ADAPTING THE LINE OPERATION SAFETY AUDIT
TO THE AGRICULTURAL MECHANICS LABORATORY

INTRODUCTION

The Line Operation Safety Audit (LOSA) is a safety assessment tool that takes human action into account. Originally developed for Delta Airlines, this safety audit uses Threat and Error Management (TEM) as a framework to discern what events surrounding multiple aspects of a flight crew contribute to the safety of the flight. There may be use for this tool in the agricultural mechanics laboratory. By utilizing TEM through the LOSA, teachers can not only learn and reflect upon what threats and errors are impacting their laboratory spaces, but they can also be better prepared to teach students how to recognize threats and errors. The purpose of this study was to adapt a LOSA to be sensitive to the agricultural mechanics laboratory environment.

WHAT IS TEM?

"a conceptual framework that assists in understanding, from an operational perspective, the inter-relationship between safety and human performance in dynamic and challenging operational contexts" (Maurino, 2005, pg. 1)

· Threats are generally defined as events that occur beyond human influence.

· Errors are actions or inactions that can result in an unexpected outcome.

FUTURE PLANS

Data collected from a study planned for Fall of 2023 will provide a look at not only what threats and errors are most common throughout a university level construction course and help in developing observer protocols for using the tool. This study is underway at the time of this presentation.

Pending results of this study, the tool will need validated through future studies spanning a variety of lab environments at the secondary and post-secondary levels. Specific areas of study might include:

- Refining intervention protocol
- Inter-state cooperative studies to gather a data pool large enough to generalize
- Qualitative studies concerning student and teacher behavior during observation
- There are tons more but my brain isn't working

RESULTS TO DATE

There have been four versions of the adapted LOSA developed. Version one was adapted as visually identical to the original LOSA form obtained for the pilot with only slight changes to the wording of the form. The first observation found this to be entirely unsuitable for the agricultural mechanics laboratory, being far too focused on individual behavior rather than recognition and approach to managing/maintaining a safe environment. Version two introduced all the features of the final form except for the time stamps. This iteration also introduced the cover page with the omission of a notes section. Observer discussions after version two resulted in the addition of a beginning time stamp and the change of result three in the resolution section from "additional error" to "injury." Including the option of time stamps provided greater context for readers on the back end as well as another data point for reflection and instruction.

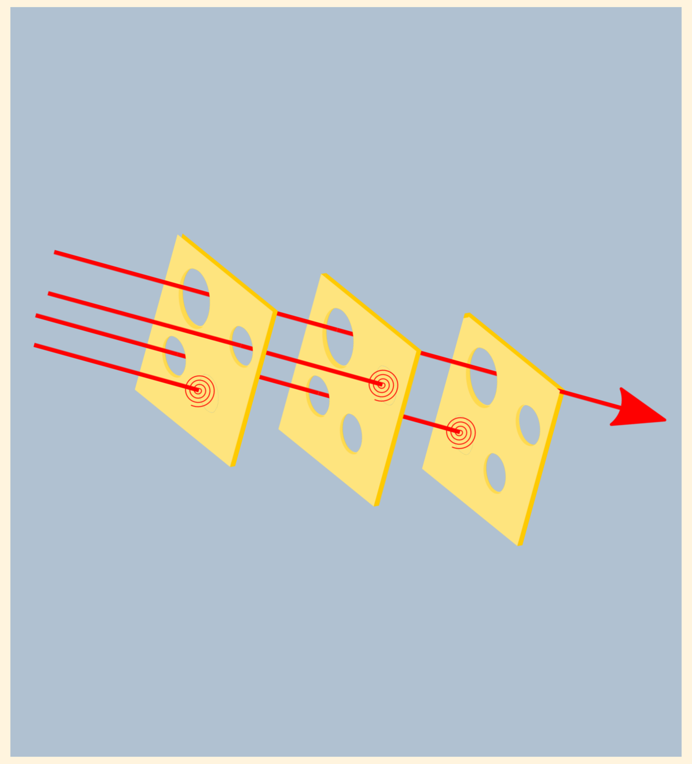
HOW IT WORKS

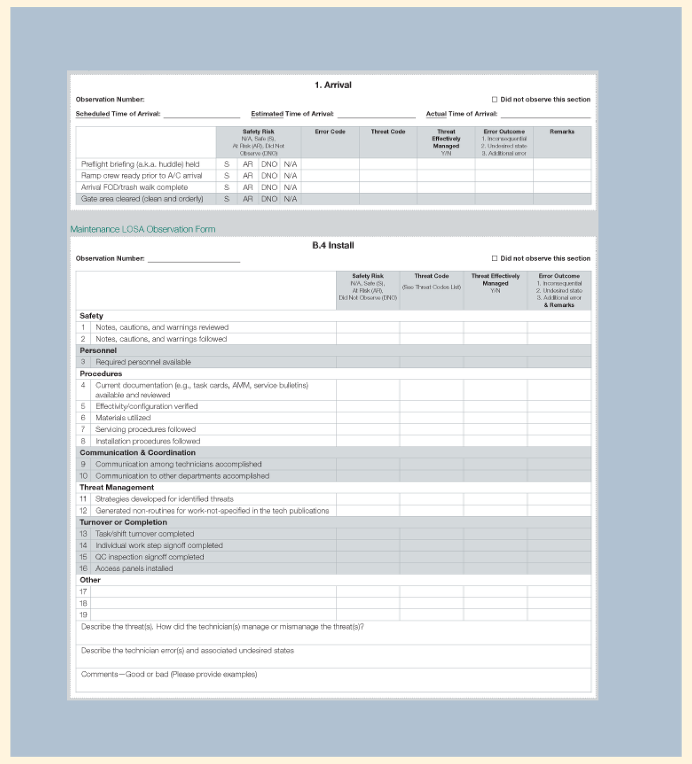
The adapted LOSA instrument used three third-party observers to assess threats and errors in a college-level, small engines class during the Spring of 2023. The first two columns of the instrument are for recording the threat or error and to assign the appropriate code from a provided index. For example, if the observers witnessed an oil spill, this would be considered a spill threat and assigned the corresponding code.

The next two columns focus on whether the threats and/or errors were recognized and addressed, either by students or teachers. There are corresponding time stamps for each of these columns to help add context to data analysis and create a valuable data point for instruction: mean response time.

The resolution column has three possible responses and allowed the observers to record the outcome of each threat and/or error.

1. Inconsequential: The threat/error was addressed and was left in a satisfactory state.
2. Undesired State: The threat/error was most likely not addressed and a threat remains present as a result.
3. Injury: a threat was left unaddressed leading to an error. This error resulted in injury





1. Arrival

Observation Number: ☐ Did not observe this section

Scheduled Time of Arrival: ______ Estimated Time of Arrival: ______ Actual Time of Arrival: ______

	Safety Risk N/A, Safe (S), At Risk (AR), Did Not Observe (DNO)	Error Code	Threat Code	Threat Effectively Managed Y/N	Error Outcome 1. Inconsequential 2. Undesired state 3. Additional error	Remarks
Preflight briefing (a.k.a. huddle) held	S AR DNO N/A					
Ramp crew ready prior to A/C arrival	S AR DNO N/A					
Arrival FOD/trash walk complete	S AR DNO N/A					
Gate area cleared (clean and orderly)	S AR DNO N/A					

Maintenance LOSA Observation Form

B.4 Install

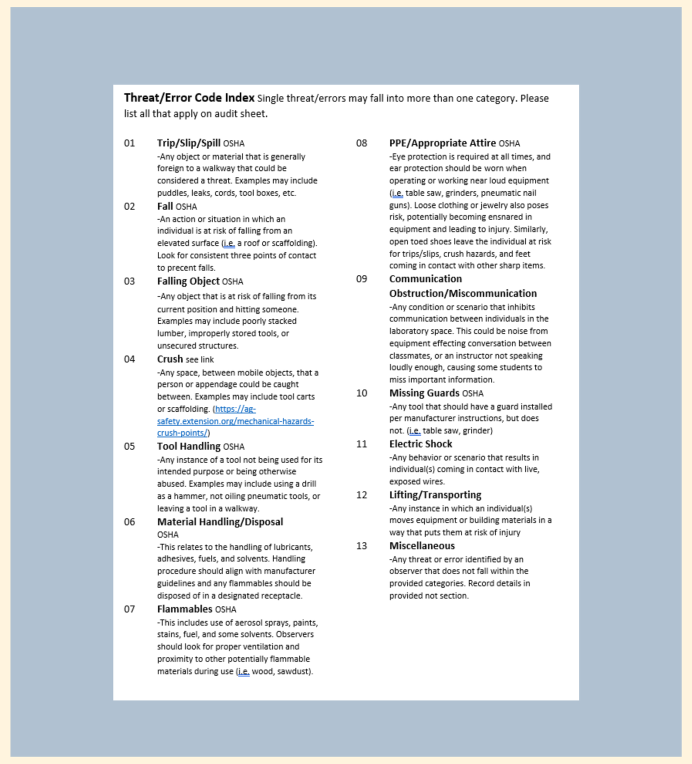
Observation Number: ______ ☐ Did not observe this section

		Safety Risk N/A, Safe (S), At Risk (AR), Did Not Observe (DNO)	Threat Code (See Threat Codes List)	Threat Effectively Managed Y/N	Error Outcome 1. Inconsequential 2. Undesired state 3. Additional error & Remarks
Safety					
1	Notes, cautions, and warnings reviewed				
2	Notes, cautions, and warnings followed				
Personnel					
3	Required personnel available				
Procedures					
4	Current documentation (e.g., task cards, AMM, service bulletins) available and reviewed				
5	Effectivity/configuration verified				
6	Materials utilized				
7	Servicing procedures followed				
8	Installation procedures followed				
Communication & Coordination					
9	Communication among technicians accomplished				
10	Communication to other departments accomplished				
Threat Management					
11	Strategies developed for identified threats				
12	Generated non-routines for work-not-specified in the tech publications				
Turnover or Completion					
13	Task/shift turnover completed				
14	Individual work step signoff completed				
15	QC inspection signoff completed				
16	Access panels installed				
Other					
17					
18					
19					

Describe the threat(s). How did the technician(s) manage or mismanage the threat(s)?

Describe the technician error(s) and associated undesired states

Comments—Good or bad (Please provide examples)



Threat/Error Code Index Single threat/errors may fall into more than one category. Please list all that apply on audit sheet.

01 **Trip/Slip/Spill** OSHA -Any object or material that is generally foreign to a walkway that could be considered a threat. Examples may include puddles, leaks, cords, tool boxes, etc.

02 **Fall** OSHA -An action or situation in which an individual is at risk of falling from an elevated surface (i.e. a roof or scaffolding). Look for consistent three points of contact to precent falls.

03 **Falling Object** OSHA -Any object that is at risk of falling from its current position and hitting someone. Examples may include poorly stacked lumber, improperly stored tools, or unsecured structures.

04 **Crush** see link -Any space, between mobile objects, that a person or appendage could be caught between. Examples may include tool carts or scaffolding. (https://ag-safety.extension.org/mechanical-hazards-crush-points/)

05 **Tool Handling** OSHA -Any instance of a tool not being used for its intended purpose or being otherwise abused. Examples may include using a drill as a hammer, not oiling pneumatic tools, or leaving a tool in a walkway.

06 **Material Handling/Disposal** OSHA -This relates to the handling of lubricants, adhesives, fuels, and solvents. Handling procedure should align with manufacturer guidelines and any flammables should be disposed of in a designated receptacle.

07 **Flammables** OSHA -This includes use of aerosol sprays, paints, stains, fuel, and some solvents. Observers should look for proper ventilation and proximity to other potentially flammable materials during use (i.e. wood, sawdust).

08 **PPE/Appropriate Attire** OSHA -Eye protection is required at all times, and ear protection should be worn when operating or working near loud equipment (i.e. table saw, grinders, pneumatic nail guns). Loose clothing or jewelry also poses risk, potentially becoming ensnared in equipment and leading to injury. Similarly, open toed shoes leave the individual at risk for trips/slips, crush hazards, and feet coming in contact with other sharp items.

09 **Communication Obstruction/Miscommunication** -Any condition or scenario that inhibits communication between individuals in the laboratory space. This could be noise from equipment effecting conversation between classmates, or an instructor not speaking loudly enough, causing some students to miss important information.

10 **Missing Guards** OSHA -Any tool that should have a guard installed per manufacturer instructions, but does not. (i.e. table saw, grinder)

11 **Electric Shock** -Any behavior or scenario that results in individual(s) coming in contact with live, exposed wires.

12 **Lifting/Transporting** -Any instance in which an individual(s) moves equipment or building materials in a way that puts them at risk of injury

13 **Miscellaneous** -Any threat or error identified by an observer that does not fall within the provided categories. Record details in provided not section.

COSTS

To date, there have been no financial expenditures since the accessed LOSA form was available at no cost. However, future studies might want to consider observer incentives to ensure maximum accuracy. Finding individuals who are willing and able to observe consistently and accurately may prove difficult. An additional challenge of aligning observer schedules is evident as it is important to inter-rater reliability for the observers to evaluate the same laboratory environments simultaneously.

MONTANA STATE UNIVERSITY | Department of Agricultural & Technology Education - ISAAC SPONHEIM - DR. DUSTIN PERRY - MONTANA STATE UNIVERSITY - 2023 -