

# Cooperative Localization in Anchor-Free Environments for Human-Autonomy Teaming



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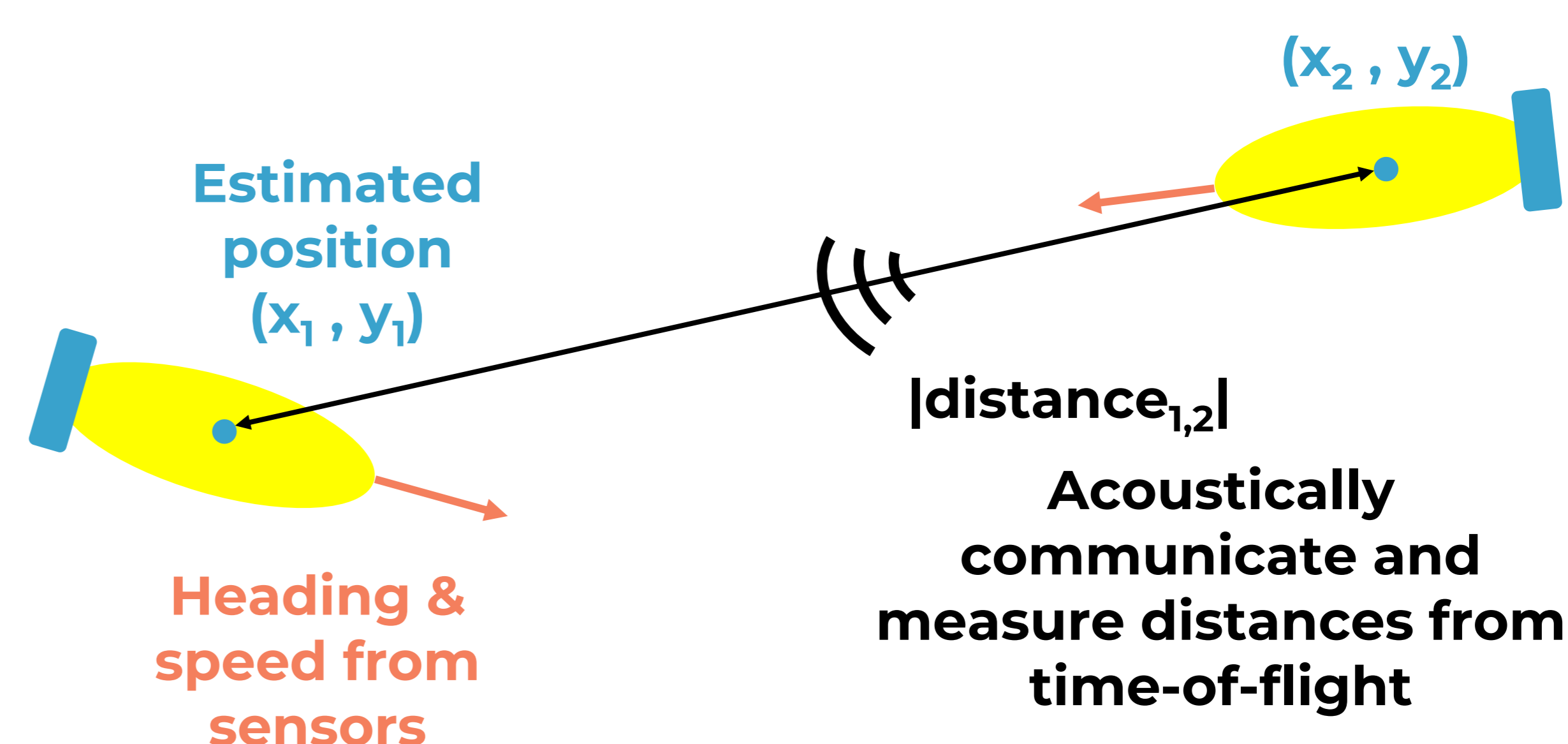
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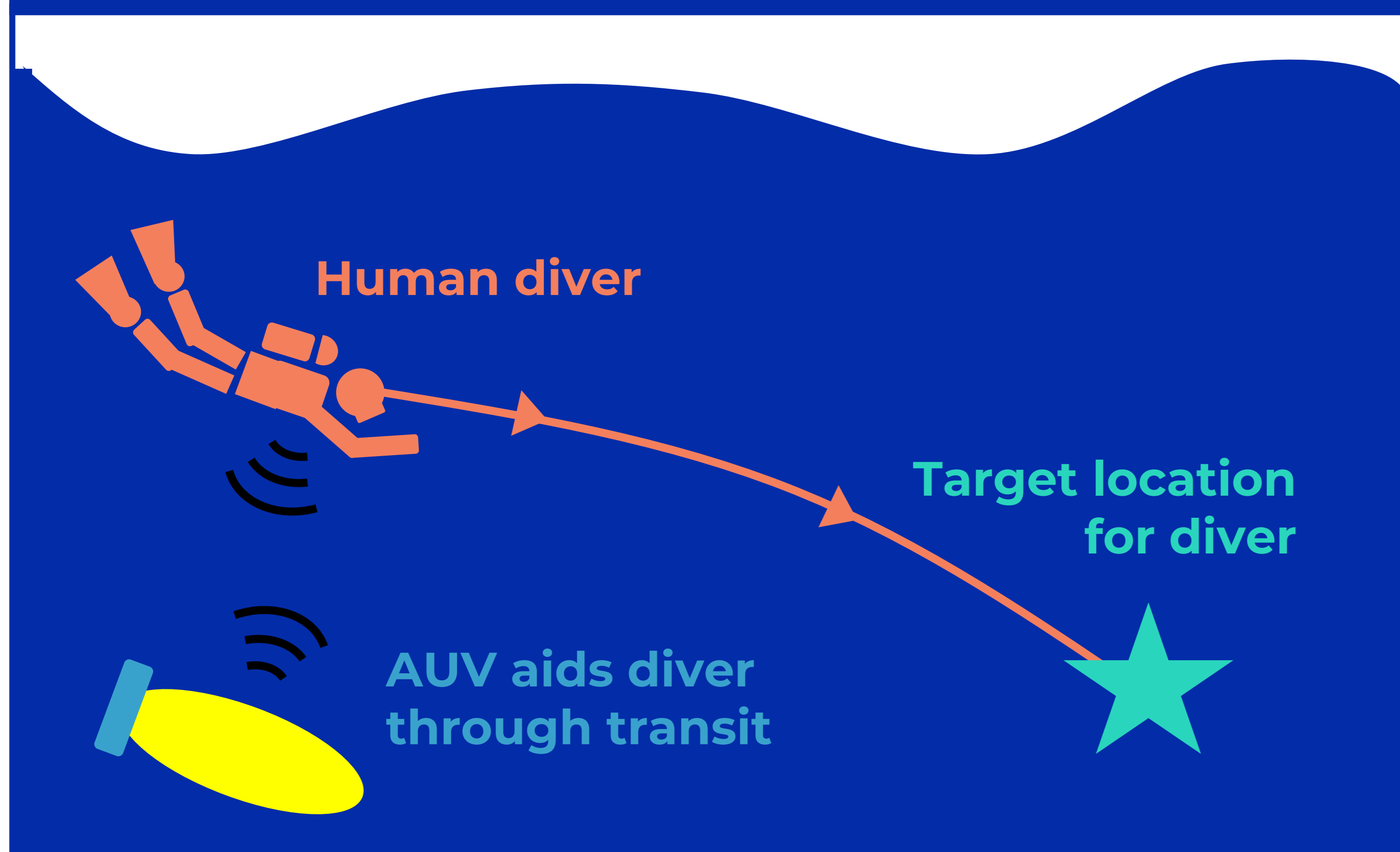
## Human – AUV Teams

- Undersea divers face adverse conditions that affect communication, safety, and navigation abilities
- Autonomous Underwater Vehicles (AUVs) can perform advanced computations, but lack manipulation and nuanced dive skills
- Pairing an AUV with a diver can enhance each teammate's strengths and create emergent team capabilities

## Basic Inter-Vehicle Ranging



## Mission Profile



## Cooperative Localization

- Teammates can use acoustic communication to transmit data and measure distances from each other
- Methods have been developed to improve position estimates by incorporating information from teammates through filtering and prediction
- Many efforts have focused on using surface crafts with access to GPS as navigational aids or “anchors”
- Aiding vehicles can try to optimize their relative positions to best support other vehicles' estimations

## Research Questions

**How can we improve on previous methods of cooperative localization when our aiding vehicle has an uncertain position? Is there an ideal path shape the AUV should take around the diver?**

## Approach

- Utilize MOOS-IvP middleware to compare filtering techniques that incorporate range measurements and sensor data for our two member team as they complete an undersea transit
- Focus on how to optimize relative path shape for an AUV with possible adaptive adjustments

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