

Current as of 14 April 2023

MEMORANDUM FOR THE ADVISORY BOARD MEETING

SUBJECT: AY23-2 USMA Chemical Engineering Advisory Board Meeting Minutes

1. The Chemical Engineering Advisory Board meeting convened at 0800 hours in BH465 for an assessment of USMA CLS chemical engineering program. The following board members were present as indicated below:

Original Board Members attending:

No.	Name	Title	Industry - University	Email
1	LTC(R) Matthew Armstrong PhD	Associate Professor (Retired LTC) and Principal Engineer	Fluor Marine Propulsion, Schenectady, NY	armstm@udel.edu
2	COL Aaron Hill, PhD, PE	Deputy Head, Department of Civil & Mechanical Engineering	USMA; CME	aaron.hill@westpoint.edu
3	COL(R) Paul Dietrich	Chemical Officer	Chemical Officer/Industry	paul@the-dietrichs.com
4	Dr. Lucy Hair	Specialist and Chemical Engineer	Jacobs Engineering at Lawrence Livermore National Laboratory	hair1@lnl.gov
5	Prof. Matthew Liberatore	Professor, Chemical Engineering	University of Toledo	matthew.liberatore@utoledo.edu
6	Prof. Kelly Schutz	Assistant Professor, Chemical Engineering	Lehigh University	kes513@lehigh.edu
7	Prof. Gautham Krishnamoorthy	Professor, Chemical Engineering	University of North Dakota	gautham.krishnamoort@und.edu
8	Mrs. Kisondra Tanev	Director, Power & Renewables Investment Banking	Bank of America	kisondra@gmail.com
9	Mr. Donald Glaser	President and Founder	Simulation Solutions	dglaser@simulation-solutions.com
10	Mr. Kevin Shipe	Account Manager, Chem E (Old Grad '08), Former Automation Engineer	The Graham Company	kevin.a.shipe@gmail.com
11	Mr. Michael DeForest	Industry, Chem E (Old Grad '07) Director of Operations,	Fortna	mike@smkpackaging.com
12	Mr. Michael Theising	Industry, Chem E (Old Grad '11), Operations Manager	Brenntag Group	m.theising@gmail.com

*Note: LTC(R) Armstrong is absent.

2. Session 1: Introductory remarks and ABET orientation
 - a. At 08:00, COL Burpo made introductory remarks on the overall direction of the chemical engineering program. COL Burpo mentioned the upcoming ABET look, the installation of bioengineering courses, the competition of talents within and outside of the Army, the importance of STEM research in the Army, and the emergence of AI-driven tools.
 - b. At 08:15, the advisory board and chemical engineering faculty introduced themselves.
 - c. At 08:25, Dr. Nagelli gave the overview of the meeting schedule to the board.
 - d. At 08:27, Dr. Nagelli provided the goals of advisory meeting, including assessment data, objectives assessment, curricular challenges, and board surveys.
3. Session 2: Assessment and program objectives feedback from Board and future challenges
 - a. At 08:30, Dr. Nagelli mentioned the upcoming ABET year (AY25-26), mentioning about the consistency of program and assessment of program data. Dr. Nagelli stated the importance of ABET accreditation, emphasizing the standards of courses, the engineering profession, opportunities for graduates, and requirement by Army.
 - b. Dr. Nagelli mentioned the student outcomes for AY19 and beyond.
 - c. Dr. Biaglow explained the assessment (coursework embedded indicators) of student outcome to the board. Dr. Liberatore asked whether such assessment is based on specific factors (i.e., PS or WPRs). Dr. Nagelli and Dr. Biaglow responded that the assessment is based on the multiple aspects of chemical engineering courses.
 - d. Mrs. Tanev about the standard assessment in CH400. Dr. Nagelli mentioned that the assessment is based on the FEE example problems, mapping back to the student outcomes covering the comprehensive range of chemical engineering courses. Dr. Biaglow added that CH400 utilizes the FEE prep software (consists of 20 quizzes) for

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cadets to assess themselves. Mrs. Tanev also asked about the overall score in CH400. Dr Nagelli mentioned that the score is raw and not normalized.

- e. Mr. Shipe asked about how CH400 closely simulates the actual FEE environment. Dr. Nagelli and Dr. Biaglow mentioned CH400 consists of multiple graded events, preparing for FEE, but most importantly, covering comprehensive concepts in chemical engineering topics.
- f. Prof. Krishnamoorthy asked about the rubric (1, 2, and 3) for assessing the student outcomes. Dr. Biaglow responded that the purpose of rubric is to give internal feedback to the course directors to make sure that the student outcomes are met in their respective courses.
- g. Dr. Schutz asked about the feedback given by cadets on the specific courses. Dr. Biaglow mentioned that the cadet survey was conducted in January to get detailed feedback on the courses.
- h. Prof. Krishnamoorthy also emphasized that multiple year surveys are important to get the averaged feedback from cadets, not depending on the specific year.
- i. COL Hill mentioned that he will get back to the CME faculty on the trend shown in MC300 by chemical engineering cadets.
- j. Dr. Biaglow mentioned that the course average with respective years is shown due to its relationship to FEE.
- k. Prof. Krishnamoorthy asked whether one instructor teaches one course throughout the years. Dr. Biaglow mentioned that the instructor is changed each year.
- l. COL Hill asked about when the end-of-semester surveys are collected. Dr. Biaglow mentioned that the surveys are collected at the end of semester.
- m. Prof. Krishnamoorthy asked about the magnitude of standard deviation associated with the performance data. Dr. Biaglow stated that the overall trend is closely observed in the performance and systematic responses can be made to improve the respective course.
- n. Dr. Schutz asked about where FEE is taken. Dr. Biaglow mentioned that most FEE is taken locally.
- o. Mrs. Tanev mentioned that it would be helpful to track and see whether cadets take FEE after graduation from West Point. COL Hill added that getting into the engineering branch helps get PE for graduates.
- p. COL Hill asked whether FEE is needed for getting honors for civil and mechanical engineering graduates. Dr. Nagelli responded FEE is not the mandatory factor for getting honors for chemical engineering cadets.
- q. Dr. Shutz asked about the results of FEE, whether the results are collected for the first-time takers. Dr. Biaglow responded, the results are collected from the first-time takers.
- r. Dr. Liberator asked how the FEE scores were obtained. Dr. Biaglow mentioned that the coordinator at the Dean's office received the overall report.
- s. Mr. Shipe asked when the major is declared. COL Burpo responded that the cadet declared their major at their 2nd semester of plebes.
- t. At 09:30, LTC Cowart mentioned several future challenges and discussion points for the board members.
- u. Dr. Liberator mentioned bringing the chemical engineering undergraduate rankings to the AIChE head.
- v. Dr. Liberator asked about enrollment in the CLS department. Dr. Biaglow and LTC Cowart mentioned the number of chemical engineering cadets is relatively stable throughout the years.

4. Board feedback on cadet interactions

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- a. Dr. Liberatore mentioned about the interaction between Cows and Firsties. COL(R) Dietrich recommended regular meeting events for all chemical engineering cadets regardless of their years. Dr. Schutz also mentioned having a technical event for cadets (i.e., inviting guest speakers). Dr. Liberatore emphasized randomly mingling cadets regardless of the years. Mr. Shipe stated that it is difficult for cadets with different years to be mixed.
 - b. Mr. Glaser and COL(R) Dietrich suggested having a dedicated space for cadets to socialize.
 - c. Dr. Schutz asked where the cadets were doing their academic work. Mr Shipe responded that most academic work is done either at the barracks or library. Dr. Biaglow added that there are AI rooms throughout Bartlett Hall and along the hallway. COL(R) Dietrich and Mr. DeForest recommended letting cadets know about the available room resources.
 - d. Mr. Glaser and Mrs. Tanev mentioned that cadets have a positive perspective on CH400 since the course is comprehensive over the major chemical engineering concepts and preparing them for FEE.
 - e. COL(R) Dietrich mentioned that chemical engineering cadets are not sure about adding 1-credit introductory chemical engineering in their 8TAP.
 - f. Mr. Shipe asked about chemical engineering junior officers teaching chemistry. Dr. Nagelli mentioned that they are part of the chemical engineering team to support many events happening in the program. LTC Cowart also stated that junior officers begin to do guest lectures in upper chemical engineering courses. Dr. Biaglow further mentioned having chemical engineering junior officers in general chemistry classes is a great promotion for drawing plebes to the program.
 - g. Dr. Schutz asked whether the concepts of concepts are being taught in physics II. Dr. Biaglow mentioned the concepts of circuits are not taught in physics II. Dr. Biaglow also stated the main reasons why circuits and statics are covered are closely related to FEE.
 - h. Mr Shipe mentioned one of the skills that many professionals lack in the industrial market is professional writing and communication. LTC Cowart mentioned one of methodologies to reinforce these skills is to go to AIADs.
 - i. Prof. Krishnamoorthy suggested it would be nice to reinforce some of the important concepts in material science.
5. Session 3: Bioengineering electives
- a. At 14:30, Dr. Yuk introduced the bioengineering course updates to the board members.
 - b. Dr. Hair asked about the prerequisites for CH300 and CH350. LTC Cowart mentioned that physics II, calculus II, and general chemistry II must be taken.
6. Session 4: Program updates
- a. At 13:33, Dr. Nagelli introduced the USMA mission and UMSA/program vision to the board members.
 - b. Mr. Glaser mentioned that the phrase “current and future challenges” might need to be incorporated in the program vision, consisting with overall USMA mission statement.
 - c. Dr. Liberatore suggested that the word “modern” can be removed.
 - d. At 13:39, Dr. Nagelli introduced the program mission to the board members.
 - e. At 13:40, Dr. Nagelli introduced the program objectives to the board members.
 - f. Mr. DeForest and Dr. Schutz suggested removing the word “operational” from the 3rd program objective. Dr. Biaglow mentioned that the student outcome and program objectives can’t be too similar.
 - g. COL Hill mentioned the necessity to put the word “expertise” in the 1st program objective.

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- h. Mr. Glaser suggested the terms “multi-functional team”, “problem-solving”, and “critical thinking” in the 1st program objectives.
 - i. Dr. Shutz and Mrs. Tanev also suggested “apply chemical engineering principles to drive innovation” in the 1st program objective, instead of “expertise.”
 - j. Mrs. Tanev suggested revising the phrase “leverage the intellectual capital” in the 2nd program objective.
 - k. Dr. Liberatore and Dr. Hair suggested switching the terms “graduate school” and “advanced study programs” in the 3rd program objective.
 - l. Mrs. Tanev suggested defining the “succeed” in the 3rd program objective.
 - m. Mrs. Tanev also suggested the phrase “continue/pursue intellectual development” to capture the continuous learning beyond graduation in the 3rd program objective.
 - n. Mrs. Tanev further suggested the phrase “apply technical expertise to succeed in military programs and graduate school” in the 3rd program objective.
 - o. Mr. Shipe and Mrs. Tanev suggested adding the term “professional and technical” into the 4th program objective.
 - p. At 14:42, Dr. Nagelli gave an overview of the research program in the CLS.
 - q. Dr. Liberatore asked whether the research course is counted as engineering electives. Dr. Biaglow responded that it can't be engineering electives since not every cadet taking the course is doing engineering-related research.
 - r. Mrs. Tanev suggested creating a general research promotion site for cadets to access easily.
7. Session 5: Future challenges II
- a. At 15:00, Dr. Nagelli presented the future challenges the chemical engineering program is facing, including faculty allocation and national rankings for undergraduate programs.
 - b. Dr. Hair asked about hiring TA or adjunct faculty.
 - c. Dr. Biaglow stated the possibility of offering CH459 for both semesters as an alternative solution for the growing population of cadets.
8. The meeting adjourned in 1520.
9. The POC for these minutes is the undersigned at enoch.nagelli@westpoint.edu.

ENOCH A. NAGELLI
Program Director, Chemical Engineering

Summary and Minutes of the Chemical Engineering Advisory Board Meeting on 13-14 April 2023

The advisory board is asked to comment on various aspects of the curriculum, the meeting content, and any other issues that they would like to raise. The survey questions are underlined and in bold font below, followed by responses of individual members. A summary in red font appears at the end of each section.

Based on the assessment data or on your personal opinion, is there a course that the program should add to the curriculum?

Dietrich: 2nd controls course and/or separations/reactions more specific to CE vs CE Thermodynamics, which is less relevant to C/E. Consider a 1-credit chemical engineering intro but implement via required engineering courses.

Hair: Materials science and engineering is an incredibly important field in civilian and military technologies – is that addressed?

Liberatore: Major fair was great and helped many pick ChE. The 1-credit intro course is great if they can fit it into the Plebe year. Do you use guest lectures (alumni) from different life roles? Moving MEB (CH362 to earlier would be good even if 1st semester yearling. Moving thermos (ME301) to yearling year would be good also. Adding more engineering earlier will help with retention and lighten the very full cow year.

Hill: Consider whether or not chemical engineering majors need MC300. Consider adding [a] second semester of organic chemistry. They want more application.

Tanev: Some students have suggested replacing MC300 and/or EE301 with another semester of control. CH400, even though survey results show less positive feedback, is much appreciated by students and they all found it very helpful to the program together and [to] prepare them for the FE.

Shipe: Not anything new, but maybe re-evaluate the current structure of courses such as whether concepts in courses like mass & energy or separations are being double covered in courses like thermodynamics. Are all current courses needed or could space be made to offer new electives/fields in ChemE?

Glaser: Prepare a separate course in process safety.

Theising: Organic chemistry 2. In my experience as a cadet, taking both semesters of organic chemistry helped drive concepts home. During the cadet discussion, they indicated they believed there is redundant thermodynamics and fluid mechanics in the current curriculum. If it turns out that we're able to condense that learning and eliminate a course, it would open the credit hours for orgo 2. If that isn't possible, it may be valuable to suggest it as an elective.

Schultz: Maybe not a course but additions to courses are technical writing & ChE economics & scientific communication. Add more in material traditionally in thermo II (fugacity, activity coefficients, etc.). Possibly limit classes with repetitive content. This may have been due to the question asked to the cows.

DeForest: Intro to chemical engineering class (1st semester yuk year) to show examples of ChemE use in the army/private industry. Let Firsties brief their senior projects / research in some classes but focus on examples in the actual army where chemical engineering is used.

Krishnamoorthy: Your cadets are exposed to several computing tools throughout the curriculum. E.g., MA103, CY105, MA206 and in many CH courses. Instead of familiarizing them with several software [packages], e.g., Mathcad, Matlab, Mathematica, would it be useful to stick to one (preferably open-source) to throughout? E.g., Python or R.

R&A: Comments are diverse. More than one person suggested reconsidering MC300 and its role in the curriculum, adding Organic Chemistry 2 to the curriculum, and removing redundant material.

Do you have any suggestions to improve the advisory board meeting for next year?

Dietrich: No comment.

Hair: Well-organized. I think the round-robin cadet interviews could be re-instated.

Liberatore: Mix of alumni, veteran, civilian, and academic is great but keeping to about 10 people is best.

Hill: No. Great event. Thank you! On second thought, it would be great to talk with some of your faculty as well.

Tanev: Would be helpful to see data on covid – of the students that weren't able to take the FE in 2020, how many went back and took the exam?

Shipe: I think it went well, however it seemed like the Firsties wanted some more time, like the cows had, to speak with the board. The Firsties would have valuable feedback being near the end of the program.

Glaser: Offer board members a chance to guest lecture – perhaps in CH200.

Theising: I might suggest leading with the discussion on the vision/mission/objectives.

Schultz: If possible, have an easier way for everyone to eat together to enable conversations between board members and cadets.

DeForest: (1) Get non-alumni to a meal in mess hall (on Thursday) to see it. (2) Get academy tour (Bartlett Hall, Barracks, Arvin).

Krishnamoorthy: None. Very well organized!

R&A: (1) Interactions in smaller groups to facilitate conversations (round-robin interviews, lunches). (2) Tours for new members, such as cadet mess, museum, visitor center. (3) More interactions with faculty.

Please add any additional comments that you would like to make below.

Dietrich: Consider suggestion of board members being members of congress or senator service academy selection boards – potential to preload USMA with chem-e info.

Hair: (1) Very positive feedback on faculty from students. (2) The difficult ChE curriculum is both a point of pride and a detriment to the cadets, the latter in lower GPA. Is there a way to offset that? (3) Add field trips for cows and Firsties. Add lunches for cows and Firsties.

Liberatore: Better communication with cadets about lounges and computer labs and other study rooms available in Bartlett Hall and unlocked. How much do cadets compete at AIChE regional meeting (ChemE Car, research papers, research posters, jeopardy) or national (ChemE sports, ChemE Cube)? Research should be able to be used for engineering elective credits. The requirement that research is engineering is solvable with a few rules.

Hill: (1) Cadets LOVE your faculty! (2) I don't understand how CH400 is a course. It sounds as though it is predominantly review. Plus, students don't have to show up once they pass the FE? (3) Cadets want a place where they can get together and study. (4) They also asked for large computer screens to plug into for efficiency.

Tanev: The students praise the accessibility of the faculty and appreciate the support and mentorship within the department.

Shipe: Thank you again for the opportunity. I think this has made real change and improved the ChemE program as a whole, and I'm excited to see how it has changed since I graduated.

Glaser: Suggest new board members take time to tour the USMA museum and visitor center – very impressive!

Theising: Emphasize to cadets that the course surveys are not about whether they like the course or if the course was "hard." It is about whether the course helps achieve student outcomes. If the end of course surveys are used as evidence of achieving student outcomes, this is obviously very important. Less so if it is only used for internal purposes, but even then, it helps steer discussions / focus efforts to address problems.

Schultz: No comment.

DeForest: Certificate or something to recognize people who have been here for a long time, ending their service, new people, etc. Ron has been here for 20 years. How are we recognizing his efforts?

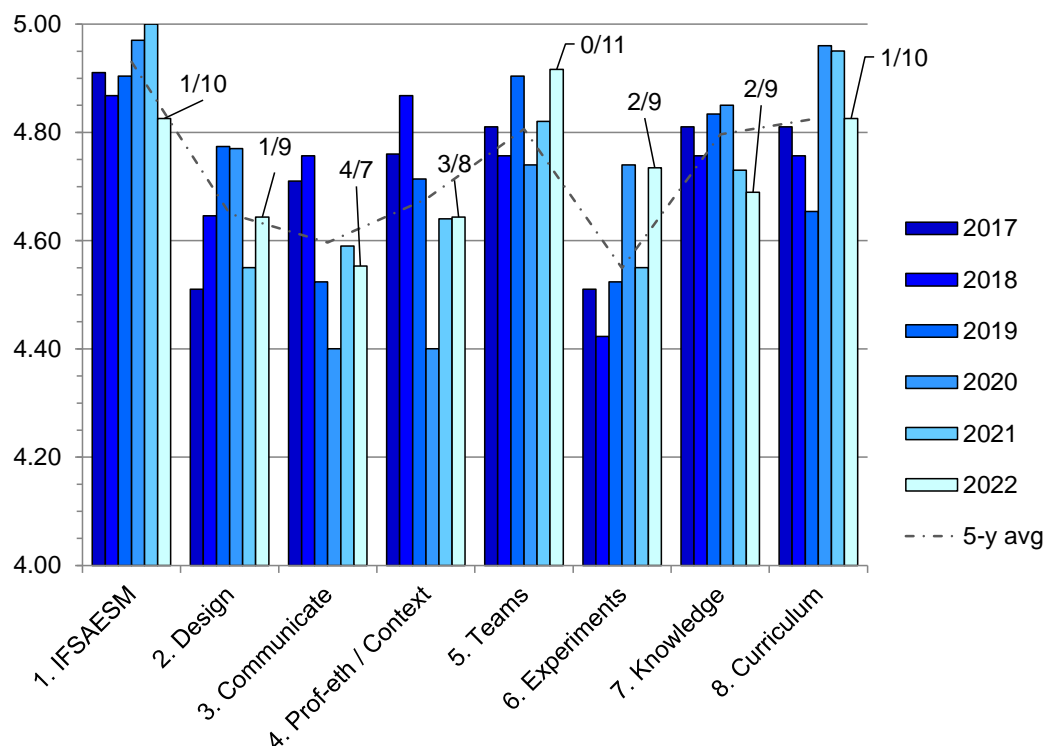
Krishnamoorthy: Thank you for the invite! You have a great, well-run program!

R&A: Comments are diverse. (1) More recognition. (2) Student orientation on surveys. (3) Faculty are appreciated by cadets.

Advisory Board Student Outcomes (SO) Survey Results:

The chemical engineering advisory board is asked to rate performance of cadets on student outcomes (SOs) based on data presented to the board at the advisory board meetings. Advisory board

responses for AY2017 to AY2022 are shown in the figure below, including the most recent advisory board meeting on 13-14 April 2023. Data for AY2023 is not available until after the advisory board meeting in spring of 2024. Data labels are response frequencies for responses of 4 or 5 (# of 4s / # of 5s) on the 1-5 Likert scale used in the survey. For example, in outcome 1 IFSAESM, 10 out of 11 board members responded with a 5 and there was one 4, so the label is 1/10. The five-year average is the dotted line. Relative lows are seen in outcomes 2, 3, and 4. The survey questions are below the figure.



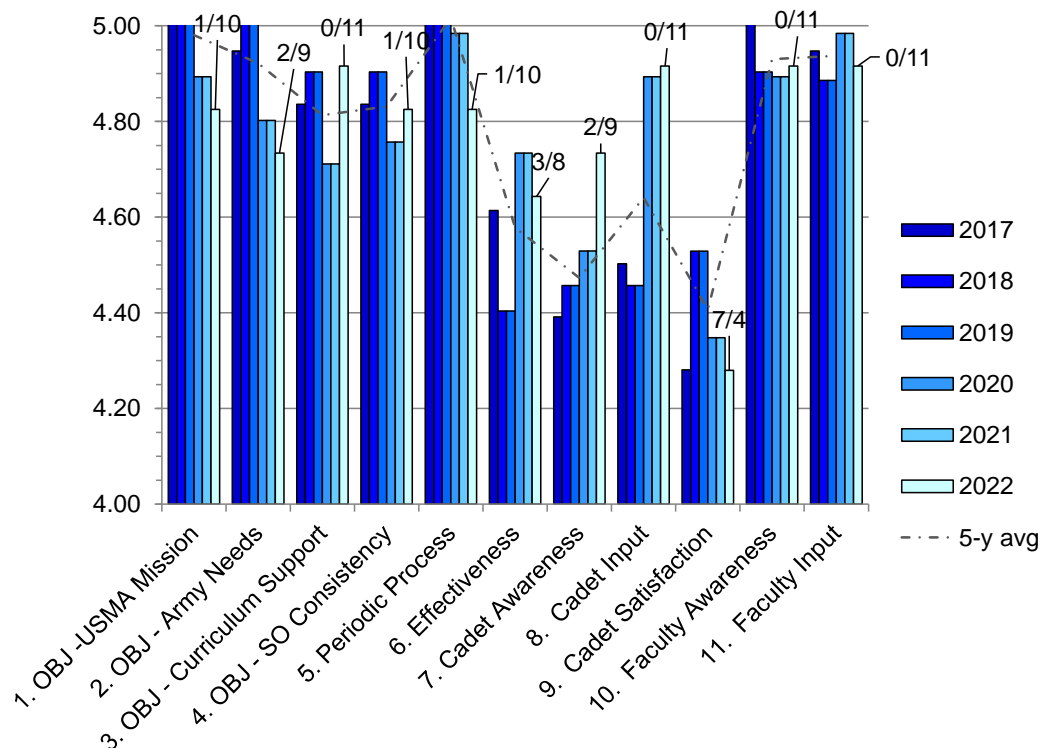
Survey Questions:

1. The cadets in the program are able to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. The cadets in the program are able to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. The cadets in the program are able to communicate effectively with a range of audiences.
4. The cadets in the program are able to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. The cadets in the program are able to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. The cadets in the program are able to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.
7. The cadets in the program are able to acquire and apply new knowledge as needed, using appropriate learning strategies.
8. The cadets in the program have attained a thorough grounding in and working knowledge of the chemical engineering curriculum.

Advisory Board Program Educational Objectives (PEO) Survey Results:

The primary task of the advisory board is to assess the program educational objections (PEOs) of the chemical engineering program. A survey is administered to the board after a series of targeted activities involving the cadets and after a presentation of the PEOs by the program director. Advisory board responses to the program survey for AY2017 to AY2022 are shown in the figure below, including the most recent advisory board meeting on 13-14 April 2023. As before, data for AY2023 (this year) is not available until after the advisory board meeting in spring of 2024. Data labels are response frequencies for responses of 4 or 5 (# of 4s / # of 5s) on the 1-5 Likert scale used in the survey. For example, in question 1, which pertains to the consistency of the PEOs with the USMA mission, 10 out of 11 board members responded with a 5 and there was one score of 4, so the label is 1/10. The five-year average is the dotted line. Relative lows are seen in cadet awareness of PEOs and cadet satisfaction with courses.



Survey Questions:

1. The program objectives are consistent with the USMA mission.
2. The program objectives are consistent with the needs of the Army.
3. The program curriculum supports the program objectives.
4. The student outcomes are consistent with the program mission and objectives.
5. The program has a process for periodically assessing the achievement of its student outcomes.
6. The survey methods used by the program are effective.
7. The cadets in the program are aware of the program objectives.
8. The cadets are given an opportunity to provide their opinion about the program objectives.
9. The cadets are satisfied with the courses in the program.
10. The faculty are aware of the program objectives.
11. The faculty are given an opportunity to provide their opinion about the program objectives.