Why there may be a **borescope** in your horoscope

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Topics

- How we got here: the history of aircraft engine inspection requirements
- Borescope anatomy
  - Traditional
  - Fiberoptic version 1: Vividia ablescope
  - Fiberoptic version 2: Teslong HD borescope
- How to use one
- What to look for
- What to do with your borescope pics

Acknowledgement

- Content in today's presentation is drawn from Mike Busch's May 2017 *AOPA Pilot* magazine article entitled "Borescope Ascendancy. Time to topple the venerable compression test?", updated with technologies that have appeared in 2022.

Engine compression tests

- Required by FAA as part of an annual (condition) inspection, and in common use for over 80 years.

- Conventional wisdom: with 80 psi input, cylinder at TDC: high 70's excellent, low 70's good, high 60's marginal, low 60's poor.

Conventional wisdom changes

- Continental service bulletins refer to research showing engines produce full horsepower with compressions as low as 40/80, though oil consumption rises with inadequate sealing of piston rings.
- Continental also issued service bulletin SB03-3 in 2003 specifying borescope + compression test annually, and borescope as gold standard for assessing airworthiness.

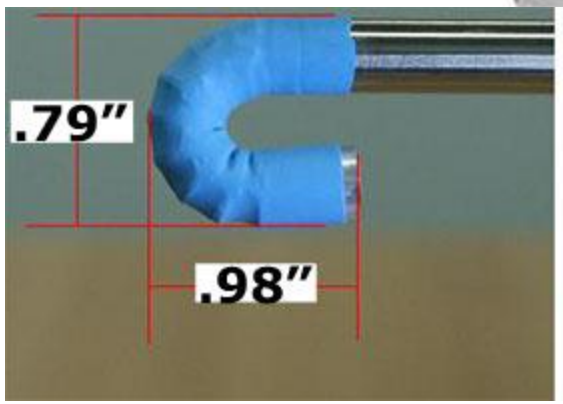
Generation 1 borescopes

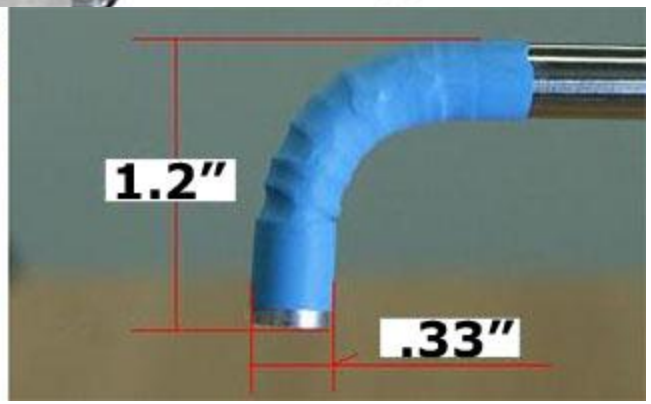
- In 2003, Continental recommended using “low cost” rigid borescope costing $2000 (Lenox Autoscope designed for cars)

- Good optics but no ability to take pictures

Gen 2 borescopes: articulating head fiberoptics

- 2016 Vividia Ablescope ($200 from Amazon)





- USB connection to computer or smartphone, app to make 640x480 pixel digital photos

Gen 3 borescope

- Teslong HD 720p High Def articulating head inspection camera
- Attaches to smartphone, records digital stills, movies, audio. Better ergonomics. Auto-downloads app and launches when scope started.
- 1920x1080 pixel images
- $200 on Amazon

(https://www.amazon.com/gp/product/B08V4DYP1S)

In person demo…

Using a borescope

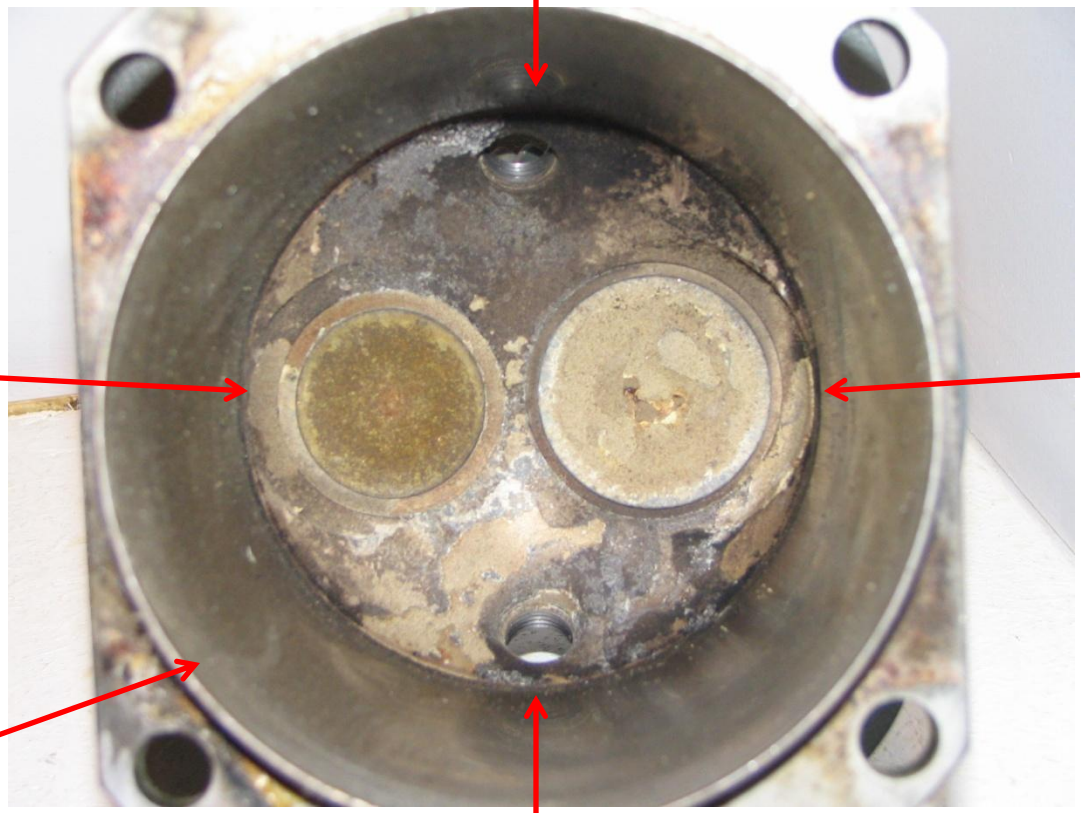
- Remove 1 sparkplug from each cylinder (top generally easiest)
- Insert scope just enough to see piston position
- Rotate prop to get piston to bottom dead center (BDC) for max viewing room in cylinder

What am I looking for?

- Piston head: deposits, heat damage, structural damage
- Cylinder walls: crosshatching, scuffing, wear
- Cylinder head deposits (carbon, lead)
- Intake and Exhaust valves
- Spark plug deposits

Valves

Cylinder anatomy



Piston with carbon deposits

Lycoming IO-540, 1250 hrs TTSN, using Teslong HD borescope

Cross-hatch from original cylinder honing during manufacture

Lycoming IO-540, 1250 hrs TTSN, using Teslong HD borescope

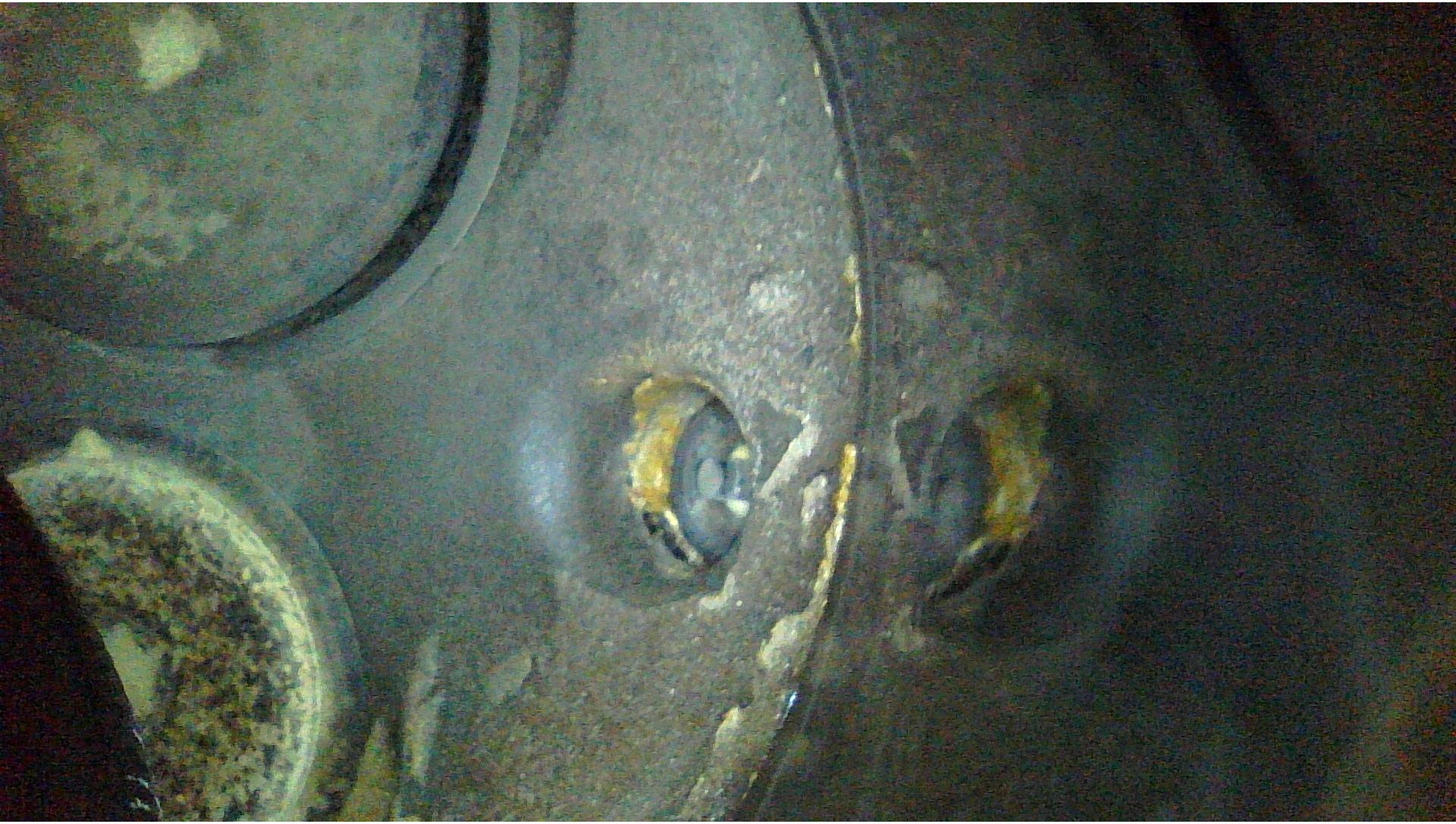
Partially open exhaust valve, normal heat pattern, cylinder head carbon and lead

Lycoming IO-540, 1250 hrs TTSN, using Teslong HD borescope

Intake Valve, partially open

Lycoming IO-540, 1250 hrs TTSN, using Teslong HD borescope

Spark plug recess

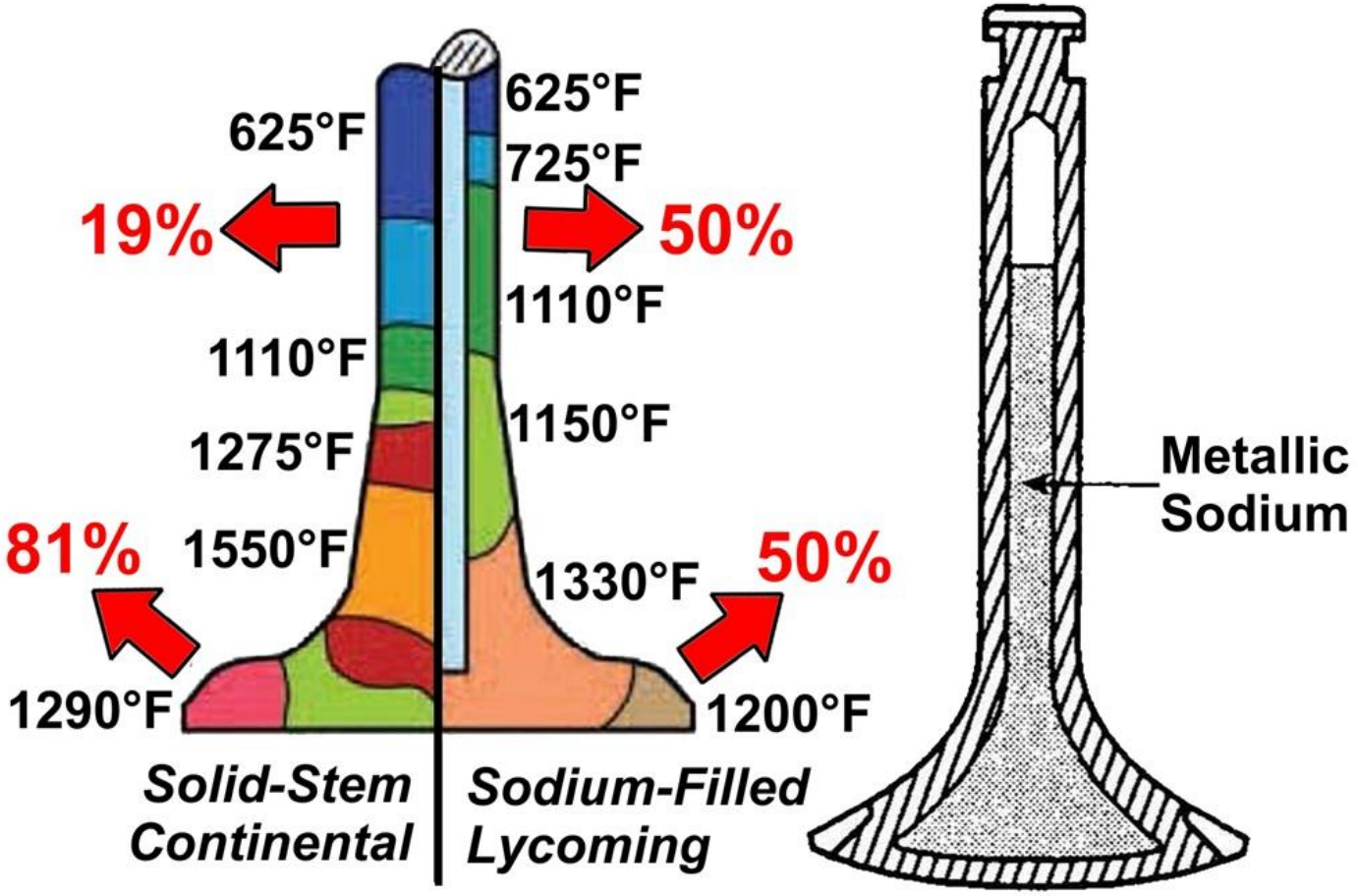


Lycoming IO-540, 1250 hrs TTSN, using Teslong HD borescope

Green = stop.
A failing exhaust valve

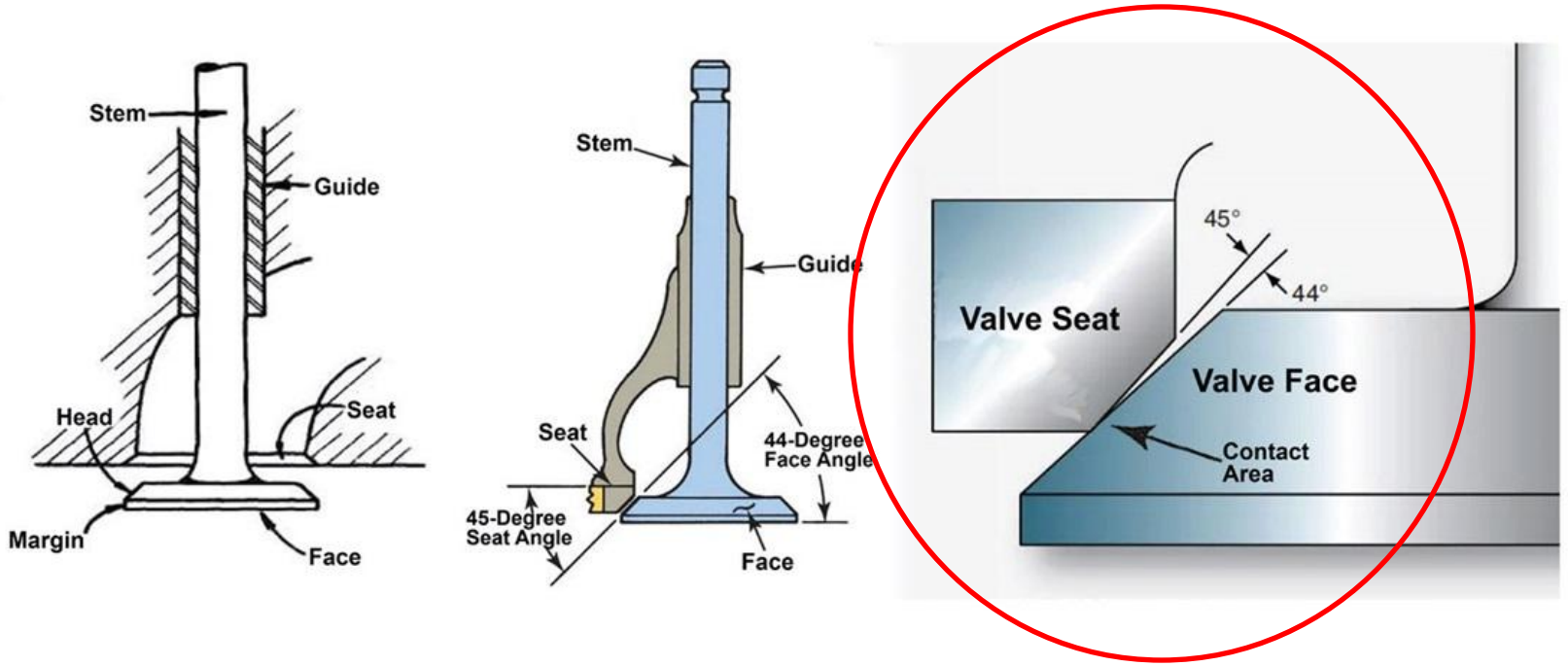
See this and you have to act immediately

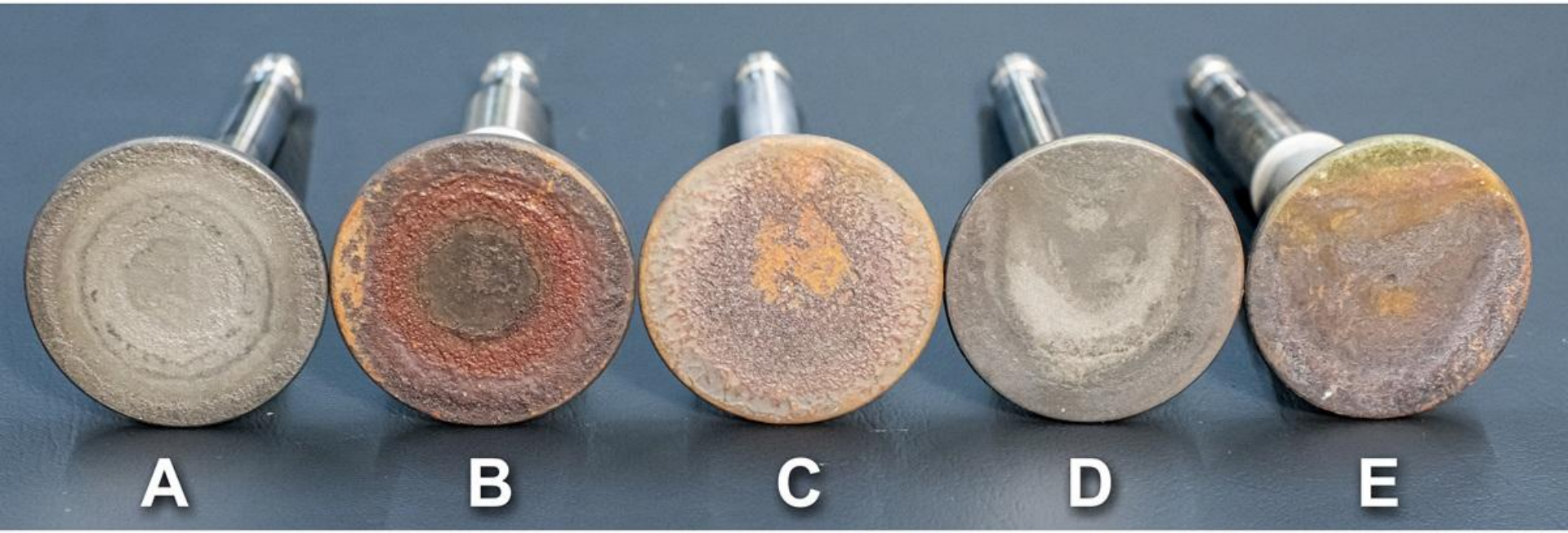
Why exhaust valves are vulnerable



Both must rotate continuously to avoid hotspots and heat damage; Continental valves more prone to failure since 81% of heat transfers to valve seat

Exhaust valve seat angle concentrates heat transfer to small area





Five exhaust valves: left side healthy, right not

What to do with your borescope pics

- Transfer from smartphone to desktop, save in a folder with date taken to use for comparison over time. Store with differential compression test results if possible. Make it an annual (at least) routine.

- Get online consultation for interpretation if in doubt (e.g. Savvy Aviation)

Questions