



Design for Safety

MCHE 201 – Spring 2019

Dr. Joshua Vaughan

Rougeou 225

`joshua.vaughan@louisiana.edu`

`@Doc_Vaughan`



Everything is Dangerous

Design for Safety Phases



1. Problem definition
2. Risk identification
3. Risk estimation
4. Risk evaluation
5. Design review

Iterative!

Guiding Principles



1. Design in Safety
2. Utilize Guards
3. Anticipate Operator Errors
4. Restrict Improper Use
5. Accommodate Unusual Operating Conditions
6. Utilize Redundancy
7. Design Safe Failure Modes
8. Facilitate Maintenance
9. Add Warning Labels and Systems

Design in Safety



This is *not* safety



Design in Safety



- Do *not* rely on warning labels
- Do *not* rely on operator training or common sense
- Modify the design to make it safe

Table Saw



- *DANGEROUS!*



Image from: <https://flic.kr/p/e6ZzRD>

Table Saw



- ***DANGEROUS!***

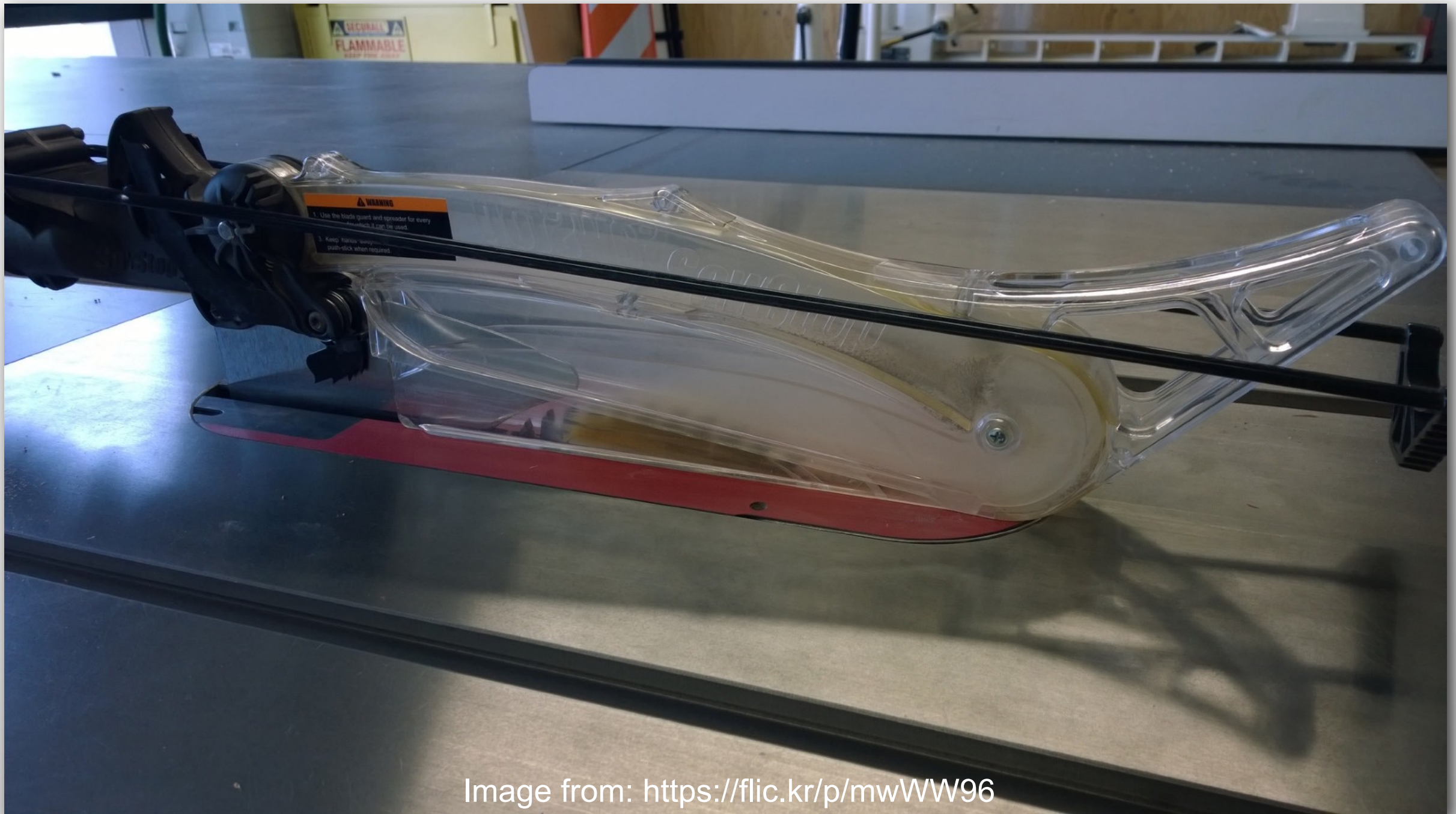


Image from: <https://flic.kr/p/mwVW96>

SawStop



Video from: <https://youtu.be/eiYoBbEZwIk>

Aerial Lift



Aerial Lift



Aerial Lift



Utilize Guards



- Don't allow access to dangerous parts of the design



Image from: <https://flic.kr/p/7a4t95>

Utilize Guards



- Don't allow access to dangerous parts of the design



Table Saw



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Table Saw

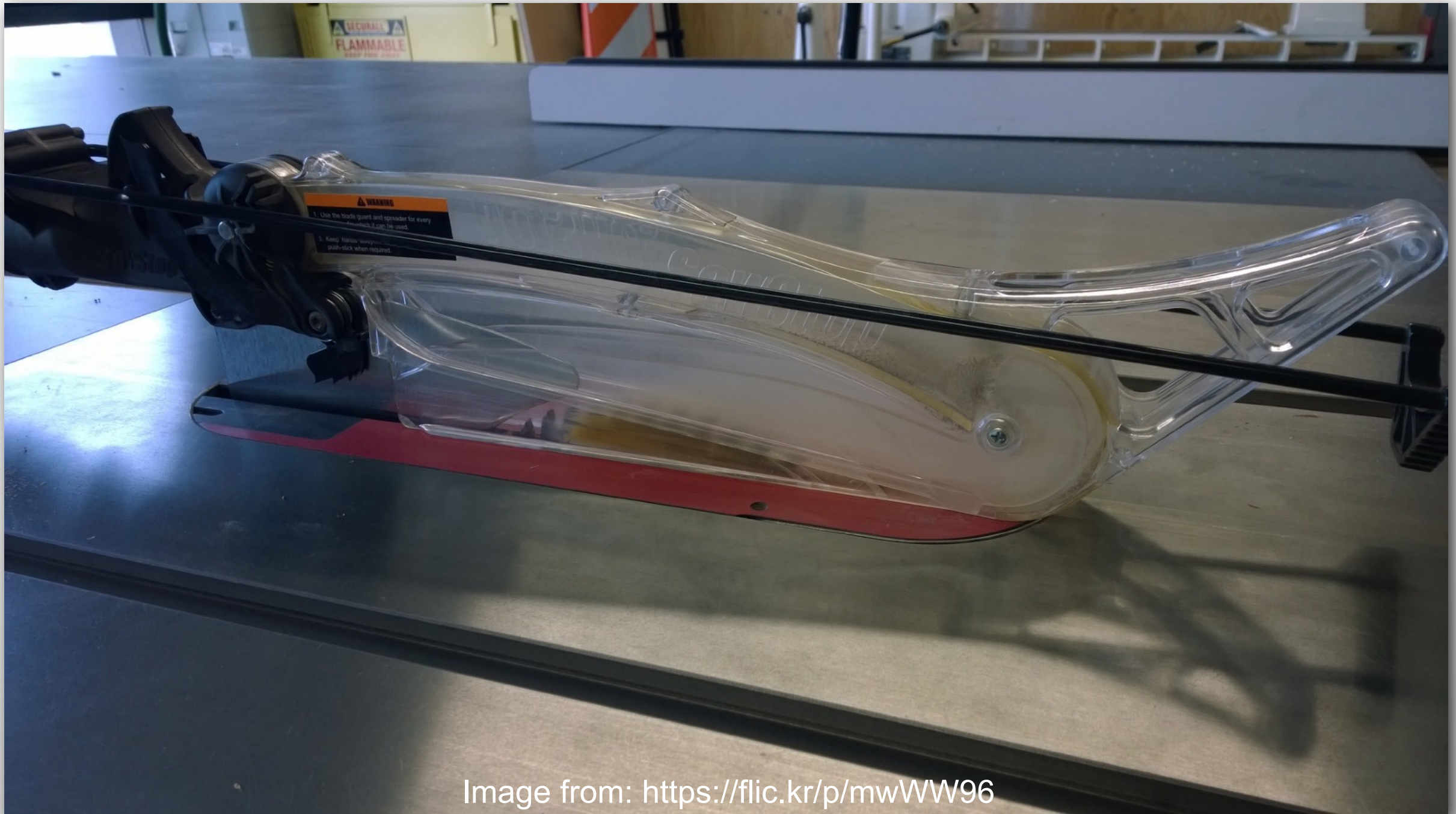


Image from: <https://flic.kr/p/mwVW96>

Anticipate Operator Errors



- People will:
 - make mistakes
 - be distracted
 - be tired
 - not read the operator's manual
 - not pay attention during and/or not remember training
 - not maintain the equipment properly
 - be drunk
- Designing for these things will typically make your design easier to use as well

The User is Drunk



Your website should be so simple, a drunk person could use it.

You can't test that. I'll do it for you.

WHAT: I'll get very drunk, and then review your website. I'll send you a document outlining where I thought the website needed help, and a screencast of me going over the website.

HOW MUCH: \$250 per site.

[Let's do it!](#)

More details:

I am a UX professional and full stack developer. I've been doing this for a long time. Here is my [website](#), my [github](#), and my [twitter](#).

One of the core tenets of UX is that you've got to design like "the user is drunk." Any feature of your site has to be able to be used by someone who could be drunk - because, invariably, the user will mess it up otherwise. Wonderful idea. The thing is, it is hard to test.

I and a lot of beer will test this for you.

Contact: richard.is.drunk@gmail.com

FAQ:

- Will you actually do this? *Yes.*
- Can I pay you more to choose what you drink? *Very yes.*
- Will you post your screencasts publicly? *Yes.*
- Is this your only job? *No. I have a full time job changing the world. This website is very much on the side, with no major ambitions.*
- Wasn't this cheaper earlier? *Yes. Raising my prices is my way of throttling the amount of jobs.*

<http://theuserisdrunk.com>

Boeing Crane Story



Image from: <https://flic.kr/p/eUNsDZ>

More Crane Accidents



Restrict Improper Use



- People will... So, don't let them mess up

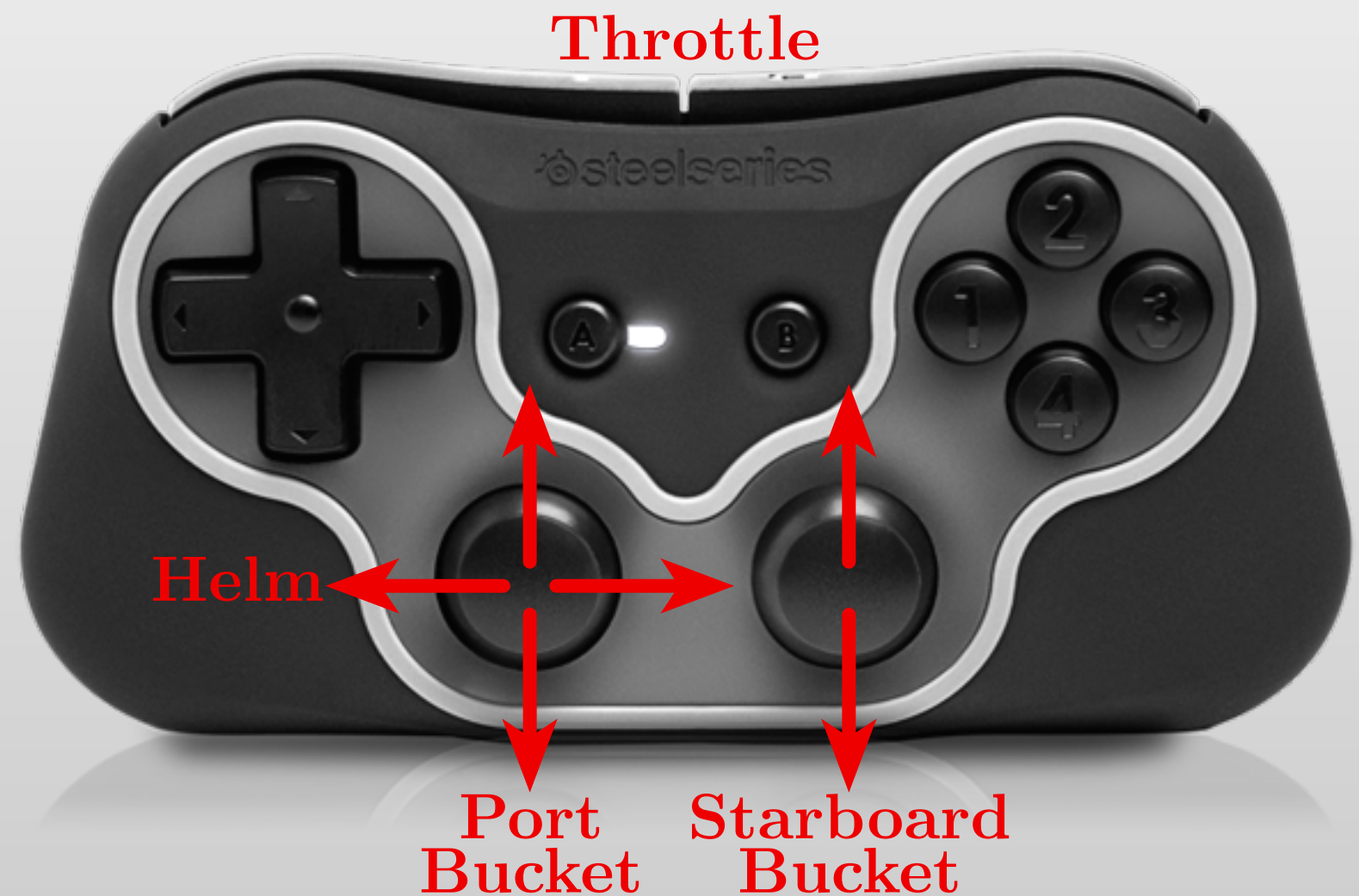


Image from: <https://flic.kr/p/jeLGc7>

Dead-man's Switch Example



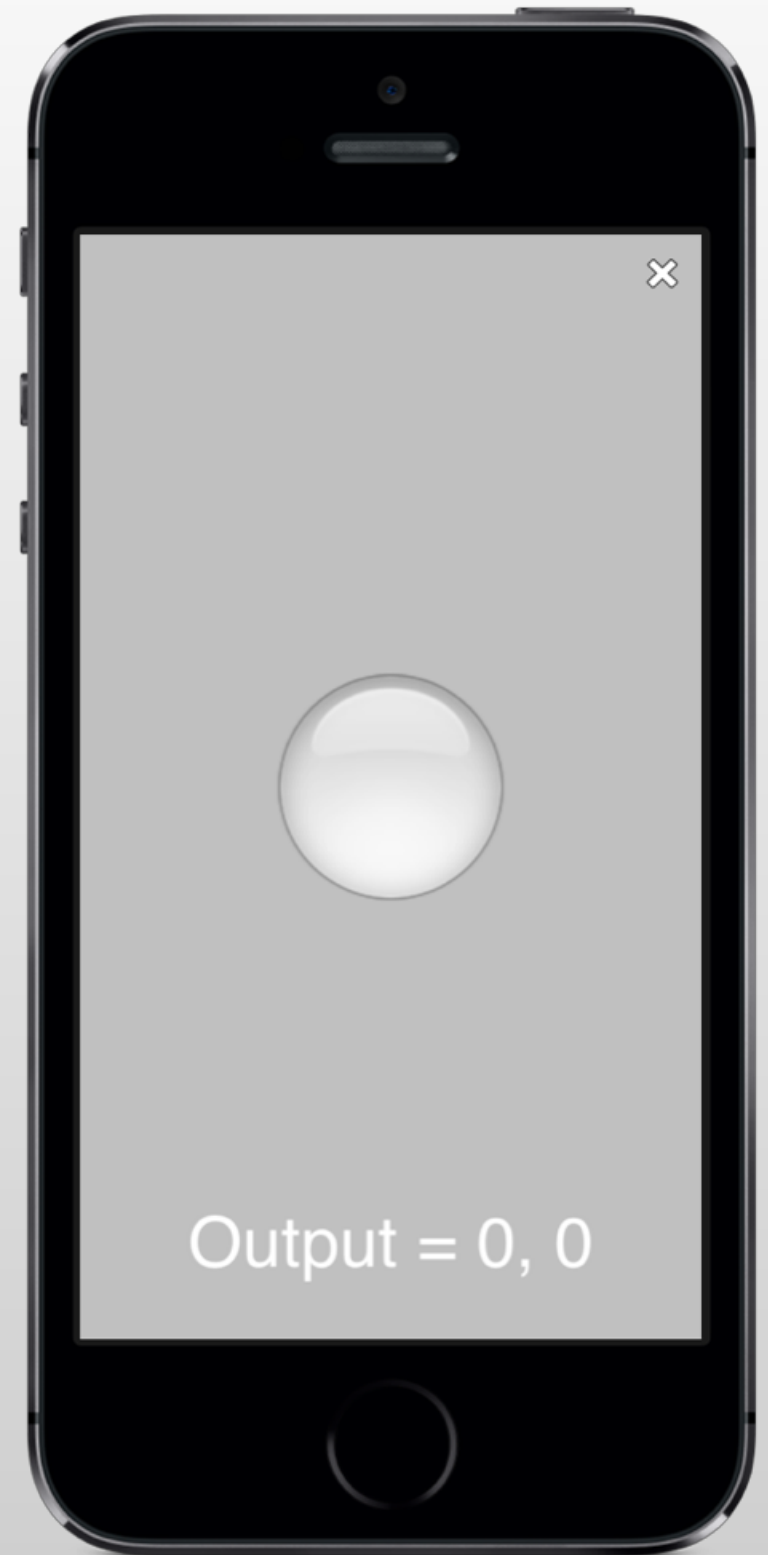
- Gamepad



Dead-man's Switch Example



- Gamepad
- iOS-based remote
 - Joystick
 - Tilt-based



At the Feb. 18 Demo



**UL Partners with SwiftShips
Autonomous Vessel**



“... it is your job to make it impossible for the user to accidentally operate your device in an unsafe manner. Users should have to make an intentional and concerted effort in order to injure themselves or others.”

Accommodate Unusual Operating Conditions



- People will use your design how they want, not how you intended.
- Anticipate improper use and unusual conditions

Utilize Redundancy



- Avoid single-point-of-failure designs



Design Safe Failure Modes



Image from: <https://flic.kr/p/cPebu>

Facilitate Maintenance



- If maintenance is needed, make it easy.



Image from: <https://flic.kr/p/eHVVe2>

Facilitate Maintenance



- If maintenance is needed, make it easy.



Image from: <http://www.chevrolet.com/corvette-z06-supercar/exterior-pictures.html>

Facilitate Maintenance



- If maintenance is needed, make it easy.

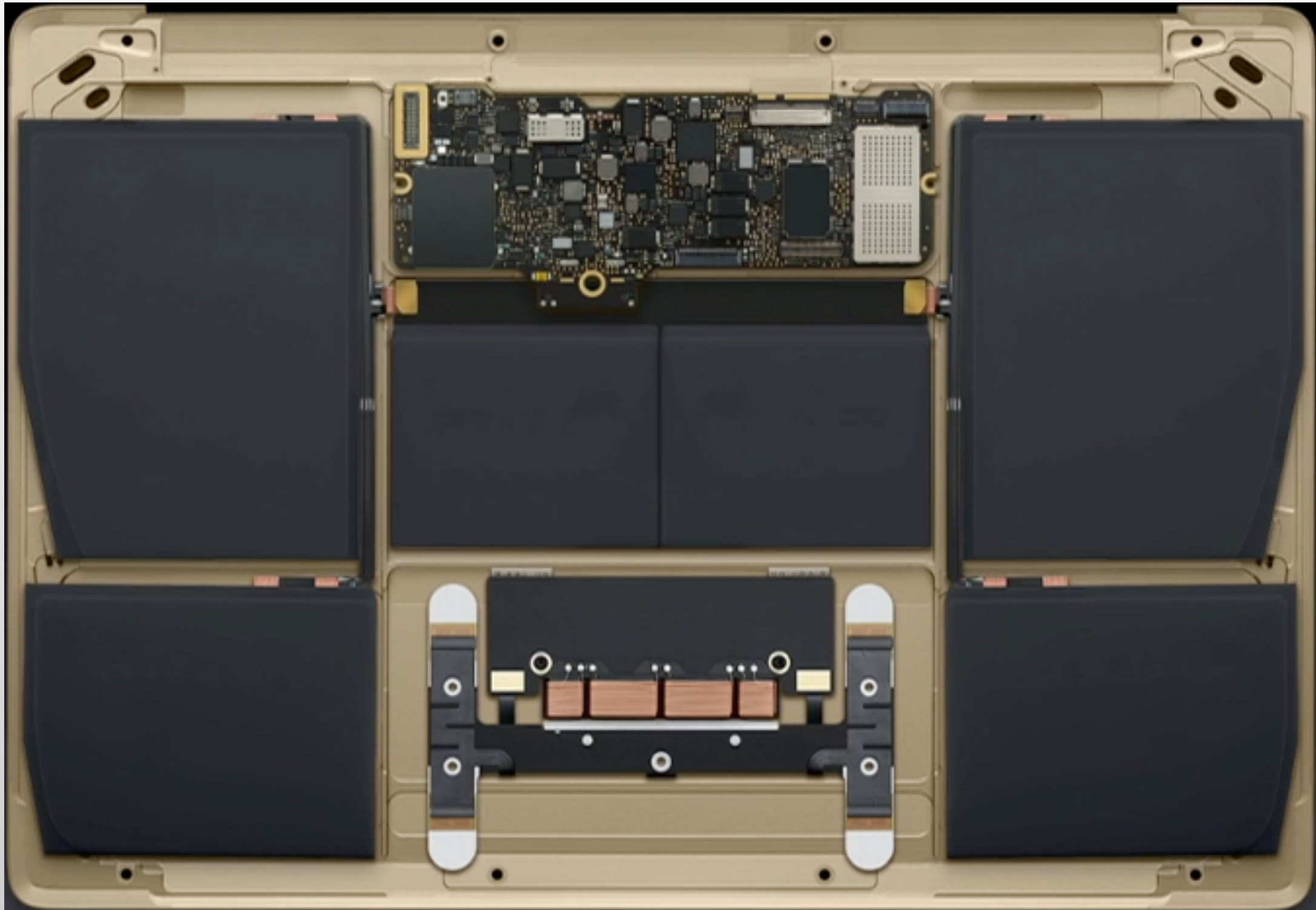


Image from: <http://www.hansotten.com/index.php?page=apple-ii>

Facilitate Maintenance



- If maintenance is needed, make it easy.



Add Warning Labels and Systems



Image from: <https://flic.kr/p/o7q6tD>

Add Warning Labels and Systems



- Do all of that and...

