**Lesson 1: What makes a F.O.D.?**

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| **Lesson** | **Title & Short Description:** | **Learning Outcome:** |
| #1 | Introduction to Unit: *Clankless in Seattle*  Pacific Airlines has hired students to figure-out where the ‘odd noise’ is coming from on their new aircraft. | Introduction to FOD – foreign object debris & prevalence in manufacturing of aircraft |

**Problem statement: How can we improve our production process so that we have less debris (foreign object debris or FOD) left on the airplane during the build stage and can deliver a clean, safe airplane? What turns an object into FOD?**

***What changes to the process could be made that would eliminate FOD in other applications?***

**Learning objectives:**I can learn about the problem being presented and my role as a mechanical engineer trying to solve the airline’s problem. I will brainstorm ideas using my own background knowledge about planes and collaborate with classmates as to what could be causing the noise in the plane.

**Standards:** Next Generation Science Standards (NGSS), Common Core Standards (CCSS)

**Next Generation Science Standards:**

**5-PS1-3:** Make observations and measurements to identify materials based on their properties.

**3-5-ETS1-1:**

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

**3-5-ETS1-2:**

Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem

**3-5-ETS1-3:**

Plan and carry out fair tests in which variables our controlled and failure points are considered to identify aspects of a model or prototype that can be improved

**Common Core Standards:**

CCSS**.**[ELA-LITERACY.SL.5.1](http://www.corestandards.org/ELA-Literacy/SL/5/1/)

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.

[CCSS.ELA-LITERACY.SL.5.1.A](http://www.corestandards.org/ELA-Literacy/SL/5/1/a/)

Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

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[CCSS.ELA-LITERACY.SL.5.1.C](http://www.corestandards.org/ELA-Literacy/SL/5/1/c/)

Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

[CCSS.ELA-LITERACY.SL.5.1.C](http://www.corestandards.org/ELA-Literacy/SL/5/1/c/)

Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

**Soft Skills:**

Listening, Critical Thinking, Collaboration, Communication (written and oral), Creativity & Innovation

**Materials:** Lesson 1 Slide Show, computers (for brainstorming ideas app) OR sticky notes (details in lesson prep), paper or science journal, pencil

Optional: Student copies of FOD Lesson 1 Storyline Clankless in Seattle and FOD Lesson 1 E-mail from CEO to Engineers.

**Lesson preparation:** 20 minutes

For the brainstorming activity you will need a way to display the teacher questions and record their answers. This can be done by using large chart paper to write the questions on before the lesson and during the lesson have the students write their thoughts on sticky notes. If your students have access to devices, you can use collaborative software which allows the teacher to input questions before the lesson and students submit their ideas live during the lesson. Possible apps include Padlet, Mentimeter or “Shout it Out” Smartboard Notebook software. If you are using Padlet, question templates can be found here: [Question 1](https://padlet.com/caroline_kelley/ajcrwssapygnq5qg), [Question 2](https://padlet.com/caroline_kelley/bs5hq3pi00vr4i5f), [Question 3](https://padlet.com/caroline_kelley/zo1azfthhimxr0ie), login and click “remake” to copy to your padlet account

Optional: make student copies of FOD Lesson 1 Storyline Clankless in Seattle Student Copy and FOD Lesson 1 E-mail from CEO to Engineers Student Copy.

**Time required:** 30- 40 minutes

**Grouping of students for instruction:** Whole class for presentation of ‘real-world’ phenomena and questions #1 & 2. (Teacher will want to gather information about what students’ prior knowledge is about airplanes & possible unusual noise) Students can then be placed with a partner (optional) to brainstorm what might be causing the noise.

**What is the instruction? Consider the PBL procedure that is being addressed here:** Teacher is introducing the problem via a real-world phenomena of a new plane creating a strange noise. The students will hear the word F.O.D.(Foreign Object Debris), but they will not be formally introduced to it yet. These concepts will be foundational to the rest of unit. Students will start discussing their initial ideas before learning more specifics about F.O.D. the goal of this lesson is to try to engage the students in an authentic problem and to help them see themselves as an ‘engineer’ that has been assigned a task that they will need to help solve over the next few weeks.

**Understanding the Problem**

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| **Teacher** | **Student** |
| 1. Introduce the problem with a hook/storyline: Teacher will show the FOD Lesson 1 Slide Show to students and read the scenario to students (FOD Lesson 1 Storyline Clankless in Seattle Student Copy) (Slides 1-7) | Listen to the scenario / problem - write down some initial ideas of what Jyoti should do next in a Science journal or notepad. If the teacher has made copies of FOD Lesson 1 Storyline Clankless in Seattle Student Copy, students can read along and take notes. |
| 1. Read FOD Lesson 1 E-mail from CEO to Engineers (Slide 8, FOD Lesson 1 Slide Show) to students.   Explain that we will have several weeks to help Mr. Eagle solve his problem. We will be working in groups to help the company come up with new ‘systems’ to make the production process more efficient. | Listen to the task introduction - write down questions in Science journal or notepad.  If the teacher has made copies of FOD Lesson 1 E-mail from CEO to Engineers Student Copy, students can read along and take notes. |
| 1. The teacher will present question #1 for the Brainstorming Activity using software or sticky notes: *“Have you ever flown on a larger commercial aircraft? What did you notice about the plane?”*   Allow the students to have up to 3 responses each. When all of the students are done, the teacher will ask the students to help her/him group the responses according to common characteristics (ex. size of plane, amenities, etc.) | The students will reply to question #1 using the Brainstorming apps or students will write their responses on sticky notes.  Students will help the teacher group the responses according to common characteristics |
| 1. The teacher will present question #2 for the Brainstorming Activity using software or sticky notes:*“What noises have you heard or what noises might you expect to hear while flying on a plane?”*   Allow the students to have up to 3 responses each. When all of the students are done, the teacher will ask the students to help her/him group the responses according to common characteristics (ex. sound the plane makes while taking off & landing, sounds that people make on the plane, etc.) | The students will reply to question #2 using the Brainstorming apps or students will write their responses on sticky notes.  Students will help the teacher group the responses according to common characteristics. |
| 1. The teacher will present question #3 for the Brainstorming Activity using software or sticky notes: *“What do you think might be causing the unique and unusual clanking noise on this new plane?”*   Allow the students to have up to 3 responses each. When all of the students are done, the teacher will ask the students to help her/him group the responses according to common characteristics.  Note: You can break the students up into partners at this point to discuss their ideas. | The students will reply to question #2 using the Brainstorming apps or students will write their responses on sticky notes.  Students will help the teacher group the responses according to common characteristics. |
| 1. The teacher will close the lesson by reviewing what the students have discussed so far and explain that the class will be exploring the possible cause of this clanking. The teacher should also explain that the class will continue to learn about the role that engineers play in creating systems to produce airplanes and other products. | In small solution workgroups/teams, students will get into character of engineers and mindset to solve problems as engineers |

**Accommodations:**

Groupings can be 1 person or a complementary group. In small groups or with a partner, the students can support one another. For students with special needs (IEPs or 504s), these students can have some extra one-on-one time with the teacher(s) to clarify the problem statement and provide additional support as needed. Students can continue to work with a partner versus alone for the entire lesson to help them clarify and communicate their ideas.

**Extensions:** What is that noise? Using the sound clips from [“A Nervous Flyer’s Guide to Every Ding, Buzz and Whir You Hear on an Airpla](https://www.smithsonianmag.com/travel/airplane-sounds-decoded-180961044/)ne”let students listen and guess the sounds they might hear during a flight.

**Assessment:**

Formative assessment: Students can be assessed on their communication of their ideas through-out the lesson. Since this is the beginning of the unit, the goal of this lesson is to try to engage the students in an authentic problem and to help them see themselves in the aviation industry.

**References/Resources:**

FOD Lesson 1 Slide Show

FOD Lesson 1 Storyline Clankless in Seattle

FOD Lesson 1 E-mail from CEO to Engineers

Slide Show Formatting Template: <https://slidesgo.com/theme/flight-attendant-cv#search-Travel&position-15&results-18>

[“A Nervous Flyer’s Guide to Every Ding, Buzz and Whir You Hear on an Airpla](https://www.smithsonianmag.com/travel/airplane-sounds-decoded-180961044/)ne” By [Jennifer Billock](https://www.smithsonianmag.com/author/jennifer-billock/), Smithsonian Magazine Nov 2016

<https://www.smithsonianmag.com/travel/airplane-sounds-decoded-180961044/>

Padlet, Mentimeter or “Shout it Out” Smartboard Notebook software.

Brainstorming Software:

Padlet <https://padlet.com/> If you are using Padlet, question templates can be found here: [Question 1](https://padlet.com/caroline_kelley/ajcrwssapygnq5qg), [Question 2](https://padlet.com/caroline_kelley/bs5hq3pi00vr4i5f), [Question 3](https://padlet.com/caroline_kelley/zo1azfthhimxr0ie), login and click “remake” to copy to your padlet account.

Mentimeter <https://www.mentimeter.com/> Use live polls, quizzes, word clouds, Q&As and more to get real-time input - regardless if you’re remote, hybrid or face-to-face

Shout It Out! Smart Learning Suite Online <https://support.smarttech.com/docs/software/smart-learning-suite-online/en/creating-and-delivering-activities/shout-it-out.cshtml> Setting up and playing a Shout It Out! activity in SMART Learning Suite Online