Lesson Update and CRT Addendum	
Lesson/Activity Title: Touchdown (from "On the Moon Educator Guide")	**ID: 12-725**
Product Number: EG-2009-02-05-MSFC	**Grade: 3-8**
URL for Lesson: http://www.jpl.nasa.gov/edu/pdfs/touchdown.pdf	
Subject: Potential and kinetic energy, acceleration, air resistance, measurement, engineering processes.	
Summary: Students are designing and building a shock-absorbing system to protect two marshmallow "astronauts".	
Materials for lesson: There are suggested materials in the list but others can be added or substituted based on availability and level/depth of design.	

Review and Recommendations	
ALIGNMENT TO STANDARDS	
NGSS	**3-5-ETS1-3**
Common Core State Standards in Mathematics	
CULTURAL RESPONSIVE TEACHING (CRT) RECOMMENDATIONS	
5E Lesson/Description	
1. Engage	As written the lesson is very teacher centered. Create a dialogue with students to bring out their stories and experiences either jumping off of something or playing with something that may have landed with great force or very softly. There is wonderful opportunity to engage with students during the brainstorming sessions as well. There are a lot of suggestions and students are led in very specific directions with folded card stock, for example. Removing those suggestions and letting students discover those possibilities will free them. Giving too many suggestions can lead to students just shutting down their own creative process in lieu of just taking the "easy" path of following your lead. Allow students to struggle with the problem to create their own path to a solution.
2. Explore	This activity should be all about students exploring and experimenting with possible materials, design, and construction techniques. As stated in the "Engage" section, present the problem, but allow students to explore paths to their own solutions. Make explicit the use of different units of measure and the different ways to estimate quantities and relationships.

	Encourage students to draw from their own experiences and allow them to use multiple modes of communication to express or share their processes.
3. Explain	No justification or explanation is prompted by student worksheet. Teacher guide includes a section titled "Discuss what happened;" suggested questions could result in explaining (e.g., "after testing, what changes did you make to your lander?") or might not (e.g., "what forces affected your lander as it fell?") depending on teacher implementation. Use evidence to reason or support claims.
4. Expand/Enhance	• Add discussion of "fair test" and control of variables to lesson plan. • Improve connection between scientific/engineering practices with engineering design ideas. • Draw on physical science concepts of energy transfer and transformation to make sense of elements used in the design process. • Consider making the extended challenge part of the lesson if the goal is to cover this mathematical practice. • Align with grade-level content standards. • Connect the standards for Mathematical Practices to the Standards for Mathematical Content for a deeper conceptual understanding. • The lesson needs to include grade-level standards and suggestions on how to customize learning. • Make other connections to other disciplines. • Lesson should encourage multiple inputs. • Expand affective domain considerations. • Increase intellectual safety and create a sense of belonging, • Add language objectives to each of the activities.
5. Evaluate	Incorporate a pre and post assessment of students understanding of key concepts. Collaborate with students to create a method for recording results and changes made.

Additional Resources:

https://tracs.txstate.edu/access/content/group/1f661749-a288-4c82-af20-eac949ac1c67/Lesson%2012/_12_%20725%20Touchdown%20_from%20%E2%80%9COn%20the%20Moon%20Educator%20Guide%E2%80%9D_.pdf