

LOOKING OUTSIDE THE COCKPIT: AN IN-DEPTH LOOK AT AIRPORT SIGNAGE

Oliver Austin, TUG '22



ABOUT ME

- San Jose, CA
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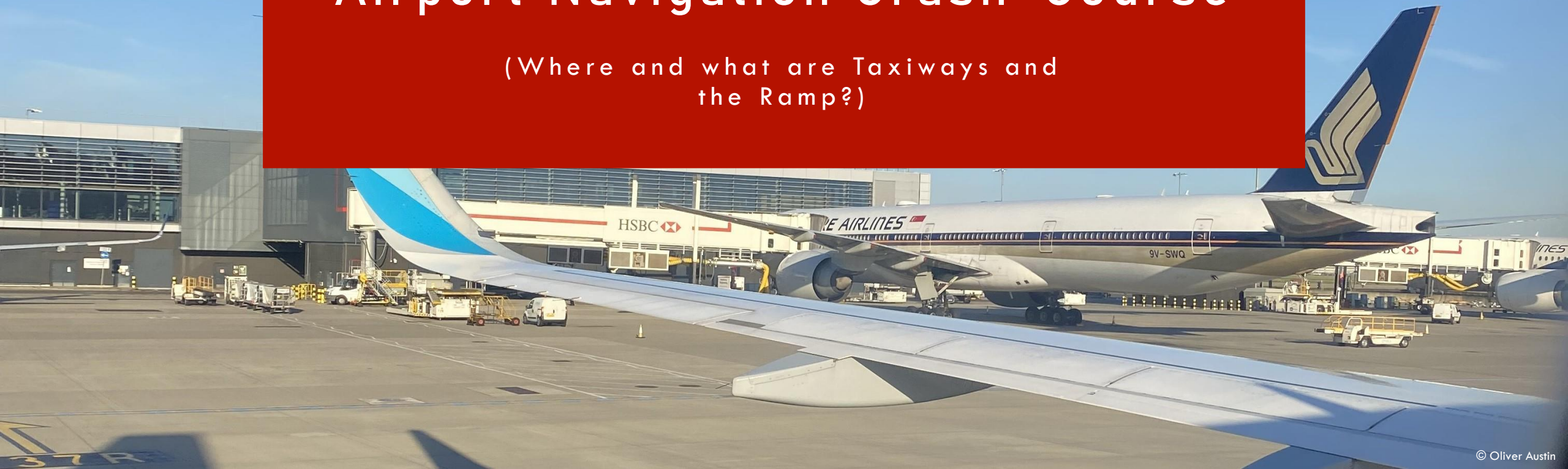
DISCUSSION OVERVIEW

- Types of signage found on Taxiways and the Ramp/Apron
- Correlations between character/sign design choices and intended usage
- Importance in the introduction of autonomous aircraft



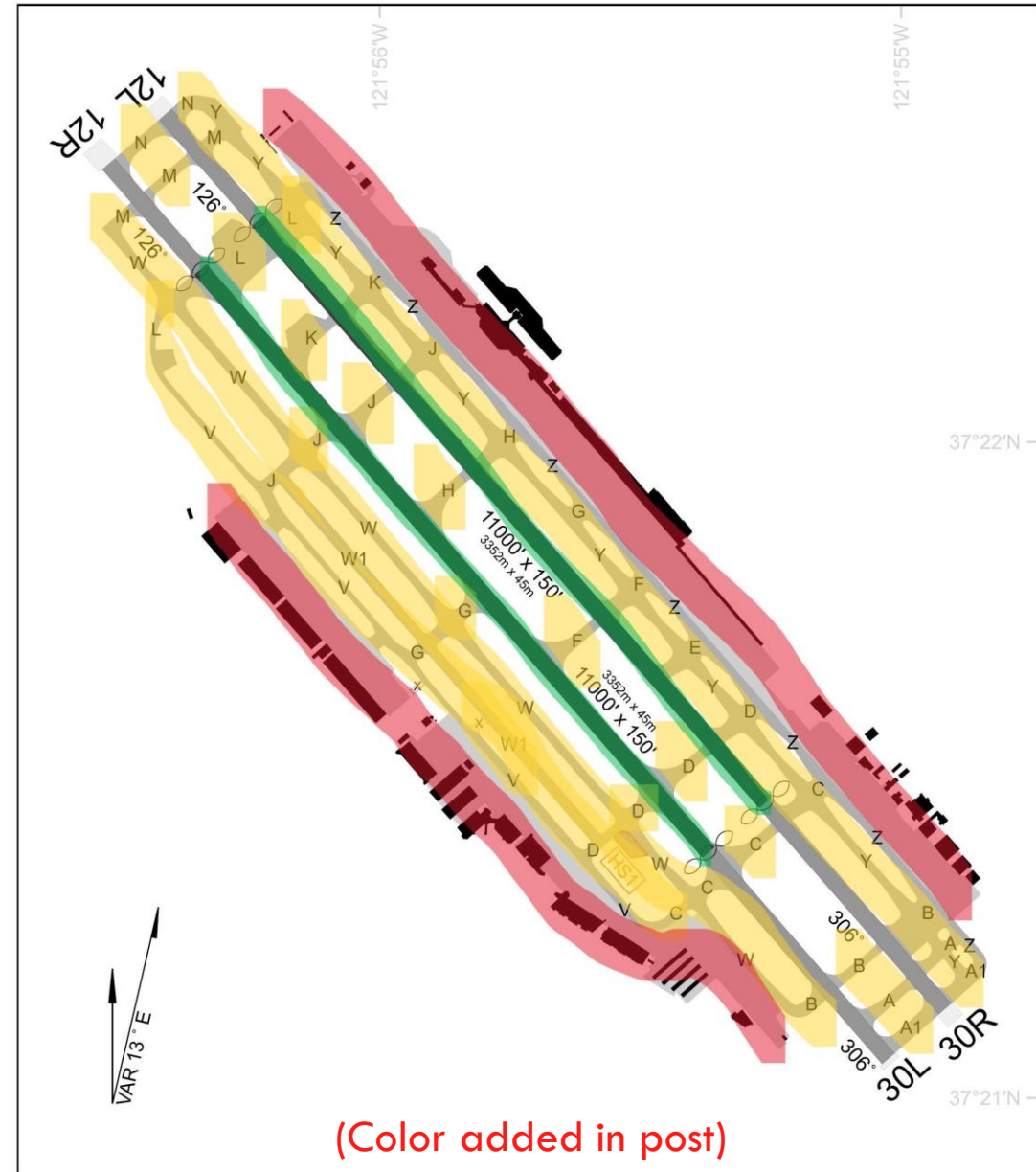
Airport Navigation Crash-Course

(Where and what are Taxiways and
the Ramp?)



TAXI DIAGRAMS

- Map of an airport for pilots
- Green indicates the runway(s)
- Yellow indicates the taxiways
- Red indicates the ramp (officially recognized as the “apron” by the FAA and ICAO)



LOOKING OUT THE WINDOW

Green – Runway

Yellow – Taxiway

Red – Ramp/Apron



AIRPORT SIGN AND MARKING – QUICK REFERENCE GUIDE

Ref. AC 150/5340-1J Standards for Airport Markings, and AC 150/5340-18D Standards for Airport Signs Systems









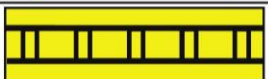





EXAMPLE	TYPE OF SIGN	PURPOSE	LOCATION/CONVENTION
	Mandatory: Hold position for taxiway/runway intersection.	Denotes entrance to runway from a taxiway.	Located <u>L side</u> of taxiway within 10 feet of hold position markings.
	Mandatory: Holding position for runway/runway intersection.	Denotes intersecting runway.	Located <u>L side</u> of rwy prior to intersection, & <u>R side</u> if rwy more than 150' wide, used as taxiway, or has "land & hold short" ops.
	Mandatory: Holding position for runway approach area.	Denotes area to be protected for aircraft approaching or departing a runway.	Located on taxiways crossing thru runway approach areas where an aircraft would enter an RSA or apch/ departure airspace.
	Mandatory: Holding position for ILS critical area/precision obstacle free zone.	Denotes entrance to area to be protected for an ILS signal or approach airspace.	Located on twys where the twys enter the NAVAID critical area or where aircraft on taxiway would violate ILS apch airspace (including POFZ).
	Mandatory: No entry.	Denotes aircraft entry is prohibited.	Located on paved areas that <u>aircraft</u> should not enter.
	Taxiway Location.	Identifies taxiway on which the aircraft is located.	Located along taxiway by itself, as part of an array of taxiway direction signs, or combined with a runway/ taxiway hold sign.
	Runway Location.	Identifies the runway on which the aircraft is located.	Normally located where the <u>proximity of two rwys</u> to one another could cause confusion.
	Runway Safety Area / OFZ and Runway Approach Area Boundary.	Identifies exit boundary for an RSA / OFZ or rwy approach.	Located on taxiways on <u>back side</u> of certain runway/ taxiway holding position signs or runway approach area signs.
	ILS Critical Area/POFZ Boundary.	Identifies ILS critical area exit boundary.	Located on taxiways on <u>back side</u> of ILS critical area signs.
	Direction: Taxiway.	Defines designation/direction of intersecting taxiway(s).	Located on <u>L side</u> , <u>prior to intersection</u> , with an array L to R in clockwise manner.
	Runway Exit.	Defines designation/direction of exit taxiways from the rwy.	Located on same side of runway as exit, prior to exit.
	Outbound Destination.	Defines directions to take-off runway(s).	Located on taxi routes to runway(s). <u>Never</u> collocated or combined with other signs.
	Inbound Destination.	Defines directions to airport destinations for arriving aircraft.	Located on taxi routes to airport destinations. <u>Never</u> collocated or combined with other types of signs.
	Information.	Provides procedural or other specialized information.	Located along taxi routes or aircraft parking/staging areas. May not be lighted.



Image courtesy of Justin Kim



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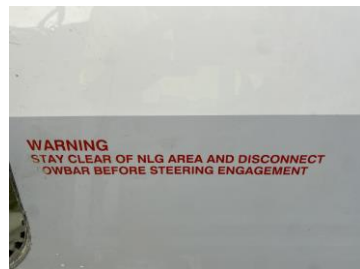
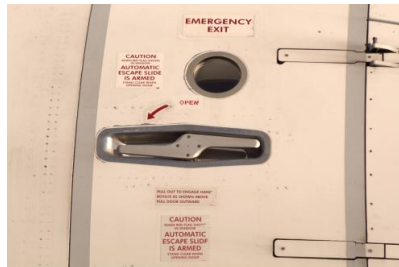
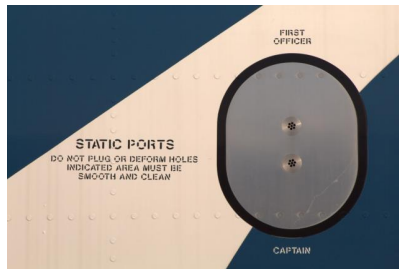


"Best Practices." Watsonville, Watsonville Municipal Airport, <https://www.cityofwatsonville.org/335/Best-Practices>.



Federal Aviation Administration

SIGNAGE AROUND THE RAMP/APRON



1



1. UNLOCK VE

2



3



4



1. REMOVE ROD FROM STOWAGE

ROD AND FULLY UP. OR LOCKED. ROD TO STOWAGE.

CLOSE

1



- 1. REMOVE ROD FROM STOWAGE.
- 2. ENGAGE THE ROD AND WHILE PUSHING IT UP, TURN IT TO UNLOCK THE DOOR.
- 3. LOWER DOOR.
- 4. RETURN ROD TO STOWAGE.



- 1. CLOSE DOOR.
- 2. PUSH MAIN HANDLE FULLY DOWN.



- 1. PULL VENT PANEL UNTIL FLUSH.



- 1. ENSURE THAT DOOR IS CORRECTLY CLOSED (FLUSH).
- 2. CHECK FOUR DOOR INDICATORS GREEN.

Why Do Signs Look the Way They Do?
 (Comparisons between font design and intended usage/location)

TAXIWAY SIGNAGE

White On Red

- Used to protect runways/areas of importance
- Red is the universal color for “STOP”
- Stands out from other colors

Yellow On Black

- Indicates current location/taxiway (if you see it, you're there!)
- Contrasts against other color combinations

Black On Yellow

- Used to show intersecting taxiways and display general information
- More yellow (a bright color) than black → a more noticeable sign

RAMP SIGNAGE

Cautionary

- Red, Yellow, or brightly colored text/background
- Usually Geometric, Humanistic, or Monospaced

Instructions

- Duller colors (black, white, sometimes red)
- Large characters
- Neo-Grotesque, Geometric, or Monospaced

General Information

- White on dull background or black on white background
- Neo-Grotesque and/or Humanistic

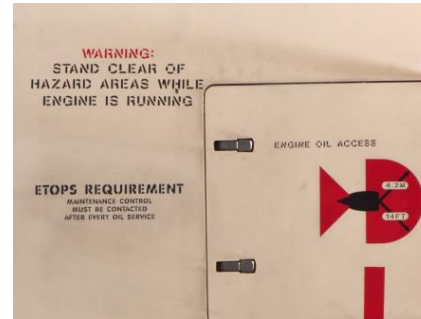
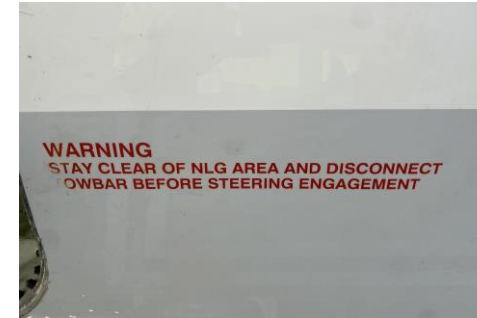
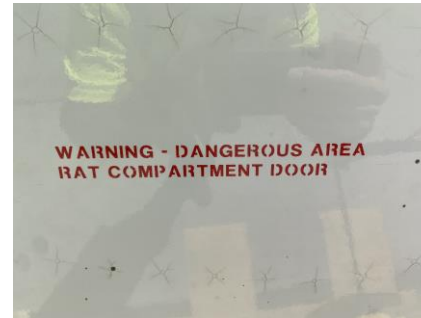
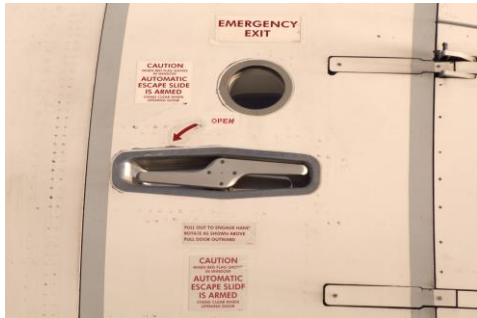
If blue beacon activates,
call 277-5100 immediately
to notify Airport Operations

CAUTIONARY SIGNS (GENERAL EQUIPMENT)



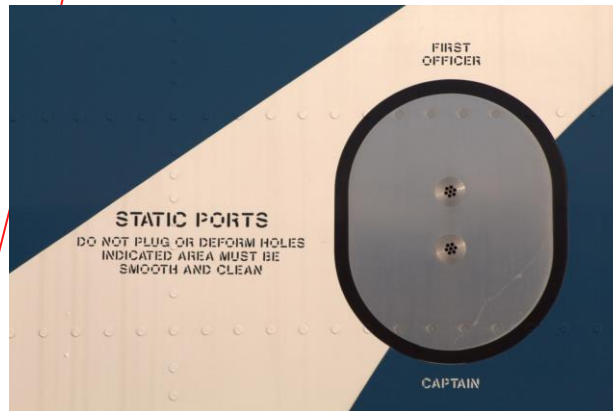
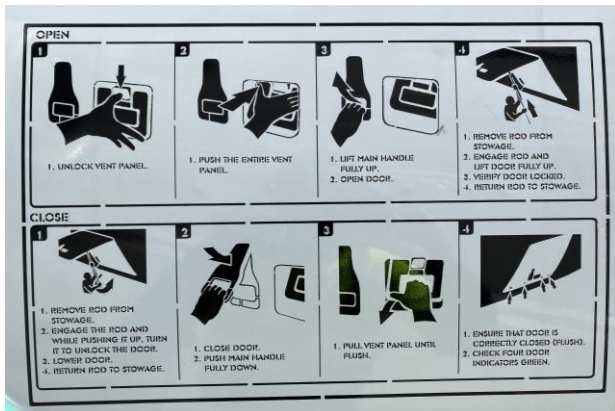
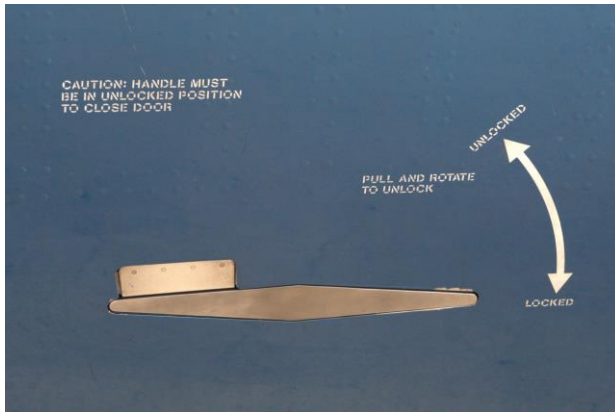
Images courtesy of Justin Kim

CAUTIONARY SIGNS (AIRCRAFT-SPECIFIC)



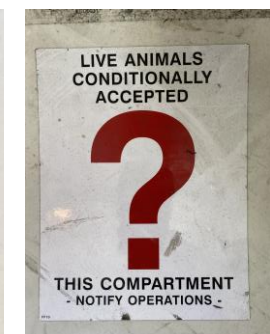
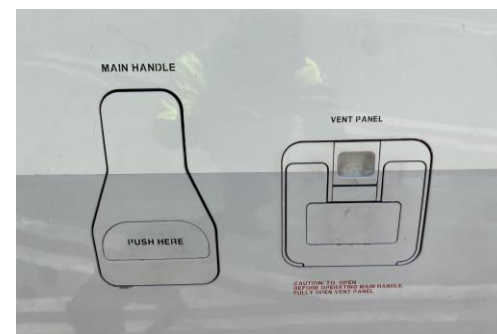
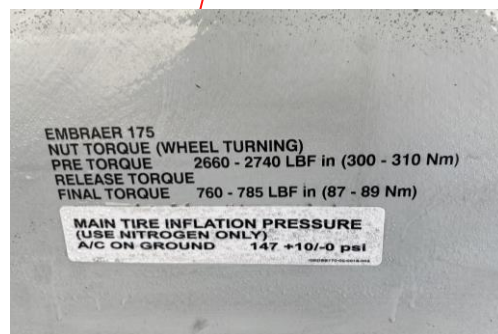
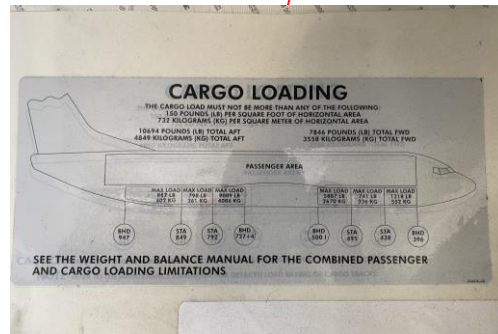
Images courtesy of Justin Kim

INSTRUCTIONAL SIGNS



Images courtesy of Justin Kim

GENERAL INFORMATION SIGNS



Images courtesy of Justin Kim

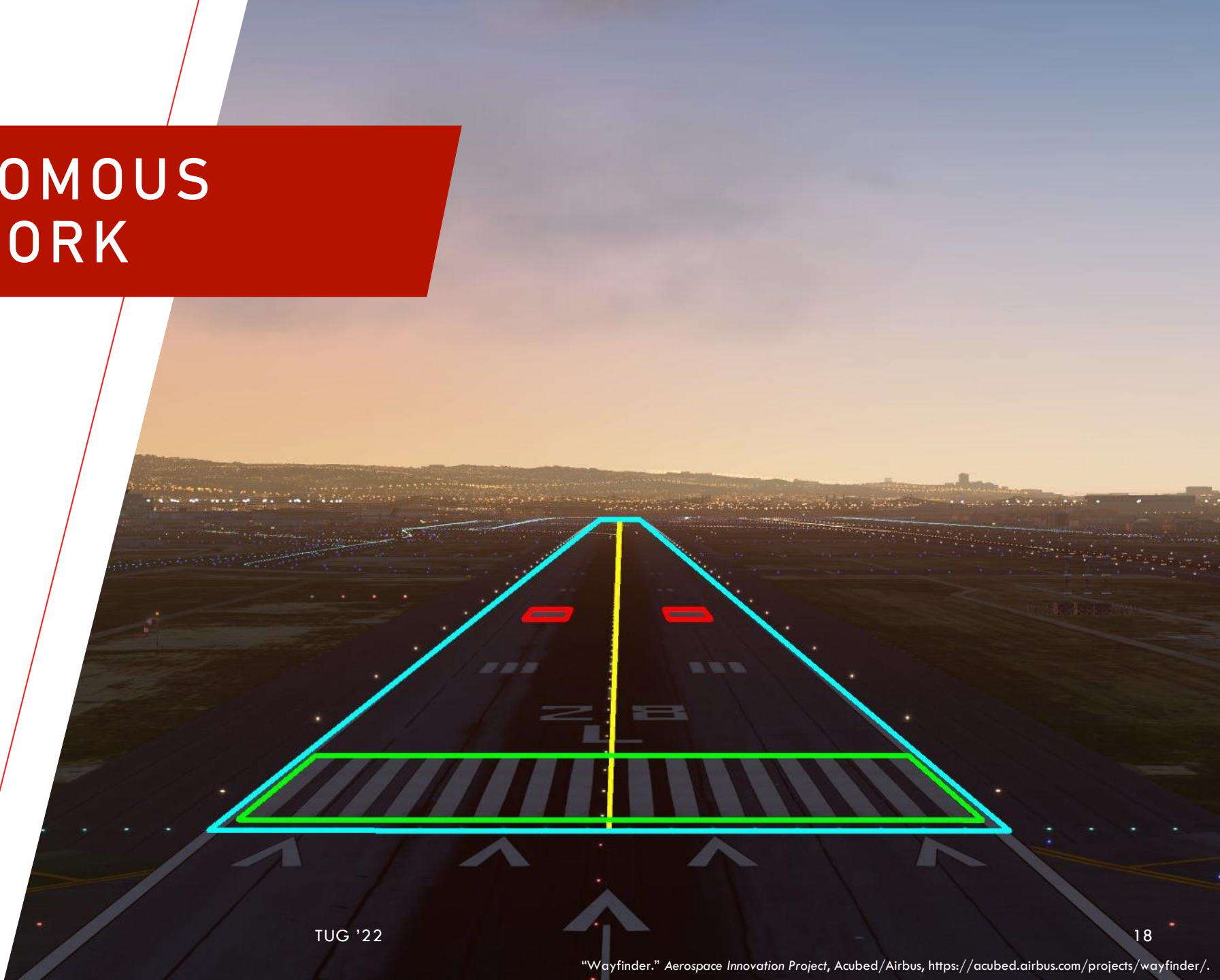
Why this all matters?

(Onset of Autonomous Aircraft)



HOW AUTONOMOUS VEHICLES WORK

- Vision-Based Navigation Systems Consist of One or More Cameras that Feed Directly into an Onboard Computer
- Use of Cameras Helps Systems Achieve Higher Precision when Controlling Vehicles
- Most Prevalent Use is with Road Vehicles (i.e. Tesla Automobiles)



VERTEX

Demonstrating simplified mission preparation and control for Vertical Take Off and Landing (VTOL) aircraft, reducing pilot workload using intuitive devices on the Airbus helicopter FlightLab



Technologies will be transferred to future VTOL

Focus on mission by reducing pilot workload

Disruptive HMI for mission preparation and in-flight monitoring & control

Vision-based sensors detect low altitude low speed obstacles

Automatic taxiing, take off, navigation and landing



Onboard Technology

- 2-axis camera
- Infrared camera
- LIDAR sensor

Computing Capabilities

- High Power CPU
- High Power Avionics
- Fly-by-wire Helicopter

Pilot Interfaces

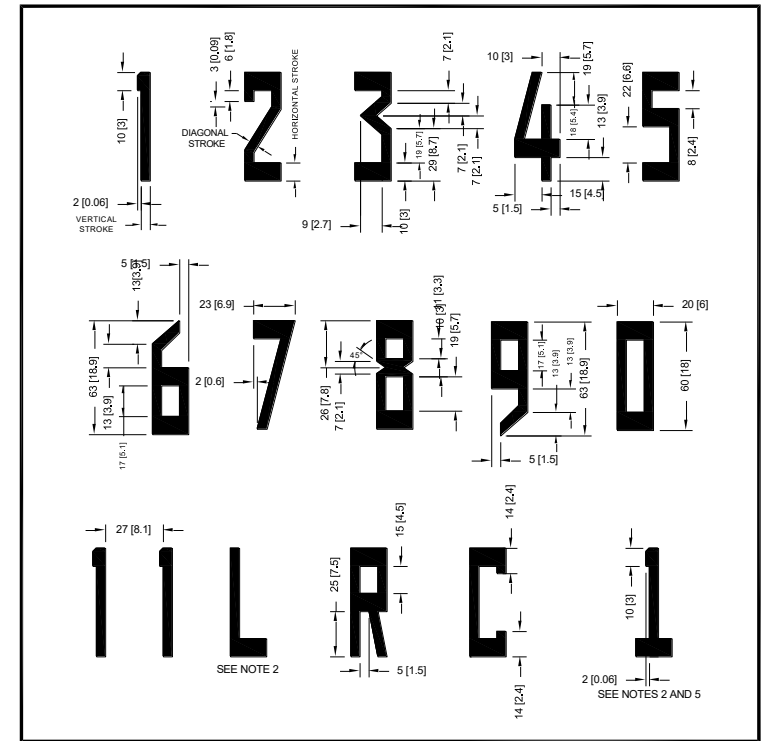
- Handheld Tablet
- Head worn Display

AIRBUS

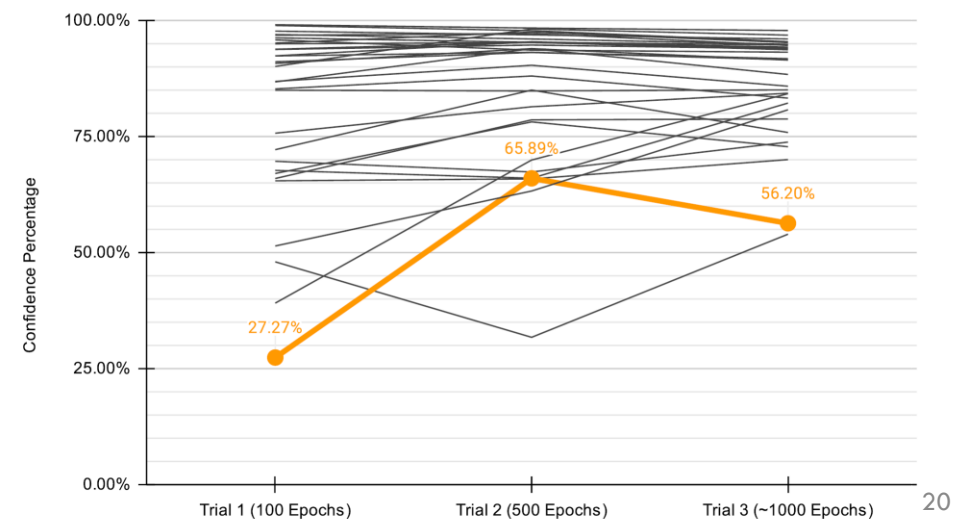
TUG 2021 PRESENTATION

- Ran machine learning trials on font used for runways
- Data showed current font significantly underperforming in recognition tests*
- Raised questions as to how well other aviation fonts may compare

*in comparison to 30 other randomly selected fonts



Summarization of Data

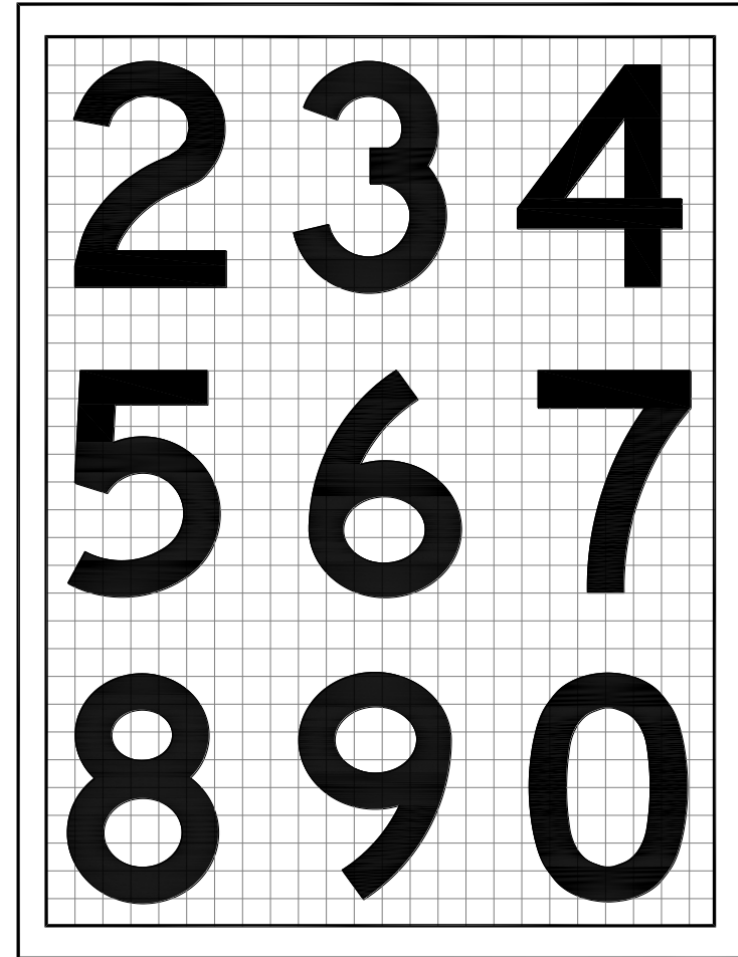


TAXIWAY FONT VS HIGHEST PERFORMER

Allumi

0 1 2 3 4 5 6 7 8 9

L C R



THANKS FOR LISTENING!

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Photos by Justin Kim

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(Instagram)

USE SKYWEST FORM
M-339 FOR PROPER
TIRE INFLATION PRESSURE

EMBRAER 175
NUT TORQUE (WHEEL TURNING)
PIPE TORQUE 700 - 725 Lbf IN (70 - 82 Nm)
RELEASE TORQUE
FINAL TORQUE 2103 - 2112 Lbf IN (32 - 33 Nm)

NOSE TIRE INFLATION PRESSURE
(USE NITROGEN ONLY)
A/C ON GROUND 102 +10/-0 PSI

174SY