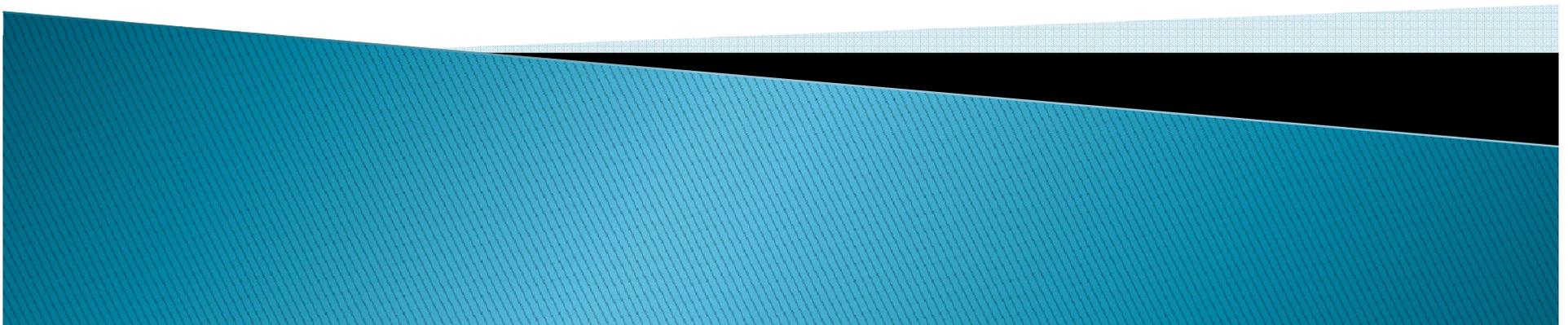


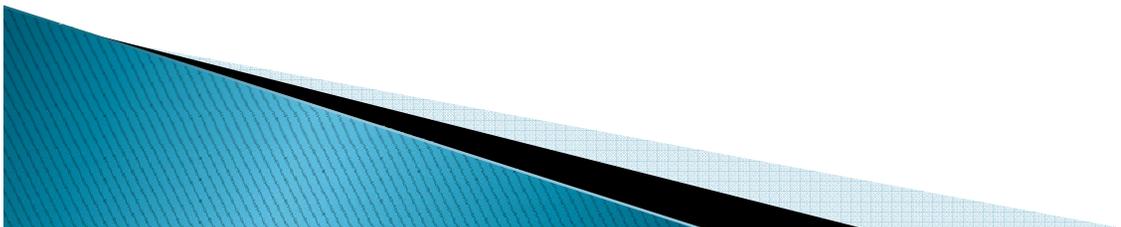
Appendix I
Pre-Brief Presentation

AIRPORT PAVEMENT ROUGHNESS STUDY



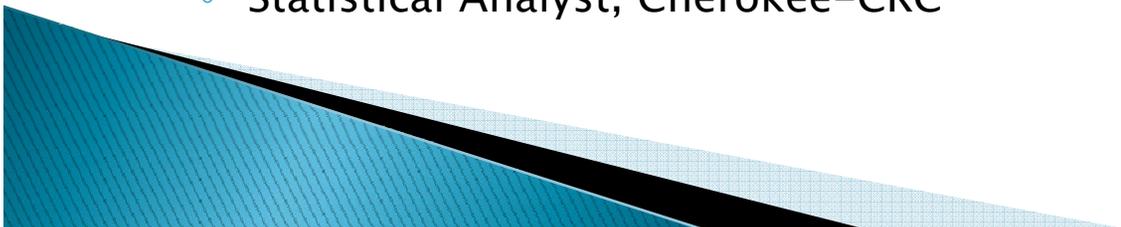
Overview

- ▶ Pre-Brief 15 minutes
- ▶ Simulator Session 2 hours
- ▶ Break 10 minutes
- ▶ De-Brief 30 minutes



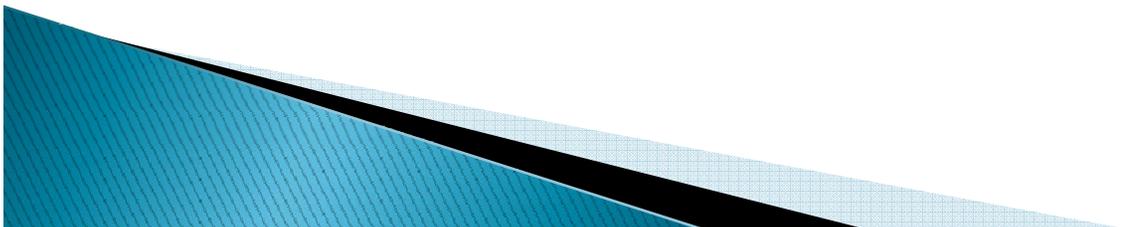
Introductions

- ▶ Al Larkin
 - FAA, Airport Technical R&D Branch, ANG-E262, Hughes Technical Center
- ▶ Gordon Hayhoe
 - FAA (Retired), Airport Technical R&D Branch, AJP-6312, Hughes Technical Center
- ▶ Skip Hudspeth
 - Simulator/Flight Operations Engineer, Cherokee-CRC
- ▶ Jeard Ballew
 - Project Operations Management, Cherokee-CRC
- ▶ George Lyddane
 - Human Factors Analyst, Cherokee-CRC
- ▶ David Stapleton
 - Statistical Analyst, Cherokee-CRC



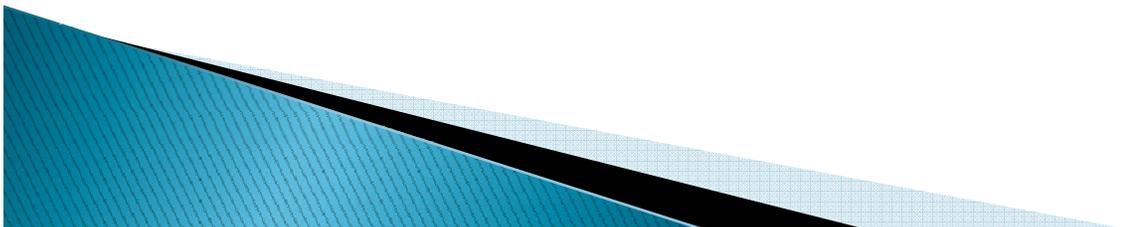
Background

- ▶ **New Construction:**
 - Current runway roughness standards are in place for the construction of new taxiways and runways.
- ▶ **Post-Construction:**
 - However, there is no system in place today to determine when in service pavement becomes “too rough”
 - Repairs are often based on pilot complaints alone.



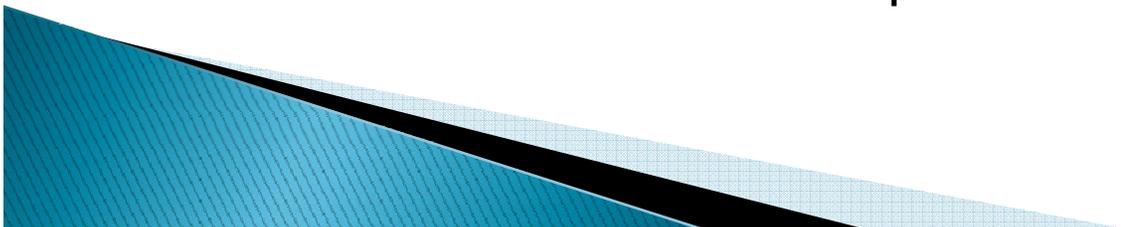
Study Objectives

- ▶ Develop a subjective roughness rating scaled from 10 (Perfect) to 0 (Impassable)
- ▶ Correlate the subjective ratings with objective measures of roughness
- ▶ Identify roughness limits to determine when pavement maintenance is recommended or required



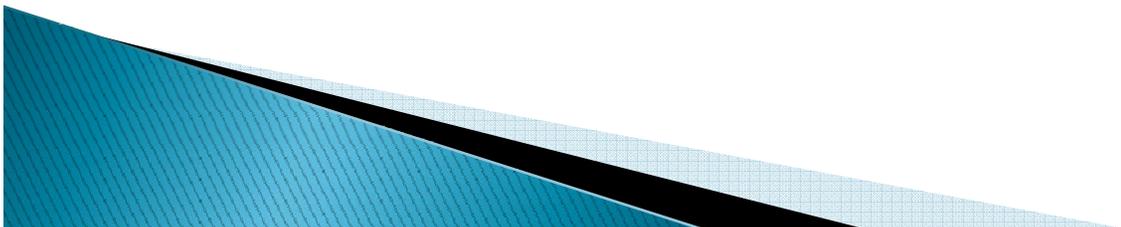
Study Conditions

- ▶ B737–800 Simulator
- ▶ 80 Test Scenarios:
 - 40 Taxiway profiles at 20 knots constant speed
 - 40 Runway profiles at 100 knots constant speed
 - 30 seconds of movement along profiles
 - Profiles are from domestic and foreign airports
 - Pavement conditions range from smooth to very rough
 - Same generic visual scene used for all scenarios
 - Visual scene does not depict real–world surface details



Roughness Rating Sessions

- ▶ Pilots seated in Capt, F/O, and Observer seats
- ▶ Pilots will assume the roles of passive observer
- ▶ Aircraft movement will be automated – no control inputs required
- ▶ Concentrate on rating ride quality
- ▶ Provide ratings on form at end of each scenario
- ▶ Two warm-up scenarios provided for familiarization



Rate the Level of Pavement Roughness or Smoothness for this Scenario

Run Number _____

Seat Position _____

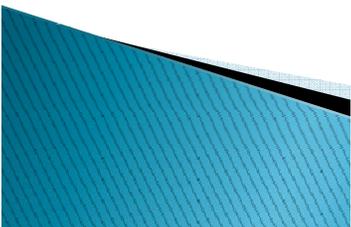
Pilot Number _____

Perfect	_____	10
Very Good	_____	9
	_____	8
Good	_____	7
	_____	6
Fair	_____	5
	_____	4
Poor	_____	3
	_____	2
Very Poor	_____	1
Impassable	_____	0

NEED FOR IMPROVEMENT (Check Only One Box)

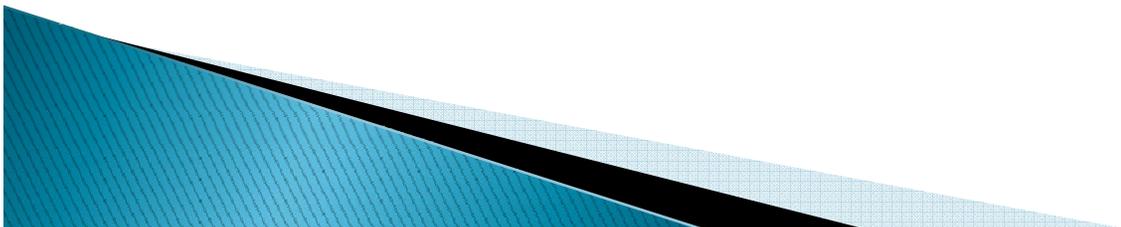
Acceptable: Ride Quality Does Not
Need Improvement

Unacceptable: Ride Quality Needs
Improvement



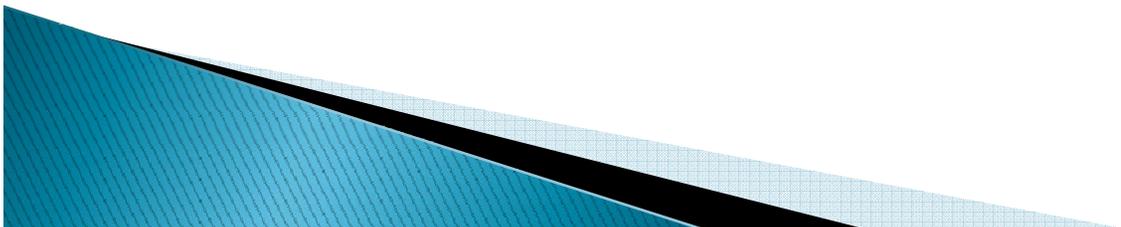
Pilot Rating Form

- ▶ Scenarios present aircraft movement over taxiways and runways with a wide range of roughness
- ▶ Each scenario provides 30 seconds of movement
- ▶ After each scenario we will ask for two inputs:
 1. Rate ride smoothness/roughness on 0 to 10 scale
 2. Indicate if you think an effort should be made to improve the ride quality of the runway or taxiway



Marking Your Ratings

- ▶ Consider the ride as you move along the surface
- ▶ At end of each scenario, indicate your rating with a small mark across the vertical line of the scale
- ▶ Indicate if you feel ride quality needs improvement by selecting the appropriate box:
 - Acceptable indicates you think no improvement is needed
 - Unacceptable means you think improvement is required



Rate the Level of Pavement Roughness or Smoothness for this Scenario

Run Number _____

Seat Position _____

Pilot Number _____

Perfect	10
Very Good	9
	8
Good	7
	6
Fair	5
	4
Poor	3
	2
Very Poor	1
Impassable	0

A red diagonal line is drawn across the scale, starting from the left side of the line between 6 and 7, and extending upwards and to the right, ending at the right side of the line between 7 and 8.

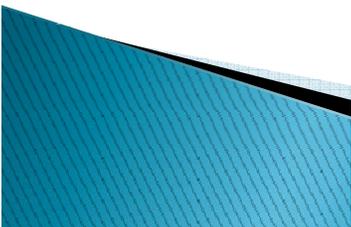
NEED FOR IMPROVEMENT (Check Only One Box)



Acceptable: Ride Quality Does Not
Need Improvement

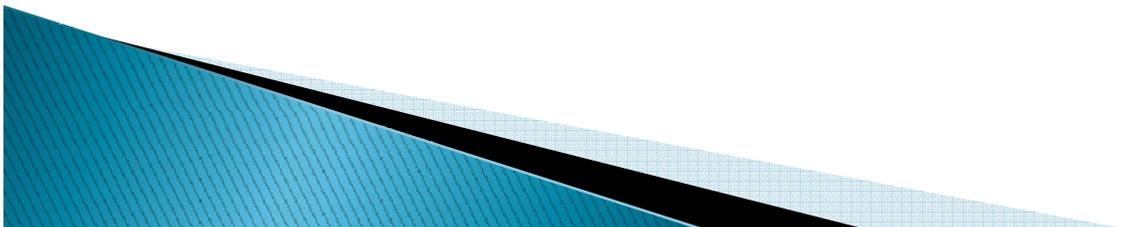


Unacceptable: Ride Quality Needs
Improvement



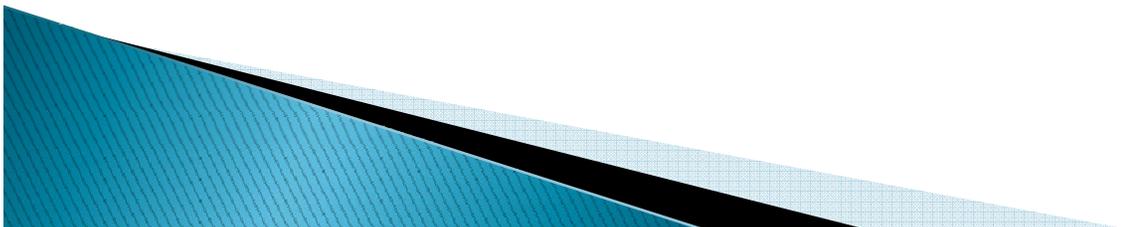
Definitions of Endpoints

- ▶ All surfaces are between two extremes, somewhere
- ▶ Between impassable and perfect.
- ▶ **Impassable:** A surface so bad that you doubt the aircraft will make it to the end at the speed you are traveling
- ▶ **Perfect:** A surface so smooth that at the speed you are traveling you would hardly know the surface was there

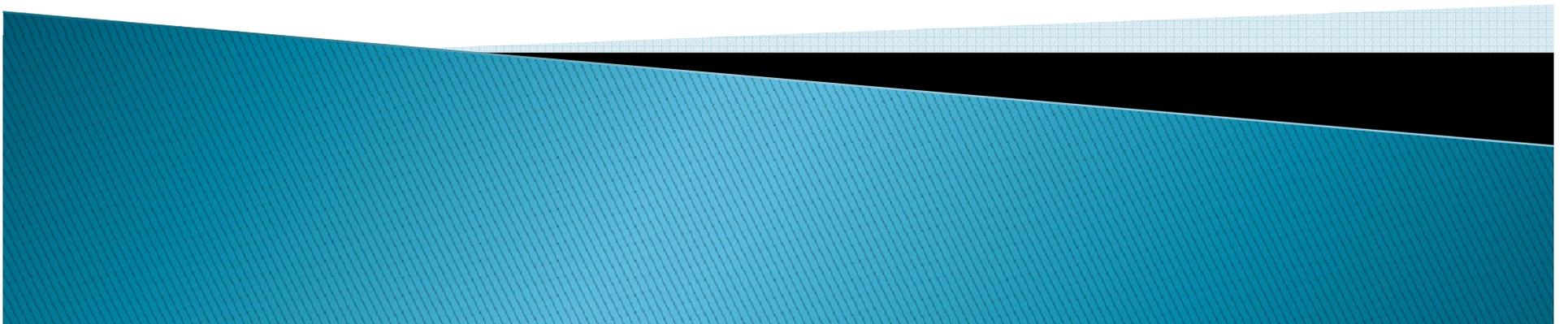


Rating Session Instructions

- ▶ Please keep conversations in the cockpit to a minimum.
- ▶ Do not discuss ratings or comment on the roughness level experienced.
- ▶ If comments arise for specific scenarios, make a note on the rating form for discussion later during the de-brief

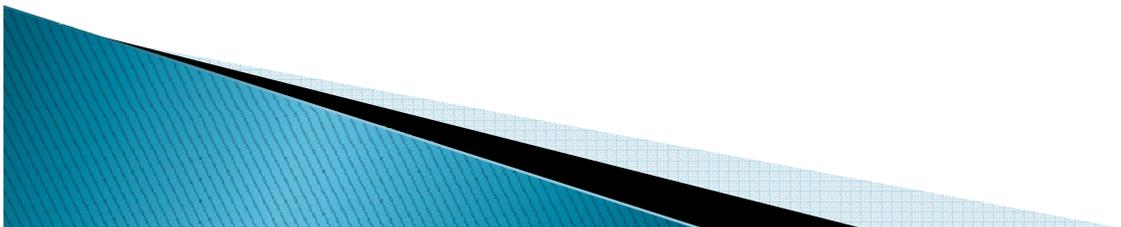


Post Brief Survey and Discussion



Session Debrief

- ▶ Realism
- ▶ General Impressions
- ▶ Criteria for ratings
- ▶ Suggestions for study improvements
- ▶ Opinions of system to gather this info

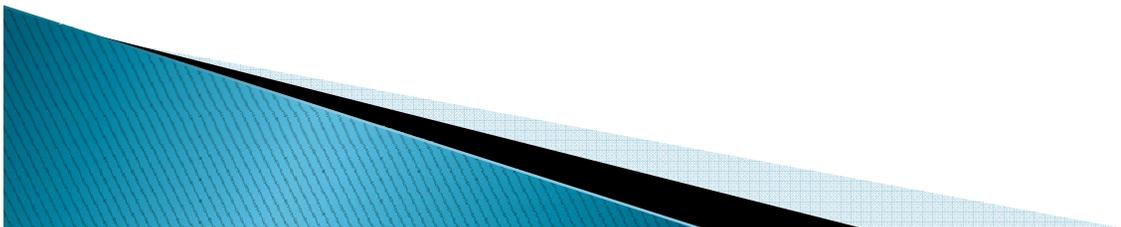


POST FLIGHT QUESTIONNAIRE

▶ Rate the Fidelity of Surface Roughness Simulation

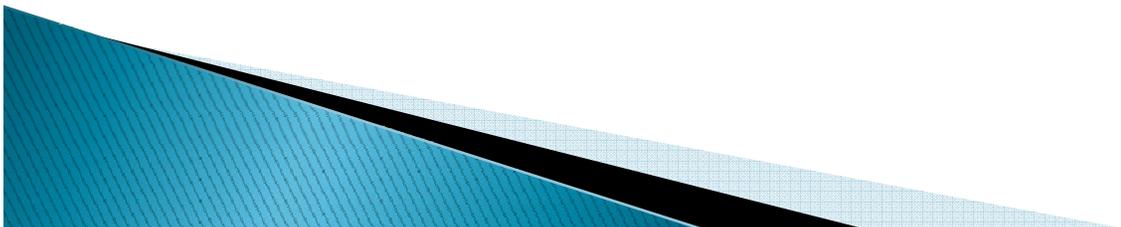
10 = Perfect, 7 = Good, 5 = Fair, 3 = Poor, 0 = Unacceptable

- Motion Realism
- Visual Realism
- Sound Realism
- Overall Realism of Taxiway Roughness
- Overall Realism of Runway Roughness

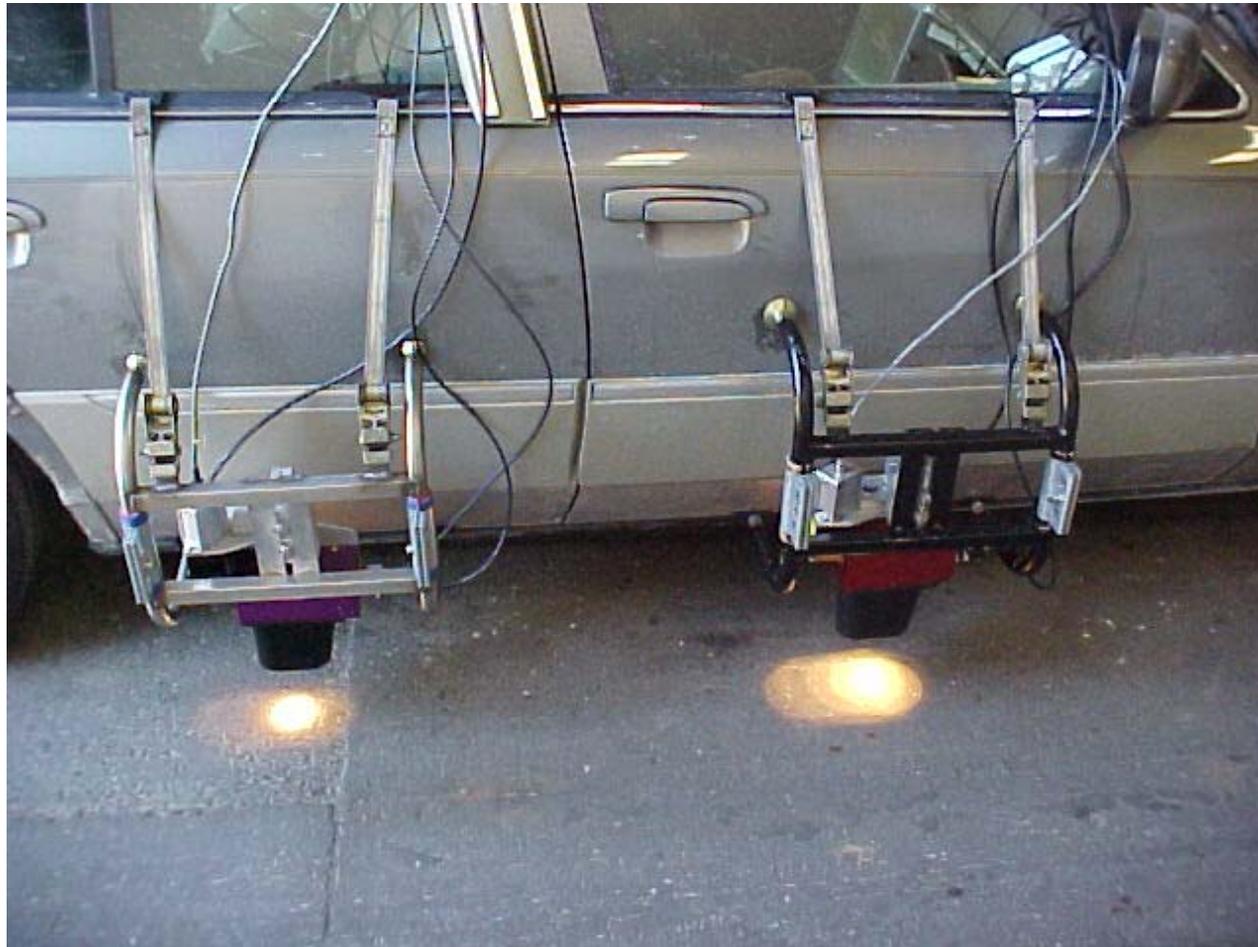


POST FLIGHT DISCUSSION

- ▶ Questions?
- ▶ Comments on realism of taxiway and runway roughness
- ▶ How were your roughness ratings influenced by the lack of pavement visual cues? (Bumps, patches, joints, etc.)
- ▶ Some scenarios had uniform roughness while others had distinct sharp jolts. How did the non-uniformity of roughness influence your ratings?
- ▶ Suggestions for improving the study
- ▶ Suggestions for reporting real-world airport surface conditions



FAA Runway Profiling Device



The project team would like to
acknowledge the support
of AFS-440

Harry Hodges

Vince Liao

Frank Howard

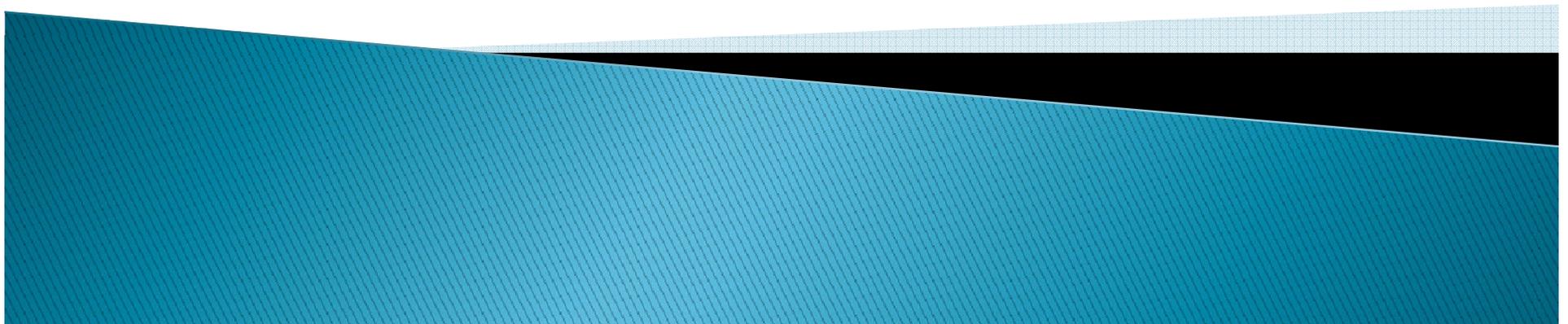
Randall Cooper

Steve Barnes

Ricky Zoellner

Pete Rohde

Rick Dunham



THANK YOU!

