

## Systems Engineering Management Plan (SEMP) Training Transcript (09-23-2021)

### Speaker – Deb Curtis (Intro Slides)

So, let us take a few minutes to review the program.

Although most of you are already familiar with it.

Next slide, please.

So, this is a high-level summary of the complete trip ITS4US program.

As you can see there are multiple partners involved with this initiative with the goal of deploying innovative and integrated trips to support mobility for all users with a particular focus on underserved communities.

So, as you can see here, this involves the lead ITS Joint Program Office from the US Department of Transportation, but also involves the Federal Highway Administration and the Federal Transit Speaker: Deb Curtis This will allow us to take revolutionary steps to integrate advanced technologies, especially those that enable Administration. We are looking to make these large-scale deployments that are replicable and address the challenges of planning.

And executing all segments of the complete trip.

We would like to target all users across all modes regardless of location, income, or disability.

Speaker: Deb Curtis

Next slide, please.

So, we have 5 program goals.

And these program goals are spur high impact, integrated complete trip deployments nationwide, this first goal is to assist the transportation industry in tackling the difficult challenge of providing complete trips for all travelers nationwide by streamlining and expediting solution development.

Through pilot deployment.

Yes.

High impact, replicable integrated solutions developed by these pilot deployments.

Will reduce the cost of future deployments of these critical personal mobility enhancements.

The second goal is to identify needs and challenges by populations.

The needs and of the communities to support mobile mobility options for all travelers, regardless of location, income, or disability are important populations within each community have different needs

and challenges for accessing transportation options to improve their quality of life.

The third goal is to develop and deploy mobility solutions that meet user needs.

This will allow us to take revolutionary steps to integrate advanced technologies, especially those that enable adaptive and assistive transportation technologies into the management and operations of the transportation network, including non-motorized modes.

Here we are.

Our goal is to engage key partners within the federal government.

The research community, stakeholder organizations, and private industry to support development of potential solutions for all travelers.

The fourth goal is to quantify and evaluate the impact of the integration of these advanced technologies strategies and applications.

The improvement of safety and mobility of all travelers, quantified impact support, communication of technology benefits to future deployers.

And decision makers.

And finally, the fifth goal is to determine which technologies, strategies, applications and institutional partnerships demonstrate the most potential to address identified barriers to providing complete trips to all travelers in a variety of communities and build environments.

This we also.

The goal is to disseminate the lessons learned from replicable solutions developed by the deployment sites to catalyze additional deployment.

The systems engineering process that we are going to talk about is critical to all of these goals.

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The US Department of Transportation has awarded five teams with Phase One funding to support the development of their deployment concepts. These five deployment sites include the University of Washington, California Association of Coordinated Transportation, Heart of Iowa Regional Agency.

ICF International in Buffalo, NY, and the Atlanta Regional Commission. Next slide please.

There are three deployment phases, and one post deployment phase.

Participants are currently in the first phase concept development where they will develop their ideas to ensure future success in later phases.

They will test and evaluate their projects.

The deployments are expected to sustain operation for at least five years after the program is completed. Next Slide Please.

**Speaker: Deborah Curtis (Task 12 Slides)**

So welcome to the Complete Trip – ITS4US task 12 training.

Yes, we're on task 12 already. So good going guys.

Next slide please.

If any of you by chance don't know me, I'm Deborah Curtis. I'm a highway research engineer with the Federal Highway Administration's Office of Operations Research and Development, but I think I know most of you by now.

Next slide, please.

So today we're going to talk about the systems engineering management plan or the SEMP, which is your task 10 deliverable.

And we're going to go through the template and all of the different components of that, and then give you some final thoughts with some useful references and how you can stay connected to us.

Next slide, please.

Alright, so let's get going with the systems engineering management plan.

Next slide, please.

So the SEMP is where you'll document how your project will conduct all of the systems engineering technical processes, and since many of the projects intend to use agile, this is also where you're going to document that and how that defines your project will be conducted in using agile processes.

So each of your projects has already started defining the systems engineering technical processes in the UNIRP document way back at the beginning, and the SEMP will just continue to define the remaining systems engineering processes.

How your project plans to integrate agile processes into the overall systems engineering process, and a high-level overview of the agile processes themselves.

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So the USDOT strongly encourages all the sites to use the USDOT provided template. Because of the number of sites, the USDOT is requesting that the sites use this same template because this will make for more efficient use of the USDOT and the Technical Support contractor review time and really give you a faster return of comments so that you can begin to address them and finalize your SEMP.

It's also important to use a common template because it will really promote easy replicability for those that come after you that may want to use what you have developed to deploy this in their own area.

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This slide should look very familiar to you all.

It shows how the SEMP relates to the other key deliverables within the project, so you can see everything that we have done in the systems engineering process to date, which is the UNIRP, the ConOps, and then the system requirements, which we just got yesterday. Thank you all so much.

These are inputs to be used into developing this systems engineering management plan, and then really the outputs of this are mostly phase two documents. But you're also going use this to help document how you will use the agile process or the agile software development process in phase two of your project.

Next slide please.

So let's go ahead and get into some of the sections of the SEMP template that was sent to you.

Next slide, please.

So the introduction should really provide a high-level overview of your project.

You can reuse what you already have developed for other deliverables or tweak it if you feel it needs it to be more relative to this document.

But the main purpose of this section is to give your readers an overview of your project and of the system without them having to read the full ConOps or the system requirement documents, because you know, those are a couple 100 pages and not everybody has time to do that.

This is the time in the section where you can concisely articulate what your system is going to do, what your project goals are, and really help people to understand your objectives in a very concise way.

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So section 2 is meant to define the processes that you'll use for the full systems engineering lifecycle. This is broken into 2 main subsections.

The first is the systems engineering process planning, which really covers the overall project organization and the processes that span the full system engineering life cycle.

The second is the systems engineering technical processes, which will cover the individual systems engineering technical processes for the remainder of the SE life cycle.

All of Section 2 should be considered a living document.

I know we've said that about many of the systems engineering documents that you've developed thus far, but in particular it is relevant here and this can provide high level processes that can be developed in more detail as the projects gets closer to executing those processes.

So we don't really expect you to have all the answers right now, but you should have a very high-level understanding of what processes you will be using in your project, and that's what we'd like you to document here

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So the systems engineering process planning covers how the project team is constructed and those processes that cut across the multiple phases of the systems engineering lifecycle.

Some of the upfront sections of section 2.1 cover areas that have already been defined or described in other documents.

So in many cases this information can either be pulled from those documents directly, or you can reference the appropriate sections of those documents.

I'm a big fan of each document being a standalone in and of itself, but that's a lot of information to cut and paste into this document, and it would just end up being very big.

So if you feel that it is more appropriate for you to reference people back to the PMP or to the CONOPS or the system requirements, please feel free to do so in this section.

Next slide please.

So let's break down the systems engineering process planning a little further.

So in section 2.1.5, which is your system milestones and your decision gates, this is where you should discuss those and what those mean within your project.

You should briefly discuss the activities that encompass phases one, two, and three of the ITS4US effort, and how the program transitions between those phases. It should also detail any internal project milestones or decision gates, such as preliminary design reviews, initial operational capability, or even the full operational capability.

In section 2.1.6, you're going to talk about standardized processes.

This section should really list any standardized process that your systems engineering processes are based on, and any standardized development processes that your team will be using, you know, for example these include ISO/IEC/IEEE 15288.1, INCOSE SE Handbook, CMMI, ISO/IEC 90003, etc.

So any of these processes that rely on a particular published standard, that's where you should reference it here.

And then in section 2.1.7, this section should provide an overview of the defect or discrepancy processes that will be used by your project. This could include whether a specific tool will be used for tracking defects or discrepancies, how the defects and discrepancies will be reported. What categories of defects and discrepancies will exist, and really, how will the defects and discrepancies be resolved?

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Moving on to section 2.2, which is the systems engineering technical processes. This is where you define the processes for the remaining activities within the systems engineering vee.

You've already defined processes for user needs and requirements and so you may just reference those in the UNIRP section where you did that in this template.

Again, I'm a big fan of things standing up, a document being stand alone, but that's a lot of information, so please feel free to reference back to the UNIRP if you feel that best suits your needs.

And although other processes will not be conducted until phase two, it starts to define your high-level processes now and that'll really help you ensure a smooth transition to phase two.

Breaking it down a little bit in section 2.2.3, you know this is the section where you should provide high level processes for developing the systems architecture and the systems interfaces.

This should include any traceability between the system requirements and the system architecture and interfaces; tools that will be used to develop the systems architecture; architecture and interface related deliverables and artifacts (such as the systems architecture document, the interface control documents, etc.); and how the system architecture and interfaces will be configuration managed.

We talked a lot about making sure that these are living documents and that we go back and we update things as things change with what we know and with what's possible within our project, but you need a configuration management system to help you to ensure that your architecture and your interfaces reflect all of the changes that happen during your project development.

And then finally in section 2.2.4. This is where you should provide a high-level process for designing the system. That should include how traceability will be maintained between the user needs, the system requirements and system design; any known analysis methods that will be used during the design process; design related deliverables and artifacts (such as your system design document, updated requirements traceability matrix, etc.); and finally, how the system design will be configuration managed.

Again, that's super important to make sure that when we're changing deliverables, when we're changing artifacts and documents, that is reflected throughout the suite of documents.

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Continuing on section 2.2.5, is where you should provide an overview of how the different parts of your system will be developed or procured. In this section you can include which parts of the system would be a new software development, what parts of the system may update, augment, enhance existing software, and which parts of the system may be procured as a commercial off the shelf technology.

For those systems and subsystems that will be developed by the project team, you should note whether the system will use an agile development approach, a waterfall approach, a hybrid approach, or another approach to software development. You don't need to detail the agile process in this section as that will be included in a separate section of this document.

It's important to note that the BAA open-source language states that application enhancements, alterations, or adaptations for the purposes of the deployment that are developed through federal funding are expected to be shared broadly with the community to inform other deployers and prospective deployers.

This includes adaptations to integrate multiple applications together to form a synergistic whole and the center systems engineering documentation, source code, and code documentation are required to be shared with the USDOT and the community.

Existing applications brought to the deployment need not be made open source, although new interfaces and any enhancements are required to be made open source. The SEMP shall identify where the deployment will result in the contribution of open-source code and documentation and shall include a source code management plan.

Additional guidance will be provided in the near future on the development of Appendix C of this document, which will include the source code management plan.

And then finally in section 2.2.6. This is where you should provide an overview of the system implementation, integration and lower level testing (at the unit, subsystem, and integration testing level) and your processes that your project will utilize should also be documented here.

This should really include whether subsystems or components must pass functional tests before starting the integration process and any dependencies between subsystems and or components that need to be met before starting the integration process.

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And we're not quite done yet. This is a very long section, but it is a very important one because section 2.2.7 speaks to verification and validation. This section should provide an overview of the verification and validation processes that your project will use.

This should include how traceability between system requirements and test cases will be managed, a high-level overview of the different levels of testing that will be performed and any interdependencies within those levels, a high-level overview of how the testing program supports the assessment of operational readiness, and verification and validation of related deliverables and artifacts (such as your system test plans, your test cases, your test procedures, your test reports, and other sorts of things).

Section 2.2.8 should provide a high level overview of the typical operations and maintenance type processes.

Areas to consider would include how issues are reported or detected in the operational environment, if there are any specific regular maintenance windows or times and how often they occur (such as Patch Tuesdays, deploying updates late at night, etc.), will there be any specific testing for operations and maintenance personnel or training, are there any specific areas of the system where components are removed and replaced for maintenance offsite (such as signal controllers, those sorts of things).

And then finally section 2.2.9, and this is where you should provide a high level overview of the plans for the system after the conclusion of phase three. This should include for how long the system is expected to operate after phase three, if there will be any anticipated change in who operates and manages the system after phase three, and if the system will continue to receive updates and enhancements. So really sort of your plan for where it goes from here.

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So Section 3 is the agile process application and it's really meant to define your projects agile process and how they integrate into the larger systems engineering process that we've been following here.

Section 3.1 should have a subsection for all the major parts of your system that will be using the agile development process. In each subsection you can detail if that specific development effort will differ from the larger agile process your project will use. For example, if that specific section will have shorter or longer sprint cycles, different core stakeholders, those sorts of things.

And then in section 3.2, this is where you should describe how the agile process will integrate with the more traditional systems engineering process. And for this we need to include the system requirements to epic or user story traceability, how will you decompose those into something that's ingestible in the agile process, and how agile testing supports the overall verification and validation efforts and the operational readiness.

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Continuing with the agile theme, this section should really describe who will be supporting the different agile roles and be sure to include information on how the USDOT and how stakeholders will be included in the agile process. This will usually be a project owner or will be a stakeholder. Here's where you define all the different roles that are so important in keeping an agile development on track.

In section 3.4, this is where you should describe at a high level, any plans for communities of practice that will be set up within your agile processes.

You all have very robust stakeholder communities and stakeholder partners. This is where you should look at which of those stakeholders, which of those partners should transition into your community of practice to really be the one that is supporting you in your development and doing a lot of ground roots thing for you to make sure that what you're doing is appropriate and it's going to meet their needs.

And then additionally, if there are any known or likely communities of practice that exist or that can be started, they can be listed right here in this section.

And then section 3.5 should discuss how your releases and your sprints are planned and the length of the releases and the sprints. So I know two weeks is somewhat common. I have found three weeks to work better in research, at least for micro agile projects, but that's up to you to decide.

And here's where you should discuss how the subsystems using agile will be mapped out on a roadmap setting for each release with the proposed features for that release.

And you can include information on how the minimum viable product (the MVP) of the subsystem will be determined and how that will be worked into your release plan.

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And then in section 3.6 this is where you should discuss which agile development tools you're planning to use, how access will be granted to those tools, and the types of roles and their associated privileges for each role.



And here you should include information on what tools you plan to use to manage, test, and deploy the subsystem and what potential subsystem environments you plan to deploy, such as development, staging, production etc.

And then finally in section 3.7 you should discuss how the agile user demonstrations will be conducted, how user feedback will be gathered and prioritized, and how the subsystem releases will be deployed after the agile user demonstrations are complete.

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Finally we get to Appendix C, which is the source code management plan. As you heard before, this is required in the BAA, so Appendix C of this document will contain this source code management plan, and this appendix will further detail your open source code and your documentation processes and how you plan to do those. And we are developing further guidance and training that we'll be providing to you in the near future related to this.

So for now start thinking about what tools you're going to be using, how you're going to be managing your code, where your code is going to be hosted, how you're going to give people access to it, and all these things that go into a successful agile development effort.

But we'll provide you with more guidance about what we're looking for to sort of tick all the boxes for the source code management plan in the near future, but in the meantime, I think there's a lot of information that you all have that can get you started thinking about what this is going to look like.

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Just some final thoughts for you today.

Next slide, please.

As always, you know we're going to provide you with some useful references.

You know there's IEEE resources that are standards, but can provide guidance about systems engineering documents, as we've seen before, and as we've said many times these are eligible as purchases under this effort.

Then there's other FHWA developed documents and one from North Dakota DOT that really provide some guidance and some information about systems engineering principles and approaches, and then the last one noted here is NASA resources, which we've included in the template and contains great information on writing a good requirement.

I've seen a number of your systems engineering deliverables coming in recently referencing the NASA resources and I think that's great because they really are a tremendously valuable resource for you.

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So if you have any questions, please feel free to reach out to us. My contact information is here, Elina's contact information as the program manager, and also the website which I'm sure you all are very familiar with.

Please feel free to reach out to us if you have any questions, if you have any concerns, if you want some feedback and maybe just a quick check of things before you proceed all the way down the path. But when you do this, please make sure that you copy your COR and Elina as the program manager.

I am just one of your leads as the systems engineering lead for this project so I cannot provide you with any direction, technically or otherwise that is not blessed by your COR, so please make sure you include them in any correspondence. You've all been very good about doing that thus far, I don't think it'll be an issue, but it doesn't hurt for me to mention it again just so that we don't miss that.

So with that next slide, please.

We will now go into the Q&A portion.