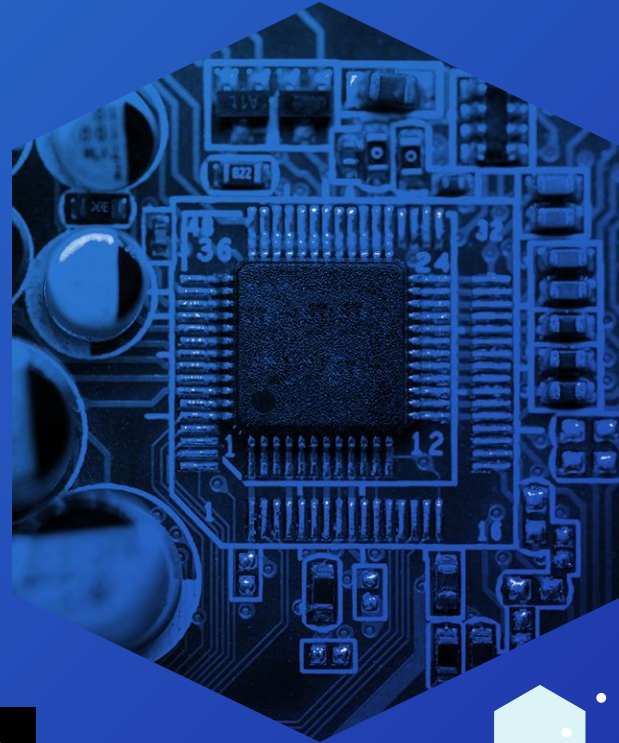


ESD Sensitive Electronic Board made using Acetone

Failure Mode and Effects Analysis
Case Competition

Tran Diep
Caroline Kolb
Peter Cook



BYU

**NORTHROP
GRUMMAN**

**NO SAFETY
KNOW PAIN**



**KNOW SAFETY
NO PAIN**



#SAFETYWORKINGDAY

OUTLINE



**OVERVIEW OF
THE PROCESS**



**FAILURE MODES AND
EFFECTS ANALYSIS**



VENDORS



**SUMMARY
Q&A**



Operation Steps

01

DROP-OFF

Operator(s) bring in a full box of blank boards in front of a robot

02

TRANSFER

Robot transfers blank boards to a conveyor belt

03

BLACK BOX

Several processes convert the blank board into a computer board

04

HEATING

The computer board is heated to 150°F

05

PACKAGING

An operator remove the finished computer board and place it into a plastic package

General Failure Mode O1

ESD initiation of flammable Acetone from human spark



Potential Effects

- Flash fire
- Severe personal injury
- Damage to equipment and warehouse

Recommendations

- Static dissipative floors
- Black Box design
- PPE/ Warnings

General Failure Mode O2

Propagation of fire



Potential Effects

- Large, uncontained fire
- Damage to equipment and warehouse

Recommendations

- Spill dikes
- Training
- PPE/ Warnings

General Failure Mode 03

Robot malfunction during maintenance and abnormal operation



Potential Effects

- Damage to robot
- Bodily injury
- Death

Recommendations

- Light curtains
- Manual mode
- PPE / Warnings

General Failure Mode O4

Robot sparks and catches acetone on fire



Potential Effects

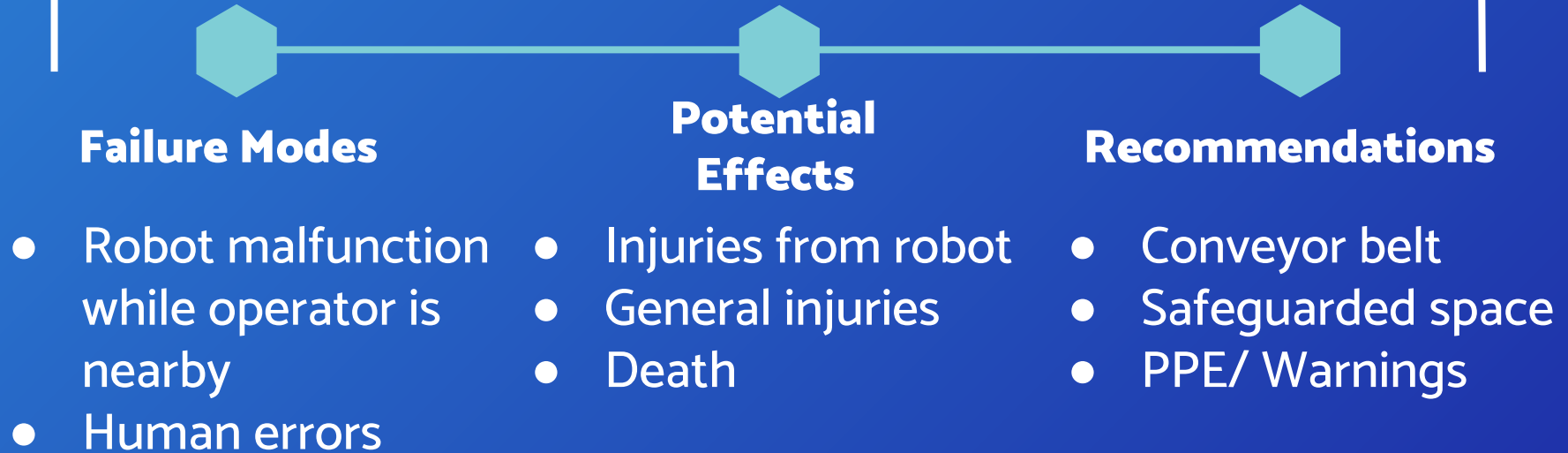
- Flash fire
- Severe injury
- Damage to robot

Recommendations

- Sensor
- Emergency shut off
- Warnings

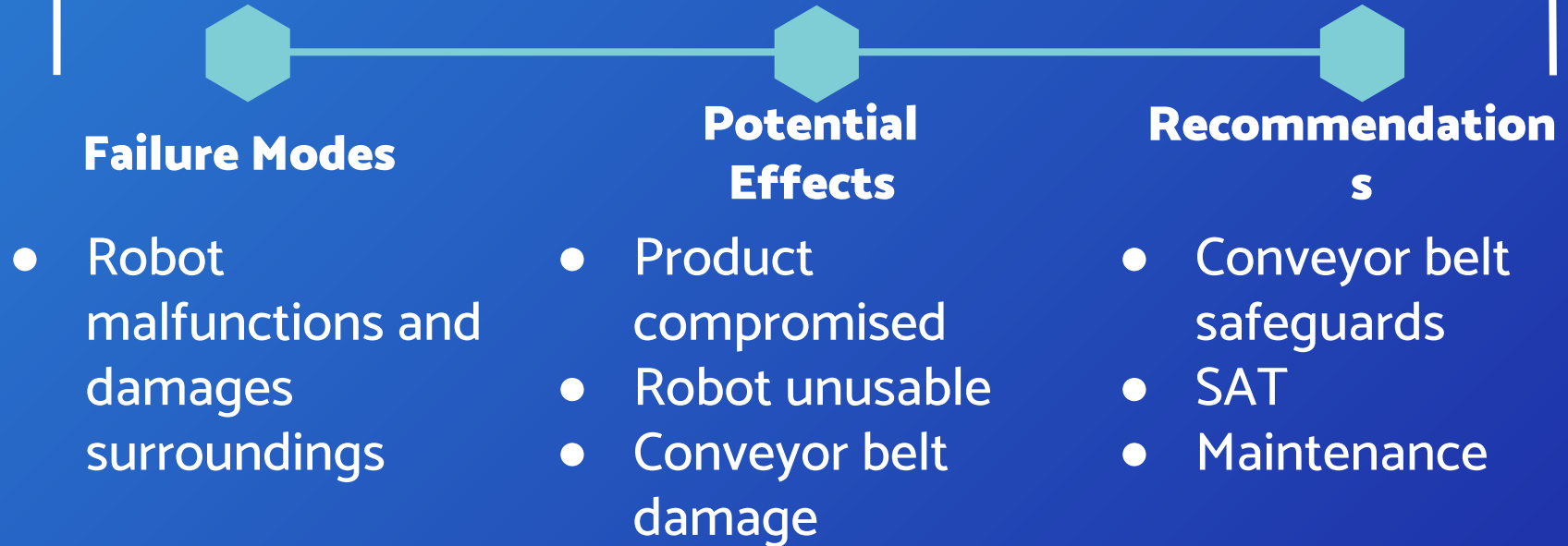
OPERATION STEP 01

DROP-OFF



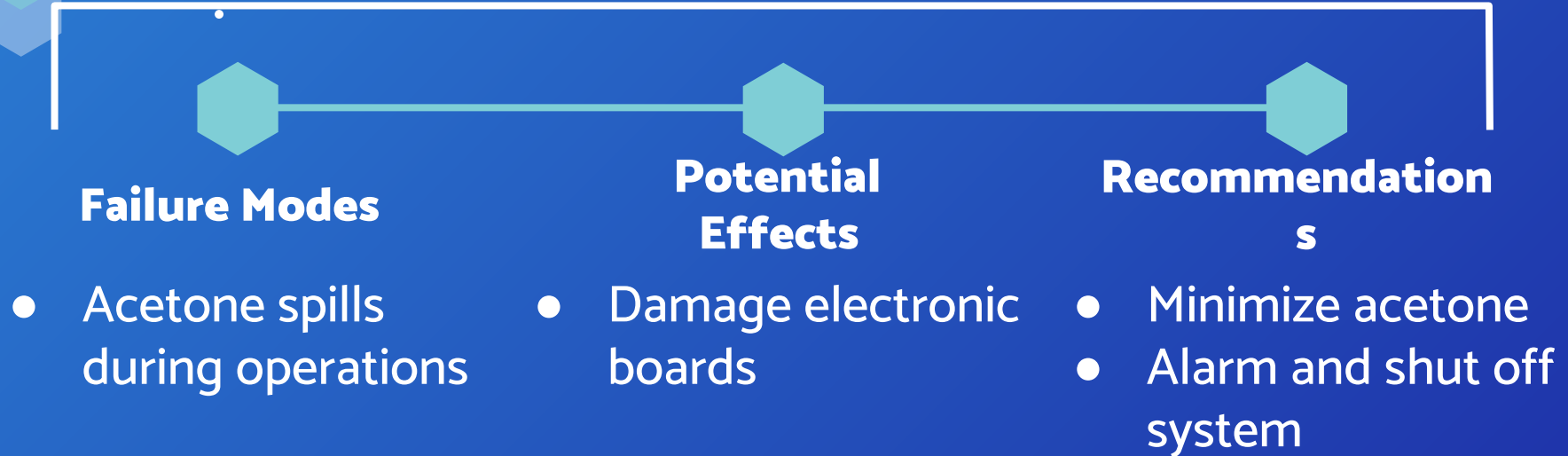
OPERATION STEP 02

TRANSFER



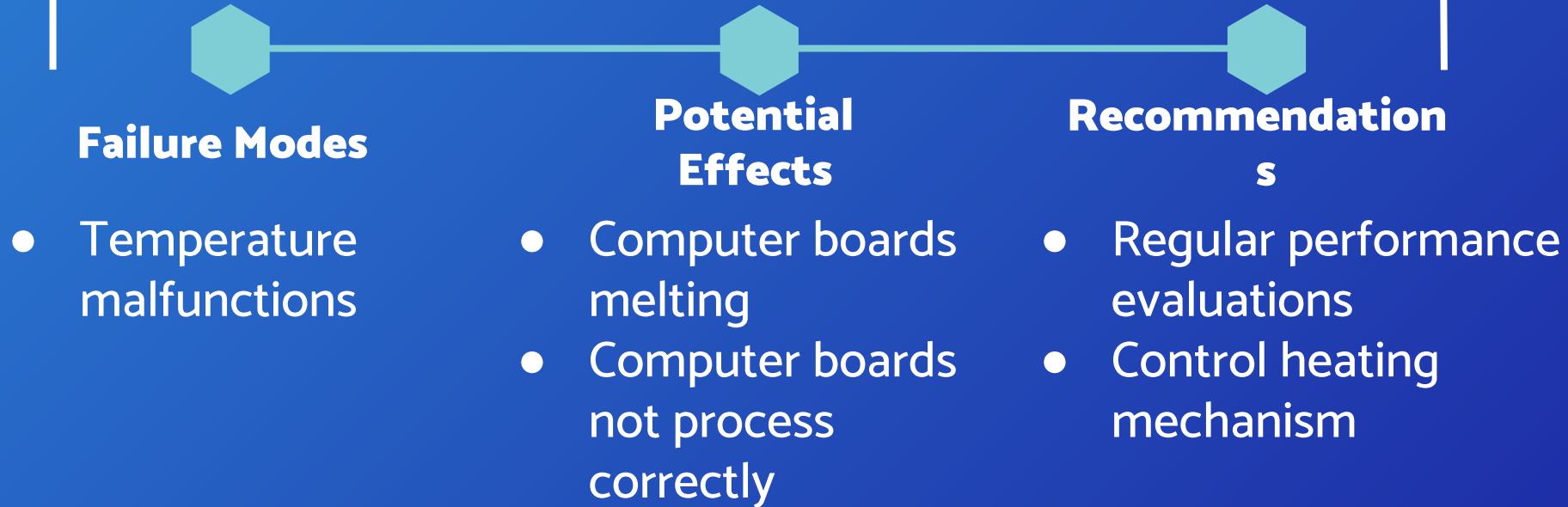
OPERATION STEP 03

BLACK BOX



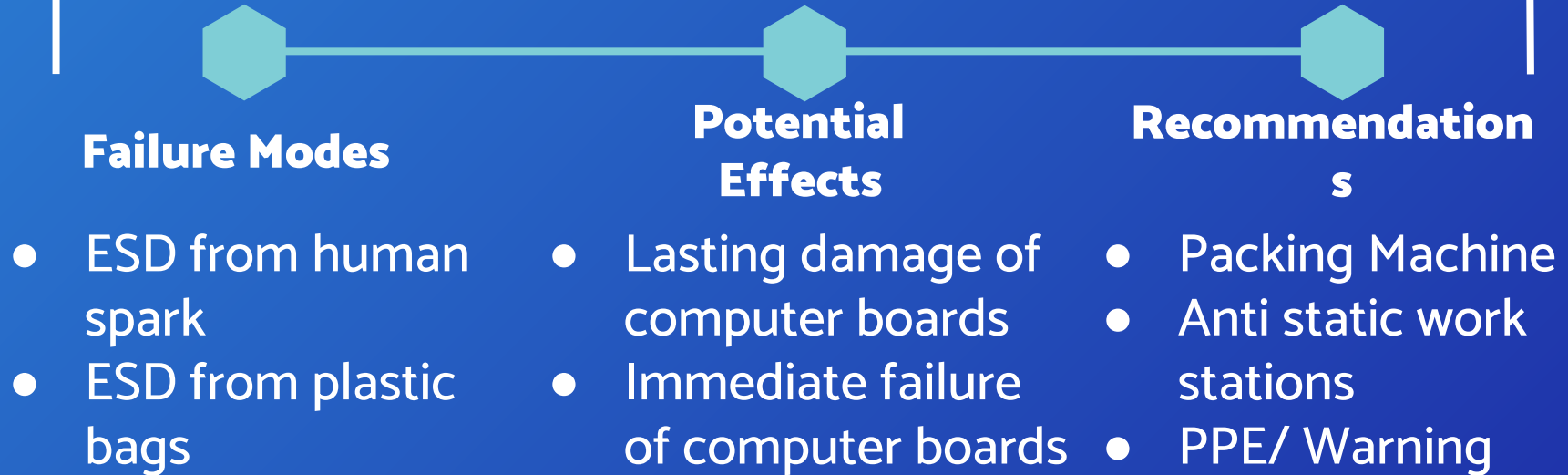
OPERATION STEP 04

HEATING



OPERATION STEP 05

PACKAGING



Vendors



Yaskawa GP7



New Pig Co spill dikes



Grainger anti static bubble wrap



Frain Industries PFM Falcon
Horizontal Flow Wrapper

SMC Light Curtains





Thank you!

Q & A