

The Effects of Turbulence on the Suppression of Navy Cable Fires

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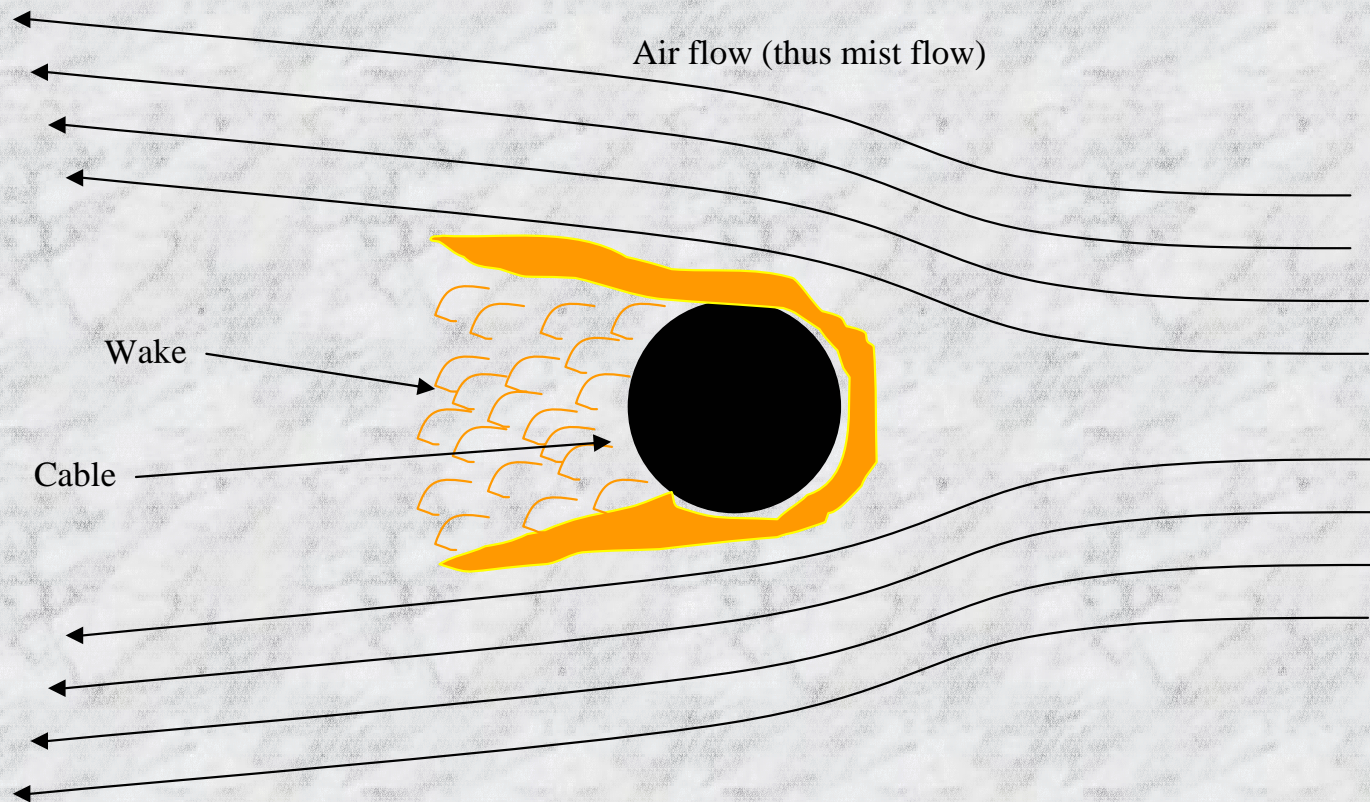
Laboratory Name: NRL

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Motivation

- Navy Ship sub-floor compartments contain power and communication cables vital for ships mission
- Need to quickly extinguish the sub-floor fire to save the ship mission
- Ultra Fine Mist (UFM) is a good candidate to quickly extinguish sub-floor fire since the UFM is environmentally safe and has minimal water damage
- UFM is effective has large surface area to volume ratio, thus it evaporates quickly and can extinguish the fire

Motivation (continued)

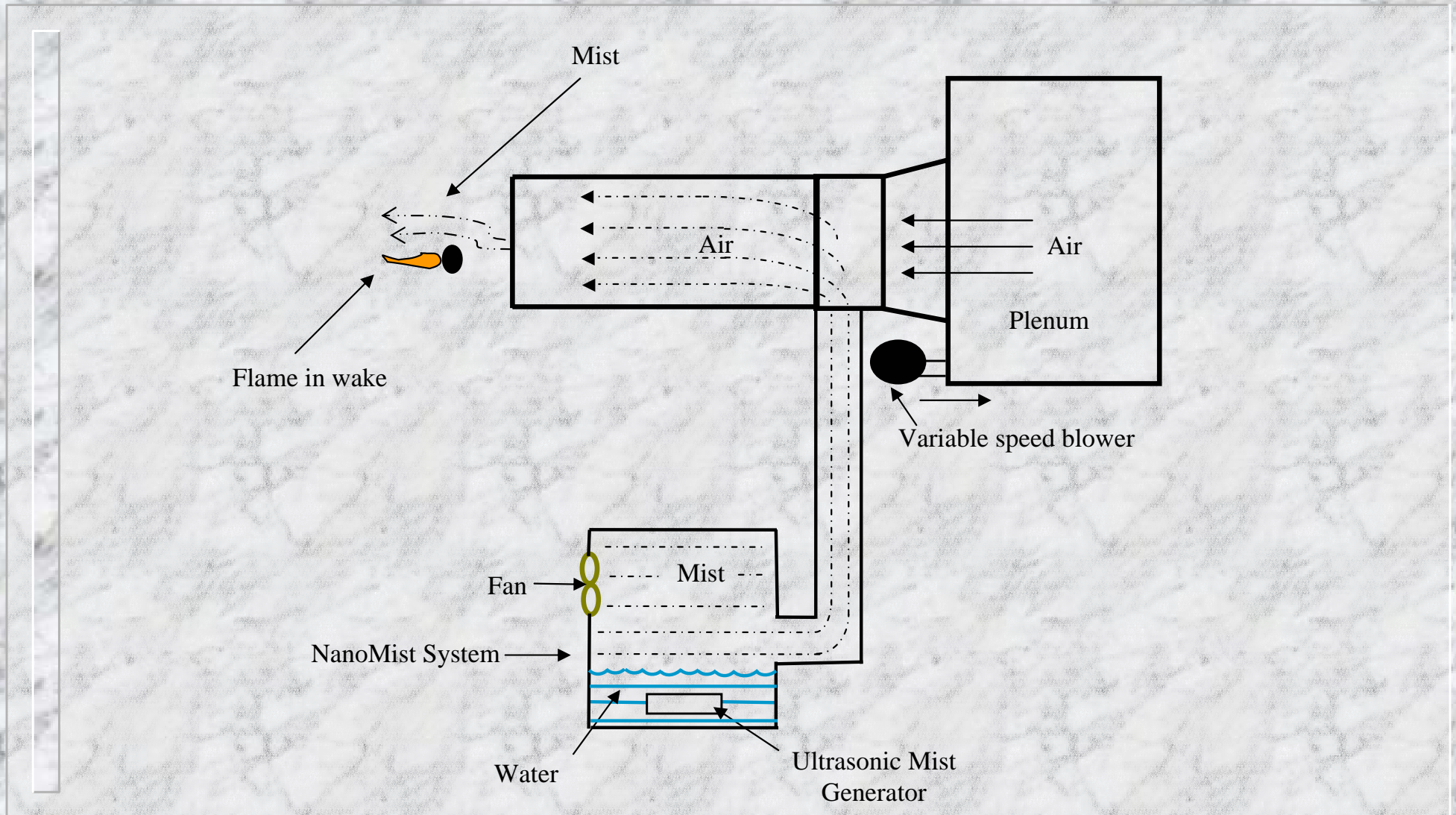


- Flame hides in the wake behind the cable in a flow field because of the geometry of a cable
- Thus cable fires are very difficult to extinguish in a flow field

Objective

- The objective of this work is to conduct proof of concept preliminary tests to determine whether induced turbulence in the mist and air flow would enhance the performance of the UFM
- UFM droplets, in a laminar flow, follow the air streamlines even at low velocities and may not effectively reach the fire in the wake

Experimental Setup

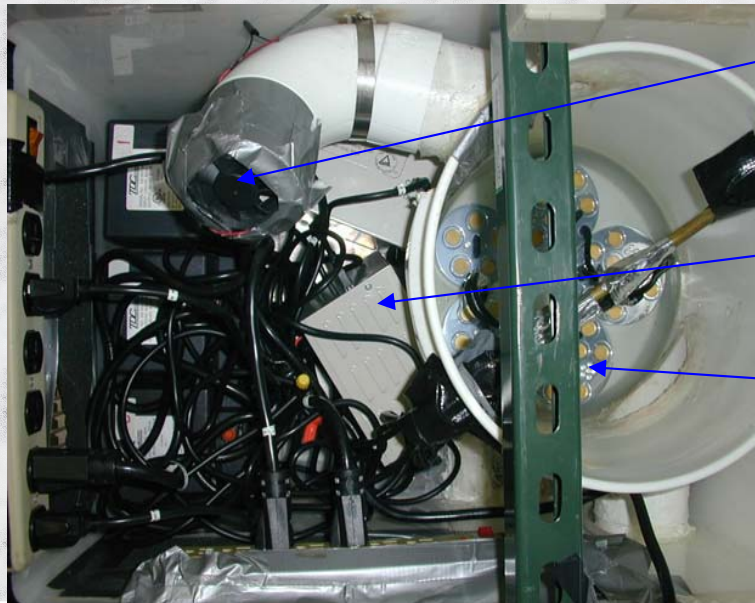


Experimental Setup (continued)



Piezoelectric Disc

Sensor

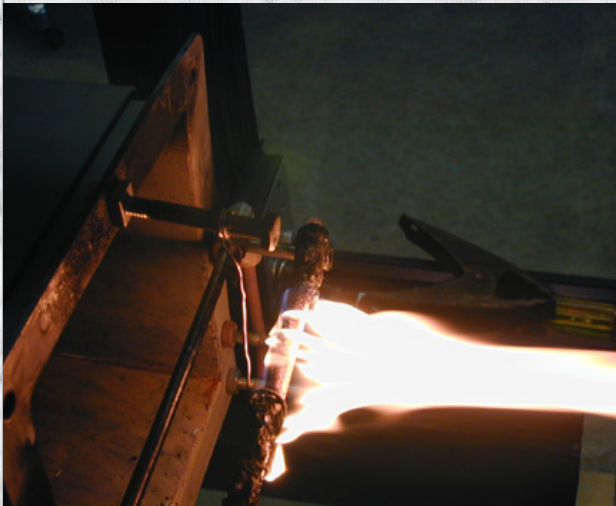


Small fan

Transformer

Sprayers

Cable Burning



Flame rapped around cable



Flame hiding in wake



Dying flame that is dwindling in the wake

Results

TESTS WITH AND WITHOUT TURBULENCE

Test condition	Ignition time (min)	Total Time (min)	Self Burn Time (min)	Burnt wt (gm)	% total wt burned	Mist Conc
BC	1.5 min				34.75	
BC	1.5	2.73	1.23	6.83	34.6	
BC	1.5	2.88	1.38	6.86	33.88	
Laminar	1.5	4.12	2.62	7.32	34.5	~7%
Laminar	1.5	3.167	1.667	6.94	33.7	~7%
Laminar	1.5	3.73	2.23	6.02	28.6	~7%
Turbulent	1.5	3.25	1.75	3.67	17.4	~7%
Turbulent	1.5	3.2	1.7	3.65	17.38	~7%
Turbulent	1.5	2.5	1	2.83	13.7	~7%
Laminar	1.5	2.5	1	2.67	13.18	~9%
Turbulent	1.5	1.83	0.33	1.71	7.2	~9%
Turbulent	1.5	1.96	0.46	1.47	6.06	~9%

Conclusion

- I had to rebuild and update our mist generator to produce higher concentration of mist
- We performed preliminary proof of concept tests and determined that turbulence increases the performance of the Ultra Fine Mist in suppressing cable fires.
- The turbulence in conjunction with the Ultra Fine Mist helps give the mist the ability to extinguish the fire that remains in the wake of the cable.



Acknowledgements

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- Dr. Ramigopal Ananth

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