1. Industry Partner Information

- Name of Industry Partner: Guohong Xu
- Job Title: Design Engineer
- Organisation: Omega Dot Ltd
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- Company Description:

  Omega Dot Ltd is a Turbomachinery engineering consultancy. Our main product are bespoke air foil bearings, tailor to client's application requirements.

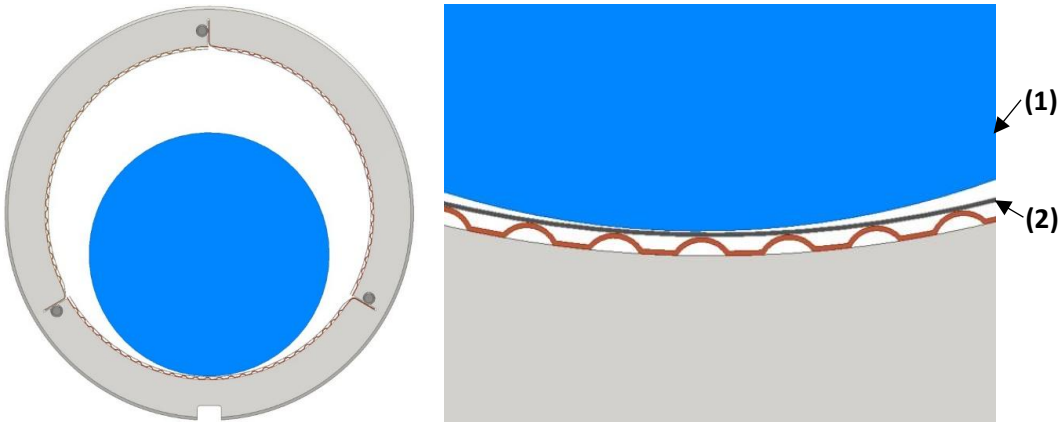
  An air foil bearing is hydrostatic bearing which uses a thin cushion of pressurised air, to support a rotating shaft, making it contactless during operation. The only contacting period is when the shaft is stationary or when rotates below certain speed. This is before enough pressurised air is generated in the bearing before lift-off. During this period, frictional wear on coating and shaft could occurs.

2. Problem Statement

- Problem Description (up to 300 words):

  PTFE has been a reliable and cost-effective coating with ideal performance characteristics for air foil bearings. However, due to a recent announcement by REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals), a European Union regulation, restrictions on the manufacturing of PTFE will be implemented. These restrictions are expected to take effect in 2026–2027 and will pose significant challenges for its production, impacting many industries, including ours.

  We are currently exploring alternative coating options to replace PTFE. However, this has proven difficult, as most research on air foil bearings is theoretical, with limited real-world data available to validate potential alternatives. Additionally, coating technologies are often considered proprietary, making it unlikely that companies will publicly share detailed information. A device capable of measuring the coefficient of friction could assist us in narrowing down suitable coating options.



An image of an air foil radial bearing with a shaft (Not to scale). Shaft (1) and PTFE coated top foil (2) is the only contacting surface.

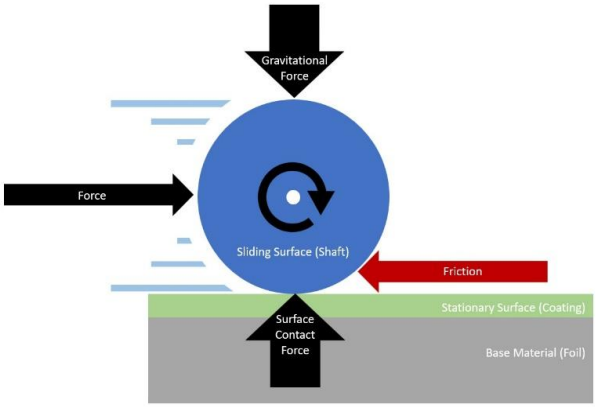


Diagram showing forces acting on the sliding surface (shaft) against the stationary surface (coating).

Design a measurement device that can accurately measure the coefficient of friction (μ), how much one surface resists sliding over another.

The device must give reliable and repeatable results when testing different materials samples and coating samples. It should also be easy to use and set up.

The goal is to create a system that works smoothly and gives precise readings. The results will be used to compare each coating.

The coefficient of friction should be measured based on the kinetic friction between sample pieces at speeds below the lift-off point. For this project, the sliding surface (shaft) will be rotating at 1,000 rpm.

The design should allow the user to mount and remove samples easily, while keeping the user safe during testing. The controls should be simple and clear.

Finally, the design should be practical to build. It should use materials and parts that are commercially available. The parts should be easy to make using common tools or machines. If possible, the design should allow future upgrades—like testing under different weights or in different temperatures.

3. Project Objectives

- Objective 1:
  Identify and propose a suitable method for measuring the coefficient of friction between supplied coating samples and material samples representing a shaft. Coating samples will be provided to support your concept development.

- Objective 2:
  Develop a design concept for a coefficient of friction measurement device. Use 3D CAD software to produce a detailed design of the proposed prototype. The design should be based on the provided coating samples. If changes to the sample pieces are needed, please inform us early so we can explore manufacturing them in time.

- Objective 3:
  Use your prototyping knowledge to build the device using commercially available materials, components, and tools. The device must be functional and capable of providing accurate coefficient of friction values between sample pieces.
- Objective 4:

  Test and validate the functionality of the device using sample pieces. Document and present your findings.