must complete the following courses with a minimum grade of C within two attempts:

1. CHM2045 General Chemistry or CHM2095 Chemistry for Engineers 1
2. EML2023 Computer Aided Graphics and Design
3. MAC2311 Analytical Geometry and Calculus 1
4. MAC2312 Analytical Geometry and Calculus 2
5. MAC2313 Analytical Geometry and Calculus 3
6. MAP2302 Elementary Differential Equations
7. PHY2048 Physics with Calculus 1
8. PHY2049 Physics with Calculus 2

B) Students must maintain a minimum critical tracking GPA of 2.8 (based on best attempt in each tracking course)

Note that both the science elective and the course EML2023 are currently required in the curriculum. This proposal simple exchanges the two as critical tracking courses. Thus, no changes to the semester by semester recommended plan of study is required.

**Pedagogical Rationale/Justification** Please see attached document for better formatting

Critical Tracking / Universal Tracking is an important academic monitoring and feedback mechanism that provides students with assessment of timely progress toward completion of degree requirements. Semester 1 and Semester 2 are particularly important for helping students evaluate the suitability of their declared major. For the aerospace engineering and mechanical engineering BS degree programs, the semester 1 and semester 2 critical tracking courses are CHM2045 Chemistry 1, CHM2046 Chemistry 2 (or other approved science elective), MAC2311 Analytical Geometry and Calculus 1, MAC2312 Analytical Geometry and Calculus 2, and PHY2048 Physics with Calculus 1. The effectiveness of these courses as predictors of success in engineering is shown in Table 1 which provides the correlation between course grade and upper division engineering GPA. The course EGM3520 is also included in Table 1 for comparison to show the standardized correlation for an upper division engineering course within the major (correlation coefficient of 0.267 for both female and male students with high level of significance). Surprisingly, MAC2311 and PHY2048 do not display good statistical significance for either male or female students. CHM2045, CHM2046, and MAC2312 are acceptable predictors for male students, but are statistically significant predictors for female students. Thus, the program currently does not have a critical tracking course that serves as a good predictor of success within the major for both female and male students. Evaluation of alternative courses revealed that the semester 2 course EML2023 Computer Aided Graphics and Design is a good predictor of success within the major for both female and male students. Further analysis has shown that many students delay taking the CHM2046 or other science elective options since they are not required as a prerequisite for other courses in the curriculum. However, students do not delay taking EML2023 since it is a prerequisite for other required courses in the major. In summary, the course EML2023 Computer Aided Graphics and Design is an outstanding candidate as a critical tracking courses since it is a good predictor of success in the major for both male and female students and is typically taken during the second semester by the majority of first time in college students.

Table 1: Predictive Value of Term 1 and 2 Critical Tracking Courses for Success in Upper Division Mechanical And Aerospace Engineering Courses

Course	Term	Gender	Standardized Correlation Coefficient	Significance	Good
CHM2045 Chemistry 1	1	F	0.139	0.018 > 0.05	No
		M	0.071	0.006	
					Yes
MAC2311 Analytical Geometry & Calculus 1	1	F	0.150	0.010 > 0.05	
		M	0.022	0.392 > 0.05	
					No
MAC2312 Analytical Geometry & Calculus 2	2	F	0.149	0.012 > 0.05	
		M	0.119	0.000	
					Yes
PHY2048 Physics 1 with Calculus	2	F	0.123	0.068 > 0.05	No
		M	0.047	0.091 > 0.05	
					No
CHM2046 Chemistry 2 (Science Elective)	2	F	0.065	0.101 > 0.05	No
		M	0.064	0.001	
					Yes
EML2023 Computer Aided Graphics & Design	2	F	0.193	0.000	Yes
		M	0.148	0.000	
					Yes
EGM3520 Mechanics of Materials (Provided for comparison – Not a Critical Tracking Course)	5	F	0.267	0.000	Yes
		M	0.267	0.000	Yes

The second aspect of this proposal is to raise the average Critical Tracking GPA based on best

attempt from a 2.5 to a 2.8. Note that students are required to make a C or better on each critical tracking course and are allowed a maximum of two attempts. In addition to earning the C or better in each attempt, students currently are required to earn a 2.5 GPA average on the best of the attempts in all Critical Tracking courses. The proposal is to raise the CT GPA average from a 2.5 to a 2.8. The program has observed that students with higher CT GPA tend to have higher overall UF GPA at time of graduation. The motivation to raise CT GPA is to promote higher average overall UF GPA at time of graduation to a 3.0 (on average for all students). Feedback from students within the program, graduating seniors, recent graduates, the Career Connections Center, and the Department External Advisory Board indicate that a 3.0 UF GPA is increasingly becoming a target UF GPA set by engineering recruiters for new hires. Some employers will not even interview students with lower GPAs. Additionally, students with a 3.0 or higher UF GPA have maximum opportunities for advanced study. Multiple constituencies of the mechanical and aerospace engineering program have identified the desirability of raising academic standards and the positive impact this will have on the marketability and long term value of the degree for our students.

An analysis of graduating seniors in 2017 is shown in Figure 1. UF GPA at time of graduation is plotted vs. Critical Tracking GPA (CT GPA). The dashed line is a linear curve fit to the data showing that a target GPA of 3.0 at graduation corresponds to the proposed CT GPA of 2.8. Also notice in this figure a few odd features. It is possible to have a CT GPA below 4.0 with a UF GPA of 4.0. This is due to transfer students since the UF GPA is based only on courses taken at UF while CT GPA includes courses taken at other schools. Also note that some students with a perfect CT GPA of 4.0 have lower UF GPA at time of graduation. Various factors can cause a drop in performance as students move into the upper division, including financial, family, injury, psychological, medical, and other issues.

#### **Impact on Enrollment, Retention, Graduation** Please see attached document for better formatting

Students are currently advised by the Herbert Wertheim College of Engineering First Year Advising Program the first two semesters. Students in good academic standing that meet relevant critical tracking criteria then matriculate to their chosen major for advising at the end of two semesters. Students who are "off track" are placed on UES-Probation where they are given additional counseling and either resolve the academic difficulties or change majors to a more appropriate option. Currently the HWCOE had 1416 first year students in summer 2018. With a 2.5 CT GPA requirement 13% (187) were placed on UES Probation and not allowed to matriculate to their selected major at the start of the Fall 2018 semester. Mechanical and Aerospace Engineering (MAE) portion of this student population is approximately 345 entering the mechanical and aerospace engineering BS programs and 47 students in UES-Probation seeking admission to the ME or AE BS programs. Raising the CT GPA from 2.5 to 2.8 would cause an additional 24 students not being allowed to matriculate into the ME or AE BS programs. The percentage of students not meeting the CT GPA requirement would rise from the current 13% to 20%. Students who don't meet the CT GPA would be detected early in their academic careers (during the first two semesters). Some would be able to fix their academic problems and eventually compete the degree programs. Others would change to new majors. Since these student would be detected early, they would have a large degree of flexibility in terms of identifying a more suitable major and would still be able to graduate in a timely manner.

In summary, raising the CT GPA from a 2.5 to 2.8 for the aerospace engineering and mechanical engineering BS degree programs would affect approximately 24 student each fall semester and a much small number each spring semester (approximately 6 students in the spring term). For the aerospace engineering program alone, this change would affect approximately 8 students each fall semester and 3 students in the spring semester. The affected students we be at the end of their second semester and eligible to change to other majors at UF.

The new Critical Tracking course (EML2023 Computer Aided Graphics and Design) is not available at the majority of state colleges and the vast majority of transfer students with the AA degree would not complete this course prior to transfer. For purposes of transfer admissions, the science elective would continue to be used. Transfer students would complete EML2023 during their first semester (as is currently done) and this would delay graduation for these students. The MAE program already accepts as transfer credit any state college or university offerings of EML2023 or equivalent.

Initially the program speculated that CT GPA would have a strong influence on time to graduation. However, analysis of several years of recent graduation data has shown only a weak, although statistically significant, correlation between terms in school and CT GPA ( $R = -0.338$ ,  $p = 1.1e-15$ ). A more detailed analysis is needed that accounts for the many factors including internships, double

majors, minors, participation in professional societies, traumatic events, illness, study abroad, participation in 4/1 program, etc.

**Assessment Data Review** Please see attached document for better formatting

Program Goal 1: Prepare students to meet the expectations of employers of aerospace engineers. Anecdotal feedback from Career Resource Center (Career Connections Center) and Exit Interview with graduating students indicates desirability of 3.0 GPA at time of graduation in terms of maximizing opportunities for job placement and graduate study options.

Program Goal 4: Increase diversity of undergraduate student population

Graduation Data from UF Office of Institutional Planning and Research ([ir.aa.ufl.edu/degrees-grades](http://ir.aa.ufl.edu/degrees-grades))  
ASE BS Degree

	Female	Asian	Black or African American	Hispanic / Latino	Nonresident Alien	White	Unreported
2015/16							
(81 degrees)	10 (12.3%)	*	*				16
(19.7%)*	60						
(74.1%)	5						
(6.2%)							
2016/17							
(85 degrees)	19						
(22.4%)	6						
(7.1%)	2						
(2.4%)	20						
(23.5%)*	52						
(61.2 %)	5						
(5.8%)							

**Academic Learning Compact and Academic Assessment Plan** No changes to academic learning compact or academic assessment plan

# AEROSPACE ENGINEERING

## MAJOR

Critical Tracking records each student's progress in courses that are required for entry to each major. Please note the critical-tracking requirements below on a per-semester basis.

Equivalent critical-tracking courses as determined by the State of Florida [Common Course Prerequisites](#) may be used for transfer students.

## SEMESTER 1

- Complete 1 of 8 tracking courses with a minimum grade of C within two attempts: [CHM 2045](#) or [CHM 2095](#), [approved science elective](#) [EML2023](#), [MAC 2311](#), [MAC 2312](#), [MAC 2313](#), [MAP 2302](#), [PHY 2048](#), [PHY 2049](#)
- [2.58](#) GPA required for all critical-tracking courses
- 2.0 UF GPA required

## SEMESTER 2

- Complete 1 additional critical-tracking course with a minimum grade of C within two attempts
- [2.58](#) GPA required for all critical-tracking courses
- 2.0 UF GPA required

## SEMESTER 3

- Complete 2 additional critical-tracking courses with minimum grades of C within two attempts
- [2.58](#) GPA required for all critical-tracking courses
- 2.0 UF GPA required

## SEMESTER 4

- Complete 2 additional critical-tracking courses with minimum grades of C within two attempts

- 2.58 GPA required for all critical-tracking courses
- 2.0 UF GPA required

## SEMESTER 5

- Complete all 8 critical-tracking courses with minimum grades of C within two attempts
- 2.58 GPA required for all critical-tracking courses
- 2.0 UF GPA required

**Request:** Change Critical Tracking Criteria for Aerospace Engineering

**Description of Request:**

**Submitter:** Bruce Carroll  
[bfc@ufl.edu](mailto:bfc@ufl.edu)

**Major Name:** Aerospace Engineering (Bachelor of Science)

**Major Code:** ASE

**Degree Program Name:** Aerospace Engineering

**Undergraduate Innovation Academy Program:** No

**Effective term and Year:** Fall 2019

**Current Curriculum for Major:**

- A) Students must complete the following courses with a minimum grade of C within two attempts:
1. CHM2045 General Chemistry or CHM2095 Chemistry for Engineers 1
  2. Approved Science Elective (AST3018, AST3019, BSC2010, CHM2046, CHM2096, or PHY3101)
  3. MAC2311 Analytical Geometry and Calculus 1
  4. MAC2312 Analytical Geometry and Calculus 2
  5. MAC2313 Analytical Geometry and Calculus 3
  6. MAP2302 Elementary Differential Equations
  7. PHY2048 Physics with Calculus 1
  8. PHY2049 Physics with Calculus 2
- B) Students must maintain a minimum critical tracking GPA of 2.5 (based on best attempt in each tracking course)

**Proposed Curriculum Changes: (Changes in Bold and Underlined)**

The proposed curriculum change includes two parts. First is to replace the critical tracking course “science elective” with the course “EML2023 Computer Aided Graphics and Design”. Second is to raise the minimum Critical Tracking GPA from 2.5 to 2.8.

- A) Students must complete the following courses with a minimum grade of C within two attempts:
1. CHM2045 General Chemistry or CHM2095 Chemistry for Engineers 1
  2. **EML2023 Computer Aided Graphics and Design**
  3. MAC2311 Analytical Geometry and Calculus 1
  4. MAC2312 Analytical Geometry and Calculus 2
  5. MAC2313 Analytical Geometry and Calculus 3
  6. MAP2302 Elementary Differential Equations
  7. PHY2048 Physics with Calculus 1
  8. PHY2049 Physics with Calculus 2



- B) Students must maintain a minimum critical tracking **GPA of 2.8** (based on best attempt in each tracking course)

Note that both the science elective and the course EML2023 are currently required in the curriculum. This proposal simply exchanges the two as critical tracking courses. Thus, no changes to the semester by semester recommended plan of study is required.

**Pedagogical Rationale / Justification:**

(Describe the rationale for the proposed changes to the curriculum)

Critical Tracking / Universal Tracking is an important academic monitoring and feedback mechanism that provides students with assessment of timely progress toward completion of degree requirements. Semester 1 and Semester 2 are particularly important for helping students evaluate the suitability of their declared major. For the aerospace engineering and mechanical engineering BS degree programs, the semester 1 and semester 2 critical tracking courses are CHM2045 Chemistry 1, CHM2046 Chemistry 2 (or other approved science elective), MAC2311 Analytical Geometry and Calculus 1, MAC2312 Analytical Geometry and Calculus 2, and PHY2048 Physics with Calculus 1. The effectiveness of these courses as predictors of success in engineering is shown in Table 1 which provides the correlation between course grade and upper division engineering GPA. The course EGM3520 is also included in Table 1 for comparison to show the standardized correlation for an upper division engineering course within the major (correlation coefficient of 0.267 for both female and male students with high level of significance). Surprisingly, MAC2311 and PHY2048 do not display good statistical significance for either male or female students. CHM2045, CHM2046, and MAC2312 are acceptable predictors for male students, but are not statistically significant predictors for female students. Thus, the program currently does not have a critical tracking course that serves as a good predictor of success within the major for both female and male students. Evaluation of alternative courses revealed that the semester 2 course EML2023 Computer Aided Graphics and Design is a good predictor of success within the major for both female and male students.

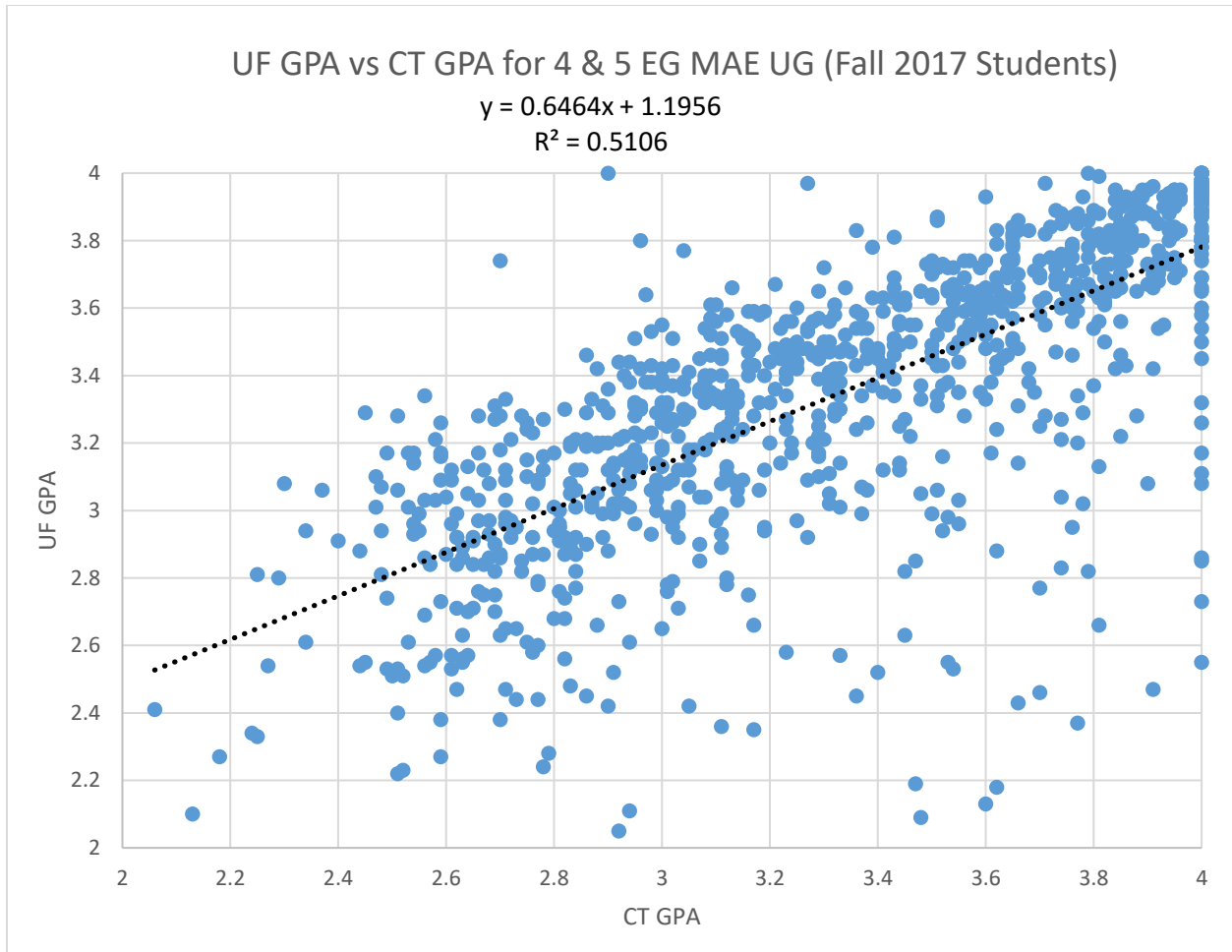
Further analysis has shown that many students delay taking the CHM2046 or other science elective options since they are not required as a prerequisite for other courses in the curriculum. However, students do not delay taking EML2023 since it is a prerequisite for other required courses in the major. In summary, the course EML2023 Computer Aided Graphics and Design is an outstanding candidate as a critical tracking course since it is a good predictor of success in the major for both male and female students and is typically taken during the second semester by the majority of first time in college students.

<b>Table 1: Predictive Value of Term 1 and 2 Critical Tracking Courses for Success in Upper Division Mechanical And Aerospace Engineering Courses</b>					
<b>Course</b>	<b>Term</b>	<b>Gender</b>	<b>Standardized Correlation Coefficient</b>	<b>Significance</b>	<b>Good Predictor</b>
CHM2045 Chemistry 1	1	F	0.139	0.018 > 0.05	No
		M	0.071	0.006	Yes
MAC2311 Analytical Geometry & Calculus 1	1	F	0.150	0.010 > 0.05	No
		M	0.022	0.392 > 0.05	No
MAC2312 Analytical Geometry & Calculus 2	2	F	0.149	0.012 > 0.05	No
		M	0.119	0.000	Yes
PHY2048 Physics 1 with Calculus	2	F	0.123	0.068 > 0.05	No
		M	0.047	0.091 > 0.05	No
CHM2046 Chemistry 2 (Science Elective)	2	F	0.065	0.101 > 0.05	No
		M	0.064	0.001	Yes
EML2023 Computer Aided Graphics & Design	2	F	0.193	0.000	Yes
		M	0.148	0.000	Yes
EGM3520 Mechanics of Materials (Provided for comparison – Not a Critical Tracking Course)	5	F	0.267	0.000	Yes
		M	0.267	0.000	Yes

The second aspect of this proposal is to raise the average Critical Tracking GPA based on best attempt from a 2.5 to a 2.8. Note that students are required to make a C or better on each critical tracking course and are allowed a maximum of two attempts. In addition to earning the C or better in each attempt, students currently are required to earn a 2.5 GPA average on the best of the attempts in all Critical Tracking courses. The proposal is to raise the CT GPA average from a 2.5 to a 2.8. The program

has observed that students with higher CT GPA tend to have higher overall UF GPA at time of graduation. The motivation to raise CT GPA is to promote higher average overall UF GPA at time of graduation to a 3.0 (on average for all students). Feedback from students within the program, graduating seniors, recent graduates, the Career Connections Center, and the Department External Advisory Board indicate that a 3.0 UF GPA is increasingly becoming a target UF GPA set by engineering recruiters for new hires. Some employers will not even interview students with lower GPAs. Additionally, students with a 3.0 or higher UF GPA have maximum opportunities for advanced study. Multiple constituencies of the mechanical and aerospace engineering program have identified the desirability of raising academic standards and the positive impact this will have on the marketability and long term value of the degree for our students.

An analysis of graduating seniors in 2017 is shown in Figure 1. UF GPA at time of graduation is plotted vs. Critical Tracking GPA (CT GPA). The dashed line is a linear curve fit to the data showing that a target GPA of 3.0 at graduation corresponds to the proposed CT GPA of 2.8. Also notice in this figure a few odd features. It is possible to have a CT GPA below 4.0 with a UF GPA of 4.0. This is due to transfer students since the UF GPA is based only on courses taken at UF while CT GPA includes courses taken at other schools. Also note that some students with a perfect CT GPA of 4.0 have lower UF GPA at time of graduation. Various factors can cause a drop in performance as students move into the upper division, including financial, family, injury, psychological, medical, and other issues.



**Impact on Enrollment, Retention, Graduation:**

(Describe any potential impact on students who are currently in the major)

Students are currently advised by the Herbert Wertheim College of Engineering First Year Advising Program the first two semesters. Students in good academic standing that meet relevant critical tracking criteria then matriculate to their chosen major for advising at the end of two semesters. Students who are “off track” are placed on UES-Probation where they are given additional counseling and either resolve the academic difficulties or change majors to a more appropriate option. Currently the HWCOE had 1416 first year students in summer 2018. With a 2.5 CT GPA requirement 13% (187) were placed on UES Probation and not allowed to matriculate to their selected major at the start of the Fall 2018 semester. Mechanical and Aerospace Engineering (MAE) portion of this student population is approximately 345 entering the mechanical and aerospace engineering BS programs and 47 students in UES-Probation seeking admission to the ME or AE BS programs. Raising the CT GPA from 2.5 to 2.8 would cause an additional 24 students not being allowed to matriculate into the ME or AE BS programs. The percentage of students not meeting the CT GPA requirement would rise from the current 13% to 20%. Students who don’t meet the CT GPA would be detected early in their academic careers (during the first two semesters). Some would be able to fix their academic problems and eventually compete the degree programs. Others would change to new majors. Since these student would be detected

early, they would have a large degree of flexibility in terms of identifying a more suitable major and would still be able to graduate in a timely manner.

In summary, raising the CT GPA from a 2.5 to 2.8 for the aerospace engineering and mechanical engineering BS degree programs would affect approximately 24 students each fall semester. The affected students would be at the end of their second semester and eligible to change to other majors at UF.

The new Critical Tracking course (EML2023 Computer Aided Graphics and Design) is not available at the majority of state colleges and the vast majority of transfer students with the AA degree would not complete this course prior to transfer. For purposes of transfer admissions, the science elective would continue to be used. Transfer students would complete EML2023 during their first semester at UF (as is currently done) and this would not delay graduation for these students. The MAE program already accepts as transfer credit any state college or university offerings of EML2023 or equivalent.

Initially the program speculated that CT GPA would have a strong influence on time to graduation. However, analysis of several years of recent graduation data has shown only a weak, although statistically significant, correlation between terms in school and CT GPA ( $R = -0.338$ ,  $p = 1.1e-15$ ). A more detailed analysis is needed that accounts for the many factors including internships, double majors, minors, participation in professional societies, traumatic events, illness, study abroad, participation in 4/1 program, etc.

**Assessment Data Review:**

(Describe Student Learning Outcome and/or Program Goal Data that was reviewed to support the proposed changes.)

**Program Goal 1: Prepare students to meet the expectations of employers of aerospace engineers.**

Anecdotal feedback from Career Resource Center (Career Connections Center) and Exit Interview with graduating students indicates desirability of 3.0 GPA at time of graduation in terms of maximizing opportunities for job placement and graduate study options.

<b>Program Goal 4: Increase diversity of undergraduate student population</b> Graduation Data from UF Office of Institutional Planning and Research (ir.aa.ufl.edu/degrees-grades) ASE BS Degree							
	Female	Asian	Black or African American	Hispanic / Latino	Nonresident Alien	White	Unreported
2015/16 (81 degrees)	10 (12.3%)	*	*	16 (19.7%)	*	60 (74.1%)	5 (6.2%)
2016/17 (85 degrees)	19 (22.4%)	6 (7.1%)	2 (2.4%)	20 (23.5%)	*	52 (61.2 %)	5 (5.8%)

**Academic Learning Compact and Academic Assessment Plan:**

(Describe the modifications to the Academic learning Compact (for the undergraduate programs) and the Academic Assessment Plan that result from the proposed change)

No changes to the Academic Learning Compact requested