



*Autonomous Systems for SAV Restoration:  
Field Results from Virginia's Eastern Shore*



## Limited logistics drive restoration.

Virginia's coastal bays host the most successful SAV restoration effort ever.

**~12K**

*Acres restored*

**70+**

*Million seeds broadcast*

**26**

*Years of work*

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However, labor bottlenecks scale.

*In 2022, a record year:*

**79**

*Volunteers*

**10**

*Million seeds collected*

**287**

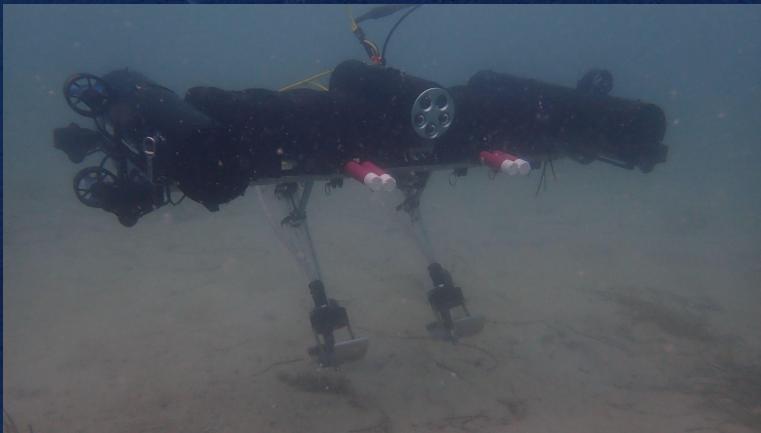
*Working hours*





# Closing the gap

We're working build systems that restore at ecosystem scales.





# How we're doing it

We've built a Lego-style system that lets us customize for any environment

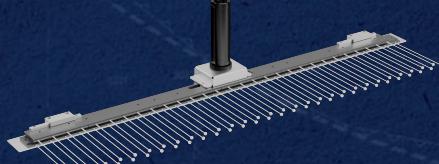


Our universal interface lets us add any custom or off-shelf payload equipment

Seed planters



Seed collectors



Sonars



Sondes



Multibeams

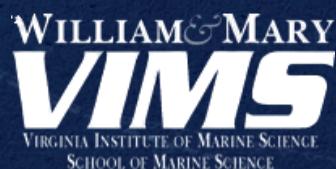


# Our mission in Virginia (2025-2026)

Develop autonomous systems that accelerate every stage of eelgrass restoration.

Stage	Manual Capacity	Constraint	Ulysses Target
<b>Seed Collection</b>	45K seeds / hr	Cost, labor	45K seeds / hr
<b>Seed Processing</b>	30,000 seeds / hr	Hand sorting	150,000 seeds / hr
<b>Seeding</b>	2 ha / person / day	Precision, scale	5 ha / day
<b>Monitoring</b>	Seasonal	Cost, weather	Continuous

**Project  
Partners:**





# Seed Collection

**First Trial:** May 2025

## Trial Goals:

- AUV-mounted shoot cutter
- Height actuator to adjust for canopy variation
- Capture net integrity

## Next Improvements:

- AI models to detect flowering shoots to cut selectively
- More precise cutter adjustments
- Hubless thrusters to minimize entanglement





# Seed Processing

**First Trial:** May - July 2025

## Goals

- Automated stirring and waste material removal
- Remote operation & monitoring

## Next Improvements:

- Upgraded rust-proof structure
- Improved waste removal
- Stir paddles with brushes or flaps to contact the bottom
- Intuitive controls





# Seeding

**First Trial:** October 2025

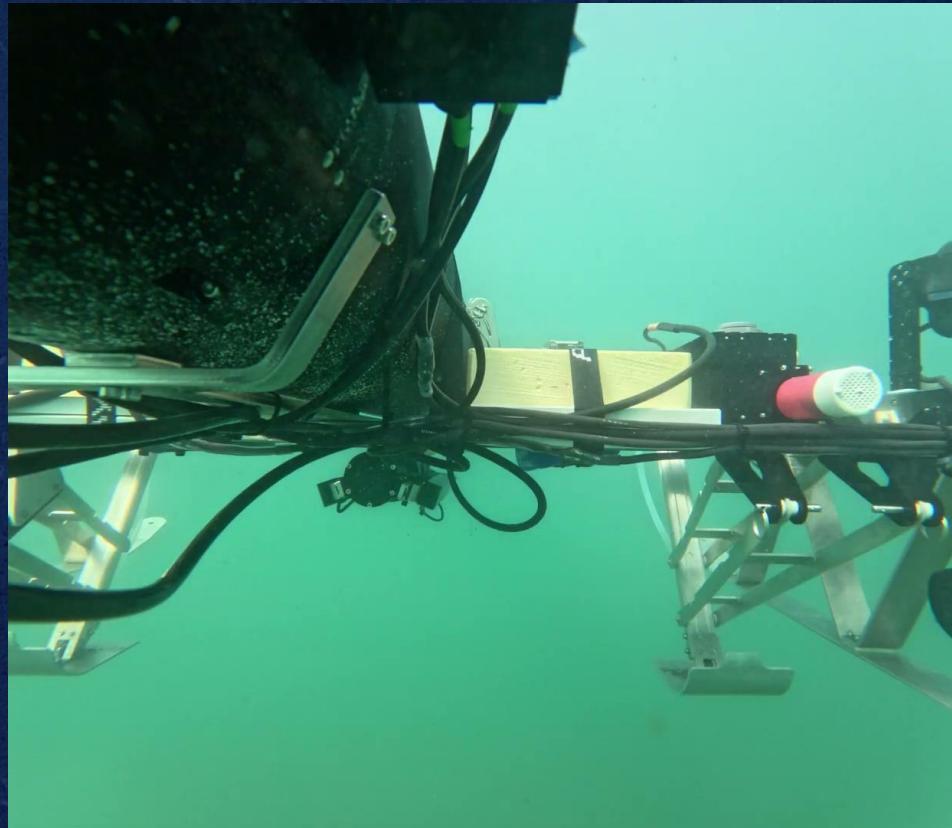
**Seeds:** 80,000

**Plot Size:** 1 acre

**Time to Complete:** 1 full working day

## Next Improvements:

- Longer, autonomous runs
- Higher seed capacity per dive
- Fully automated planting patterns





# Monitoring

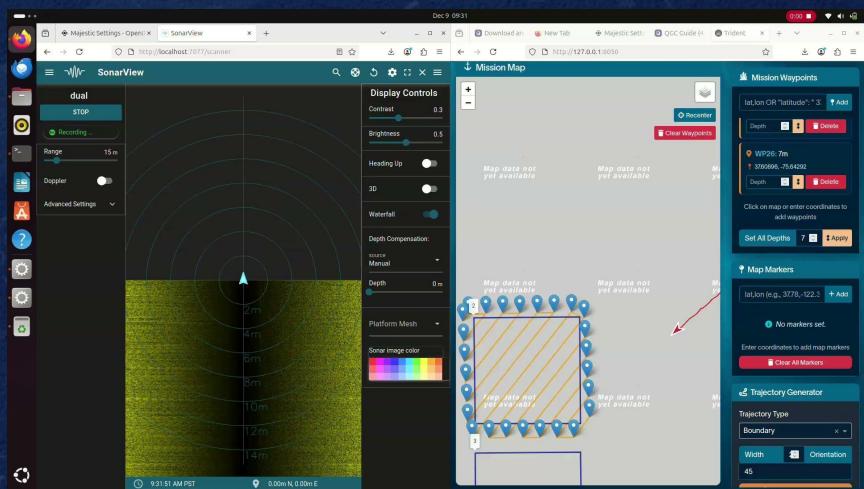
**First Trial:** December 2025 (in progress)

## What we're testing:

- Autonomous navigation in low-visibility conditions
- Sidescan sonar for seedling detection
- AUV seeding success rates

## What we're seeing:

- Navigation successful in poor environments
- Sidescan operating well
- Seedling verification ongoing





# Lessons learned and next steps

## 2026 Plans:

- Scale collecting and seeding to multiple hectares / day.
- Operate over a much larger time frame (February → April).



Stage	2025 Results	2026 Improvements
<b>Collection</b>	Cutter payload successful first test	AI targeting, hubless thrusters
<b>Processing</b>	Separation mechanism functional	Rust-proofing, waste removal
<b>Seeding</b>	80k seeds / 1 acre / 1 full day	Autonomous paths, larger hopper
<b>Monitoring</b>	Nav + sidescan functional	More seedling detection validation



# Scaling up our efforts

SAV conditions are generally improving, but need assistance.

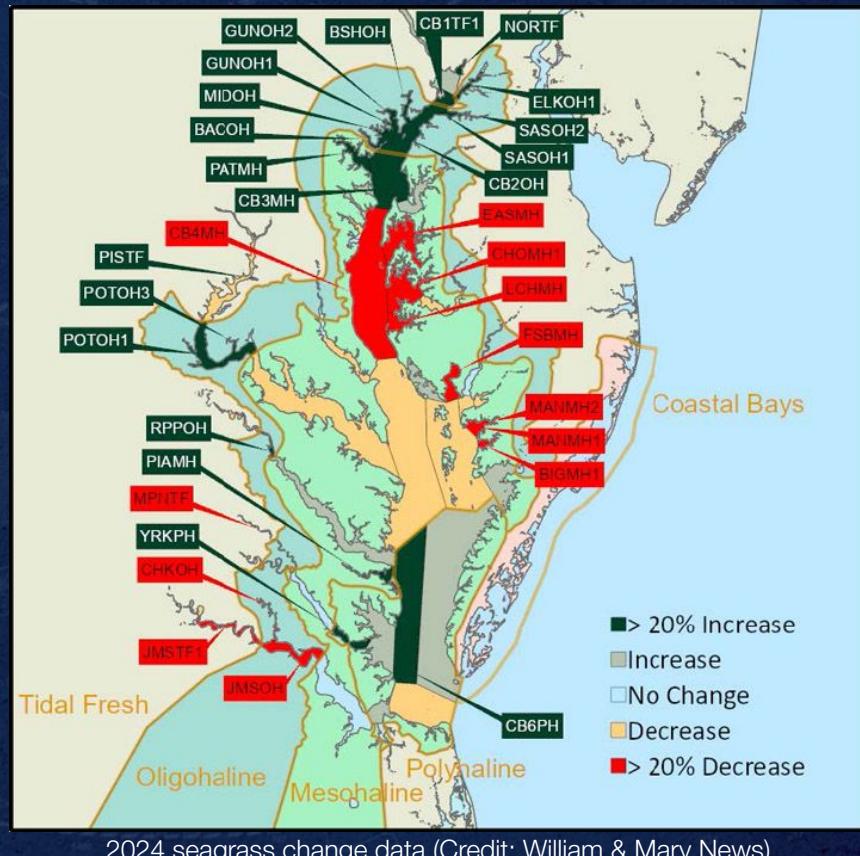
## What Virginia proved:

- Collection, planting, and monitoring at field scale
- Operation in conditions that slow manual methods
- Acre-scale seeding with first-generation systems

## What we need to scale:

- More field time in real conditions
- Sites with restoration need and scientific support
- Funding to deploy full-scale operations

**We're aiming to restore 500 acres of SAV - We can't do it alone.**





Thank you.

Nate L'Esperance  
*Project Development Lead*  
[nate@ulysses.eco](mailto:nate@ulysses.eco)