Keywords: Systems engineering, aerospace, self-guided

Choose your own aerospace adventure:

An Interactive Electronic Textbook for Introductory Aerospace Design

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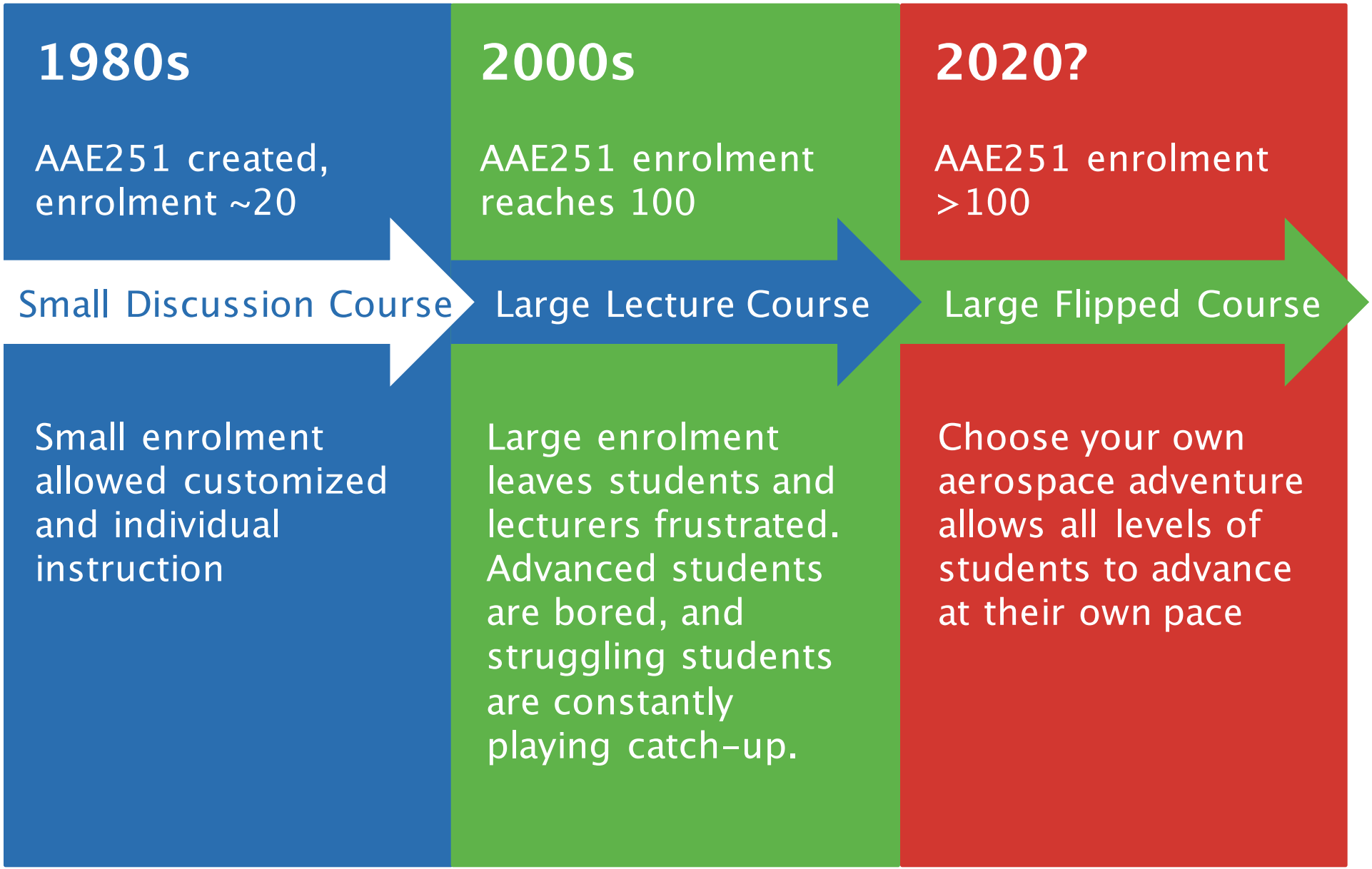
Why?

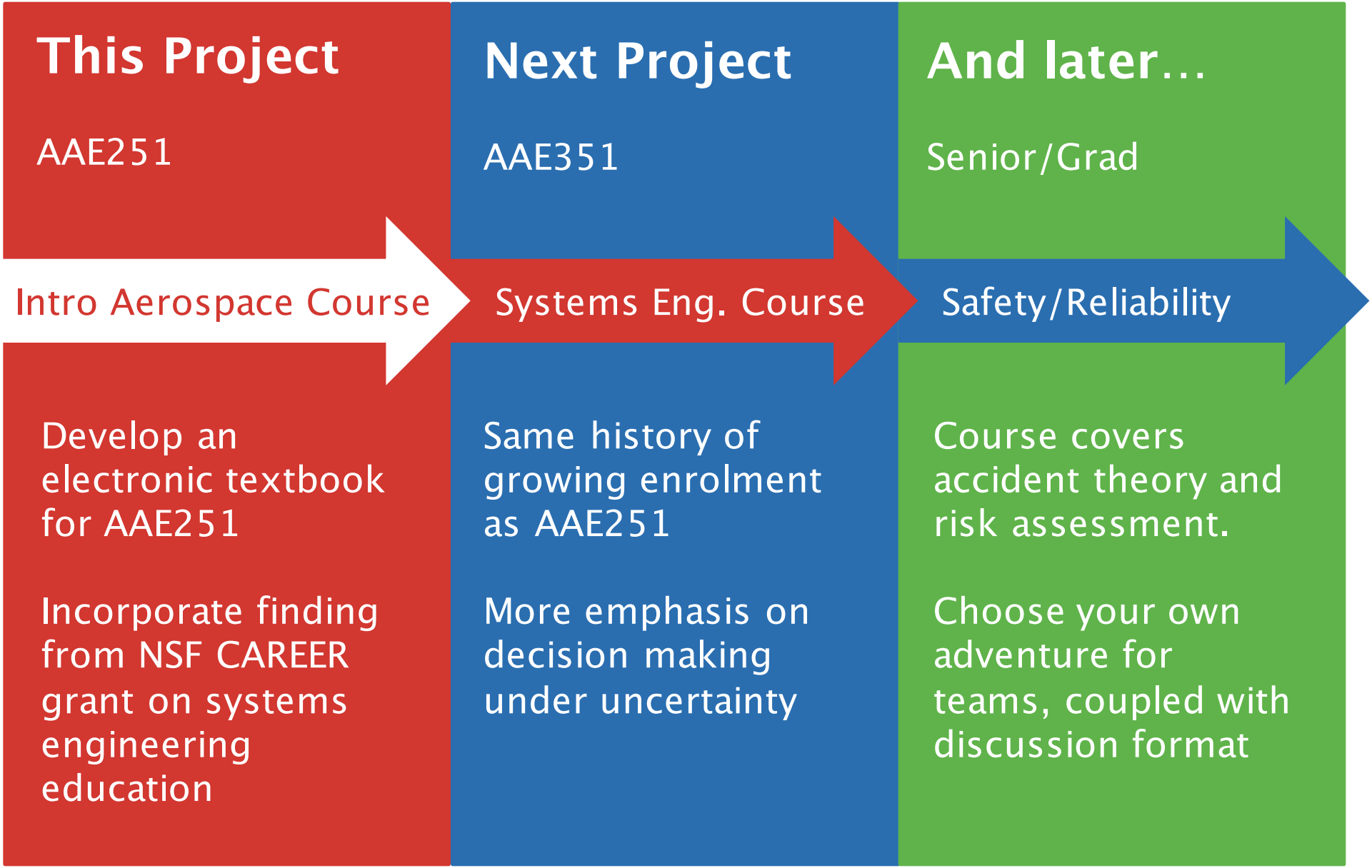
Large enrolment introductory aerospace design courses are challenging

- Students' skill sets range from advanced to struggling with basic physics.
- Must cover breadth of aerospace engineering and shift topics quite significantly every two to three weeks.
- Growing enrollment makes providing students with personal attention logistically challenging.
- **Cornerstone** course must address so many different subjects, there is not enough time to provide much detail on any one topic, leaving advanced students somewhat bored, while less-advanced students are frustrated.

When?


1980s
AAE251 created, enrolment ~20
Small Discussion Course
Small enrolment allowed customized and individual instruction
2000s
AAE251 enrolment reaches 100
Large Lecture Course
Large enrolment leaves students and lecturers frustrated. Advanced students are bored, and struggling students are constantly playing catch-up.
2020?
AAE251 enrolment >100
Large Flipped Course
Choose your own aerospace adventure allows all levels of students to advance at their own pace

Where?


This Project
AAE251
Next Project
AAE351
And later…
Senior/Grad
Intro Aerospace Course
Systems Eng. Course
Safety/Reliability
Develop an electronic textbook for AAE251
Incorporate finding from NSF CAREER grant on systems engineering education
Same history of growing enrolment as AAE251
More emphasis on decision making under uncertainty
Course covers accident theory and risk assessment.
Choose your own adventure for teams, coupled with discussion format

What?

Developments so far

- ✓ Partially-flipped lectures
- ✓ Mini-research projects on relevant aerospace vehicles
- ✓ Team design project with milestones matching course material

Theory of Change

An interactive electronic textbook can increase learning in large-enrolment design class by:

Allowing students to proceed at their own pace; and

Freeing instructors from lectures and giving them time to interact with small groups of students

Outside Class	Inside Class
Read extract from Aircraft Design about aircraft sizing. Do online exercise to plot the relationship between empty weight fraction and takeoff weight. Develop example missions for different aircraft types. Use online tool to estimate takeoff weight aircraft identify key drivers. Develop own Matlab tool to estimate takeoff weight. Develop mission and calculate takeoff weight.	Present mini-lecture on the Spruce Goose. Present mini-lecture on the U2. Get help on how to write iterative algorithms in Matlab. Discuss how and why aircraft missions differ.

Prognosis?

Looking for Advice and Conversation

How do you teach introductory design courses?

How does your school include design in the curriculum?

Have you tried an electronic textbook?

Impact

Student grades

Course evaluations

Performance in subsequent courses

External evaluation by our Industrial Advisory Council

Challenges

Student resistance to active learning

Finding time!

Formal recognition for educational innovation and research