Statement of Work

Proposal Number: MTEC-20-12-COVID-19_Diagnostics-046

Organization: Sibel Inc.

Title: ICU-Grade Wearable Sensors with [redacted] to Diagnose and Detect Pre- and Very Early Symptomatic COVID-19 Infection [redacted].

Introduction/Background

COVID-19 is a highly contagious respiratory infection that ranges from asymptomatic presentation to fatal, progressive pneumonia. The continued lag in availability of COVID-19 laboratory testing necessitates the need for [redacted]. Early symptoms of COVID-19 infections are predictable: fever, cough, shortness of breath, and hypoxia measured by pulse oximetry. Unfortunately, the most popular wearables are unable to measure any of these parameters. Clinical signs such as skin rashes on the toes and patient-reported symptoms such as a loss of smell have been identified as signatures of early infection. Currently, there is a lack wearable diagnostic systems that capture sufficient objective and subjective data specific to COVID-19 for pre and early symptomatic detection. [redacted] is a next generation wearable monitoring system that offers ICU-grade measurement parameters and novel respiratory biomarkers specifically relevant to COVID-19. The core [redacted] We hypothesize that the ANNE^{TM} One system is one of the most comprehensive wearable monitoring platforms commercially available providing rich, ICU-grade physiological inputs that will serve as the basis for predictive algorithms to detect pre and early COVID-19 infection.

Scope/Project Objective

Task	Goals / Objectives	Major Milestone / Deliverables
1	• [redacted]. • Second, we will automate calculation of vital signs to reflect compensatory reserve, an earlier and more sensitive marker of decompensation. • Third, we will deploy a daily symptom survey on our mobile tablet specific to COVID-19 symptoms not captured by our sensors (e.g. appearance of characteristic skin findings or loss of taste/smell with independent prognostic value).	Deliverable: [redacted]

2A	We will [redacted] (b) (4) [redacted] (nurses, physicians, close contacts of COVID+ individuals) leveraging (b) (4) [redacted] existing monitoring, surveillance, and testing infrastructure for 3 months continuously. A power analysis is detailed later on with each subject generating ~2,000 hours of data with an expected 48 positive cases.	Deliverables: final clinical trial report from first to final patient enrollment.
2B	We will review our survey and physiological results from our sensor and app for positive and negative tests via the medical record and compare them to healthy controls to train machine learning algorithms.	Deliverables: Predictive algorithms for early COVID-19 infection.
3A	We will [redacted] (b) (4) [redacted] where we will enable low cost and accurate patient monitoring by pararescuemen, during en route care, and in military treatment facilities.	Deliverables: (b) (4) [redacted]
3B	This will be validated by human testing in (b) (4) [redacted] (n=20) subjects with the (b) (4) [redacted] to demonstrate sensor performance, data quality, and user-reported comfort.	Deliverables: demonstration of system's applicability in a military context
4	Sibel is an FDA-registered, ISO-13485 medical device manufacturer with an established North American only supply chain. We have the current capability to produce (b) (4) [redacted] monthly. However, we will establish a clear production plan and vet domestic vendors that can enable higher scale production (b) (4) [redacted] within 15 days of EUA. increase scalability	Deliverable: high scale domestic manufacturing plan
5	Obtain FDA feedback in a Q-Sub meeting followed by EUA within 9 months	Deliverable: FDA EUA

Requirements

The **overall objective** of the program is to obtain FDA EUA for the (b) (4) [redacted] for pre and early symptomatic detection of COVID-19 infection. The key needs are listed here:

Key Needs
1. Designed for pre-detection and early-detection of infection and pathogenic response.
2. Continuous wearable functionality with low user burden with a single device is preferable.
3. Easily interpretable data by non-technical personnel. The data should be easily saved, transmitted, and shared securely in a HIPAA compliant manner.
4. Operates and stored: (b) (4) [redacted]
5. Physiological signatures yield predictive algorithms that are verified by subsequent antibody/molecular measurements.
6. Established manufacturing capability for the platform on a large scale.
7. FDA EUA within 9 months of start of the program.

Our sub-objectives and scope are summarized below.

- **Objective Aim 1**: Design, validate, and rapidly develop a COVID-19 specific analytics platform and accompany mobile application. We will expand beyond our current abilities to display and calculate core vital signs to include advanced metrics of physiological respiratory-specific digital biomarkers (e.g. cough count, cough intensity, respiratory effort), compensatory reserve (e.g. heart rate response to physical activity stressors), , and a COVID-19 specific psychometric survey for patient reported symptoms to improve the ability to generate predictive algorithms. This will serve as the basis for a new software platform acting as a medical device that will be submitted to the FDA for EUA.
- **Objective Aim 2:** Conduct a single-arm, open-label observational study of at least n=322 subjects at high-risk of contracting COVID-19 at (b) (4) [redacted] wearing our sensor continuously in order to establish predictive algorithms of asymptomatic and early symptomatic infection confirmed by subsequent antibody / molecular assays.
- **Objective Aim 3A:** To establish strong military relevancy, this RPP will also support integration of our soft, flexible family of sensors (b) (4) [redacted] platform via a software development kit (SDK).
- **Objective Aim 3B:** We will then conduct a single-arm, pilot study of n=20 pararescuemen during en route care, and in military treatment facilities with this integrated (b) (4) [redacted].
- **Objective Aim 4:** Establish and validate a high volume manufacturing plan that extends our ability to increase production to at least (b) (4) [redacted] monthly with a focus on domestic vendors.

Deliverables

Deliverables
• (b) (4) [redacted] for iOS and Android
• Clinical report on patient enrollment, adherence, and enrollment
• Finalized predictive algorithm model and performance criteria
• Demonstrated MVP and test report for (b) (4) [redacted] mobile application
• Updated cost and lead time estimates in the context of a high volume manufacturing plan
• FDA EUA within 9 months of project start

Milestone Payment Schedule

MTEC Milestone #	Significant Event	Due Date	Program Funds	Sibel Cost Share
1	Kickoff meeting with DOD to review GANTT chart with project plan.	7/31/2020	$(b) (4)	(b) (4)
2	IRB modification submitted	8/15/2020	$(b) (4)	$(b) (4)
3	Mobile and Algorithm Package for COVID-19 Completed	9/15/2020	$(b) (4)	$(b) (4)
4	First Patient Recruited	9/30/2020	$(b) (4)	(b) (4)
5	Quarterly Report 1 (July-September)	10/25/2020	(b) (4)	(b) (4)
6	Quarterly Report 2 (October-December)	1/25/2021	(b) (4)	(b) (4)
7	Final Data Report	4/15/2021	$(b) (4)	$(b) (4)
8	EUA Submitted	4/30/2021	$(b) (4)	$(b) (4)
9	Final Report	4/30/2021	(b) (4)	(b) (4)
	Total		$2,396,958.00	$(b) (4)

Shipping Provisions

The shipping address for all matters:

(b) (4), (b) (6)