

Understanding the Noise of Your Aircraft

NAVAIR Topic N102-128

Robert P. Dougherty

About OptiNav, Inc.

- Wave propagation analysis, especially microphone arrays and aircraft acoustics
- Significant Technical History
 - Several NASA SBIRs, also DOT contracts
 - Patent applications for Functional Beamforming and Sound Sphere measurement.
 - Many technical papers
- Key Resources
 - Dr. Robert P. Dougherty: world leader in aeroacoustic beamforming
 - Close relationship with Signal Acoustics Group (SIG): digital microphone arrays
 - Affiliate Associate Professor at Univ. of WA Aeronautics & Astronautics Dept.
 - 1400 sq. ft office/warehouse used as laboratory space
- Other
 - 2000 AIAA Aeroacoustics Award
 - Beamforming software licensed to NASA and aerospace companies
 - Many sales of OptiNav Beamform Interactive software and SIG ACAM hardware

The Navy Challenge

- OBJECTIVE
 - Develop a practical approach to defining the noise radiating properties of a supersonic jet
- DESCRIPTION
 - Reliably and economically characterize the external noise field created by Navy aircraft
- Expected Transition Target
 - Technical data from tests
- ACQUISITION PROGRAM
 - NAWC-AD Propulsion and Power Engineering
- TECHNOLOGY AREAS
 - Air Platform, Information Systems, Sensors
- WHERE TO FIND INFORMATION
 - Navy SBIR 2010.2 - Topic N102-128
https://www.navysbir.com/n10_2/N102-128.htm

<https://www.defense.gov/observe/photo-gallery/igphoto/2002758818/>

Photo by: Seaman Gray Gibson



The Solution - Technology Developed

- Algorithms and software to improve jet ground test data quality
 - Remove obstacle reflections
 - Fill in missing microphones
- Revolutionary technique for noise flight tests
 - Much lower cost of facilities, personnel, equipment
 - Better accuracy
 - “Get your sound spheres here”

Current Status

Milestone	Measure of Success	Ending TRL	Date
Algorithms for ground test	Demonstrate the ability to reproduce existing (2014) test data	6	2021-07-16
Sound sphere software	Demonstrate the ability to construct the sound spheres	5	2021-08-31
Transition ground tests	Success: Data consistency	7	2021-12-31
Sound sphere target of opportunity tests	Obtain Consistent results per aircraft model	7	2022-09-30

Ground Test Advantages / Benefits

	Current	OptiNav
Microphones	Limited to affordable/working number	Interpolate to any
Test site	Reflections from obstacles may make test impossible	Obstacle effects mathematically removed

Flight Test Advantages / Benefits

	Current	OptiNav
Facility	Remote desert location	Rural or quieter site
Instrumentation	Goal-post microphone towers Weather balloons Requires multiple large cranes on site On-board GPS required	6-8 portable acoustic cameras (\$9K each) GPS only required for hover/slow speed
Personnel	30	15
Set-up	~600 man-hours: instrumentation & cables	~30 man-hours
Test time	Many repeat runs for averaging to compensate for errors due to poorly known wind	Fewer repeats: errors caused by wind are much smaller
Test cost	Several million dollars	Perhaps \$100K

Transition to the Fleet

- Support NAVAIR Propulsion and Power
 - Two ground tests planned and funded already
- Navy based sponsor is seeking general use of this technology within Navy programs

Commercial Market Analysis

- Urban Air Mobility (air taxis)
- Commercial urban drones, i.e. package delivery
 - Noise is a key constraint
 - Cheap sound spheres enable noise understanding and regulation
 - OptiNav is well positioned for this

Transition/Partnership Pitch

- Is aircraft noise a limitation for your operations?
- It will be for UAM/urban drones
- OptiNav intends to be the go-to provider of sound spheres

Closing Slide

- OptiNav, Inc
- Robert P. Dougherty
 - (425) 891-4883
- Booth location
 - Leave placeholder – will be assigned at later date
- Teaser
 - “Get your sound spheres here”

Reference Sheet

Reference Sheet for OptiNav, Inc., Topic Number N102-128

Slide Number	Slide Title	Content Citation	Graphic Citation	Notes	Checked By BC
1	Title Slide	N/A			jl-30 Jul
2	About the Company	OptiNav business development			jl-30 Jul
3	The Navy Challenge	Solicitation; Quad Chart; Abstract; TPOC Call	https://www.defense.gov/observe/photo-gallery/igphoto/2002758818/		jl-30 Jul
4	The Solution - Technology Developed	Solicitation; Quad Chart; Abstract; OptiNav derived R&D	N/A		jl-30 Jul
5	Current Status	Quad Chart; OptiNav derived R&D; PM update meeting	Copyright 2021 OptiNav, Inc		jl-30 Jul
6	Ground Test Advantages / Benefits	OptiNav derived R&D; Quad Chart	Copyright 2021 OptiNav, Inc		jl-30 Jul
7	Flight Test Advantages / Benefits	OptiNav derived R&D; Quad Chart	Copyright 2021 OptiNav, Inc		jl-30 Jul
8	Transition to the Fleet	OptiNav business development; Quad Chart	N/A		jl-30 Jul
9	Commercial Market Analysis	OptiNav business development	N/A		jl-30 Jul
10	Transition/Partnership Pitch	OptiNav business development	N/A		jl-30 Jul
11	Closing Slide	OptiNav business development	N/A		jl-30 Jul

