

# Ceramic Composite Brakes

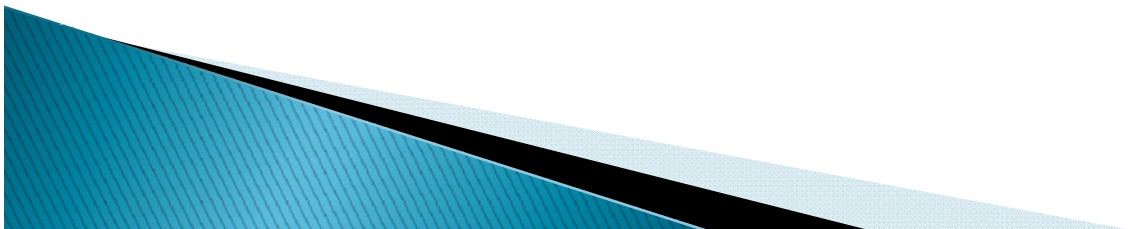
## – Slowing Down Faster

Porsche Racing: Research and Development  
Address to the Board

Nick Jenkins

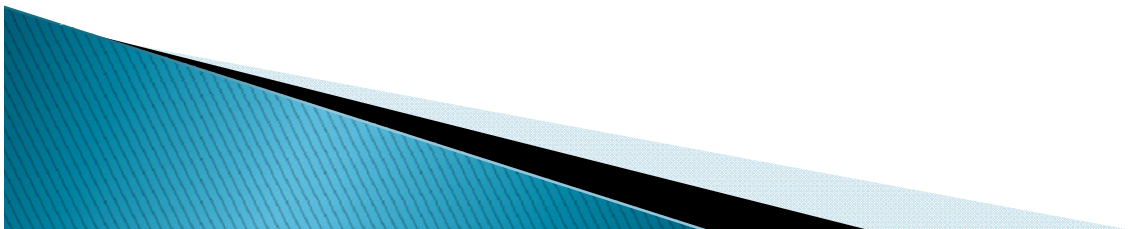
# Overview

- ▶ Ceramic Composite
- ▶ Primary Application
- ▶ Benefits of Implication
- ▶ Risks of Implication
- ▶ Other Applications
- ▶ Questions



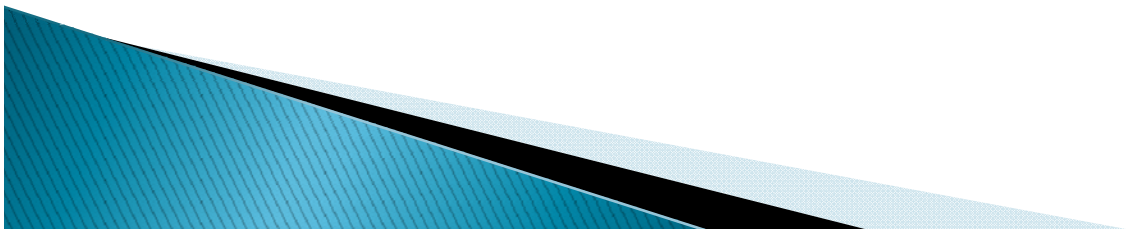
# Ceramic Composite (CC)

- ▶ Hybrid of several low-cost metals
- ▶ Inexpensive mass-production
- ▶ Unpatented as of yet
  - Low potential for patent-infringement lawsuit
- ▶ Multiple applications within Carrera GT



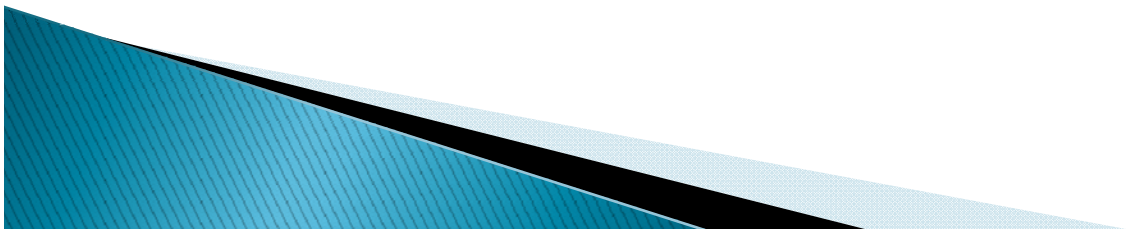
# Primary Application

- ▶ Ceramic Composite Disk Brakes:
  - Cutting edge
  - Ultra-light
  - Ultra-durable
  - Self-cooling
  - Cost effective



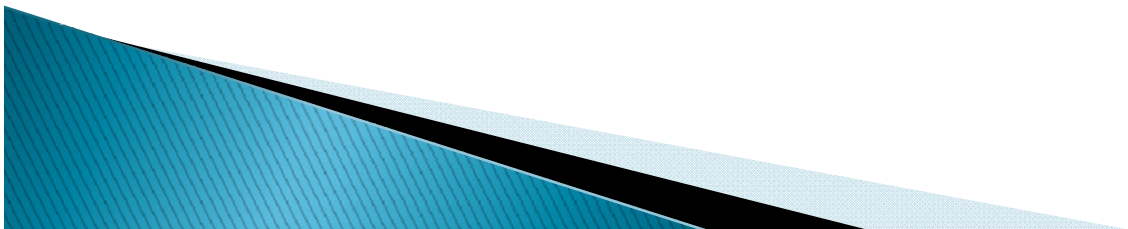
# Benefits of Implication: Cutting Edge

- ▶ Porsche R&D first to apply C.C. to brakes
- ▶ High-efficiency mass-production
- ▶ Outperforms all racing disk/calipers on market
- ▶ Technology exclusive to Porsche R&D



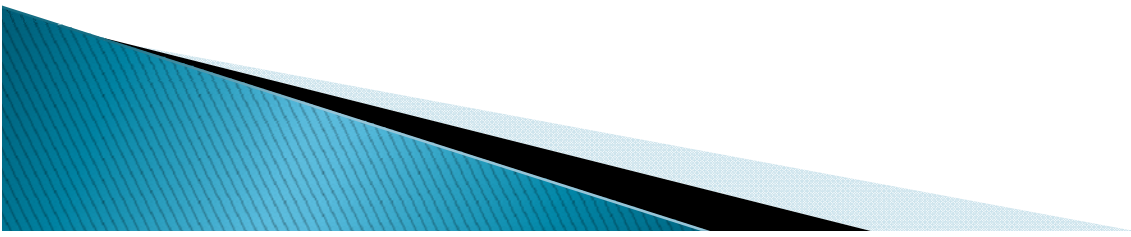
# Benefits of Implication: Ultra-Light

- ▶ Disk/Caliper set reduced to the weight of a bag of sugar
- ▶ Reduction of rolling weight by 250%
- ▶ Reduction of overall weight by 19%
- ▶ Weight reduction results in higher overall performance



# Benefits of Implication: Ultra-Durable

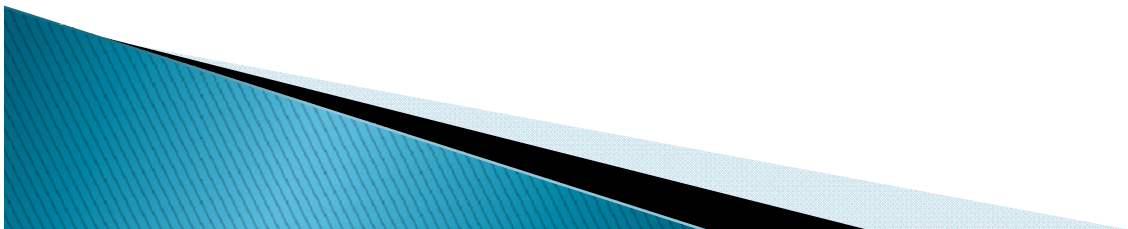
- ▶ Threshold of structural failure reduced by nearly %100
  - As compared to current GT disk/caliper sets
- ▶ Confidence in warrantee
  - 10 year / 150,000 mile brake warrantee a *safe* offer
- ▶ Boosts Porsche reliability rankings





# Benefits of Implication: Self-Cooling

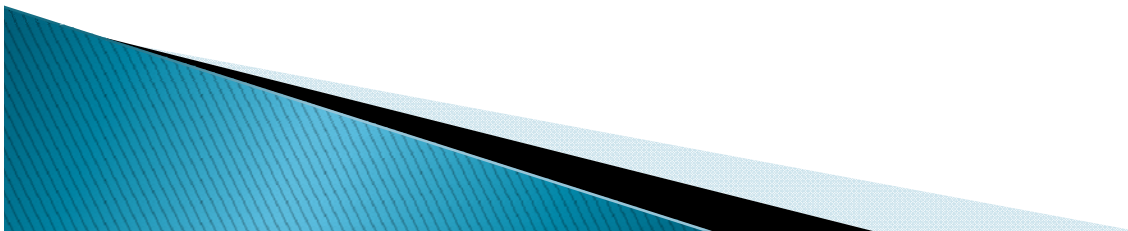
- ▶ CC has exceptionally low heat resistance
  - Air-cooling: more effective
- ▶ Internal air canals
- ▶ Cross-drilled ventilation
- ▶ Result:
  - Runs cooler
  - Runs longer
  - No heat-related performance decay
  - Higher overall performance





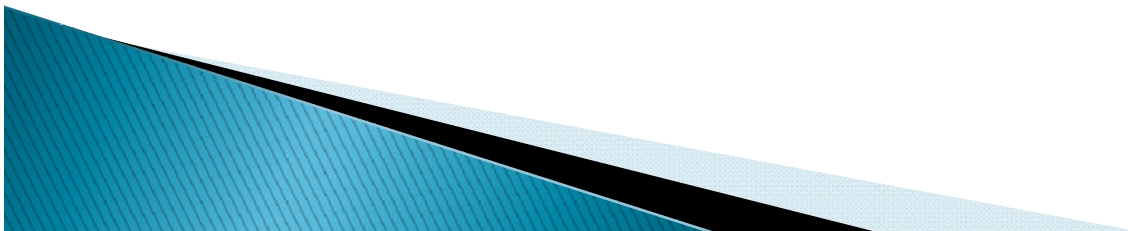
# Benefits of Implication: Cost Effective

- ▶ Relatively low cost of raw materials
- ▶ Ease of mass production
- ▶ High value to customer
- ▶ High profit margin on CC brakes



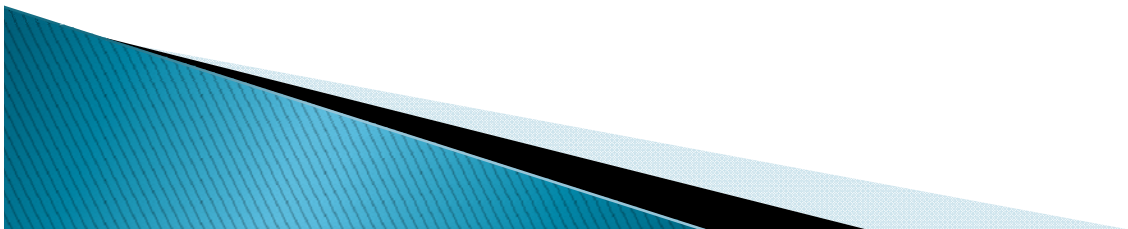
# Risks of Implication

- ▶ High cost to consumer
- ▶ Potentially illegal in some racing classes
- ▶ Currently exclusive to Carrera GT model



# Secondary Application

- ▶ Ceramic Composite clutch-plates and fly wheels
  - Dramatic weight reduction
  - Dramatic durability improvement
  - Dramatic performance improvement



# Questions?



Thank you for your time!