HBSS Agile Development Methodology

HBSS follows a very strict Agile Software Development Methodology based on Scrum. Agile methods are based on iterative and incremental development where all the requirements are not a pre-cursor to software design and development. As expressed earlier user requirements and experience evolve in an iterative manner and solutions evolve through collaboration between self-organizing, cross-functional teams. The Agile development promotes adaptive planning, evolutionary development and delivery, a time-boxed iterative approach, and encourages rapid and flexible response to change. In this section we will describe our Scrum

Figure: Agile Software Development

approach to software development, which will be applied to the development of myridenorthtexas.org website and the associated software.

The main portal and each of the subportal will be designed, developed and released using the Agile methodology. The remainder of the section describes how the different tasks listed in Appendix H of the RFP will be performed using this methodology, for each of the subportals and the main portal described earlier.

HBSS Agile Requirements Gathering Methodology

HBSS, while working closely with its existing clients has developed a very unique method of generating realistic requirements and because of this approach 99% of HBSS software features are utilized by the users. It is based on a simple observation that:

> *"Software is a tool that allows users to do their job faster, more accurately and with reduced stress. If the tool is not understood they will not use it."*

HBSS has long ago discarded the thesis of gathering all the requirements up front as a) they are gathered in a conference room not on the desk of the user when they are working, b) they are at a high level and usually gathered by 'nudging/coaxing' the user as opposed to in a free flowing environment where users can think deep, and c) developers do not relate and need to go to the users anyway. HBSS conducts a) **Scope Identification** - a preliminary discussion with stakeholders on identifying operational/functional challenges, development of initial

requirements by white boarding, screen sketching and power point animation; b) by **Iterative Modeling and Model Storming**, firming up on user interface screens and business rules by drilling down into functional details, finally developing a work plan and sharing of an high level architectural vision – so stakeholders can conceptualize the solution strategy; c) using a **Test First Approach** by rapid prototyping and allowing stakeholders and beta testers to click through and type in, develop a final requirements which are tested again with stakeholders and beta testers.

Continuous planning and design keeps the team and the system honed in on maximum business value by the deadline.

Agile Design Methodology for the Web Portal Development

The next stage after completing the Iterative Agile process of requirements gathering is the firming up of the Functional Design and the System Design. The former leads to application development framework, the latter to system architecture development.

The **functional design** process can be described in five (5) basic steps:

Assembly of all Requirements Artifacts: During requirements gathering several artifacts are gathered in an opportunistic manner. The requirements process attempts to refine and complete the missing holes as much as possible. ***Top-Down Validation and Refinement of Logical Model/DFD:*** Each user interaction is then traced from the top through all functional tasks, data stores and up until a final archival. This allows the HBSS team to evaluate any missing steps, missing requirements, missing users, missing 3rd Party components etc. ***Finalization of Functional Flow (DFD):*** Each DFD bubble is classified as a functional component to be fully defined either by further decomposing the DFD or if it cannot be further decomposed handed over to the software development team as a 'functional specification' of a 'component'. ***Creation of Data Dictionary and System Objects:*** The data elements gathered allow creation of formal data objects which map fairly closely the paper documents that record various pieces of information required to run the operation (e.g. a trip request is a data object and a driver record is a data object). ***Creation of Functional Design Document:*** The functional descriptions and data elements combined with user requirements upgrading and high level data model development leads to development of a functional design document. This document defines the overall structure of the product from a functional viewpoint.

*The following elements from the previous phases are firmed up in this phase, and are the necessary steps needed to create a formal **System Design Document**.*

[Technology Stack](#) ***Creation:*** Technology stack diagrams are provided with this proposal that will identify all the layers in the stack and the various technology components that will be required as well as any 3rd Party system components.

[User](#) ***Interface (UI) Flows Finalization:*** User interface (UI) navigation or UI-flow diagram, are the follow up from DFDs created in the functional design. Each function identified is

represented by one or more mock-up screens (continued and expanded from requirements phase).

Business Domain Model Completion: The business model finalization is an important part of complete system design. This model, that starts evolving from the requirements gathering phase is completed and ratified in this phase. It documents all of the business entities (big and small) and documents the business relationships between them.

Change Case Documentation: The DART project is designed with a futuristic viewpoint and several requirements for future development (change) like Route Optimization are already articulated. There are 2 types of changes that need to be documented: Technology changes and Business changes.

System Design Document Creation: After completing the design phase, the HBSS team will assemble the individual results of the system design process in a System Design Document (SDD). This document will completely describe the system at the architecture level, including subsystems and their services, hardware mapping, data management, access control, global software control structure, and boundary conditions.

Agile Development Methodology Using SCRUM

Scrum, the Agile method deconstructs tasks into small increments so that with minimal planning, software can be designed and developed. The time periods typically last from one to four weeks. For each iteration a cross functional team works in all functions: a) planning, b) requirements analysis, c) design, d) coding, e) unit testing, and f) acceptance testing. HBSS will, at the end of the iteration a working product is demonstrated to DART and its partners. This approach will a) minimize overall risk, b) keep DART and its partner aware of the progress, c) modify and adapt the project to user feedback, and d) steer the project in a user requirements driven manner. Even though a single iteration may not result in a release, but can be accumulated to meet the release milestones.

HBSS SCRUM Roles

Product Owner
The Product Owner will be the Technical Project Manager that will represent DART and its partners – who are the voice of the customer. He is accountable for ensuring that the team delivers value to the business.

Development Team
The HBSS Development Team will be responsible for delivering stated sub-goals in the development life cycle of the Myridesnorthdallas.org website and the web portal, at the end of each Sprint (the Sprint Goal). The HBSS team will be made up of 7 +/- 2 individuals with cross-functional skills who will do the actual work (analyse, design, develop, test, technical communication, document, etc.).

Scrum Master
The HBSS Scrum Master will be responsible for removing any impediments in the ability of the team to deliver the sprint goal/deliverables. The HBSS Scrum Master role is strictly to supervise

the Scrum process and will exclude people management which will be managed by the project manager.

The HBSS Scrum process

Sprint

Each development unit in the Scrum process is defined as Scrum. For example design of the Fixed Route Bus Itineraries can be defined as a Sprint. The time allocated for this sprint may be 1 week. The concept is called "timebox"; that is, it is restricted to a specific duration (min. is 3 days, max is 2 weeks).

Meetings

Each sprint will be preceded by a planning meeting, where the tasks for the sprint are identified and an estimated commitment for the sprint goal is made, and followed by a review or retrospective meeting, where the progress is reviewed and lessons for the next sprint are identified.

Presentation and Acceptance of Design

Agile development methods focus rigorously on **delivering business value early** and continuously, as **measured by running, tested software**. From week to week and from iteration to iteration, the HBSS team will track how many running, tested features they are delivering.

This approach helps creating a solution design and product that matches user requirements very closely and the acceptance of Design becomes more of a 'knocking of finer points' rather than a large scale evaluation of system design.

Following the Agile methodology, HBSS will keep DART team, the stakeholders and other partners in complete partnership from day one.

Software system refinement based on partner and public interface beta testing and feedback

The Myridenorthtexas.org portal when developed will be in continuous refinement from requirements stage to design to development and deployment stages. By reflecting on what features we have completed using both hard metrics like running, tested features and more subjective measures, we can then adjust our estimates and plans accordingly.

Edge Due to Continuous Beta Testing

With continuous testing the HBSS scrum team deterministically measure progress and prevents defects that may linger through the life of the project and then surprise everyone at the end of the cycle. HBSS team is continuously cranking out only the running and tested features. This enables us to reduce the risk of failure, lateness in the project.

Emergent Feature Discovery During Beta Testing

As opposed to spending weeks or months detailing requirements as in waterfall systems, and then arguing at the ending of delivery why the users did not point out flaws in the design and the requirements early on, the Agile development projects quickly prioritize and estimate features, and then refine details when they emerge during different phases of testing including late beta testing stages.

HBSS' Custom Portal Design and Development Methodology

Agile Web Development Approach

As described elaborately HBSS follows the Agile software development process and will use the same methodology with web development. This methodology will streamline the project and will allow HBSS team to spend quality time on actions that add value to the website and make it better.
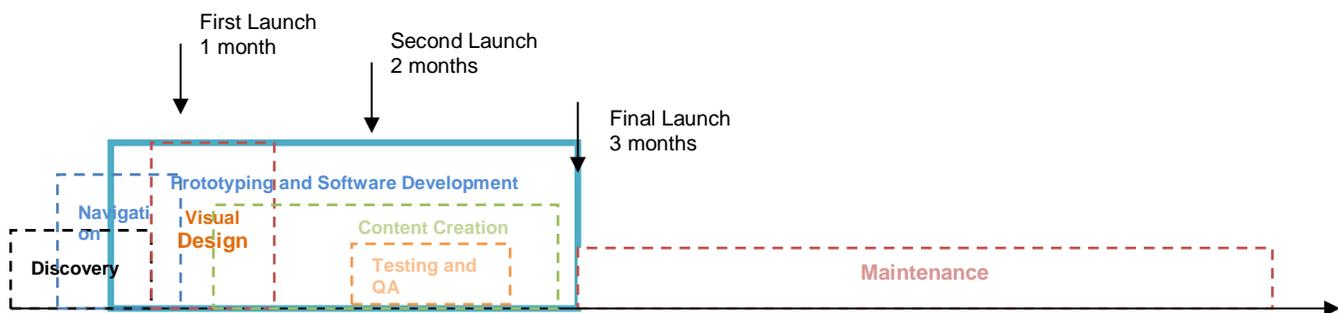

Figure: Agile Web Development Methodology (All tasks are broken into Sprints and Agile methodology is followed to speed up the Tasks). Software Development starts early in the form of Prototyping.

In the process shown above, HBSS team's web editors are interacting with content and navigation on day one. Navigation is fluid, and HBSS team is getting in front of users faster.

Website Look and Feel

Our general approach is built upon the following: a) **Affordance:** The UI displays visual clues indicating its next step: users do not "guess" their interaction; b) **Expectation:** Functionally, the UI delivers predictable results based on experience or standard UI conventions; c) **Efficiency:** The UI lets users perform an action with minimum effort. If the intention is clear, the UI delivers expected results *the first time* so users do not need to repeat efforts to achieve the desired action; d) **Responsiveness:** The UI provides immediate feedback indicating the action is in progress, and was successful/unsuccessful; e) **Forgiveness** If users make a mistake, it is easy to change or "undo" their action; g) **Explorability:** Users can navigate throughout the UI without penalty or "getting lost"; h) **No frustration** Users are emotionally satisfied with the interaction,

Cross Browser Compatibility

Any designed portal will be compatible with major web browsers including recent versions of Microsoft Internet Explorer, Mozilla Firefox, Google Chrome and Apple Safari. Any scripts used in the portal are categorized as cross-browser. Additionally the proposed portal design will have the following:

- It will not require the users to download plug-ins.
- Website will be developed on technologies that will enable cross platform deployments

ADA Requirements

The implementation of Section 508 compliance assures accessibility to web content, for example: text descriptions for visuals so users with a visual impairment, or users requiring screen readers and refreshable Braille displays, can access the content. The screen reader JAWS uses an integrated voice synthesizer with the computer's sound card to output electronic content.

Automatic Partner Content Augmentation

HBSS will develop a fully customizable website which will have full integration with the You Tube Data API. This API will allow the website to perform many of the operations available on the YouTube website such as search for videos, retrieve standard feeds, and see related content.

Work Management, Program and Cost Control

Partner Involvement

Since HBSS team will adopt the Agile Development methodology speed is of essence. Each task will be broken down into smaller tasks, and then assigned a specified time to complete it. Since human relationship cannot be achieved in time bound manner, the Agile methodology will allow us to demonstrate early capabilities to accelerate the buy-in, and carry out multiple efforts simultaneously – which should significantly reduce the risk of cost over-runs.
Agile methodology also allows a very tight Work Management control using the concept of 'Sprints'. The project manager will be managing the relationship and each relationship will be evaluated based on metrics and parameters such as: a) Executive Commitment level, b) Integration Level, c) Commerce Level, d) Match Capability Level and e) Resource Availability Level. The partners and their designees will then be engaged appropriately. This will ensure no expectation mismatch and all partners will be able to participate in the best way they can. The partnership level may change with time and engagement.

Software Development, Testing and Deployment

Requirement Gathering

HBSS' project manager will be meeting regularly with the various stakeholders as described in the partner involvement task. DART stakeholders will be involved in discussions and sharing of screen shots, architectural design, and final assessment of requirements stack. The methods used will include but not be restricted to **Identifying function Owners** - Call takers, Schedulers, dispatchers, case workers, transportation coordinators etc. The **HBSS Scrum Team** will be Assembled, among them the Scrum Master, UI/UX expert, Subject Matter Expert (SME) and project manager, and developers. **Collection of Useful Documents** - Existing documents such as agency policy manuals, existing legacy systems, or publicly available resources such as information on the web, books, magazine articles, or the products and services of 3rd Party systems (other websites) will be collected.
The program and cost control are built in the methodology as the entire process is very closely scrutinized.

Tools for Recording Requirements

The various artifacts that will be generated during the requirements gathering process will include some or all of these: a) Acceptance Test; b) Business rule definition, c) Change case, d) CRC model, e) Constraint definition, f) Data flow diagram (DFD), g) Essential UI prototype, h) Essential use case, i) Feature, j) Technical requirement, k) Usage scenario, l) Use case diagram, and m) User story.

Methods Used for Eliciting Requirements

The various methods that may be used during the requirements gathering process will include some or all of these: a) Active Stakeholder Participation, b) Electronic Interviews, c) Face-to-Face Interviews, d) Focus Groups, e) Joint Application Design (JAD), f) Legacy Code Analysis, g) Observation, h) On-Site Customer, i) Reading.

System Engineering, Design and Planning

The systems engineering, design and planning work will be managed by the HBSS Scrum Team along with regular Scrum meetings. HBSS will have a dedicated project meeting room in its Lowell office with multiple white boards. Each day during 'the sprint', a project team communication meeting occurs. This is called a daily scrum, or the daily standup. This meeting has specific guidelines: a) team comes prepared, b) starts on time, c) happens at the same location and same time, d) meeting length is 15 – 30 minutes, e) any power point will be no more than 20 slides and no more than 20 seconds will be spent on each slide (Pechakucha 20x20 method), f) designated members speak, all can listen, g) members will answer what they have done since yesterday, plans for today, and any impediments, and h) all detailed discussions to happen one on one.

Backlog Refinement

HBSS feature refinement (called backlog refinement in Scrum) process involves storyboarding (much like creating a movie scene). The stories created are described using Data Flow Diagrams (DFDs) where each bubble is a 'function or task carried about by the user' and the arrow describes the 'data' flow from one function to another. The stories (DFDs) are decomposed into smaller ones till they can be 'programmed' by one person in less than a day. So the risk that project will get beyond control are low. The Scrum Master keeps a track of all the backlog refinement process and encourages team to keep moving forward. These backlog meetings have their own criteria: a) 60 minutes or less, b) tasks are not defined in these, c) determination if further refinement is needed.

Scrum of Scrums

Each day normally after the Daily Scrum, multiple teams (designated persons) will meet briefly to discuss any areas of overlap and integration. They will evaluate project status, next set of objectives and if any impediments have arisen and how to solve them.

Sprint Planning Meeting

At the beginning of the sprint cycle (every 3–15 days), a "Sprint planning meeting" is held where: a) Sprint 'work' is selected, b) a sprint work backlog is created along with resources allocated to the 'work', c) time allowed for the sprint, d) maximum 4 hours is allocated for this planning meeting. The output is a backlog document that includes the storyboard for the sprint, the tasks to be performed and resources allocated.

End of cycle

At the end of a HBSS sprint cycle, two meetings are held: the "Sprint Review Meeting" and the "Sprint Retrospective".The Sprint Review Meeting requires: a) review of work completed, and not completed, b) demo the software to DART and its partners if feasible, else to internal stakeholders, c) demo less than

30 minutes, and meeting less than 2 hours. The Sprint Retrospective Meeting requires: a) All team members to reflect on past sprint, b) suggest process improvements, c) determine what went well and what did not and address the concerns.

Software Development

We at HBSS follow simple but very effective five-step process for managing software development. The sprints or tasks have the supporting artifacts in the form of user stories, use cases, DFDs, user interviews, functional specifications, data objects, data model and business rules, and business model. These artifacts as control tools to manage software development exercise.

Task Decomposition: In this step the HBSS team monitors tasks and continues to split big-tasks into multiple smaller tasks and identifies the time for each task **Task Assignment :** On the first day of the period of time (time-box), HBSS has a meeting where developers are explained their work and the amount of time it has to be done in. This list is documented by the project manager and reviewed by Scrum Master. This step essentially helps the developers and Project managers in understanding the following items: a) How much of the task the team can do? b) which things provide the most business value, and therefore need to be done first, and c) how much each of those business value things will take to get done. This will reduce risks significantly. **Development Proceeds:** Developers start their time-bound tasks, one task per developer which they test upon copmpletion. **Developmental Task Prioritization:** Scrum Master and the Project Manager meet every day with the teams to see how things are going and cross things off the list when they are done. *Sometimes, to get the more important stuff done first, that means a person who is working on a less important thing has to stop what they are doing, and go help a person who is working on a more important thing. This gives a clear signal that Team and hence the project is focused on priorities.*
Times Up, Verification and Validation At the end of the amount of time for a task, the Project Manage and the Scrum master review the solution, and if ok, move to the next task.

Presentation and Design Acceptance

The Agile process requires continuous presentation and acceptance process, whether it is a prototyping effort, a design decision, or feature demonstration or a system constraint. The HBSS team will be presenting and reviewing changes as discovered.

Acceptance Testing and Quality Assurance
An Acceptance Test Procedures document (ATP) shall be provided to test hardware and software components in the field. The ATP includes: demonstration of testable specification requirements and test methods; test results determining success; HBSS and the deploying agency representative responsibilities during testing, and a cross-reference table indicating the contract requirements addressed by each test procedure. The ATP shall incorporate the following distinct testing stages for the proposed system: (1) Installation Acceptance Test (IAT); (2) User Acceptance Testing (UAT).

Beta Testing and Software Refinement

Stratified Feature Release
A very important part of the HBSS' Agile Methodology is Stratified Feature Release approach. The entire product is not released all at once, rather it is released in phases with features that have been developed, tested and user verified released. This approach gives the users access to the system very early and the beta testing feedback is incorporated

These methods will ensure that the project is always under control.

Quality Control

Partner Involvement

The Agile methodology when adapted for partner involvement will provide HBSS team the same level of quality control as for software design and development. Our project team is well versed with the process and will exhibit all caution in maintaining good quality communications. Here are some components of our partner engagement protocol:

- All meetings will be preceded with an Agenda sent at least 1 week in advance (never in a meeting we will walk in cold).
- Sufficient time will be allocated for discussion and questions from users.
- During the meetings the User should be engaged in the most professional and respectful manner (as they may not be tech savvy)
- All demonstrations will be pre-tested before the demo meeting.
- Any proposals for further engagements will be followed within 48 hours.
- All members should be informed about project accomplishments in-between advisory committee meetings as well as individual one-on-one meetings, via Emails, Newsletters, Phone Calls followed by Emails (MOVET project distributes a monthly newsletter to state advisory committee members and veteran services officers via the website Massvetsadvisor.org).

Software Design, Development, Test and Deployment

Through the project review process, HBSS shall consider the following user groups identified by our Partner agency, so that the functional focus is based on these focus groups and all folks are not engaged in all functions – potentially losing their interest: Riders, Prospective Riders, Caregivers (family and friends), and Counselors; Transportation Providers; Partner Owners and System Administrators; Planners and Decision-makers; Applications Developers
The Agile methodology has quality control built into the process itself. The small size of each task (called Sprint), followed by iterative modeling and model storming and prototype testing, keeps the requirement process on track and any loss of control can be quickly adjusted.

Here are some components of our requirements gathering quality control: All meetings will be for fixed amount of time (30 minutes on average, 1 hour max); Members will come prepared for the meeting; Documents needed for the meetings will be sent before hand; Meetings will result in issue resolution; Any disagreements will be handled by the Scrum Master.