

ECE 215/S – Principles of Electronic Cyber Warfare

Block 3: Communication Systems, Radar, and Electronic Warfare

Lesson 40: Project 3 Discussion

Department of Electrical and Computer Engineering
United States Air Force Academy

Fall 2026

Today's Plan

The Project 3 design was due last lesson. Today, **in our classroom**, we take it apart.

- **Your results** — the second autograder test is now visible
- **Debrief** — open questions, in your team first
- **The lowest-cost design**, built live in the EW Simulator
- **Individual questions** — start them in class; due Thu 10 Dec, 2359 (L41 T-day)
- **Course wrap-up**

  Have your design, your paper numbers, a calculator and the equation sheet out.

Your Gradescope Results

Gradescope “Project 3” now shows both autograder tests, 1 point each:

- **Design meets every requirement** — what you saw on submission: REQ 1, REQ 2, REQ 3 and Budget, each PASS or FAIL, and the total cost
- **Lowest-cost design** — visible now. Earned only by the lowest-cost design that meets every requirement. It says one of three things:
  - “This is the lowest-cost design that meets every requirement.” — you found it
  - “A cheaper design meets every requirement.” — your radar works, and a cheaper one also works
  - “This design does not meet every requirement, so it cannot earn this point.”
- The third point is **individual**: the Project 3 Individual Questions, started today

A design that passes is a working radar. The second point asks for the cheapest working one.

Debrief (1 of 2): The Limits

In your team for five minutes, then we compare across the room.

1. For the **H-20**, which limit set your detection range: R_{noise}, R_{LOS} or R_{BT}? How did you know before you spent money?
2. Did the H-20's jammer cover your band? If it did, what was your R_{BT} — and how close can an H-20 at 30,000 ft ever come?
3. For the **CJ-10**, which limit set your detection range? Which of the six choices move that limit, and which do not?
4. REQ 2 is set by one choice. What did that choice do to your noise floor, and so to R_{noise}?

Debrief (2 of 2): The Money

5. Which purchase bought the most range per dollar? Did any purchase buy more than a requirement needed?
6. The band and the pulse width were free. When did your team choose them: before the hardware, or after?
7. Where did your paper numbers and the simulator disagree? Which step was wrong?
8. Take your design. For each purchase, would the next-cheaper option still pass every requirement? If one would, what did that cost you?

The Lowest-Cost Design, Live

Your instructor now opens the EW Simulator's **ECE 215** page and builds the **lowest-cost design that meets every requirement**, one choice at a time.

As each choice goes in, ask:

- Which requirement — and which limit — does this choice serve?
- Would the next-cheaper option still pass? If not, which requirement fails?
- Does a free choice, band or pulse width, change what the hardware must do?

Take notes: the individual questions refer to this design.

Project 3 Individual Questions

The third Project 3 point: Gradescope **"Project 3 Individual Questions"**, an Online Assignment, auto-graded: each of its 10 parts is one tenth of the point.

- **Individual** — no collaboration, not even with your teammate
- **Authorized:** a calculator; the ECE 215/S equation sheet; slides, class notes, the readings and practice problems; the EW Simulator; spreadsheets and code you write yourself (MATLAB, Python, etc.), with every AI assistant and AI autocomplete turned off; EI from ECE 215/S instructors
- **GenAI is not authorized** for any part of Project 3
- They refer to the lowest-cost design you just saw. **Start them now**, in class
- **Due Thu 10 Dec, 2359** (L41 T-day). No extensions and no corrections

Your own work: no collaboration, no GenAI.

Course Wrap-Up: What You Can Now Do

Block 1	Analyze and protect a circuit; move power through a real system
Block 2	Turn a physical signal into bits; reason about logic and state
Block 3	Predict whether a link closes, whether a radar detects, and how to deny both

- **25 objectives**, three projects, one semester
- More importantly: you can now take an unfamiliar system, pick a model, compute a number, and **defend a recommendation**

That last skill is the one that transfers to every job you will ever have.

Where This Goes Next

If this course interested you, the department offers more:

- **Circuits and electronics** — the analysis of Block 1, taken much further
- **Signals and systems** — the frequency-domain thinking of Block 2, made rigorous
- **Communications and radar** — Block 3 as a full course, with real hardware
- **Electromagnetic warfare** — ES, EP, and EA as a discipline of their own

Talk to any ECE instructor. You do not have to be a major to take them.

Closing

- Thank you for the effort you put into this course
- Feedback matters — tell us what worked and what did not

The final exam: finals week, handwritten, proctored. All three blocks.

- **Lesson 41 — Final Exam Review** is the last lesson. Bring the equation sheet and your returned quizzes
- The **Project 3 Individual Questions** are due **Thu 10 Dec, 2359** (L41 T-day)
- EI remains available right up to the exam — use it