NTSB National Transportation Safety Board

Office of Research and Engineering

SWA Flight 1248
Landing Performance Issues

Kevin J. Renze, Ph.D.
Aircraft Performance Group Chairman

Landing Performance Study

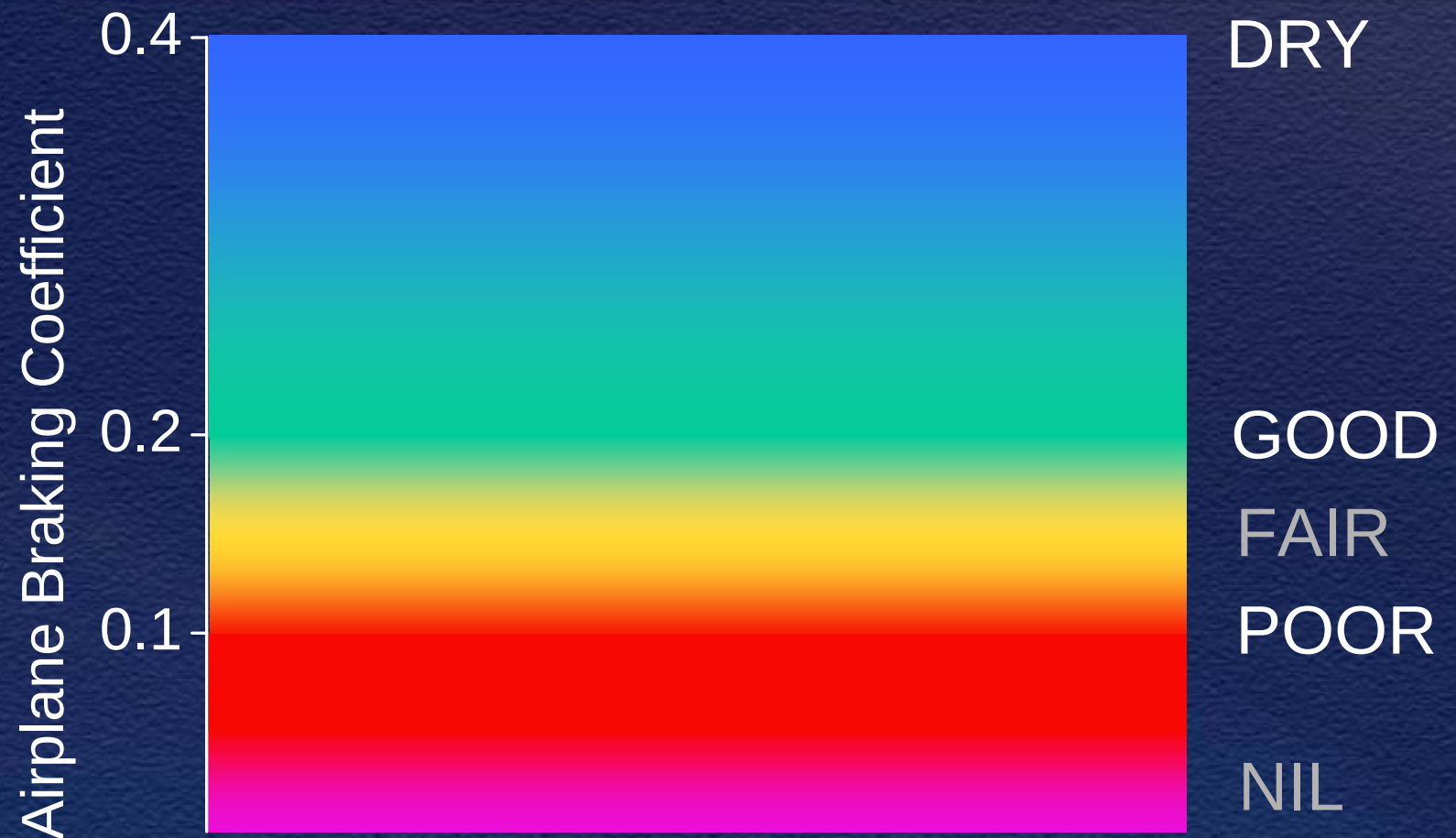
- Goals:
  - Quantify runway surface conditions
  - Determine airplane stopping capability
- Basis:
  - FDR data from five SWA aircraft
  - Boeing 737-700 engineering simulation
- Method:
  - Determine airplane braking coefficient
  - Calculate stopping margin for various stopping scenarios

NTSB

Runway Surface Conditions

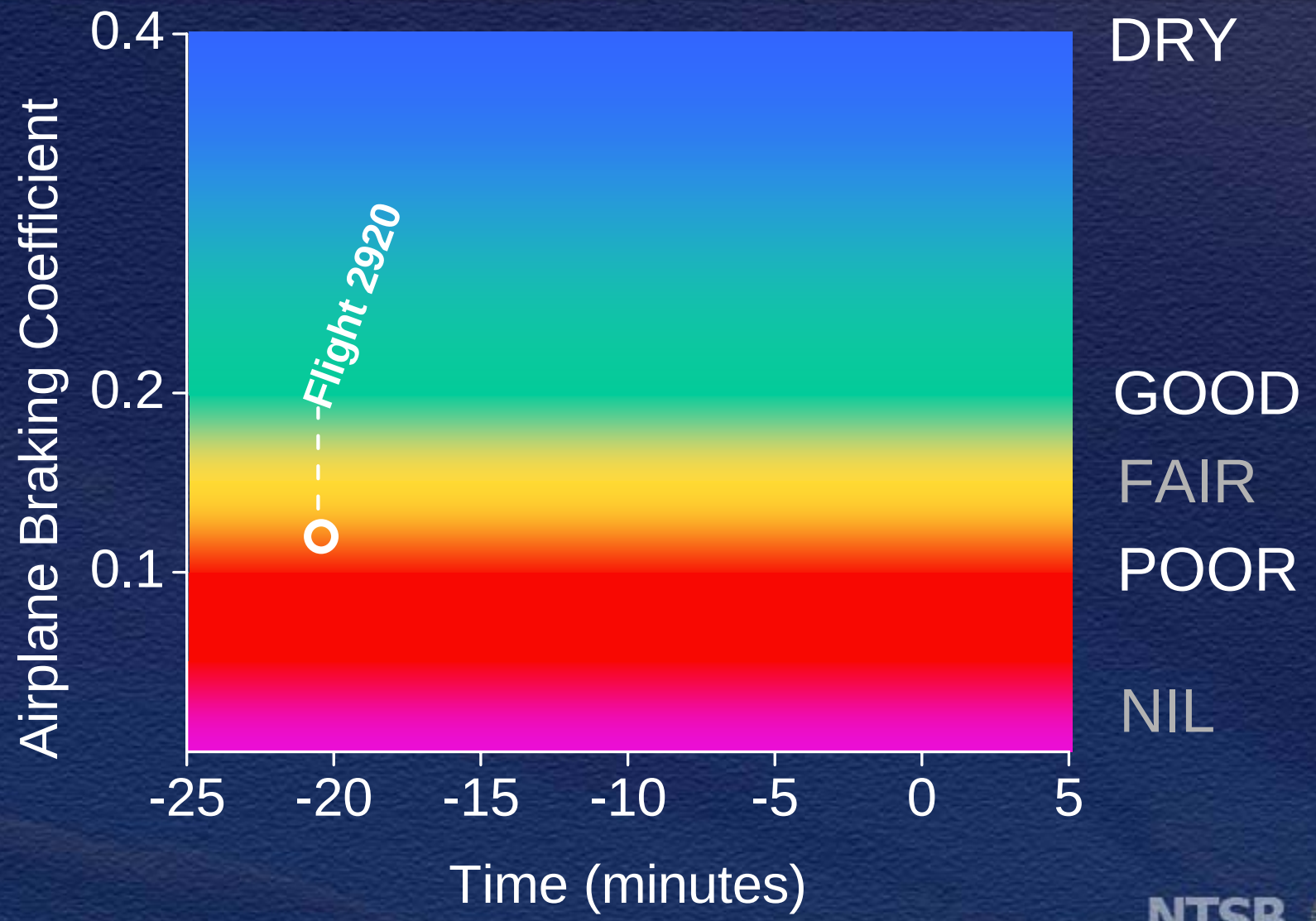
NTSB

Runway Surface Conditions



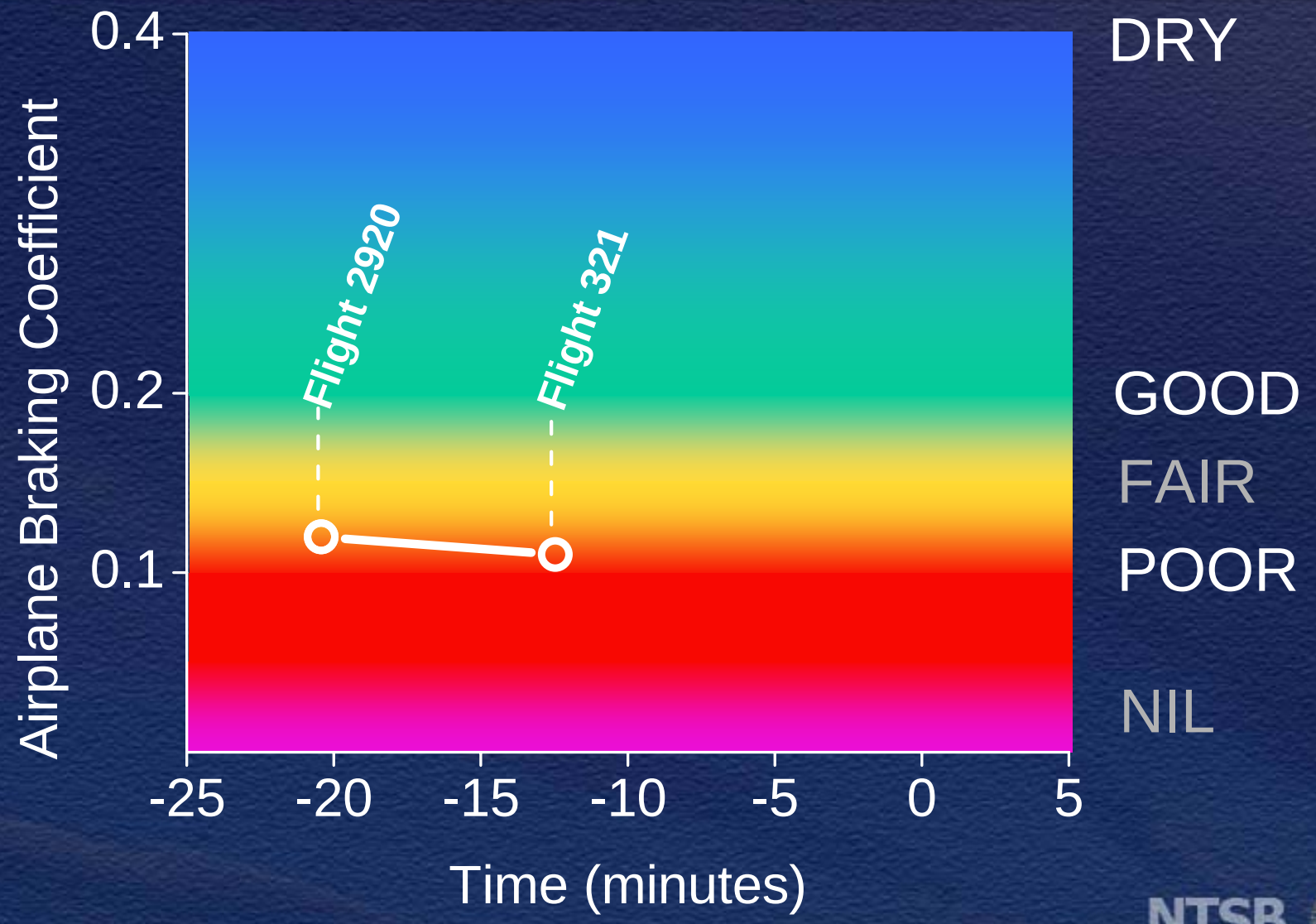
NTSB

Runway Surface Conditions



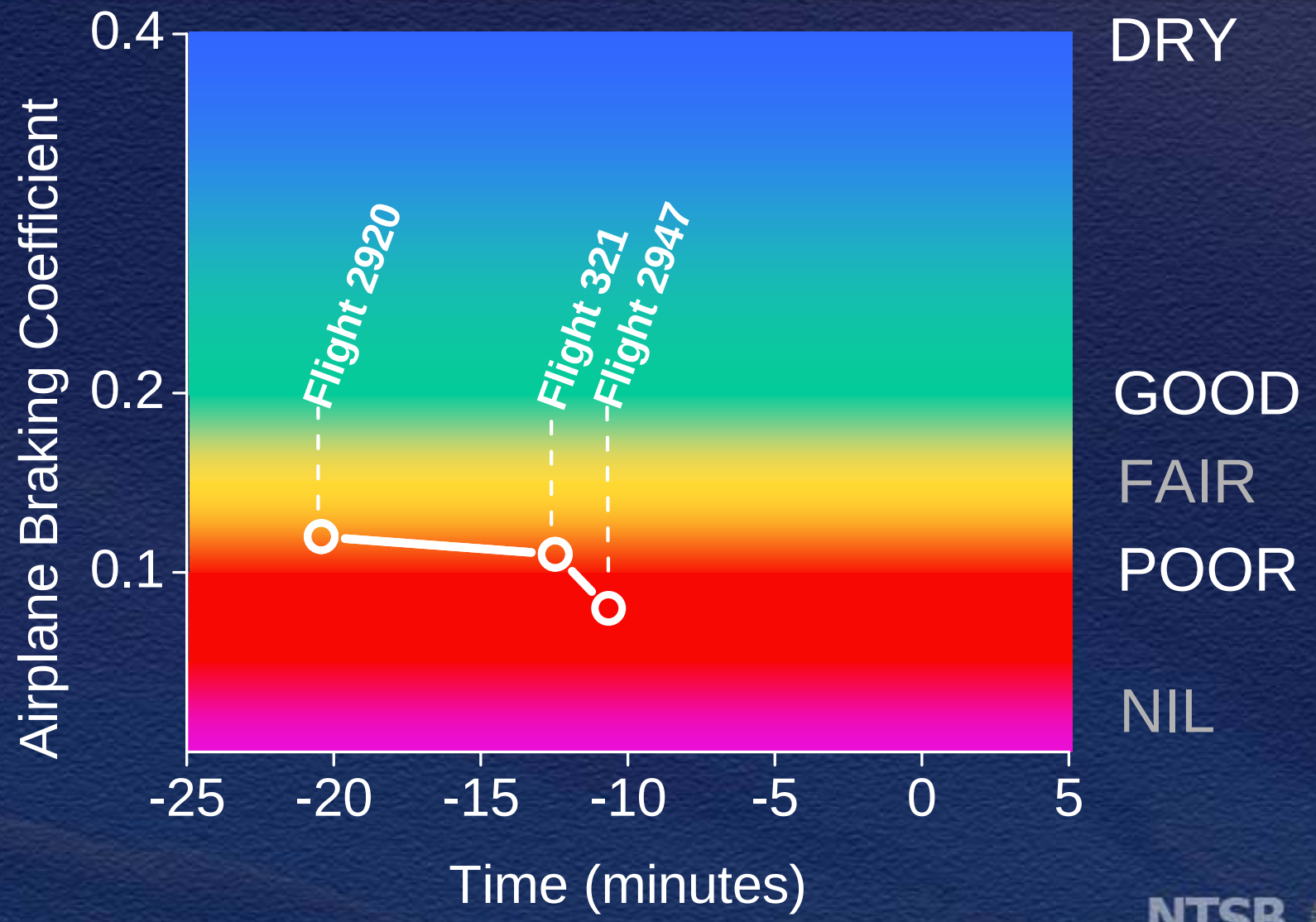
NTSB

Runway Surface Conditions



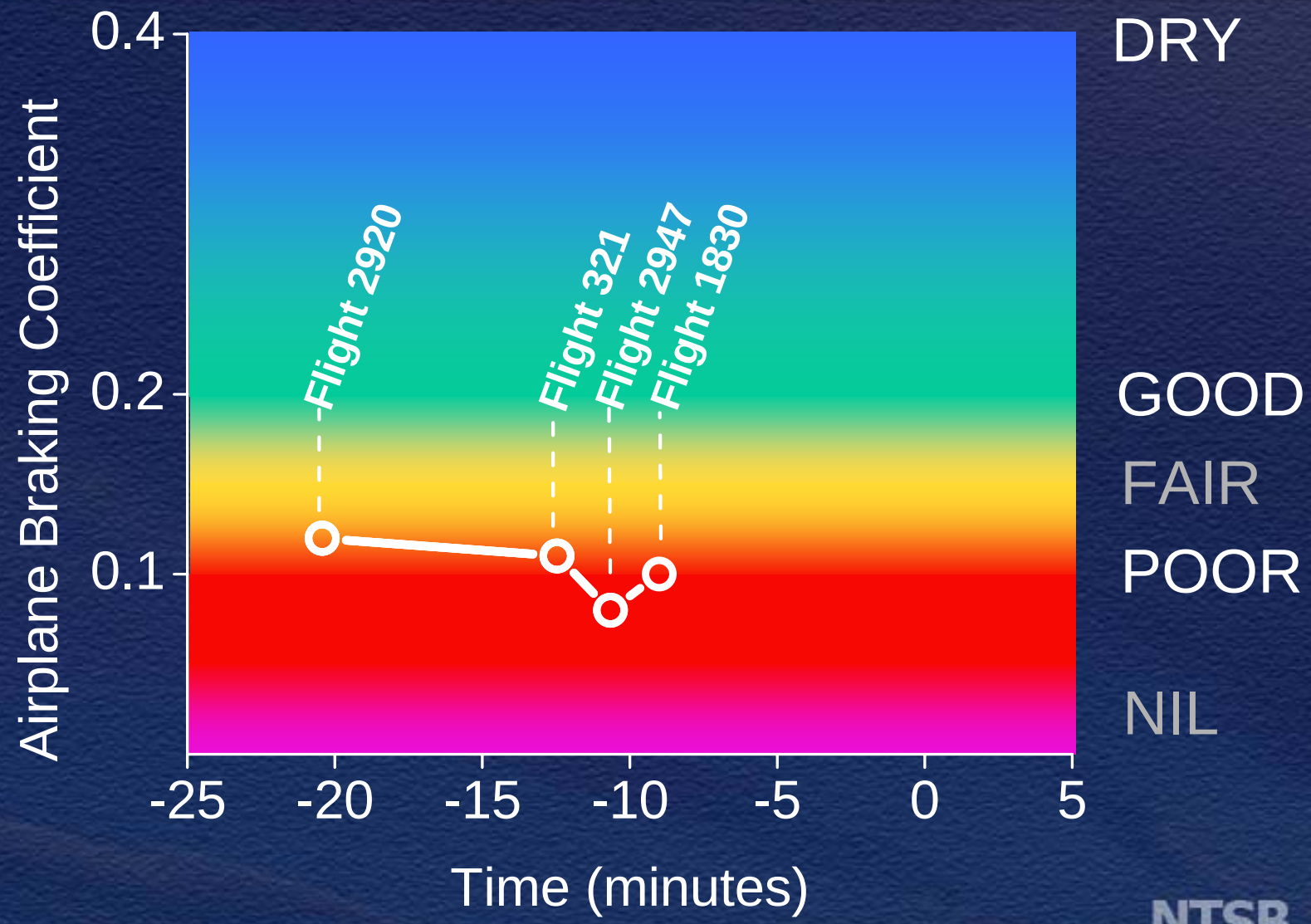
NTSB

Runway Surface Conditions



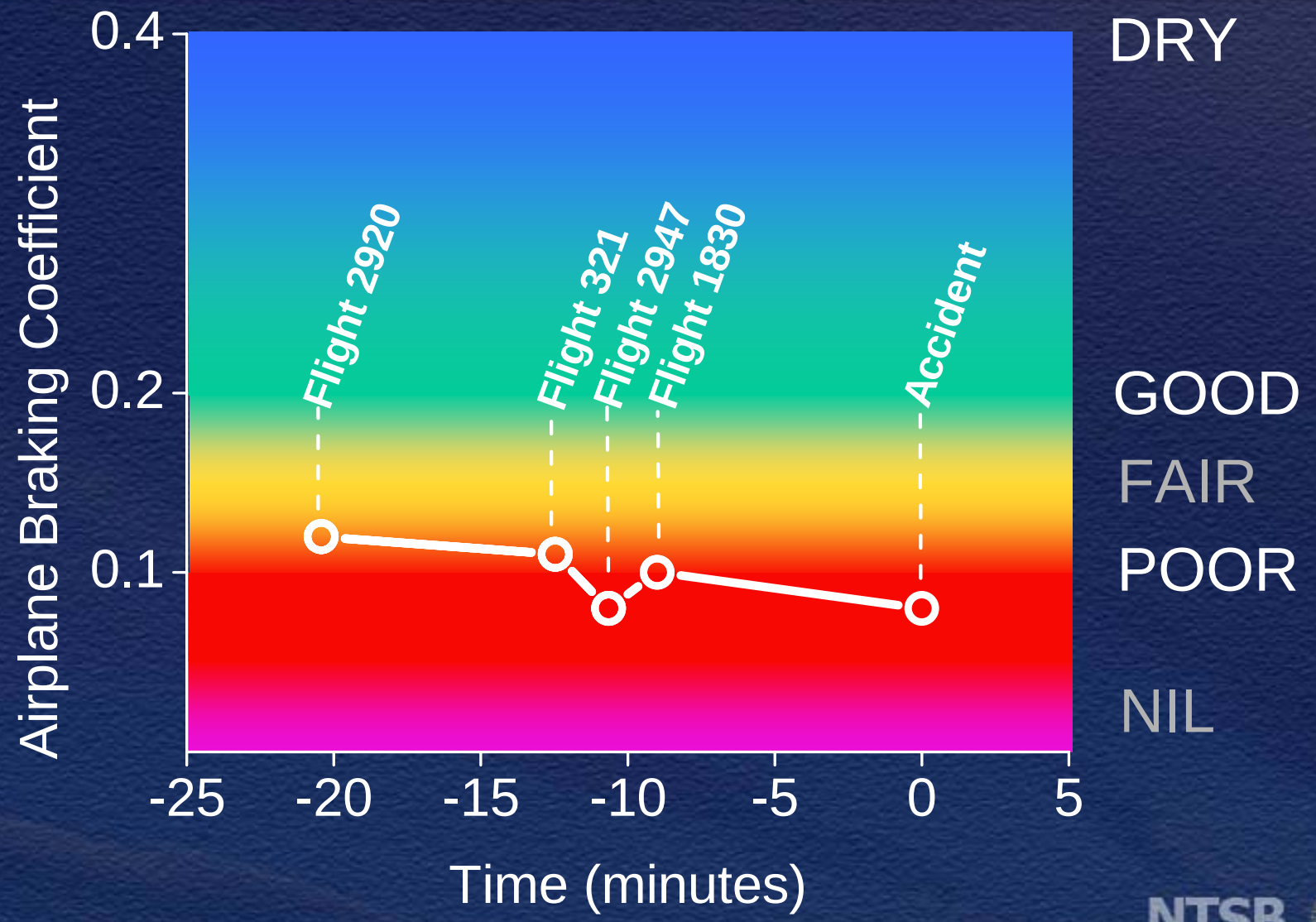
NTSB

Runway Surface Conditions



NTSB

Runway Surface Conditions



NTSB

Stopping Margin Study

- Specify deceleration configuration
  - Ground spoilers (per accident)
  - Wheel brakes (per accident)
  - Reverse thrust (varied)
    - Thrust reverser deployment timing
    - Target reverse thrust setting
    - Target reverser stowage speeds
- Compare stopping margin

NTSB

Airplane Stopping Capability

Reverse Thrust Configuration	Stopping Margin (feet)	Conclusion/ Runway Exit Speed (knots)
SWA practice [target 80/60 stow]	-1310	**Overrun (44)**

NTSB

Airplane Stopping Capability

Reverse Thrust Configuration	Stopping Margin (feet)	Conclusion/ Runway Exit Speed (knots)
SWA practice [target 80/60 stow]	-1310	**Overrun (44)**
Flight 1248 [accident conditions]	-790	**Overrun (50)**

NTSB

Airplane Stopping Capability

Reverse Thrust Configuration	Stopping Margin (feet)	Conclusion/ Runway Exit Speed (knots)
SWA practice [target 80/60 stow]	-1310	**Overrun (44)**
Flight 1248 [accident conditions]	-790	**Overrun (50)**
OPC/Boeing [target 60/30 stow]	-410	**Overrun (25)**

NTSB

Airplane Stopping Capability

Reverse Thrust Configuration	Stopping Margin (feet)	Conclusion/ Runway Exit Speed (knots)
SWA practice [target 80/60 stow]	-1310	**Overrun (44)**
Flight 1248 [accident conditions]	-790	**Overrun (50)**
OPC/Boeing [target 60/30 stow]	-410	**Overrun (25)**
Maximum reverse thrust [maintained to a complete stop]	230	**Stop**

NTSB

Airplane Stopping Capability

Reverse Thrust Configuration	Stopping Margin (feet)	Conclusion/ Runway Exit Speed (knots)
SWA practice [target 80/60 stow]	-1310	**Overrun (44)**
Flight 1248 [accident conditions]	-790	**Overrun (50)**
OPC/Boeing [target 60/30 stow]	-410	**Overrun (25)**
Maximum reverse thrust [maintained to a complete stop]	230	**Stop**
Flight 1248 [accident conditions, except with a headwind]	550	**Stop**

NTSB

Conclusions

- Airplane had sufficient performance capability to stop
- Timely selection, setting, and sustained use of reverse thrust were all critical
- Maximum safety margin was about 4%
- FAA advocates a minimum acceptable safety margin of 15%

NTSB

Conclusions

- Arrival assessment policy consistent with “layers of safety” philosophy
- Operators must assess actual arrival conditions; incorporate adequate margin
- Historic challenge to quantify runway surface conditions and trends remains

NTSB

NTSB