ABET:

1. Desired Needs

- Create an MRI-compatible fetal phantom capable of simulating fetal body motion during cardiac MRI.
- Replicate both gross fetal motion and internal heart/fluid-like motion for motion-correction research.

2. Major Constraints

- Safety/Regulatory: MRI compatibility required non-ferromagnetic materials and passive actuation methods.
- Risks: Limited MRI access, fluid leakage, inconsistent motion transfer, and mechanical friction.
- Global Impact: Improved fetal cardiac MRI could support earlier diagnosis of congenital heart disease.

3. Major Engineering Standards

- ASTM F2503: MRI safety labeling and MRI-compatible device considerations.
- IEC 60601-2-33: MRI environment and MRI system safety considerations.

4. Ethical, Environmental, and Societal Concerns

- Phantom testing reduces the need for early-stage testing involving pregnant patients.
- The device must not overrepresent clinical accuracy beyond its intended research purpose.
- Repeated 3D printing creates material waste, encouraging efficient prototyping practices.

5. Active Teamwork and Leadership

- Team members divided responsibilities across CAD/design, motion systems, testing, and MRI integration.
- Leadership roles shifted depending on subproject expertise and project phase.

6. Motivation and Persistence

- The project required learning MRI safety principles, CAD modeling, and motion actuation techniques.
- Mechanical and testing challenges encouraged self-initiated redesign and troubleshooting.

7. Innovative / Entrepreneurial Ideas

- A low-cost modular fetal motion phantom combining gross body motion and internal fluid motion.