

AFRL SBIR/STTR PHASE I & II Debriefing Worksheet (Final)

Proposal Number: F161-088-1073

Topic Number: AF161-088

Company: Zeidman Technologies

Proposal Title: Synthesizing Application Specific Operating Systems (ASOS) for Present and Future Compute Architectures

Evaluation Criteria: (Evaluation criteria are found in Section 6 of the DoD SBIR Program solicitation FY16.1)

Criterion a: The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.

Strengths:

Zeidman Technologies is proposing their SynthOS as the basis for meeting the objectives in the topic. The proposal states that “SynthOS is a patented software tool that takes software tasks written by a developer and automatically generates a real-time embedded system using parameters set by the developer. SynthOS takes input code in the C programming language and produces output code in the C programming language”. The proposal then describes how their particular product (SynthOS) compares to typical off-the-shelf Real-Time Operating Systems (RTOS) implying that their product is in fact a Real-Time Operating System (page 1) of a sort, only better. The proposal then goes on to describe the SynthOS (pages 2-4). Finally, starting on page 4, the proposal turns toward addressing the topic objective.

The offeror proposes to solve the challenge of multitasking embedded systems by leveraging SynthOS to develop an Application Specific Operating System (ASOS) that controls the execution of individual tasks [Proposal Page 3, paragraph 3]. Offeror outlined the programming challenges associated with the development of a custom Real Time Operating System (RTOS) to control multiple software (SW) tasks on networked embedded systems [Proposal Page 1, paragraph 4], and identified the proliferation of interconnected devices, often called the internet of things, as driving the need for a tool that automates the creation of a RTOS according to the requirements of the tasks that the system needs to perform [Proposal Page 2, paragraph 3]. Proposal does a good job of motivating the need to manage SW tasks between interconnected embedded systems, and outlines a logical approach to overcome these challenges.

An RTOS is intended to serve real-time applications that require very precise timing and high reliability. They are intended to reduce or eliminate the variability in the time required to service a task normally found when competing tasks are run in a general purpose operating system. The custom RTOS proposed by the offeror allows greater control over how tasks are scheduled and how memory is managed than that found in standard RTOS. This approach also appears to have benefits from the point of view of system security.

The offerors claim that the greater control they provide over process scheduling and memory management yields significant performance benefits

Weaknesses:

This proposal centers on the use of SynthOS to manage the communication and scheduling between different tasks. It is specifically stated that “*SynthOS automates the process of creating the operating system so that the engineer can focus on writing the tasks that are specific to the devices [Proposal page 3, paragraph 3]*”. This is a fundamental difference between the offeror’s approach and the solicitation objective. The objective of this solicitation was to develop a tool that would **automate the generation of optimized SW tasks/code for specific devices**. This was the intention behind the following excerpts from the solicitation: “*This topic requests the development of a tool that accepts C-language code for a suite of algorithms and outputs optimized code that can be compiled for a selected device*” and “[e]stablish methodologies that support rapid platform-agnostic code generation capable of efficiently mapping algorithms to platform-specific features and exploiting available optimizations” (Solicitation, Technology Area AF161-088, page AF-126).

The platforms of interest to the Government were identified in the solicitation, “*...future compute architectures (e.g., RADSPEED, MAESTRO [Tilera], ARM, GPU, FPGA and X86 64)*” (Solicitation, Technology Area AF161-088, page AF-126). These processors include digital signal processors (DSPs), multi-/many-core processors, graphical processing units (GPUs), and field programmable gate arrays (FPGAs). There are fundamental differences in the architecture of these devices, and accordingly, there are different programming constructs required to make optimized use of their respective computing capabilities (CUDA, VHDL, OpenMP, etc.). FPGAs and GPUs, for instance, do not run real time operating systems, but instead operate as co-processors or as streaming logic. Identification of these platforms, along with the requirement to generate optimized code for multi-core and hardware architectures was stated in the topic area as: “*Establish methodologies that support rapid platform-agnostic code generation capable of efficiently mapping algorithms to platform-specific features and exploiting available optimizations.*” (Solicitation, Technology Area AF161-088, page AF-126). Nowhere in the solicitation were problems requiring real-time operating systems for their solution enumerated as an issue to be addressed.

There is little information in the proposal that discussed how SynthOS will actually be used to address the topic objective. The first paragraph of the proposal under “Technical Objectives” (on page 4) is simply a restatement of the topic objective and included a short discussion as to how the proposed technology will be modified or tailored to address the topic objective. The last sentence of that paragraph states “Our objectives are to demonstrate a solution with the following characteristics:” followed by an itemized list (1 through 7) of characteristics of the product. Nowhere are the enumerated solution characteristics correlated to the objective of the topic area, nor is there any indication how such a solution will achieve the topic’s objective. Rather, these seven characteristics appear to be aligned with objectives of the offeror’s design, but DO NOT address the topic area objective. These characteristics are referenced in the proposal to explain how SynthOS will be used to generate an application specific operating system (ASOS), a type of operating system, but fail to explain how SynthOS will be utilized as a solution to the topic area. In a nutshell, the proposal does not demonstrate how the proposed technology will make incremental progress toward the topic solution, resulting in the assessment of a significant weakness in the proposal.

In addition, it is not clear what innovation is being proposed. The SynthOS tool is already a patented software product [Proposal Page 10, Table 2] and there is no explanation to show that commercial product will be expanded upon, modified, or otherwise further innovated as required by DoD Small Business Innovation Research (SBIR) Program Solicitation FY16.1, paragraph 4.1, wherein it states that proposals must provide sufficient information to demonstrate to the evaluator(s) that the proposed work represents an innovative approach to the investigation of an important scientific or engineering problem and is worthy of support under the stated criteria. Failing to demonstrate an innovative approach to the investigation of the problem presented by Technology Area AF161-088, is considered a significant weakness of the proposal.

Criterion b: The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the research and development but also the ability to commercialize the results

Strengths:

The key investigators are well qualified to perform the software development activities associated with the proposed effort. The PI has 25 years of hands-on software, hardware and manufacturing experience. Co-investigator has been recognized multiple times by the IEEE for outstanding achievements in engineering. The proposal specifically identifies an advisor with ample marketing experience who, presumably, would help formulate a strategy for the commercialization of the SBIR developed technology.

Weaknesses:

Costs associated with the marketing advisor are not shown in the proposal so it is unclear how much influence that person will have over the commercialization strategy. Proposal would benefit from a sentence or two describing the marketing advisor's level of effort in creating a commercialization strategy.

Criterion c: The potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization as assessed utilizing the criteria in Section 6.

Strengths:

The commercialization strategy identifies a terrestrial application for this technology; specifically, the need to manage the interplay between various software tasks on networked embedded systems.

Weaknesses:

The commercialization strategy makes no mention of specific military/space applications for the proposed technology. Commercialization strategy is essentially a restatement of the anticipated benefits section and does not offer sufficient detail for the evaluators to use in evaluation of offeror's method for transitioning the product into the market. Proposal could benefit from discussion on transition approach (SW license agreement, service contracts, etc.) and could benefit from an estimation of value proposition.

Debriefing Summary:

This proposal centered on the use of the offeror's patented technology (SynthOS) to manage the communication and scheduling between different tasks. The proposal states "SynthOS automates the process of creating the operating system **so that the engineer can focus on writing the tasks that are specific to the devices** [*Proposal page 3, paragraph 3*]". This is the fundamental difference between the offeror's approach and the objective of the topic area. The objective of this topic area was to develop **a tool that would automate the generation of optimized SW tasks/codes for specific devices**. While the proposed technical effort is interesting and has inherent technical merit, it does not address the primary objective of the topic area or demonstrate how it will incrementally progress toward a solution for the problem posed by the topic area. Failing to address the primary technology objective of the topic area is a significant weakness of this proposal.

Additionally, the offeror proposes leveraging its patented commercial product to meet the objective of this SBIR topic. However, the proposal did not explain, and therefore there was limited ability by the evaluators to understand, how the offeror intended to further innovate the patented technology to meet the intent of Technology Area AF161-088 as required by DoD Small Business Innovation Research (SBIR) Program Solicitation FY16.1. This is considered a significant weakness of the proposal.

Because of these two significant weaknesses the proposal was evaluated to have a score for the first criterion (soundness, technical merit, and innovation) lower than the other proposals for this topic area. As this was the most important of the evaluation criterion, the overall score was lower than the other proposals, and the proposal was not recommended for award.