PACDEFF 2024

Back to the future—— On the **typography** of **electronic** flight deck documentation

Pascale Schmid

I acknowledge the traditional owners of the land on which we meet today and would also like to pay my respects to Elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples.

WELCOME—HI, I'M PASCALE!

Type designer & consultant

PhD candidate & sessional academic at Griffith University

Aviation background

Greyhound enthusiast (anti-racing)

PACDEFF 2024

Pascale Schmid

Griffith University

Wayne Thompson

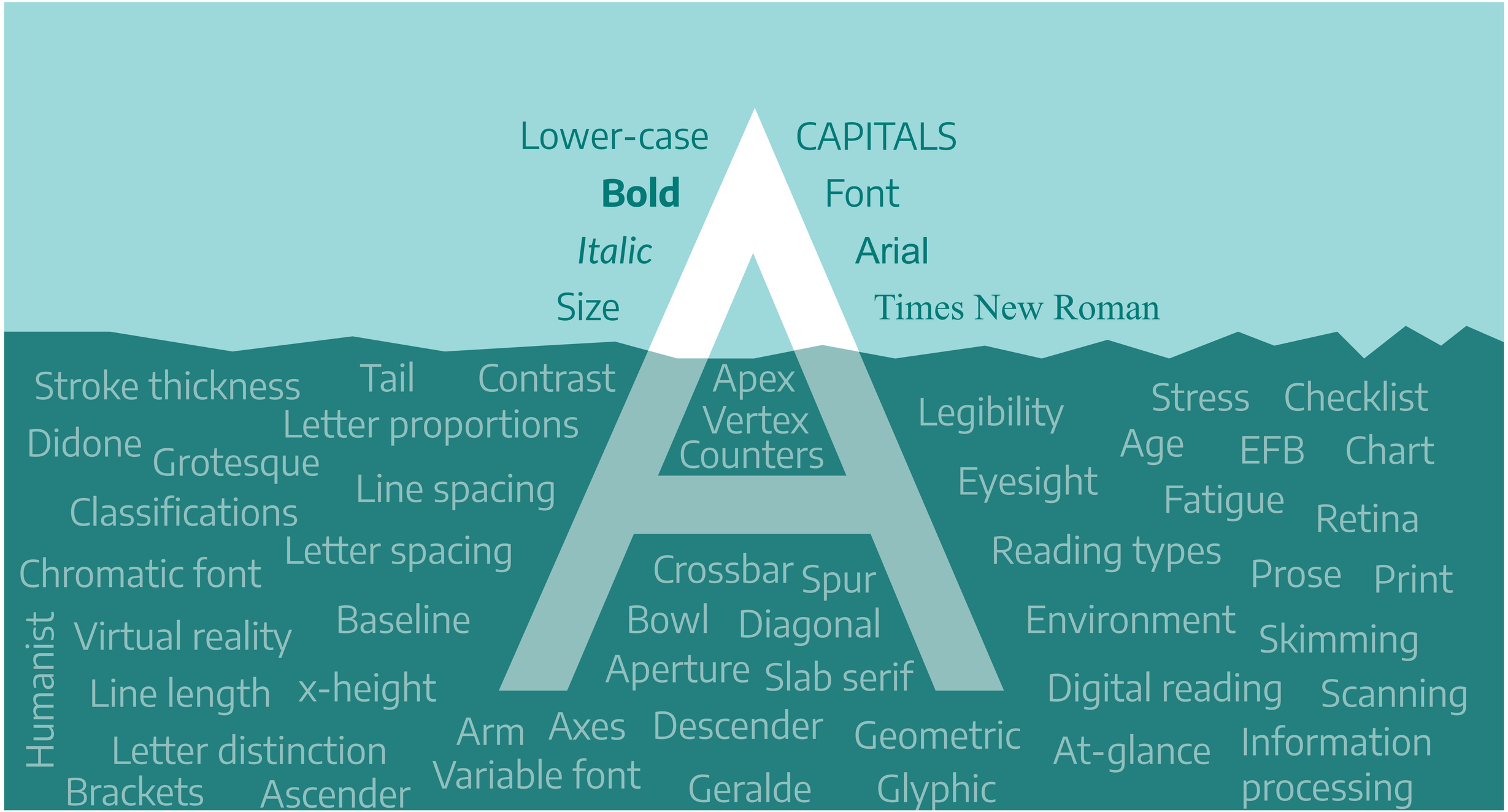
University of Newcastle
Type designer
Director—Australian Type Foundry

David Sargent

Griffith University
Type designer

- Introducing our publication
  - Background
  - The problem
  - Scope
  - Methods
- Discussing a few points &
- The future of typography

JUST A MOMENT—WHY SHOULD WE CARE ABOUT TYPE?



PACDEFF 2024

1989

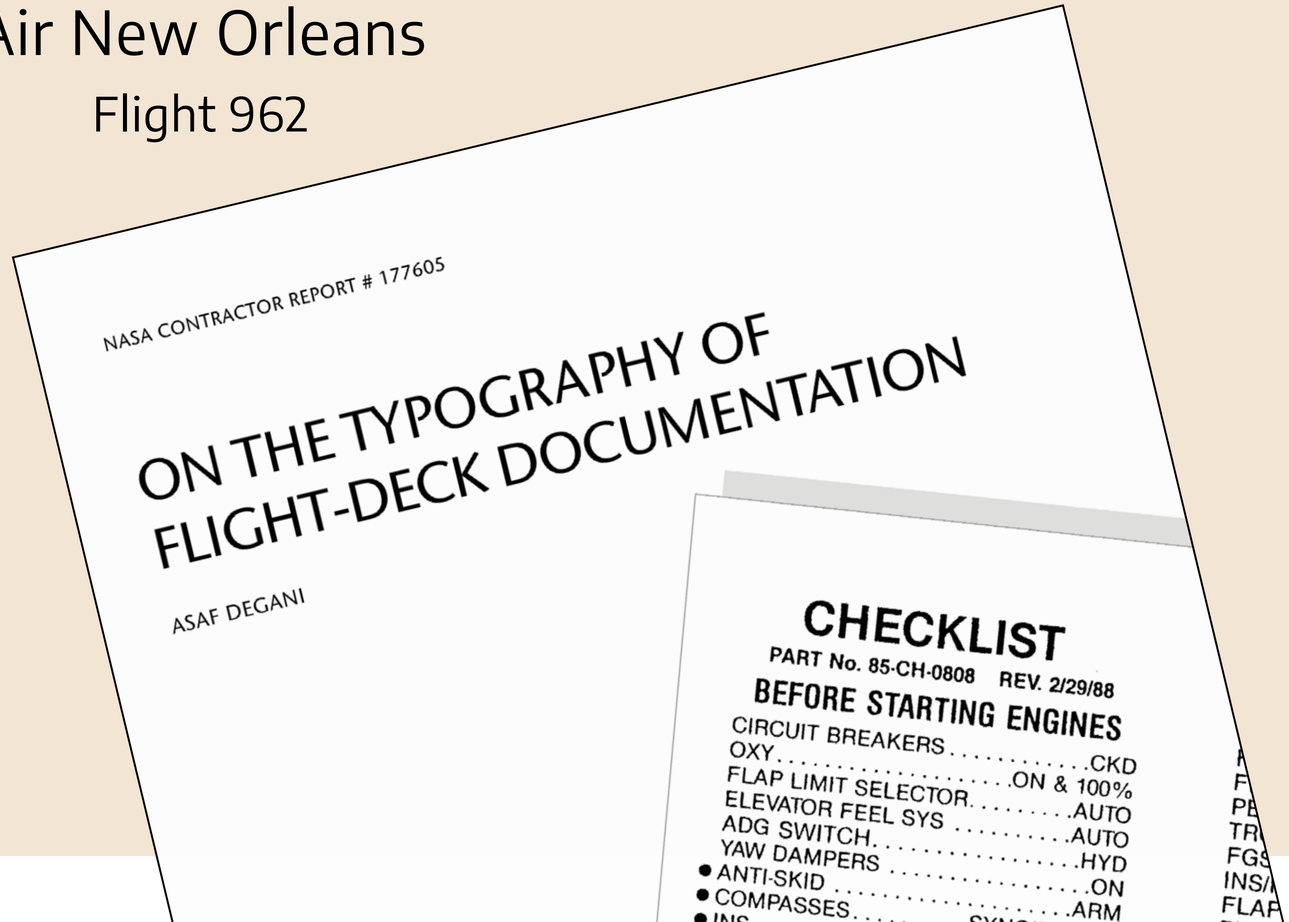
Air New Orleans

Flight 962

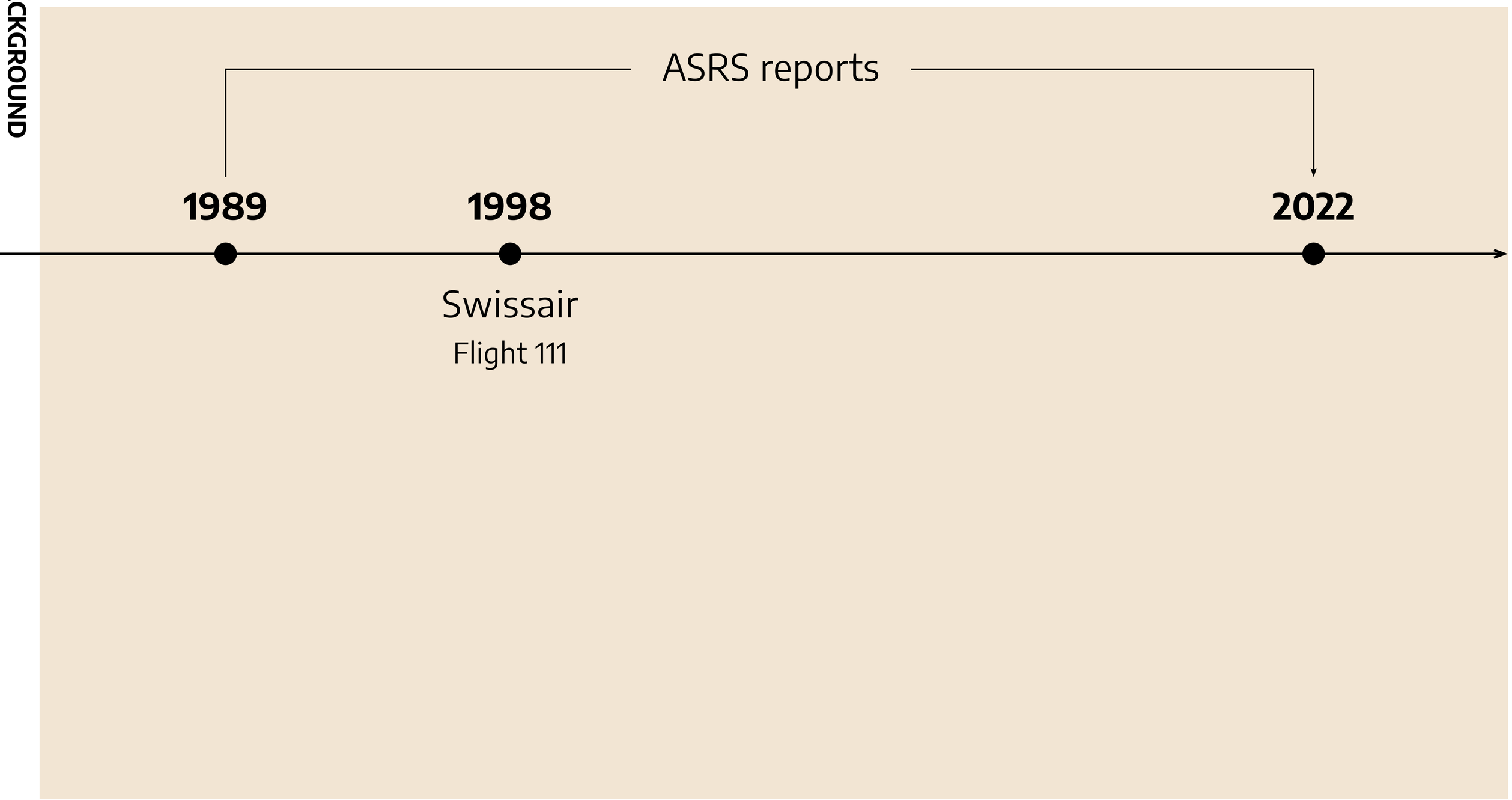
1989 **1992**

Air New Orleans

Flight 962



- Dr Asaf Degani
- Response to accidents in the late 1980’
- 19 type recommendations
- Go-to publication


ASRS reports
1989
1998
2022
Swissair
Flight 111

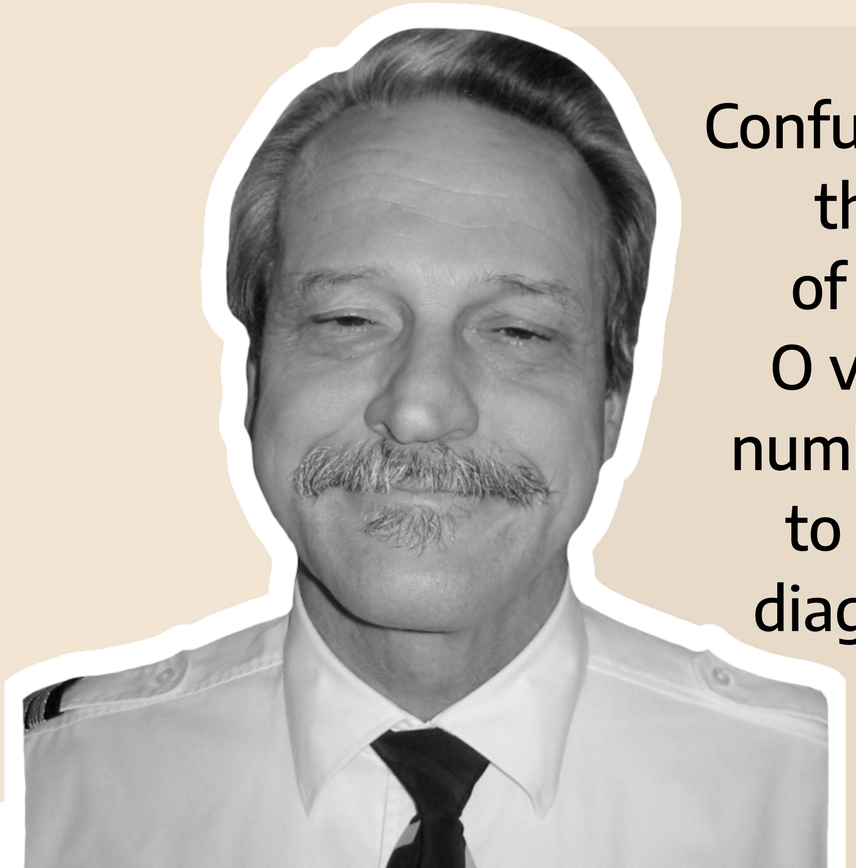
ASRS reports

1989 **2018** **2022**

... over 100 years and counting of aviation and still our charts are terrible!

ASRS reports

1989 **2019** **2022**



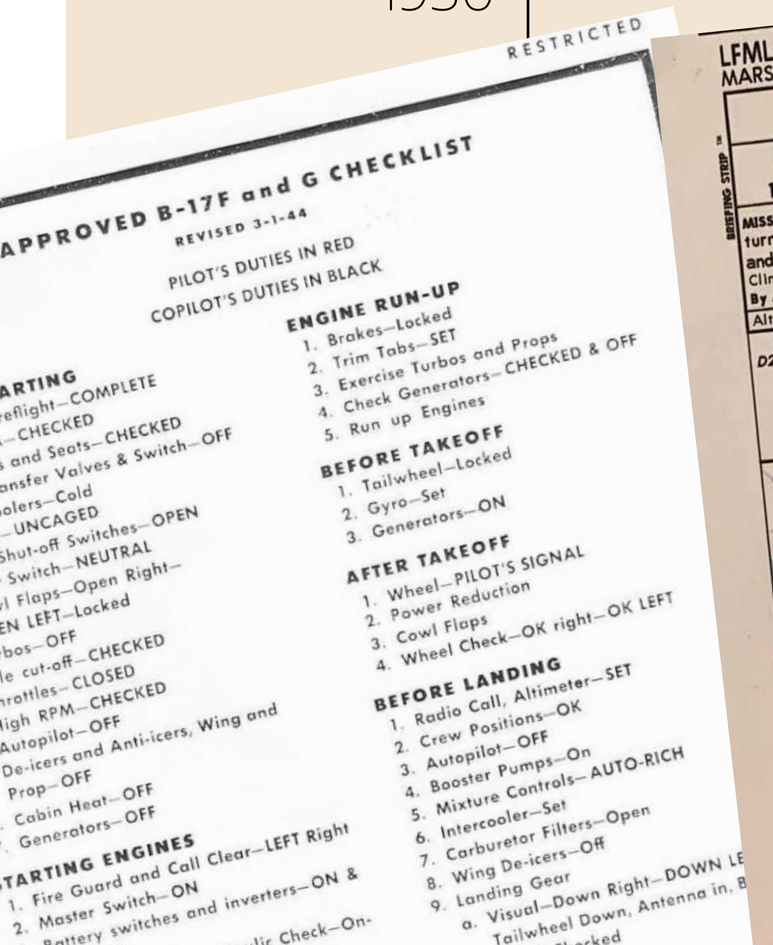
Confusion over the display of the letter O versus the number 0 due to a missing diagonal line.

THE PROBLEM

First checklist
1930'

Jeppesen chart
2008

Electronic Flight Bag (EFB)
From 2016



RESTRICTED

APPROVED B-17F and G CHECKLIST

REVISED 3-1-44

PILOT'S DUTIES IN RED

COPILOT'S DUTIES IN BLACK

ENGINE RUN-UP
1. Brakes—Locked
2. Trim Tabs—SET
3. Exercise Turbos and Props
4. Check Generators—CHECKED & OFF
5. Run up Engines

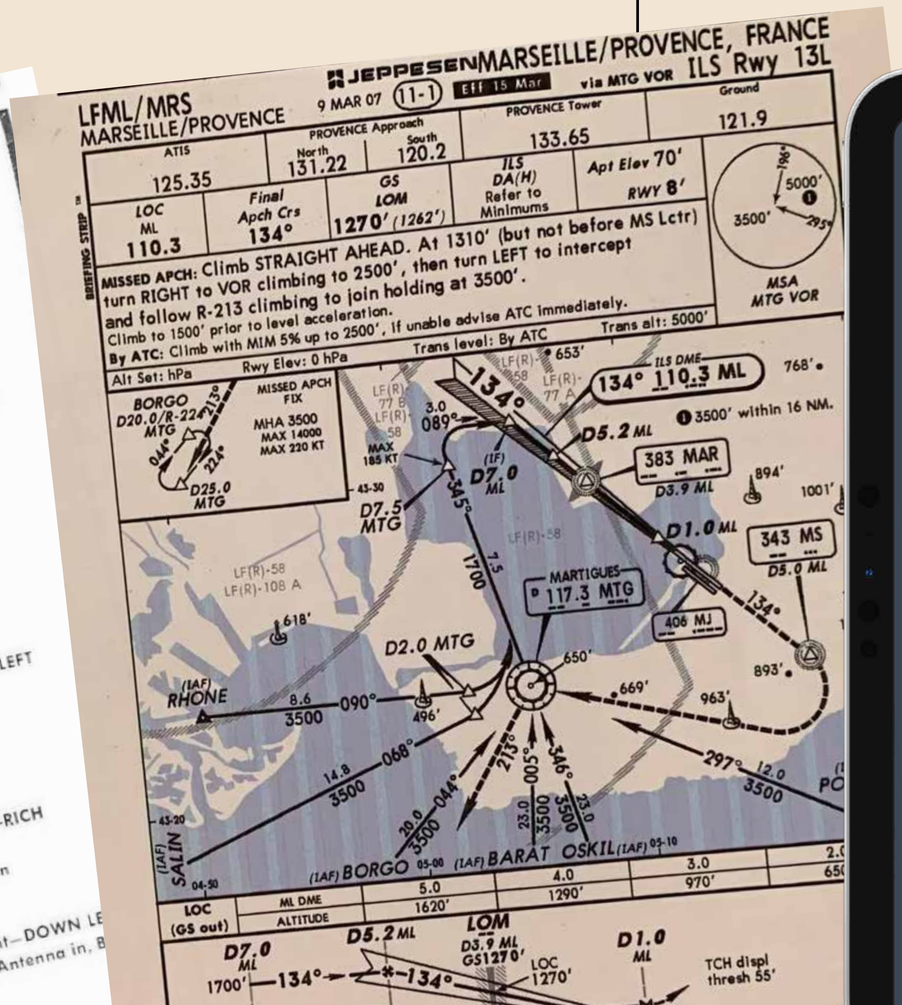
BEFORE TAKEOFF
1. Tailwheel—Locked
2. Gyro—Set
3. Generators—ON

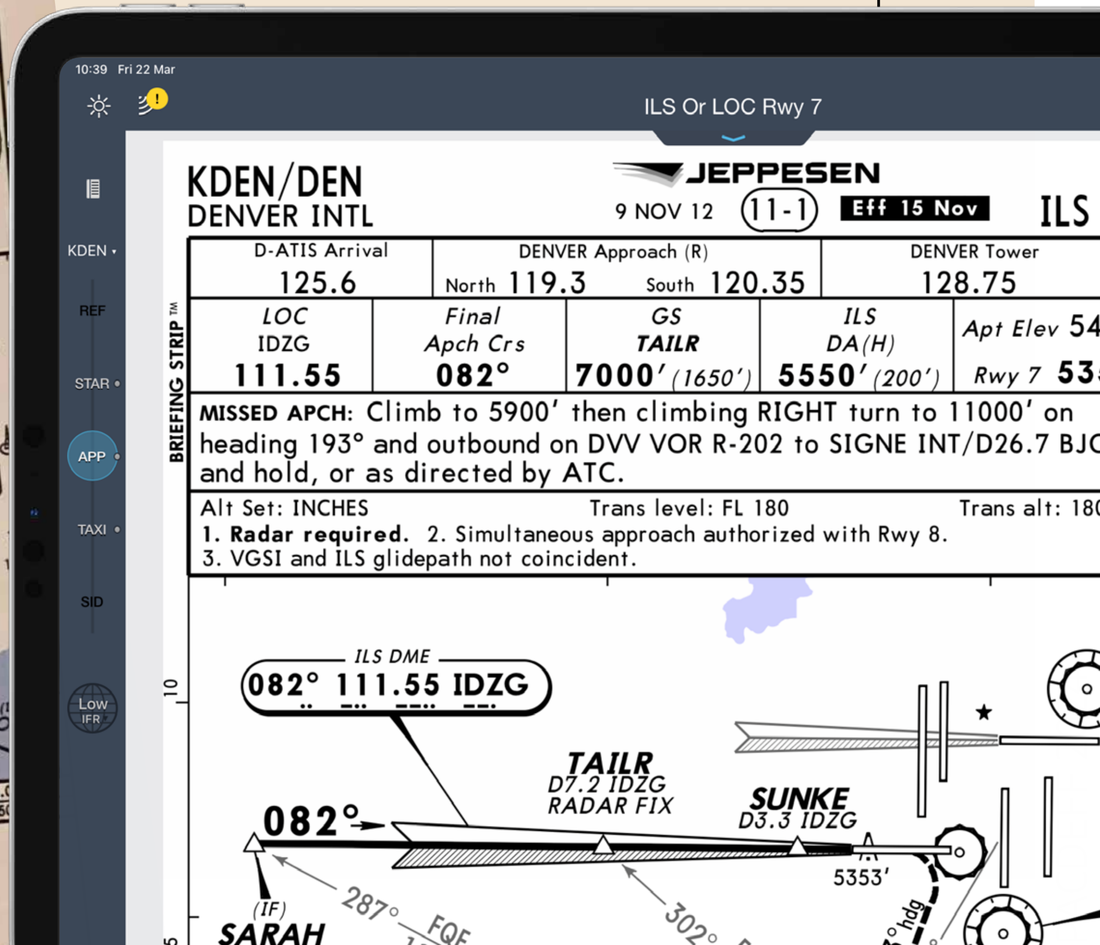
AFTER TAKEOFF
1. Wheel—PILOT'S SIGNAL
2. Power Reduction
3. Cowl Flaps
4. Wheel Check—OK right—OK LEFT

BEFORE LANDING
1. Radio Call, Altimeter—SET
2. Crew Positions—OK
3. Autopilot—OFF
4. Booster Pumps—On
5. Mixture Controls—AUTO-RICH
6. Intercooler—Set
7. Carburetor Filters—Open
8. Wing De-icers—Off
9. Landing Gear
   a. Visual—Down Right—DOWN LE
   Tailwheel Down, Antenna in, B
   Locked

ARTING
reflight—COMPLETE
—CHECKED
s and Seats—CHECKED
ansfer Valves & Switch—OFF
olers—Cold
—UNCAGED
Shut-off Switches—OPEN
Switch—NEUTRAL
l Flaps—Open Right—
EN LEFT—Locked
bos—OFF
le cut-off—CHECKED
rottles—CLOSED
igh RPM—CHECKED
Autopilot—OFF
De-icers and Anti-icers, Wing and
Prop—OFF
Cabin Heat—OFF
Generators—OFF

TARTING ENGINES
1. Fire Guard and Call Clear—LEFT Right
2. Master Switch—ON
Battery switches and inverters—ON &
lic Check—On-





OUR PROJECT

- Review of Degani’s report
- New recommendations
- New, simpler baseline
- New discussion

Safety Science 171 (2024) 106397

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/safety

Back to the future: On the typography of electronic flight deck documentation

Pascale Schmid [a, *], Wayne Thompson [b], David Sargent [a]

[a] Griffith University (Queensland College of Art), Brisbane, Australia
[b] University of Newcastle, Newcastle, Australia

ARTICLE INFO

Keywords:
Typography
Electronic flight deck documentation
Flight safety
Electronic Flight Bag (EFB)
Legibility
Digitization

ABSTRACT

Prompted by a series of air accidents in the 1980s, Dr Asaf Degani’s 1992 report, “On the Typography of
Deck Documentation,” reshaped the design of documents such as manuals, maps, charts, and checklists.
report addressed key principles of typography in printed documentation and provided 19 recommendations
best practice. These are now being applied to contemporary digital documentation. Consequently, our resea
team, comprising of practicing type designers, revisited the original report to determine whether the suggest
conventions remain applicable in a contemporary setting. The findings highlight that some recommendation
were based on misconceptions due to inconsistent terminology and now obsolete technologies, which led to
generalization of isolated typographic settings. This is problematic, given that absolute guidelines can only be
applied to one specific typeface at a time, due to the varying characteristics of letterforms among different
typefaces. Therefore, this single-source review aims to reset the baseline of typographic understanding, rekindle
the conversation about legibility in flight safety, and highlight the importance of a more comprehensive
approach to typography to improve legibility and, thus, safety. It follows the original report’s structure,
providing reflections on Degani’s findings and updated information as required. Further, we provide revised
recommendations, directions for future research and an outlook into the future of typography, which is currently
undergoing unprecedented technological changes.

1. Introduction

A pilot’s ability to read, interpret and act upon written documentation, such as manuals, checklists and charts, depends heavily on typography — the arrangement of text within a design for print or screen (Unger, 2018). Reading, a complex and inherently
that precedes comprehension (Tiefenthal
legibility, a quality aimed at
Legibility, in this
letter

features while filtering out irrelevant
process ultimately leads to
(McClelland &
identi

SCOPE

- Focus on Electronic Flight Bag (EFBs) applications
- Portable electronic devices (Apple iPad/Microsoft Surface)

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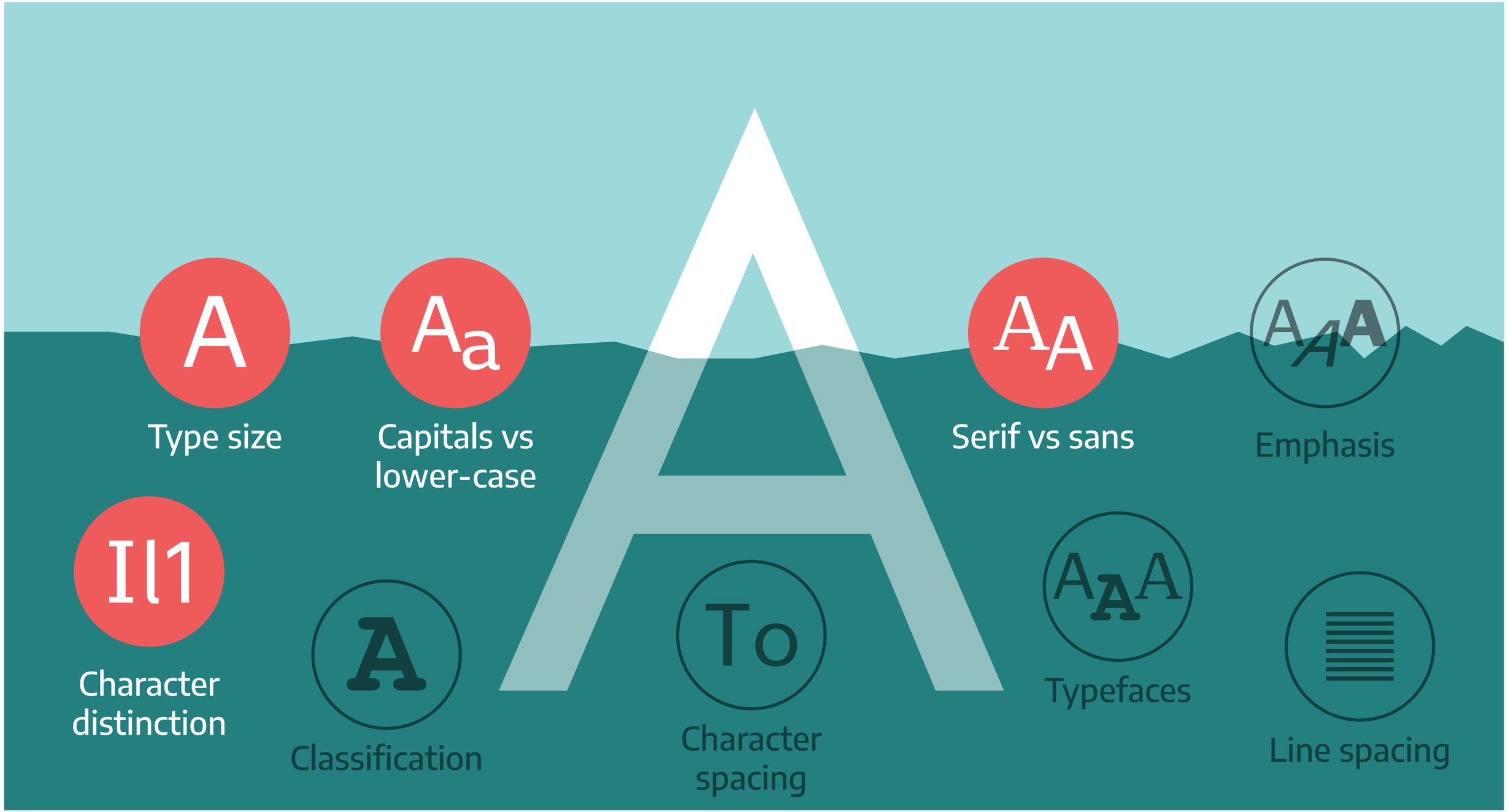
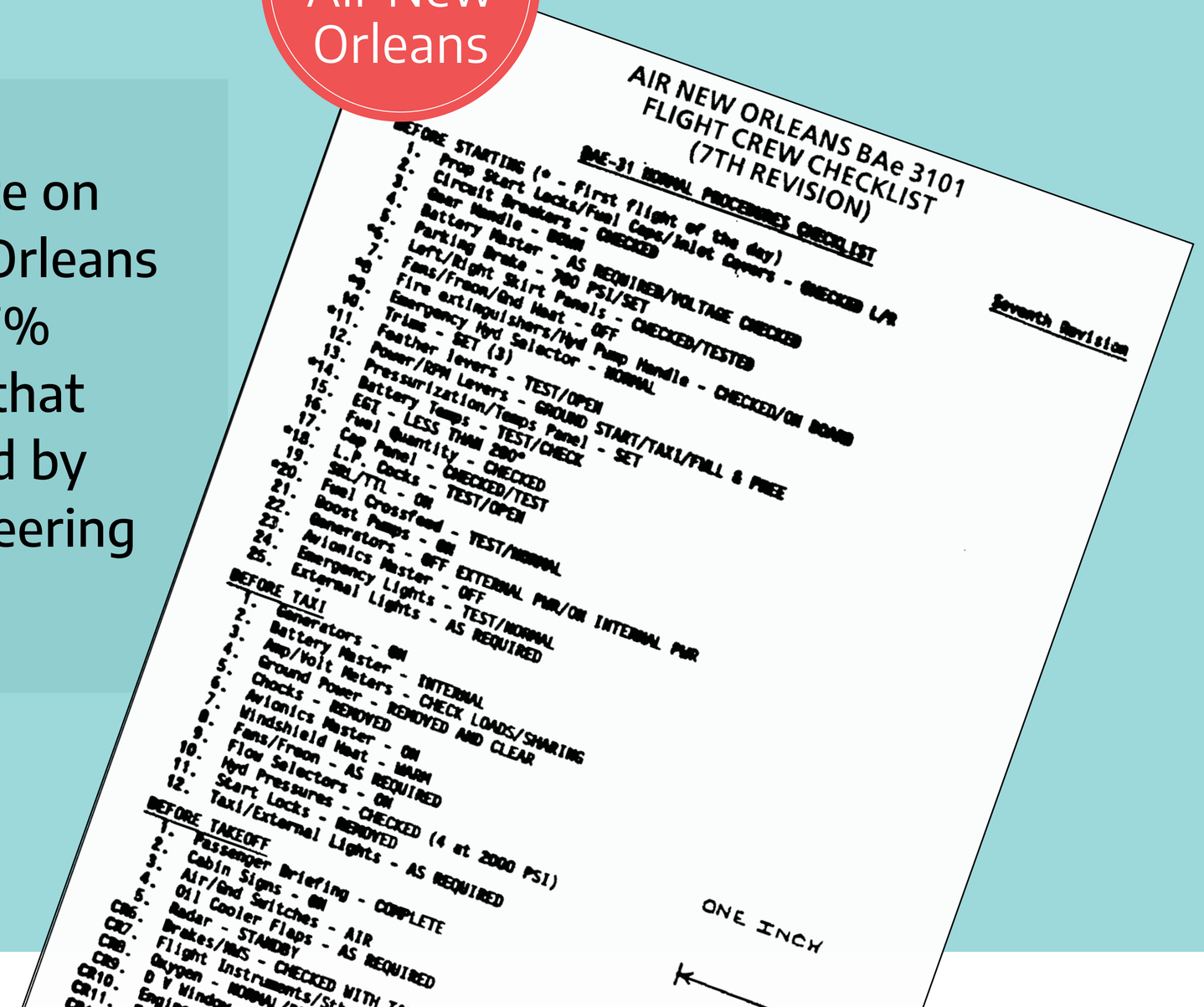
identi

Examination → Section summaries → Contemporary research → Discussion


A
Type size
Aa
Capitals vs lower-case
AA
Serif vs sans
AAA
Emphasis
Il1
Character distinction
A
Classification
To
Character spacing
AAA
Typefaces
Line spacing

1989
Air New Orleans

… the typeface on the Air New Orleans checklist is 57% smaller than that recommended by human engineering criteria.



AIR NEW ORLEANS BAe 3101
FLIGHT CREW CHECKLIST
(7TH REVISION)

Seventh Revision

BAE-31 NORMAL PROCEDURES CHECKLIST

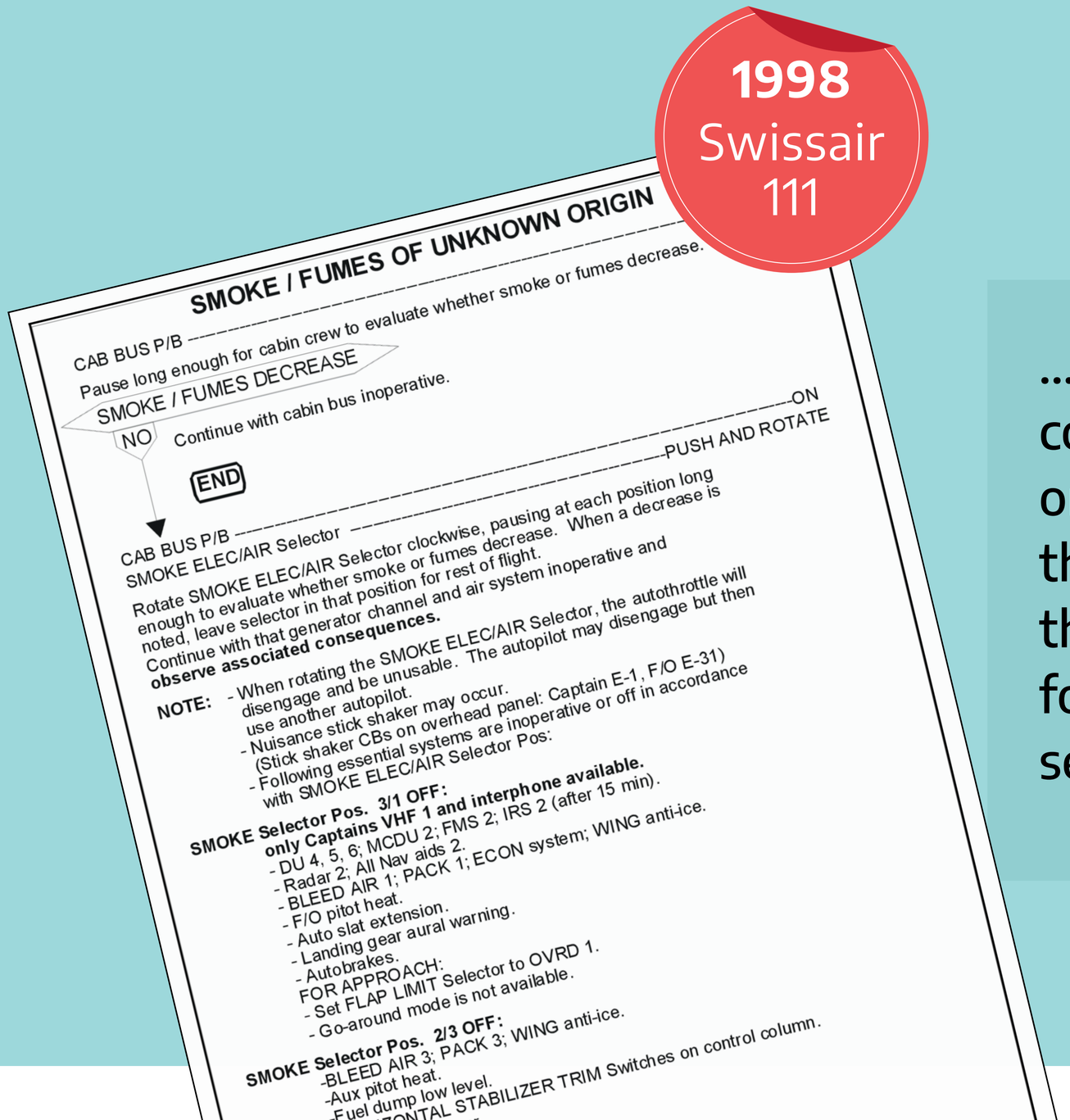
BEFORE STARTING (• - First flight of the day)
1. Prop Start Locks/Fuel Caps/Inlet Covers - CHECKED L/R
2. Circuit Breakers - CHECKED
3. Gear Handle - DOWN
4. Battery Master - AS REQUIRED/VOLTAGE CHECKED
5. Parking Brake - 700 PSI/SET
6. Left/Right Skirt Panels - CHECKED/TESTED
7. Fans/Freon/Gnd Heat - OFF
8. Fire extinguishers/Hyd Pump Handle - CHECKED/ON BOARD
9. Emergency Hyd Selector - NORMAL
10. Trims - SET (3)
11. Feather levers - TEST/OPEN
12. Power/RPM Levers - GROUND START/TAXI/FULL & FREE
13. Pressurization/Temps Panel - SET
•14. Battery Temps - TEST/CHECK
15. EGT - LESS THAN 280°
16. Fuel Quantity - CHECKED
17. Cap Panel - CHECKED/TEST
•18. L.P. Cocks - TEST/OPEN
19. SBL/TTL - ON
•20. Fuel Crossfeed - TEST/NORMAL
21. Boost Pumps - ON
22. Generators - OFF EXTERNAL PWR/ON INTERNAL PWR
23. Avionics Master - OFF
24. Emergency Lights - TEST/NORMAL
25. External Lights - AS REQUIRED

BEFORE TAXI
1. Generators - ON
2. Battery Master - INTERNAL
3. Amp/Volt Meters - CHECK LOADS/SHARING
4. Ground Power - REMOVED AND CLEAR
5. Chocks - REMOVED
6. Avionics Master - ON
7. Windshield Heat - WARM
8. Fans/Freon - AS REQUIRED
9. Flow Selectors - ON
10. Hyd Pressures - CHECKED (4 at 2000 PSI)
11. Start Locks - REMOVED
12. Taxi/External Lights - AS REQUIRED

BEFORE TAKEOFF
1. Passenger Briefing - COMPLETE
2. Cabin Signs - ON
3. Air/Gnd Switches - AIR
4. Oil Cooler Flaps - AS REQUIRED
5. Radar - STANDBY
CB6. Brakes/NWS - CHECKED WITH
CB7. Flight Instruments/St
CB8. Oxygen - NORMAL
CB9. D V Windo
CB10. Engi
CB11.

ONE INCH

1998
Swissair
111



SMOKE / FUMES OF UNKNOWN ORIGIN

CAB BUS P/B ---------- Pause long enough for cabin crew to evaluate whether smoke or fumes decrease.

SMOKE / FUMES DECREASE

NO — Continue with cabin bus inoperative.

END

CAB BUS P/B ---------- PUSH AND ROTATE

SMOKE ELEC/AIR Selector ---------- ON

Rotate SMOKE ELEC/AIR Selector clockwise, pausing at each position long enough to evaluate whether smoke or fumes decrease. When a decrease is noted, leave selector in that position for rest of flight.
Continue with that generator channel and air system inoperative and **observe associated consequences.**

NOTE:
- When rotating the SMOKE ELEC/AIR Selector, the autothrottle will disengage and be unusable. The autopilot may disengage but then use another autopilot.
- Nuisance stick shaker may occur. (Stick shaker CBs on overhead panel: Captain E-1, F/O E-31)
- Following essential systems are inoperative or off in accordance with SMOKE ELEC/AIR Selector Pos:

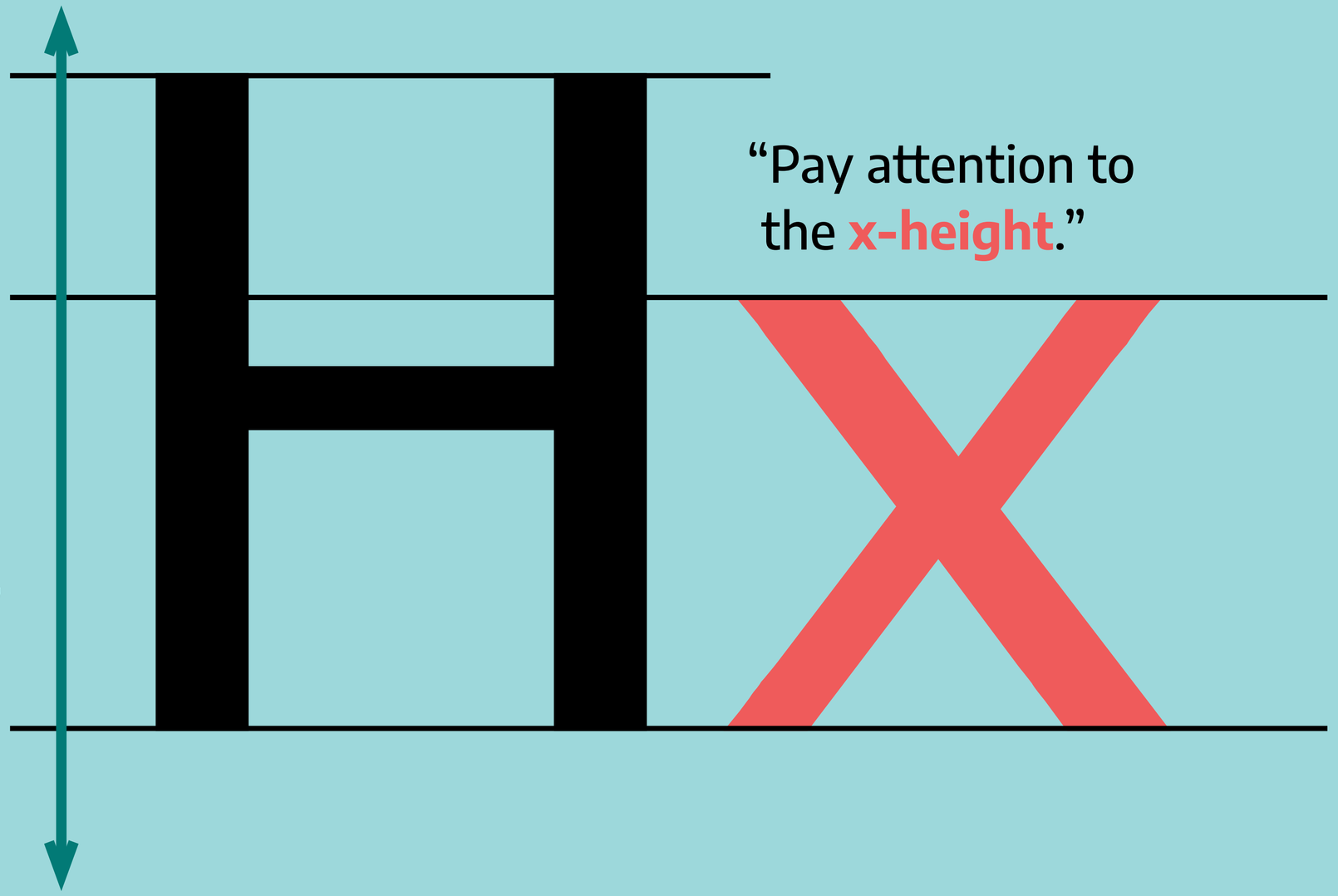
SMOKE Selector Pos. 3/1 OFF:
only Captains VHF 1 and interphone available.
- DU 4, 5, 6; MCDU 2; FMS 2; IRS 2 (after 15 min).
- Radar 2; All Nav aids 2.
- BLEED AIR 1; PACK 1; ECON system; WING anti-ice.
- F/O pitot heat.
- Auto slat extension.
- Landing gear aural warning.
- Autobrakes.

FOR APPROACH:
- Set FLAP LIMIT Selector to OVRD 1.
- Go-around mode is not available.

SMOKE Selector Pos. 2/3 OFF:
-BLEED AIR 3; PACK 3; WING anti-ice.
-Aux pitot heat.
-Fuel dump low level.
-[illegible] STABILIZER TRIM Switches on control column.

... attempts to condense this checklist onto one page led to the use of smaller-than-recommended font sizes in the notes section.

The overall **character size** "should not be set below **0.10 in**."



"Pay attention to the **x-height**."

Typeface—set of characters sharing a common design, incl. letters, numbers, and symbols.

Pay attention to the **x-height**.

Cockpit Cockpit Cockpit

Different typefaces at the **same size**.

SANS-SERIF VS SERIF—DEGANI'S RECOMMENDATION

Sans-serif typefaces are **more legible** because "**serifs** disrupt character discrimination."

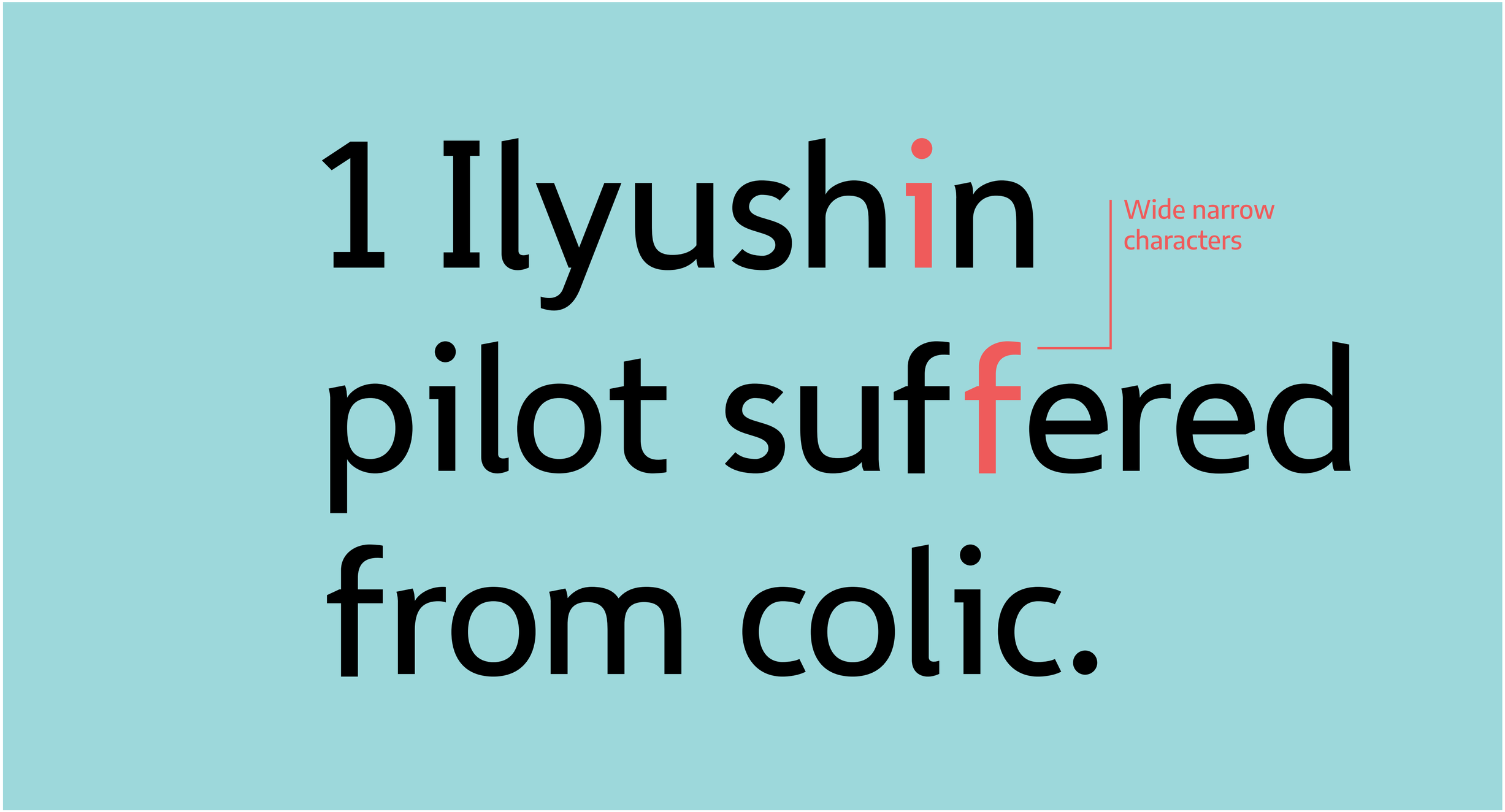
SANS-SERIF VS SERIF—BOTH OPTIONS ARE HIGHLY LEGIBLE

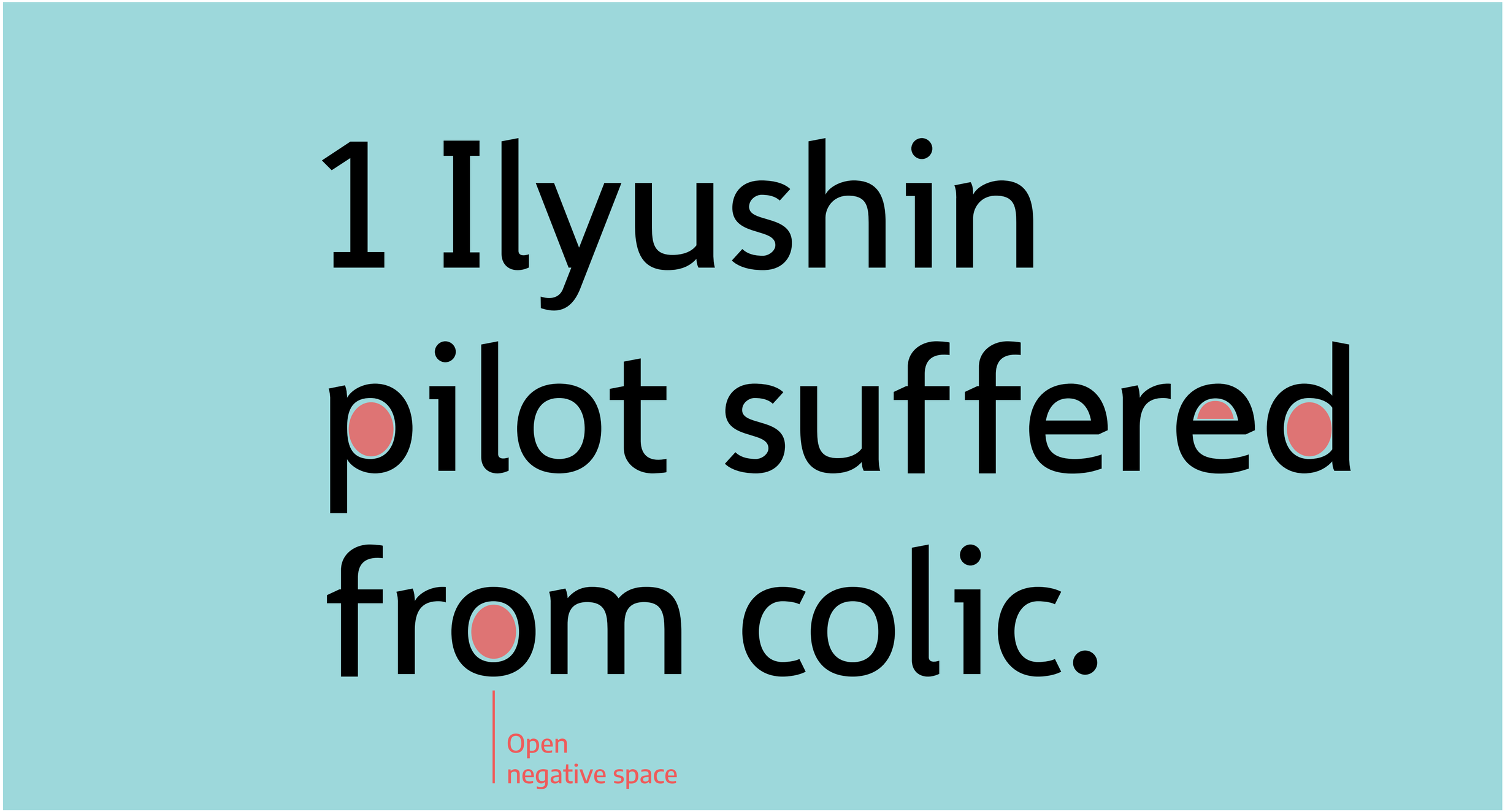
Well...

Cockpit

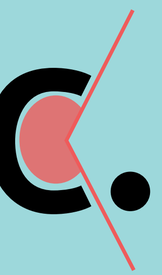
Cockpit

LEGIBILITY CHARACTERISTICS


1 Ilyushin
pilot suffered
from colic.
Wide narrow
characters


1 Ilyushin
pilot suffered
from colic.
Open
negative space

1 Ilyushin
pilot suffered
from colic.



Wide
openings

1Il aeoc O0C

Arial

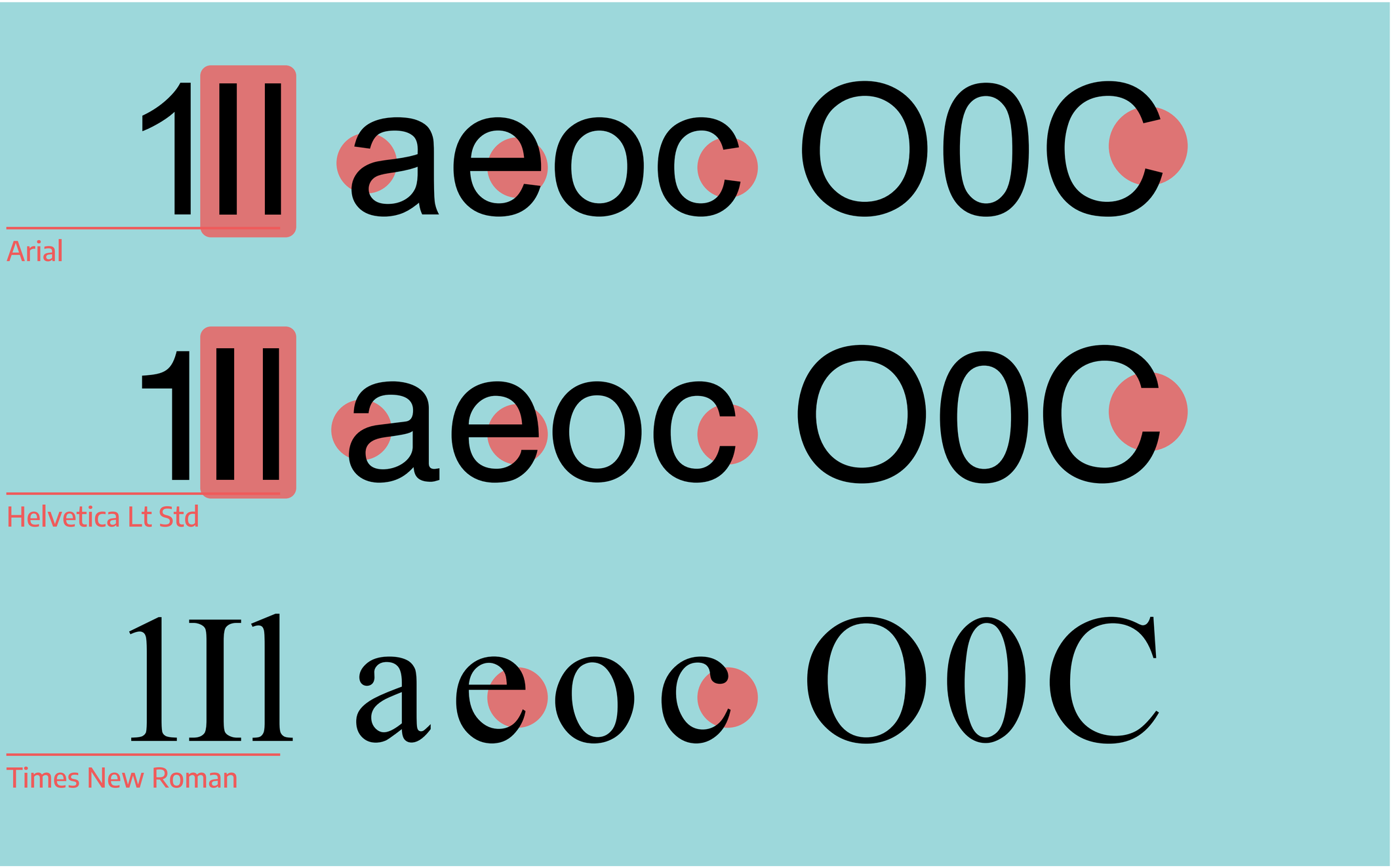
1Il aeoc O0C

Helvetica Lt Std

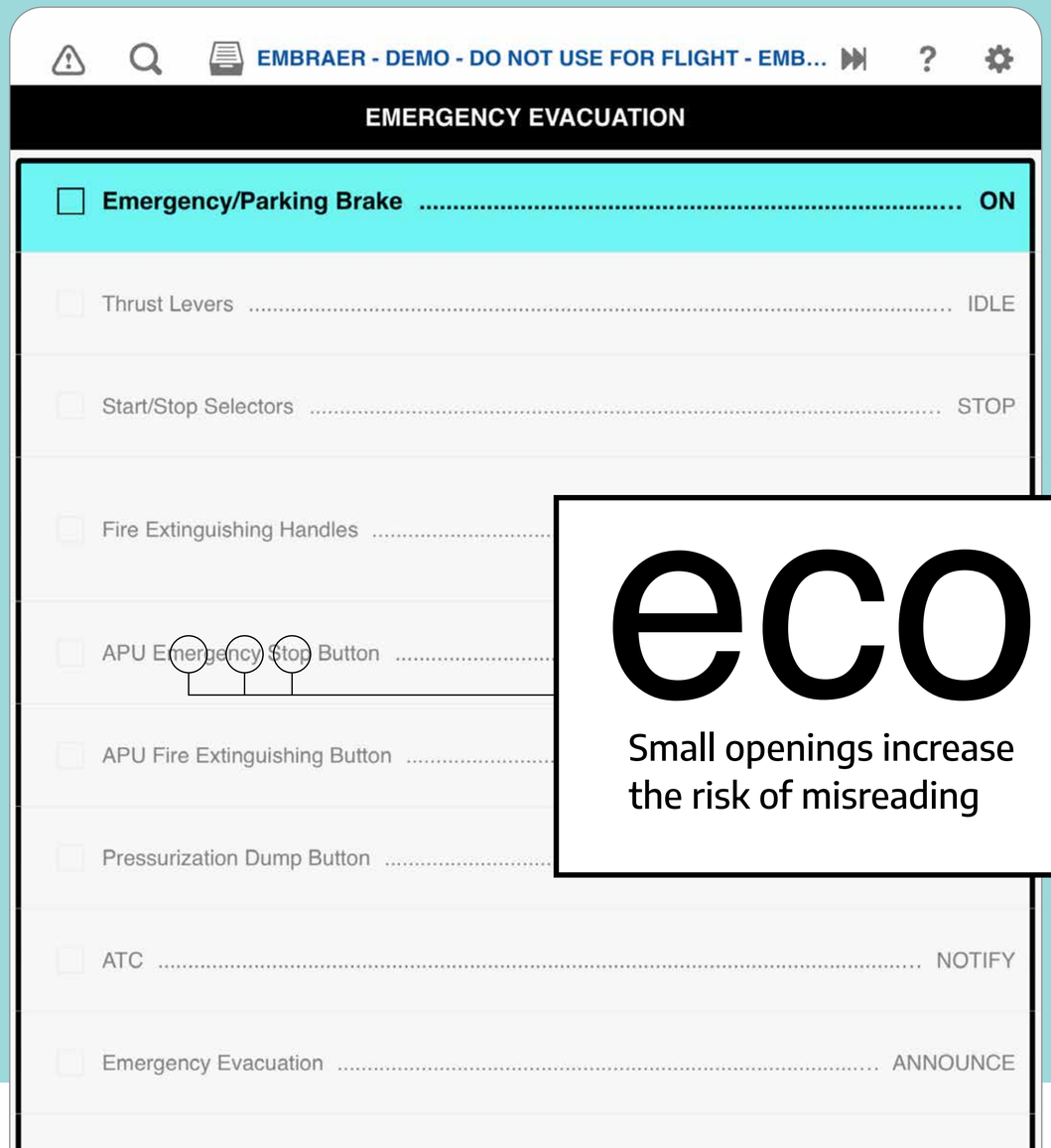
1Il aeoc O0C

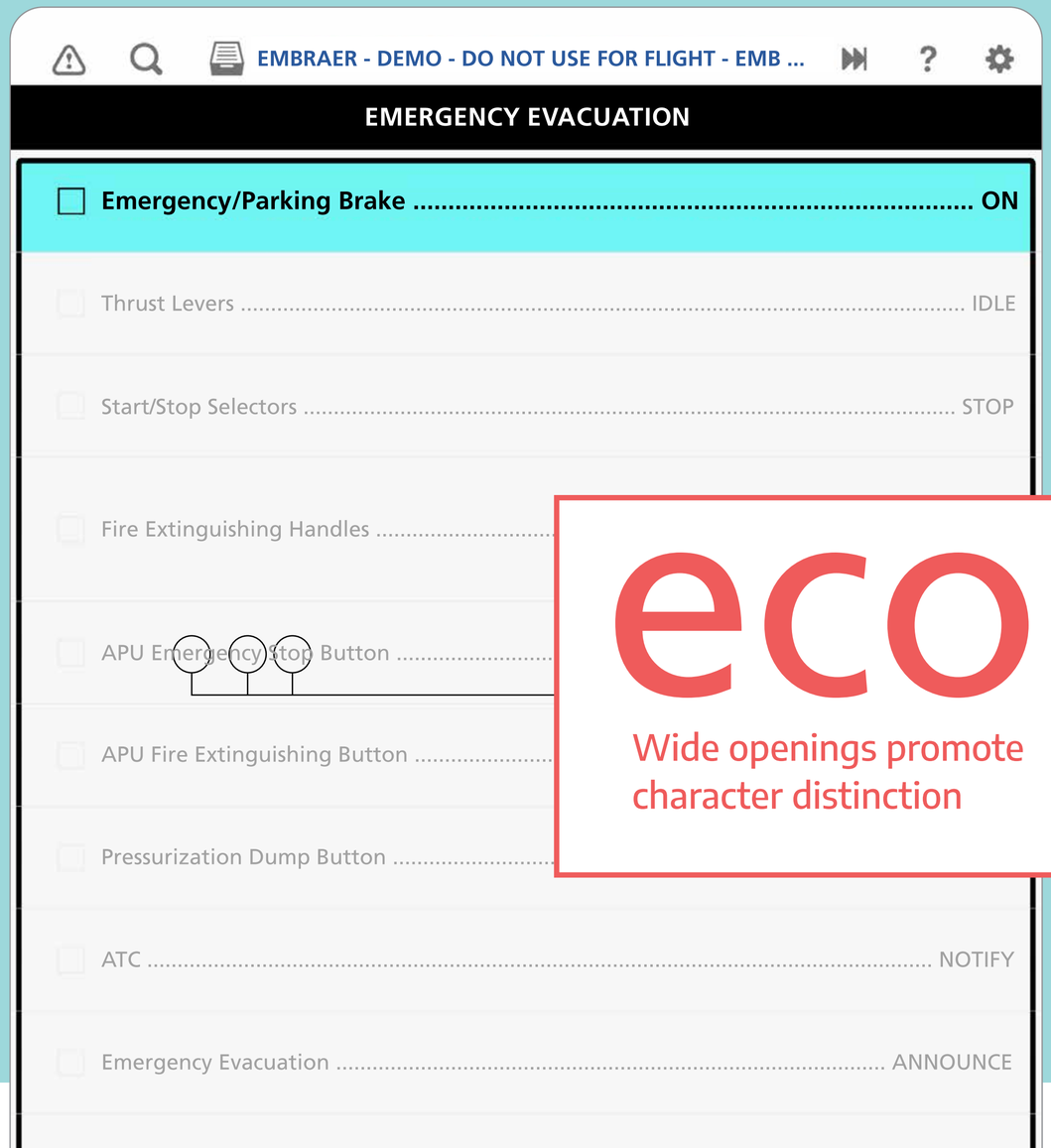
Times New Roman

LEGIBILITY CHARACTERISTICS—THE USUAL SUSPECTS



CHARACTER DISTINCTION—LOOK AT CHARACTERISTICS





cockpit

"Text should be set in **lower-case**."

"If capital letters are being used, the **first letter should be enlarged**."

COCKPIT

"Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return."

Leonardo da Vinci

"ONCE YOU HAVE TASTED FLIGHT, YOU WILL FOREVER WALK THE EARTH WITH YOUR EYES TURNED SKYWARD, FOR THERE YOU HAVE BEEN, AND THERE YOU WILL ALWAYS LONG TO RETURN."

LEONARDO DA VINCI

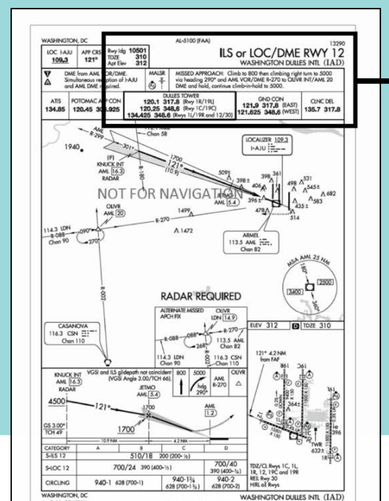
Sentence case is more legible.

An enlarged first letter may disrupt the reading flow rather than improving it due to the ticker strokes.

COCKPIT CCOCKPIT

No evidence that an enlarged first letter is more legible.

Examine type **holistically**, not by isolated characteristics.



AL-5100 (FAA)

13290

ILS or LOC/DME RWY 12

WASHINGTON DULLES INTL (IAD)

wy ldg 10501
DZE. 310
pt Elev 312

/DME.
on of I-AJU
red.

MALSR

MISSED APPROACH: Climb to 800 then climbing right turn to 5000 via heading 290° and AML VOR/DME R-270 to OLIVR INT/AML 20 DME and hold, continue climb-in-hold to 5000.

CON
025

DULLES TOWER
120.1 317.8 (Rwy 1R/19L)
120.25 348.6 (Rwy 1C/19C)
134.425 348.6 (Rwys 1L/19R and 12/30)

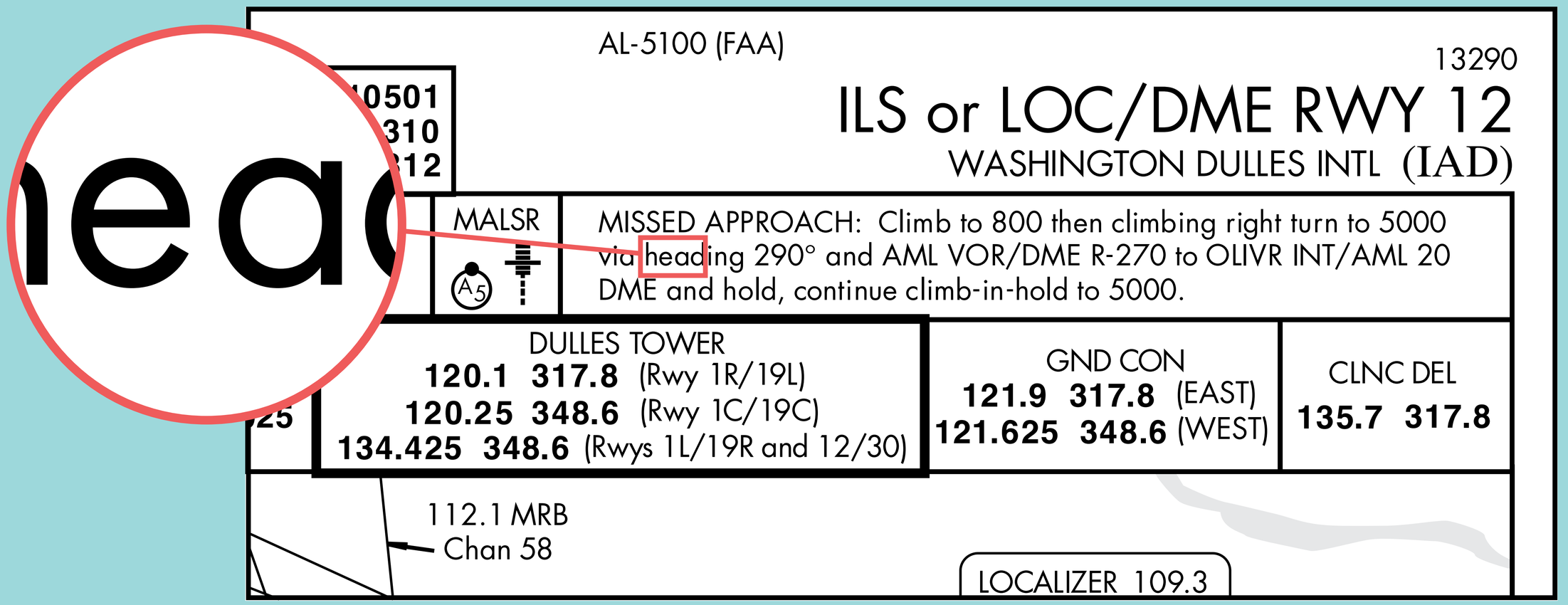
GND CON
121.9 317.8 (EAST)
121.625 348.6 (WEST)

CLNC DEL
135.7 317.8

112.1 MRB
Chan 58

LOCALIZER 109.3

Examine type **holistically**, not by isolated characteristics.



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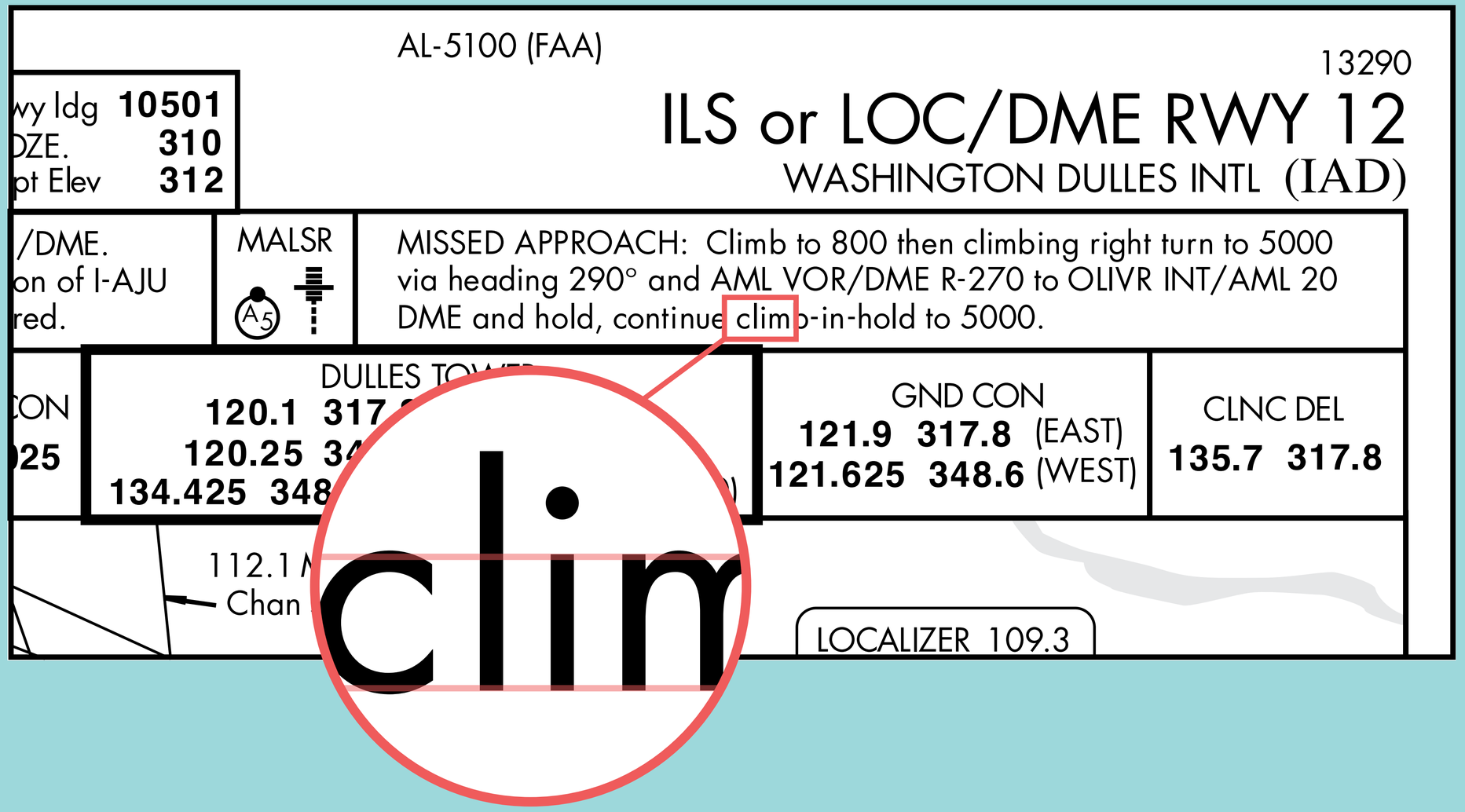

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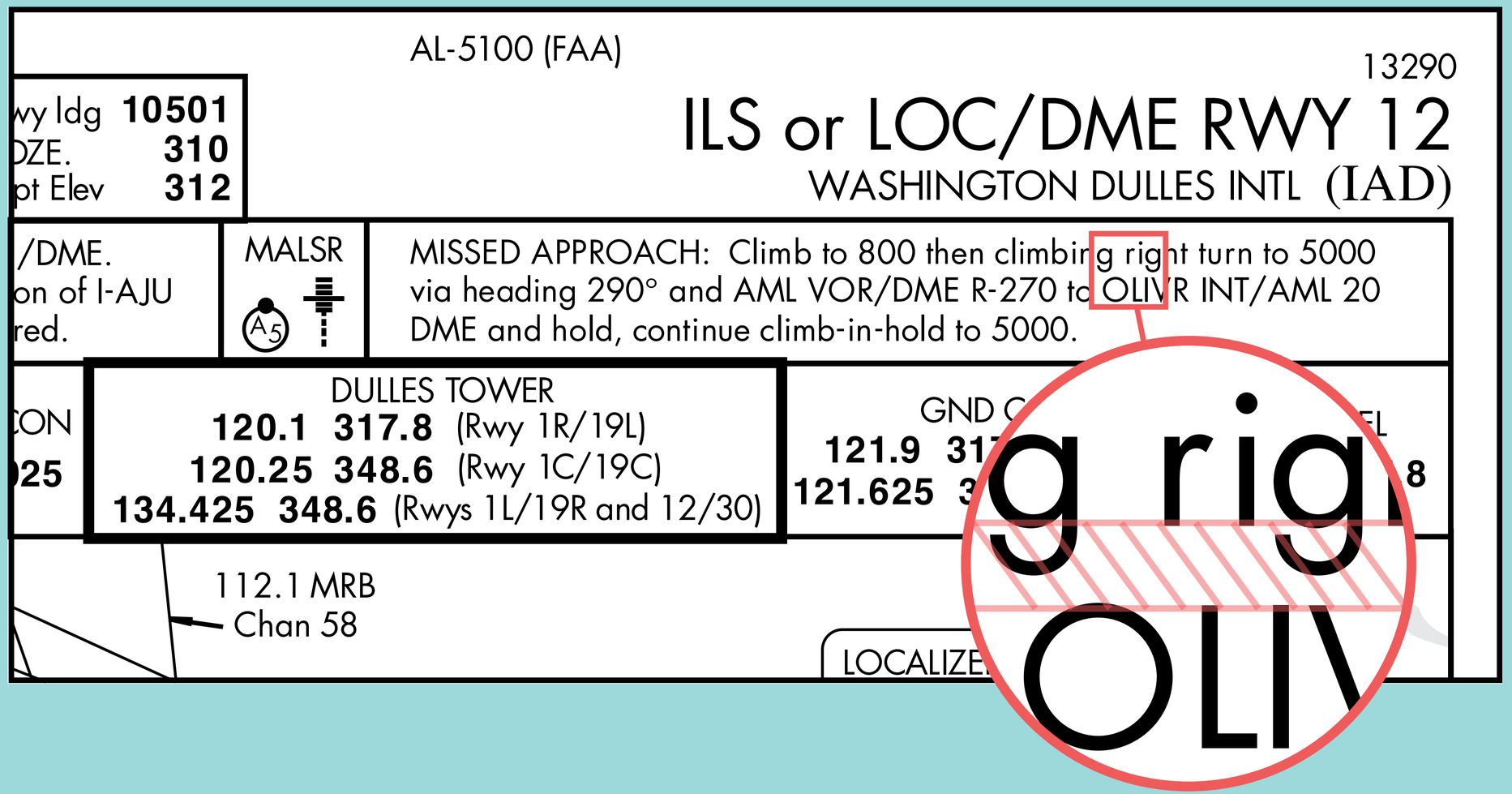
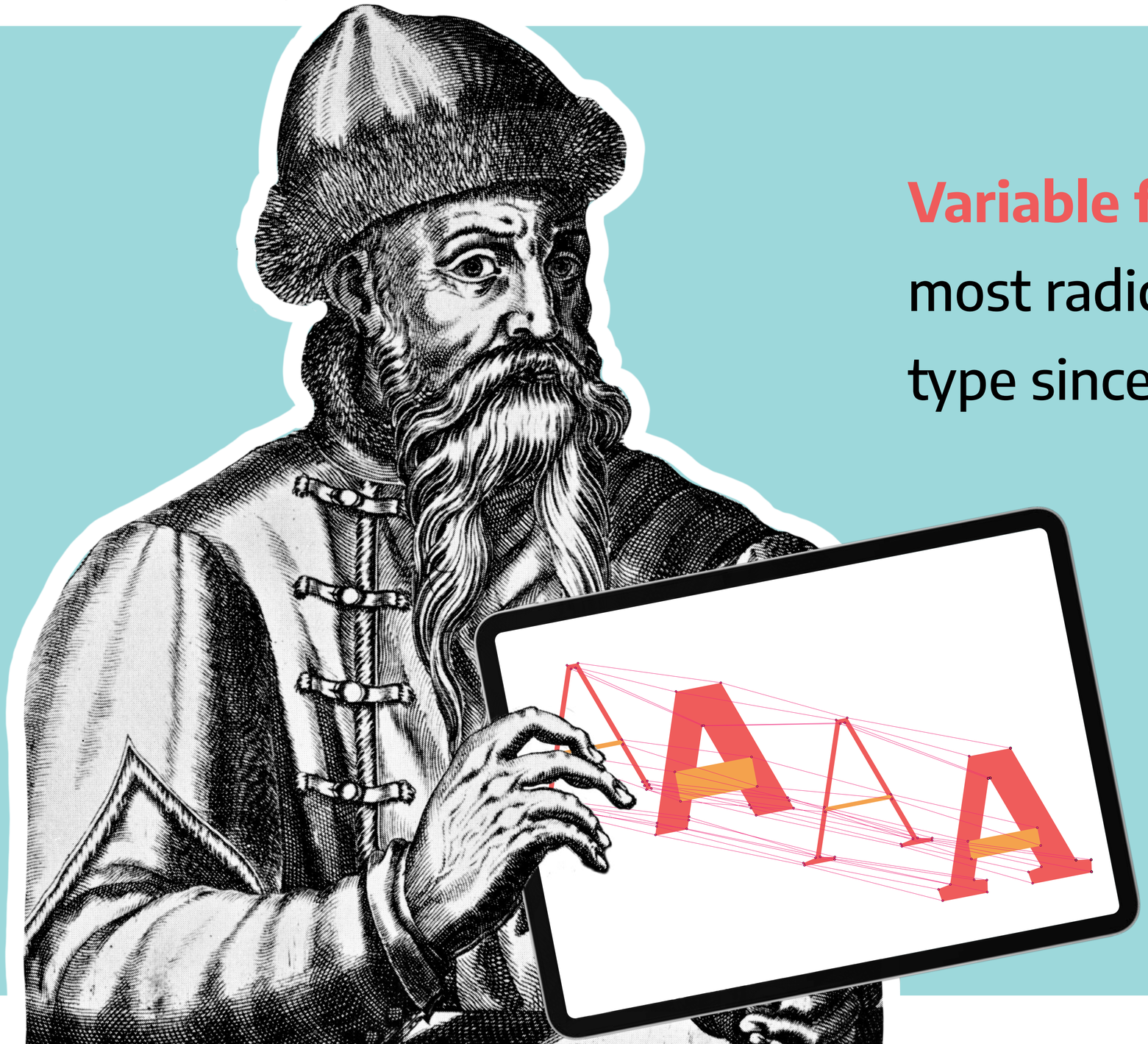
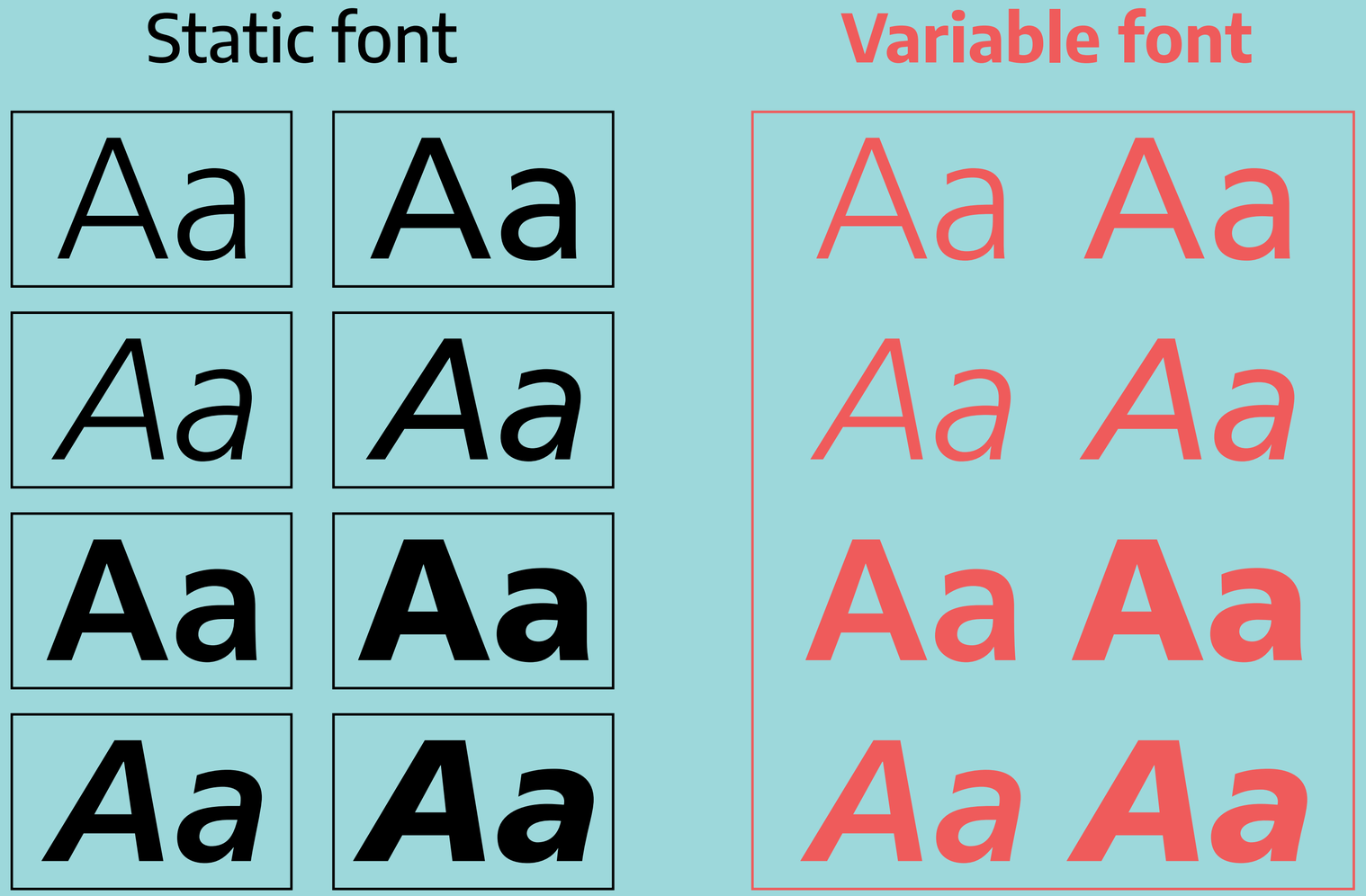


User-testing is the key to successful typographic legibility!



Variable fonts, “the most radical change in type since Gutenberg.”


Static font
Variable font
Aa
Aa
Aa
Aa
Aa
Aa
Aa
Aa
Aa
Aa
Aa
Aa
Aa
Aa
Aa
Aa

PREFLIGHT

Walk Around ..... Complete

Interior Check ..... Complete

COCKPIT

Hydraulic System ..... Pressure Up / Cb In

Ground Power ..... Connected

Aircraft Documents ..... On Board

Control Locks ..... Removed and Stowed

Controls ..... Free and Correct

Flaps ..... Selected Up

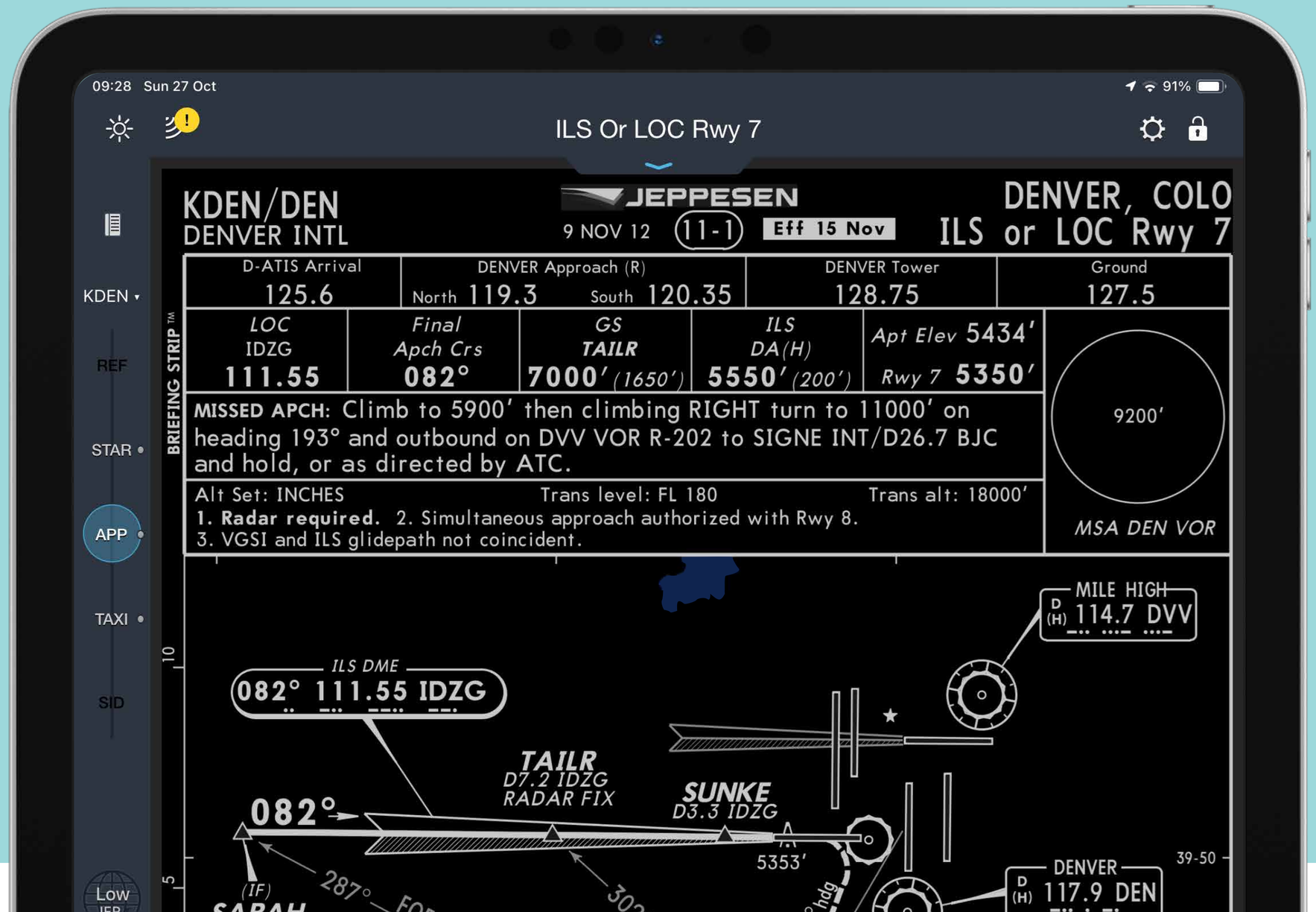
Batt / Ext Switch ..... As Required

Master Switch ..... On / Check Voltage


WIDE ANGLE
WIDE ANGLE


WIDE ANGLE
WIDE ANGLE


SANTA FE
12 MI.


09:28 Sun 27 Oct
91%
ILS Or LOC Rwy 7
KDEN
REF
STAR
APP
TAXI
SID
Low
KDEN/DEN
DENVER INTL
JEPPESEN
9 NOV 12
11-1
Eff 15 Nov
DENVER, COLO
ILS or LOC Rwy 7
BRIEFING STRIP™
D-ATIS Arrival
125.6
DENVER Approach (R)
North 119.3
South 120.35
DENVER Tower
128.75
Ground
127.5
LOC
IDZG
111.55
Final
Apch Crs
082°
GS
TAILR
7000′ (1650′)
ILS
DA(H)
5550′ (200′)
Apt Elev 5434′
Rwy 7 5350′
MISSED APCH: Climb to 5900′ then climbing RIGHT turn to 11000′ on heading 193° and outbound on DVV VOR R-202 to SIGNE INT/D26.7 BJC and hold, or as directed by ATC.
Alt Set: INCHES
Trans level: FL 180
Trans alt: 18000′
1. Radar required. 2. Simultaneous approach authorized with Rwy 8.
3. VGSI and ILS glidepath not coincident.
9200′
MSA DEN VOR
MILE HIGH
D (H) 114.7 DVV
ILS DME
082° 111.55 IDZG
TAILR
D7.2 IDZG
RADAR FIX
SUNKE
D3.3 IDZG
082°
5353′
39-50
DENVER
D (H) 117.9 DEN
(IF)
287°

A


Legi
bility
—improved
Pascale Schmid
Wayne Thompson
David Sargent

THANK YOU!

Thank you

PACDEFF 2024

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Photographs courtesy of Wayne Thompson & David Sargent.

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Screenshot of Dr Asaf Degani's report "On the typography of flight deck documentation," 1992.

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Screenshot of the "Smoke of unknown origin checklist" by Swissair.

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Excerpt from iPad application eQRH.

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Animation by Andrew Johnson and Peter van Blokland demonstrating how variable fonts can compensate for changing viewing angles.

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Photograph of B777 flight deck—Courtesy of Anders Young, @andersyoung, 05.05.2024.

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Excerpt from Schmid, P., Carim Jr, G., Sargent, D., & Falla, D. (2023). Type does matter! A systematic literature review on typographic considerations in publications on electronic documentation in aviation and medicine. Information Design Journal, 28(1), Article 1.

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MyControls application by Pascale Schmid & Richard Turner-Jones, 2023.

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Images of an animation by Andrew Johnson and Peter van Blokland demonstrating how variable fonts can compensate for changing viewing angles.

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Photograph of B777 flight deck—Courtesy of Anders Young, @andersyoung, 05.05.2024.

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Screen recording of Andrew Johnson's and Erik van Blokland's "Santa Fe ½ miles" drawn in two multiple contour masters, https://vimeo.com/178954414, 2016.

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All other graphics/photographs

Created by Pascale Schmid.