

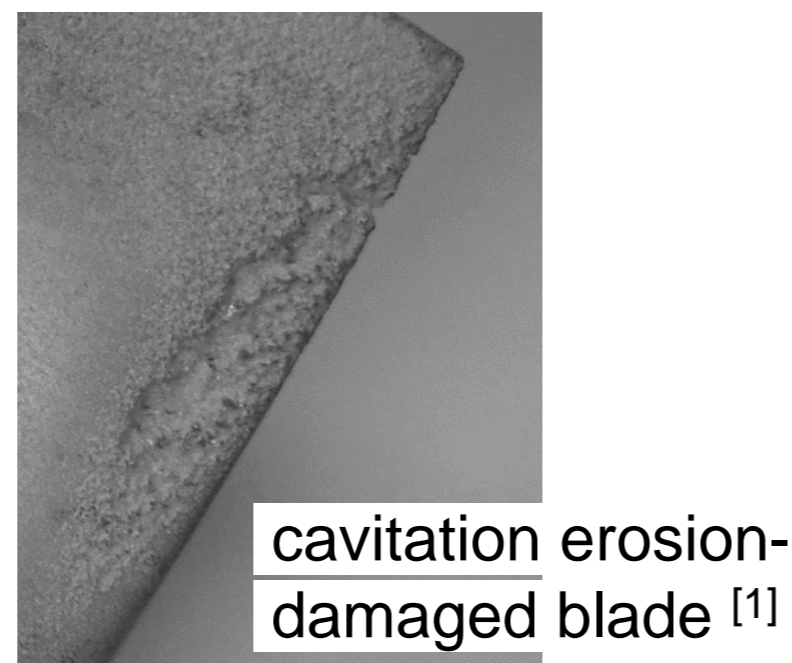
Evaluation of Wire Arc Additive Manufacturing for Cavitation Erosion-Damaged Blade Repairs

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INTRODUCTION & AIM

It is necessary to perform various types of maintenance on industrial turbopumps to keep them in service for several decades. One of these is to deal with damage to the blades caused by cavitation erosion.



Impeller with cavitation erosion-damaged blades

New parts or Repair

WAAM: Wire Arc Additive Manufacturing

Which is reasonable?

Is it reasonable to use **WAAM** for repairs?

In this study, the damage area of blades caused by cavitation erosion in a model impeller is clarified, then an evaluation on the fabrication time of the **repair process using WAAM** is conducted.

METHOD

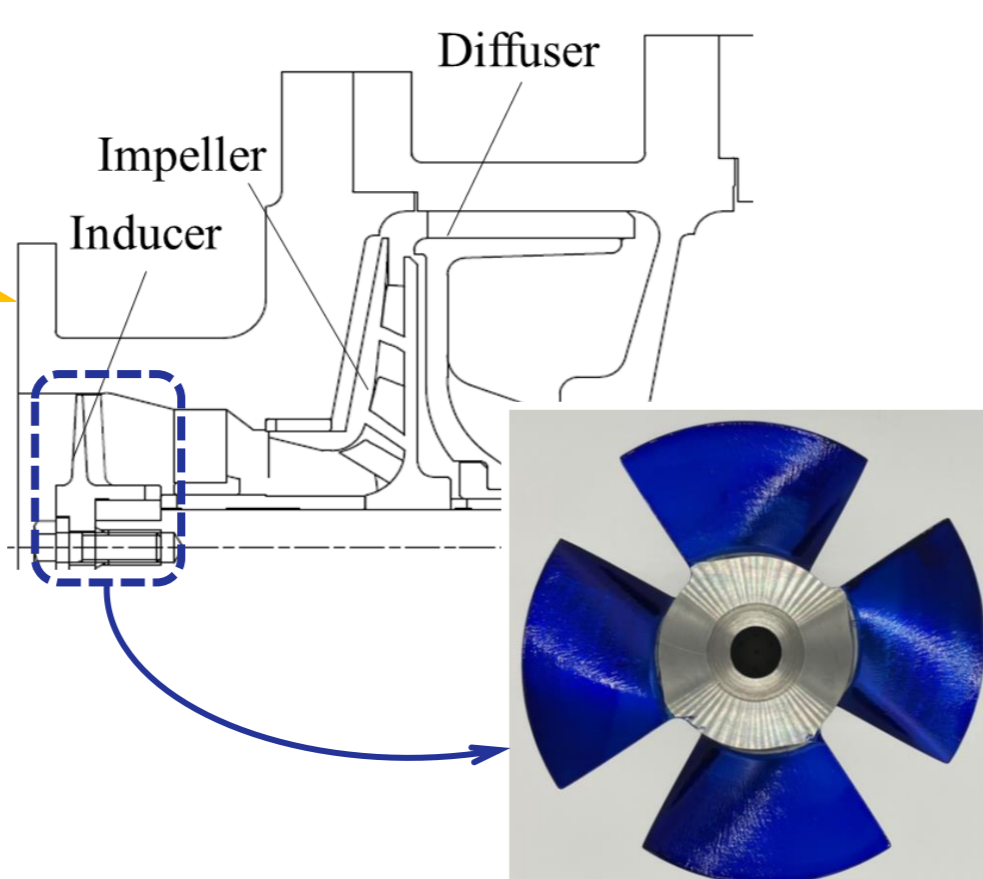
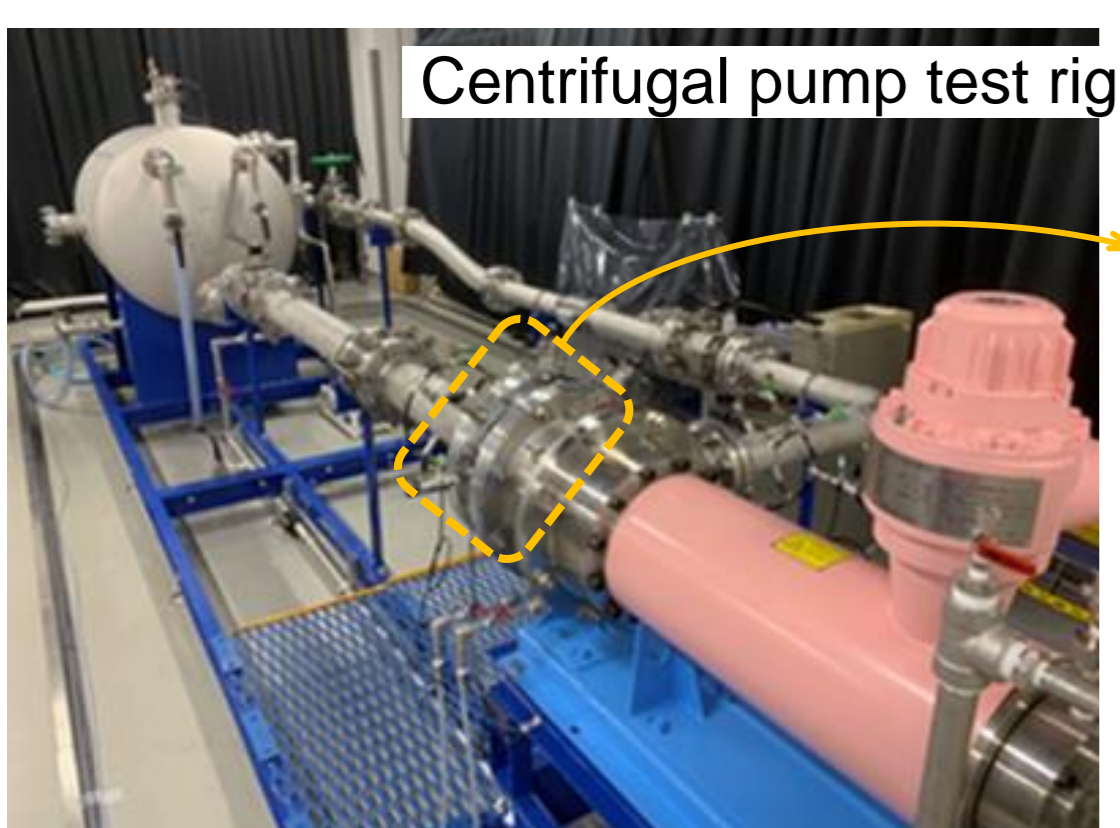
Fabrication blade using WAAM [2]



Test model impeller specification

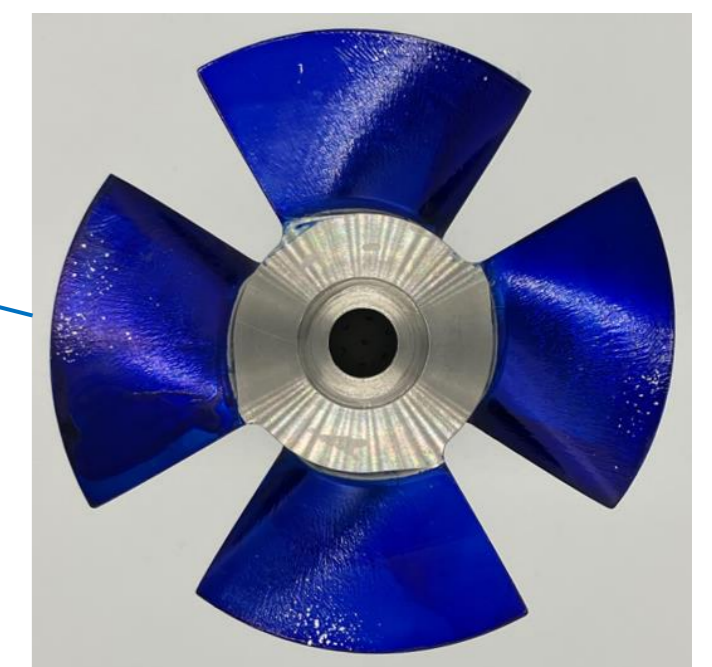
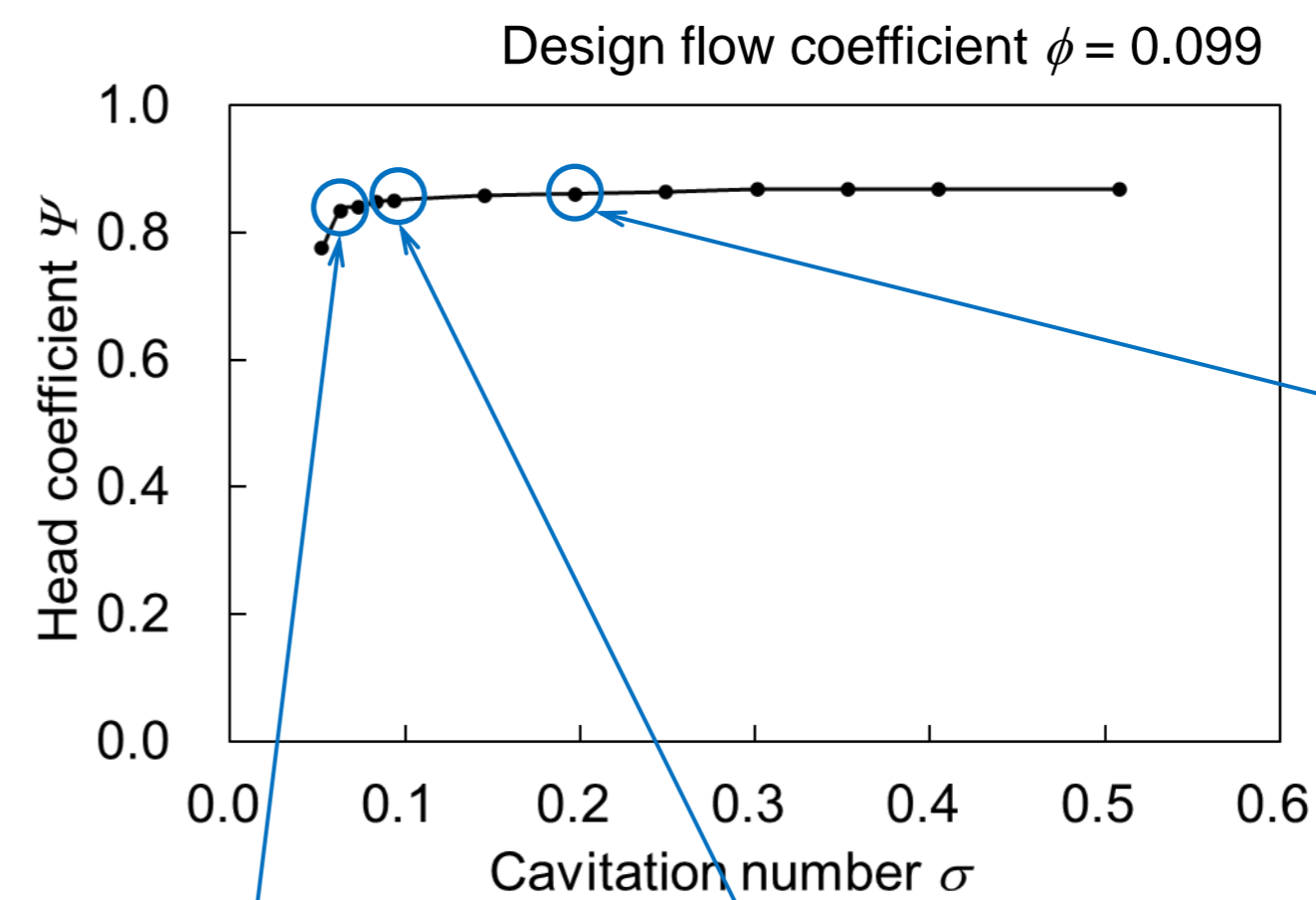
Number of blades	4
Tip diameter [mm]	125.3
Hub diameter [mm]	51
Material	SST

NPSH test & Paint erosion test [3]

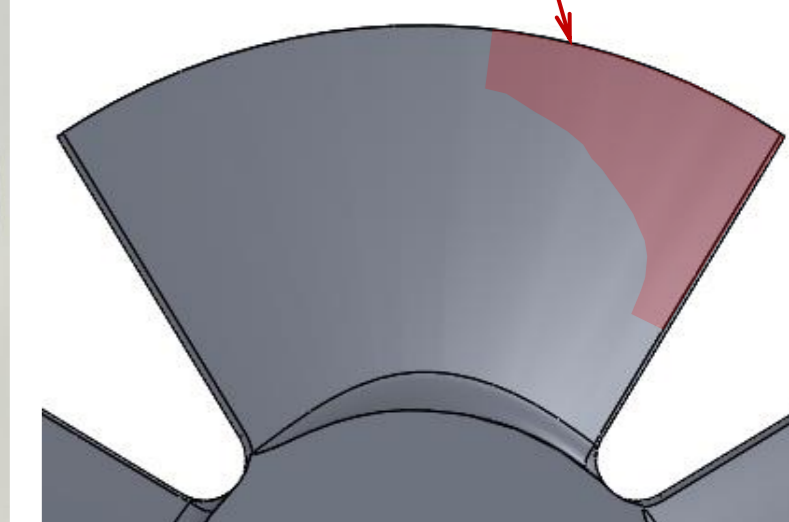
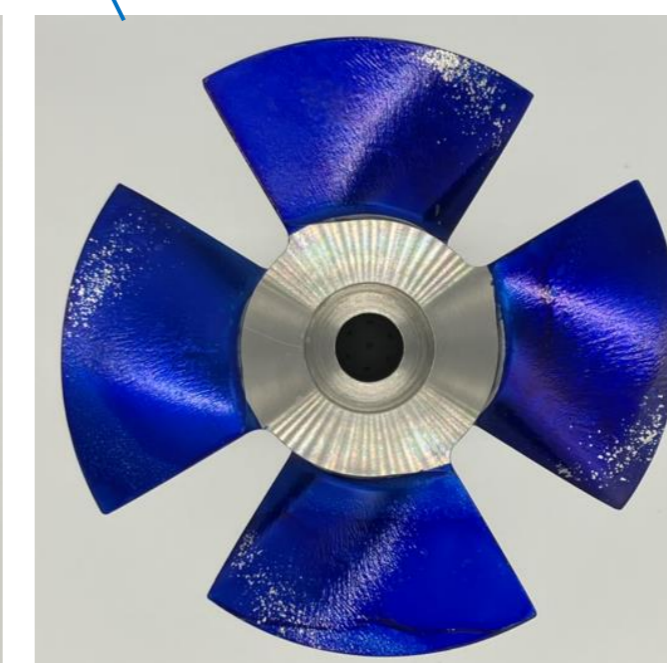


RESULTS & DISCUSSION

NPSH test & Paint erosion test results

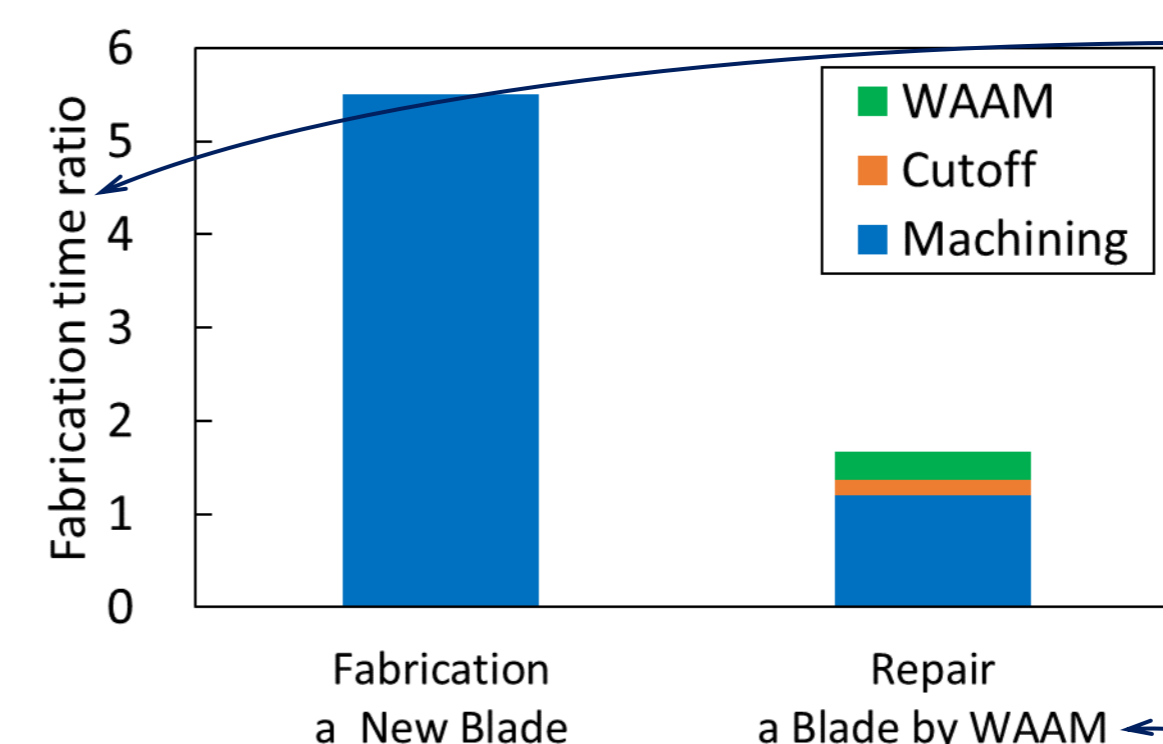


Erosion Risk Area (= Potential Repair Area)



- ◆ Operation time: 30 minutes per each cavitation number
- ◆ At all cavitation numbers, no damage due to cavitation erosion was observed on the discharge side (opposite side of photos).

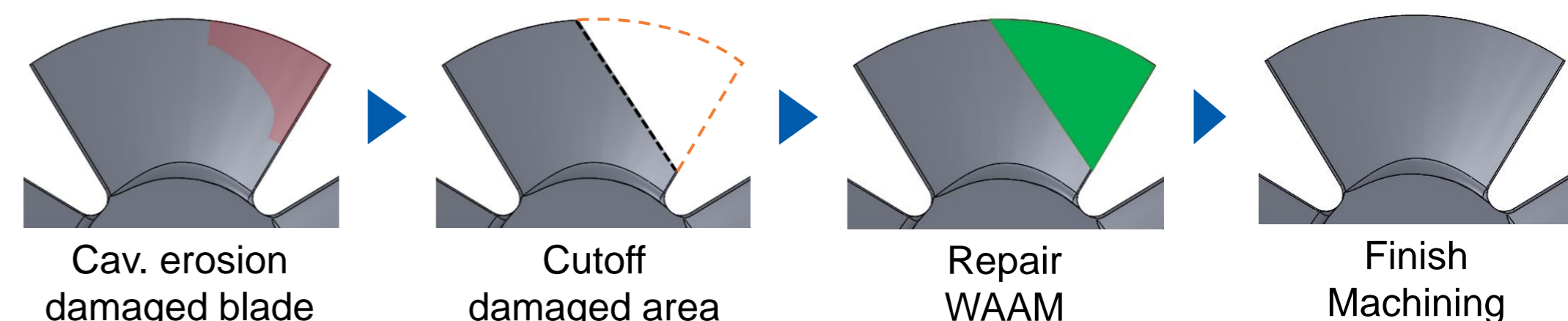
Comparison between fabrication new blade & repair by WAAM



Fabrication time of a target
Fabrication time of a near net shape blade by WAAM

Reduces fabrication time by approximately 70% applying WAAM for blade repair.

An Idea for Blade Repair using WAAM



CONCLUSION

This study presents the effectiveness of WAAM in the repair of blades damaged by cavitation erosion in stainless steel impellers.

FUTURE WORK / REFERENCES

To further clarify its effectiveness, future work will be conducted on difficult-to-machine materials.

- [1] Y. Iga, et al. *Turbomachinery*, 2024, 258-266. (in Japanese),
 [2] S. Ejiri, *International Journal of Fluid Machinery and Systems*, 2023, 16-2, pp.184-191.
 [3] H. Utsumi, et al. *Proc. Inter-Noise23*, 2023, 4889-4900.