

Simple Strategic Planning Visualization Tool



PRESENTED BY

C. Davis (Author/Presenter)

J. Samberson, B. Steinfeldt, J. Gilbride (Co-Authors)

Challenge

Feasibility Evaluation

Context of NSE Activities

Tool Requirements

Tool Overview

Benefits

Extension

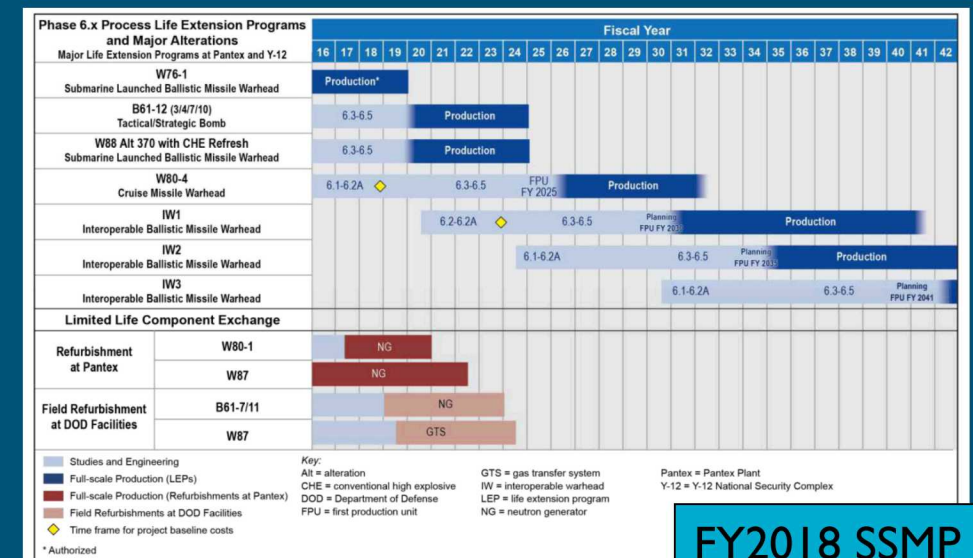
Q&A

Challenge

- The National Nuclear Security Administration (NNSA) has the mission to maintain the nation's nuclear deterrent through life extension programs and major alterations
- FY2018 Stockpile Stewardship and Management Plan (SSMP) identified timeline of activities over next quarter century
- Three months later, the Nuclear Posture Review identified a need for significant changes to the plan:
 - Modify a small number of existing warheads on submarine-launched ballistic missiles for a low-yield option
 - Pursue a modern nuclear-armed sea-launched cruise missile
 - Complete the W80-4 one year earlier
 - Start the W78 replacement warhead one year earlier
- The Nuclear Security Enterprise (NSE) needed to assess the feasibility of these (and ultimately other) proposed stockpile changes



<https://www.energy.gov/nnsa/missions/maintaining-stockpile>

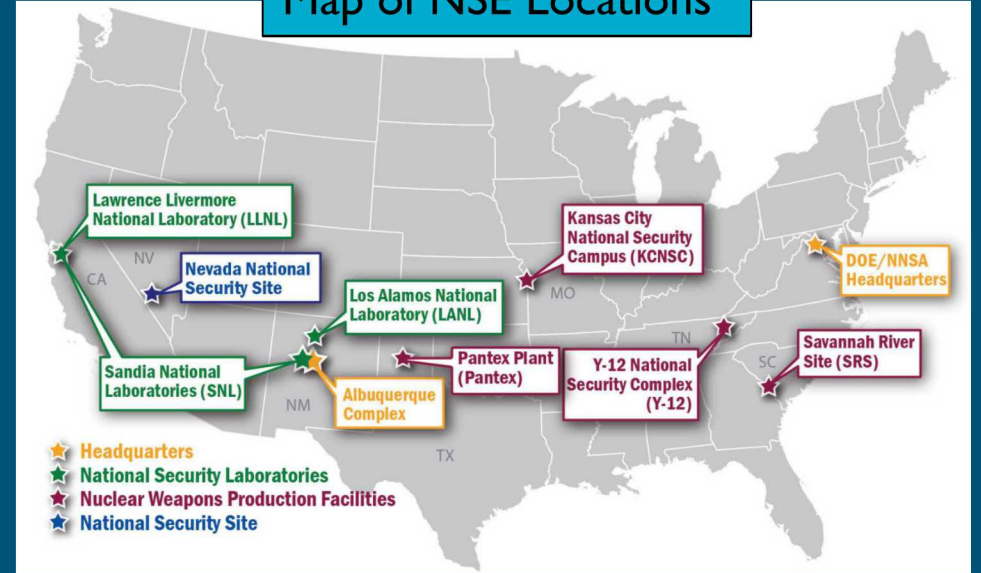


FY2018 SSMP

4 Feasibility Evaluation

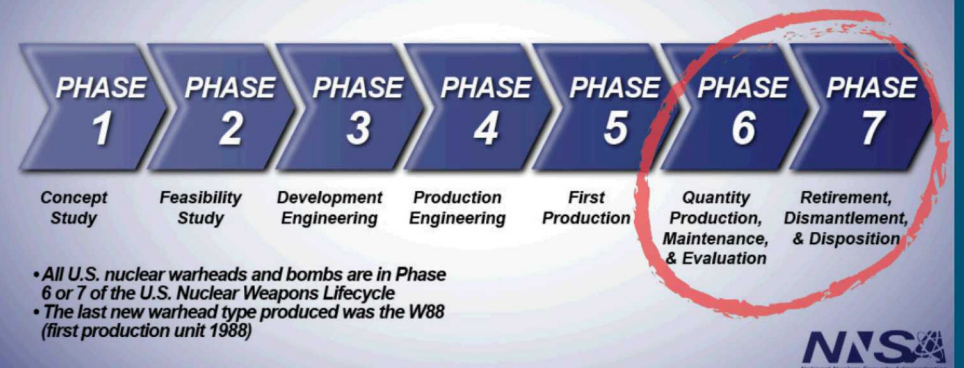
- Stockpile feasibility analysis must:
 - Include key (constraining) activities/elements of entire NSE
 - Reflect business rules and operations of the NSE
 - Represent all phases and activities of weapon system:
 - Design
 - Development
 - Production
- Tool proposed to automate and expedite analysis
 - Simple strategic planning visualization tool for NSE operations
 - Show overview of numerous parallel activities across decades with an ability to highlight points of significant resource demand
 - For hands-on use by high-level decision makers
 - Deployed on individual computers at various locations within the NSE and not require special software licenses
 - Involve input of simple, focused data sets, and run in real-time

Map of NSE Locations



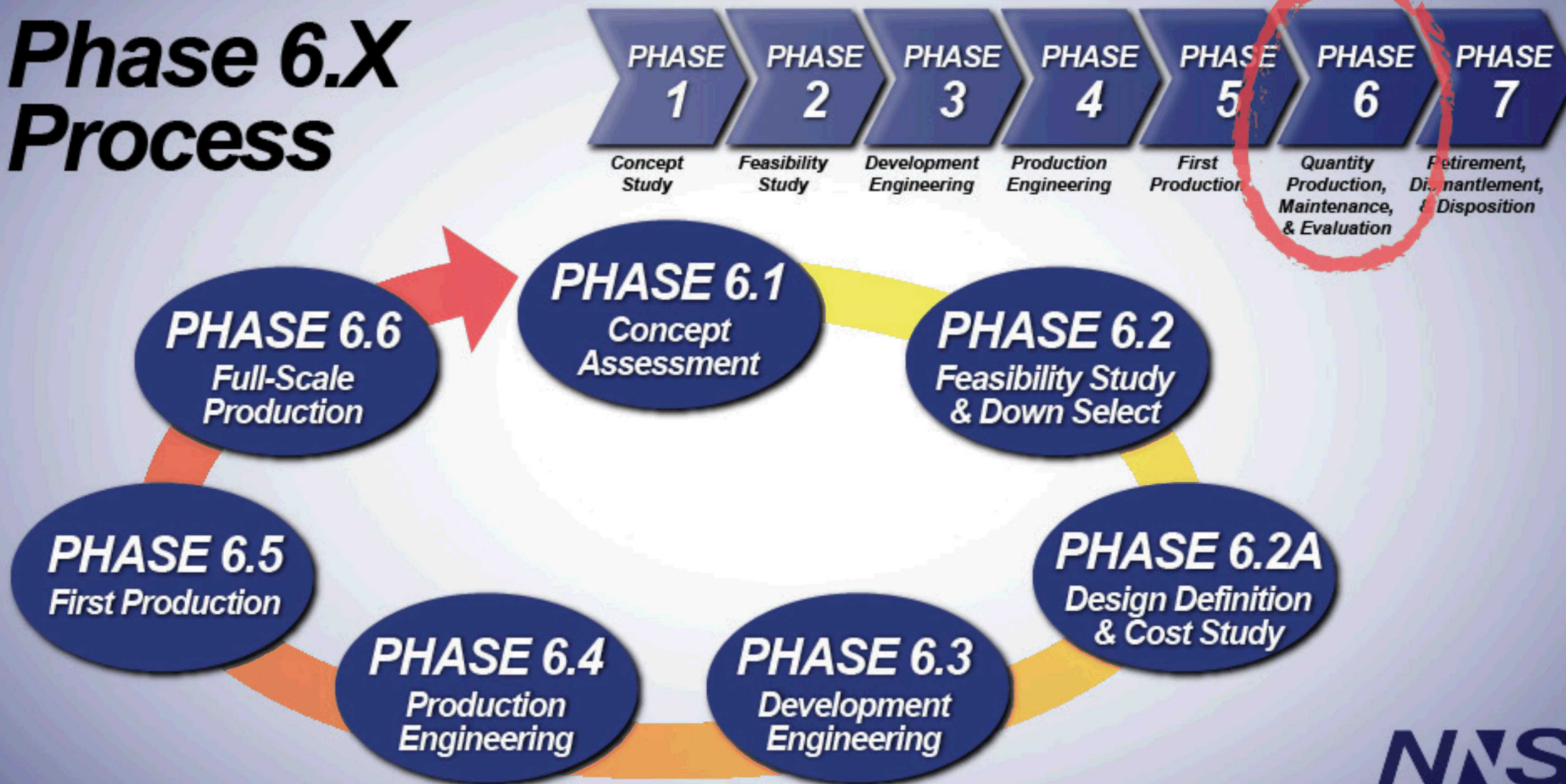
<https://www.energy.gov/sites/prod/files/2018/10/f57/FY2019%20SSMP.pdf>

U.S. Nuclear Warhead Lifecycle Phases



<https://www.energy.gov/sites/prod/files/2018/06/f53/6x%20process.pdf>

Phase 6.X Process



6 Tool Requirements

Parameter	Minimum Requirement
Time Duration	> Thirty Years
Temporal Resolution	Monthly/Annual
Stockpile Composition	Eleven Weapon Systems
Constituent Elements	Six Key Components/Subsystems
Editable Variables	System/Subsystem Identifiers (Design Options) Weapon System Quantities Production Completion Date Phase Durations Component Quantities Production Yield Production Lead Time Workload Equivalencies Design/Production Capacities
Output	Gantt Chart Design/Production Charts (Column Charts with Capacity Line) Production Schedule



Tool Overview

Phase 6.X Visualization Tool (6.XVT)

Introduction

Phase 6.X Visualization Tool (6.XVT) is part of a toolset for NNSA to use to evaluate future stockpile scenarios and compare demand across the Nuclear Security Enterprise (NSE) with known capacity constraints. Constraints under consideration include number of weapon systems simultaneously going through a given phase of the Phase 6.X design, development, and production process, as well as nominal production capacities. Tool inputs include the stockpile weapon system(s) definition and number of weapons, component constituent definition, weapon system First Production Unit (FPU) date, and phase durations. Additional component parameters / descriptors are entered representing component production requirements and metrics. On the Summary Charts, inputs allow capacity variance capability. The outputs include the start and stop dates for each phase in a weapon system, the overall schedule Gantt chart for each weapon system, and the component resource needs schedule against capacity for weapon system deployment execution.

Data Outline Features

Data is entered by the user in the "Data Entry" worksheet (details below under "Instructions/Inputs"). Information in 6.XVT is organized through use of the "Outline" feature in Excel, which allows the user to collapse or expand the data outline. The data outline is presented both on the "Data Entry" worksheet and the "Summary Charts" and "System Charts" worksheets. The user can collapse or expand the data outline by clicking either on the **+** and **-** buttons in the left margin of the worksheet, or by clicking on the **1**, **2**, or **3** buttons at the top left corner of the worksheet. The **1** button shows only a single row at that level of the outline simultaneously. The **2** button shows Phase 6.X detail for each weapon system. The **3** button shows component detail for each weapon system.

Hyperlinks and E-mail Addresses

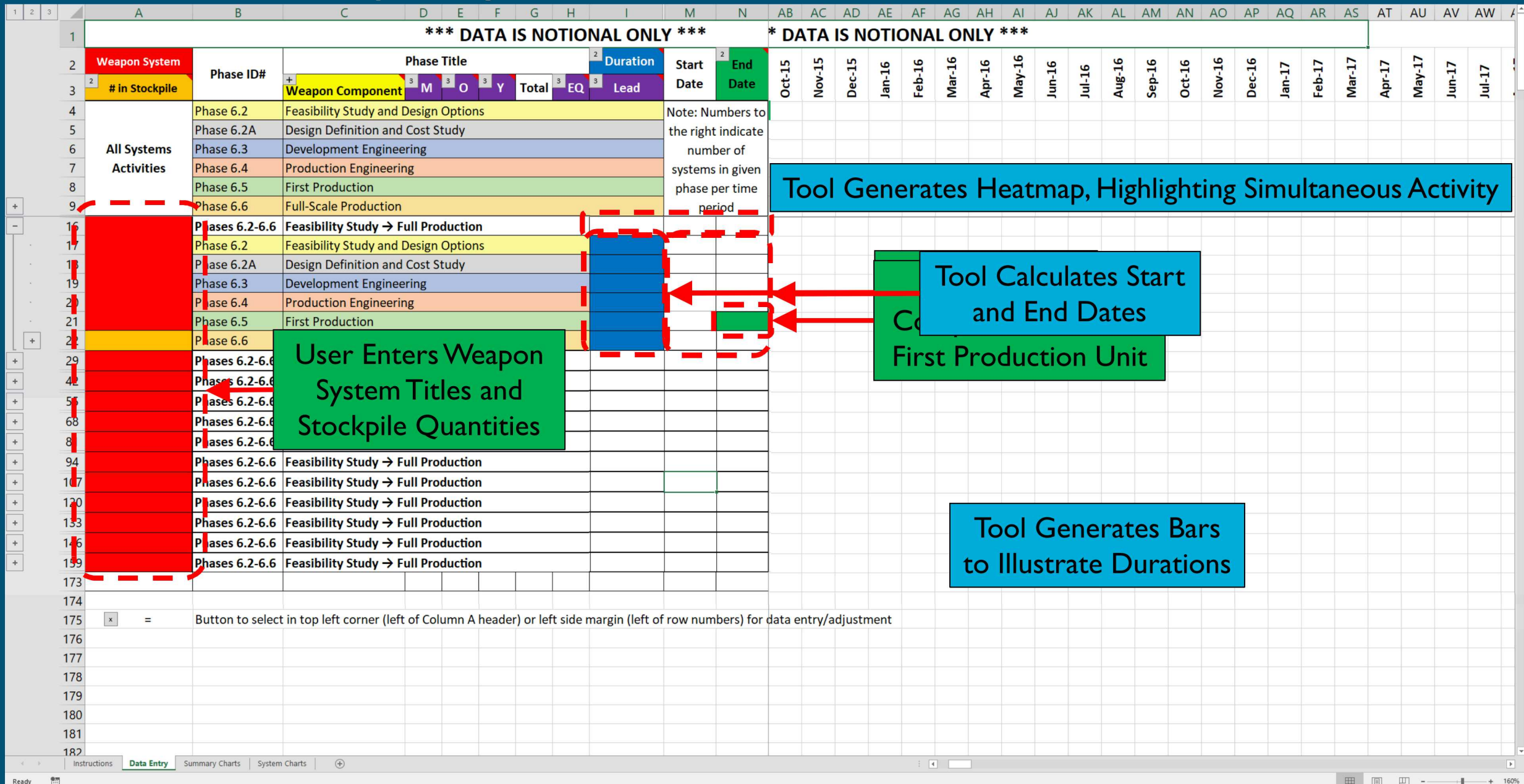
The spreadsheet includes hyperlinks and e-mail addresses for the tool developer, which can be accessed by clicking on the **+** button in the left margin next to the Weapon System name.

Mnemonics for Instructions

Instructions/Inputs

- Go to the "Data Entry" worksheet by either clicking on the tab (below the spreadsheet) or by clicking on the **1** button in the top left corner of the worksheet.
- Review the number of **Weapon System** entries in the stockpile scenario. If the number of Weapon System entries is insufficient, review and modify the number of Weapon System entries as appropriate.
- If the number of Weapon System entries is sufficient, review and modify the number of Weapon System entries as appropriate.
- Enter the **# in Stockpile** for each weapon system to include the FPU.
- Review the number of **Weapon Component** entries for the stockpile scenario. If the number of Weapon Component entries is insufficient, review and modify the number of Weapon Component entries as appropriate.
- If the number of Weapon Component entries is sufficient, review and modify the number of Weapon Component entries as appropriate.
- Enter the **End Date** for the completion of the First Production Unit (FPU) per weapon system. This will define the end of Phase 6.5, First Production. If phases per weapon system are not visible, expand the data outline either by clicking on the **2** button at the top left corner of the worksheet, or by clicking on the **+** button in the left margin next to the Weapon System name.
- Select the **Duration** of each Phase of the 6.X process for each weapon system through the pull-down list of acceptable durations. Start Date and End Date values will automatically be calculated. (Note: Phases are assumed to start on the first day of the designated month and end on the last day of the designated month; therefore, both starting month and ending month are included in the phase duration. Also, it is assumed that there is no delay between the end of one phase and the beginning of the next.)
- Enter the Multiple (M), Overbuild (O), Yield (Y), Equivalent Unit (EQ), and Lead values for each component in each weapon system. (If the data outline structure is compressed, reveal the stockpile quantity entries by clicking the **3** button in the top left corner.) These parameters are defined as:

6.XVT Data Input: System Definition and Phases

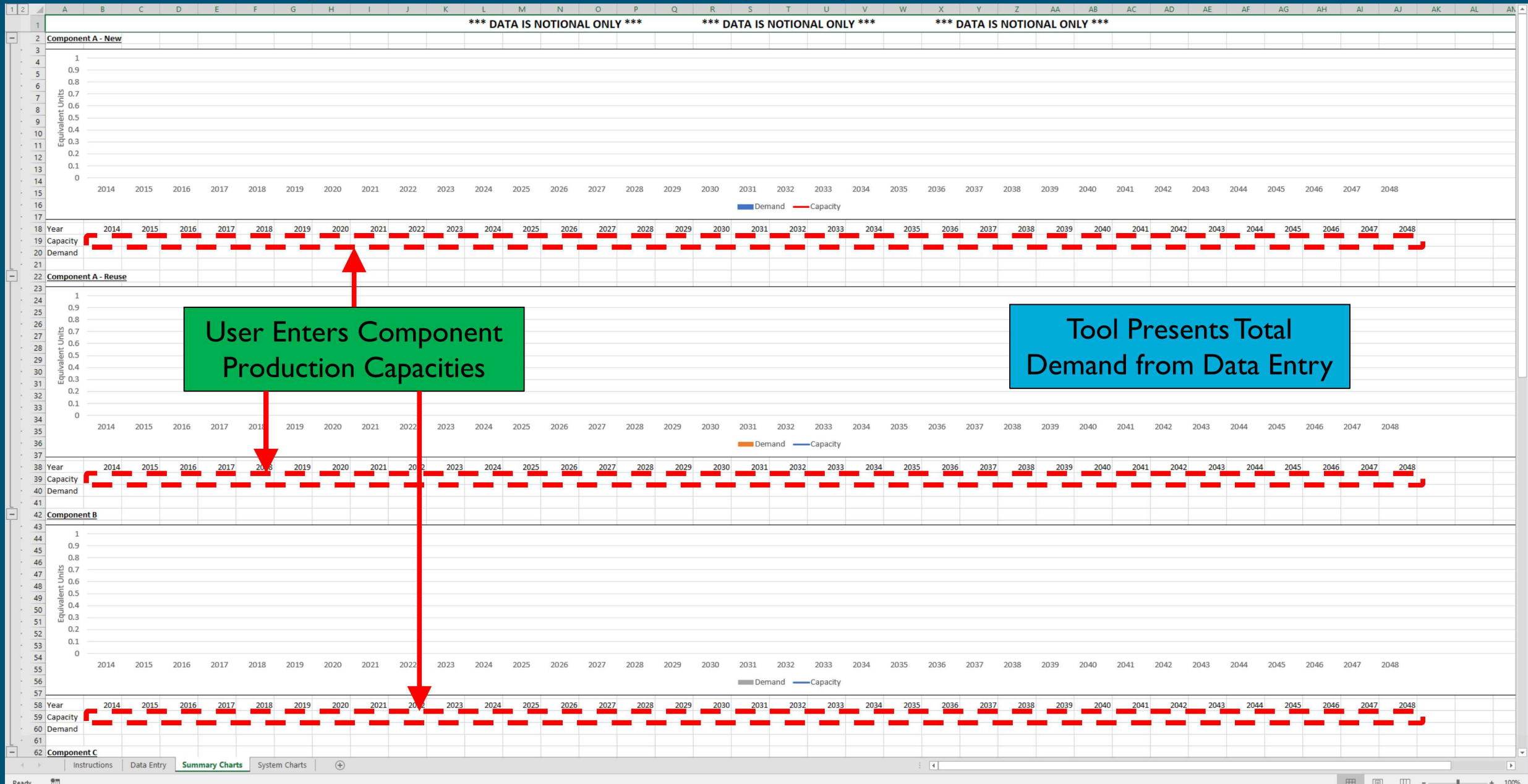


The screenshot displays a complex spreadsheet interface for weapon production planning. The spreadsheet is organized into several key sections:

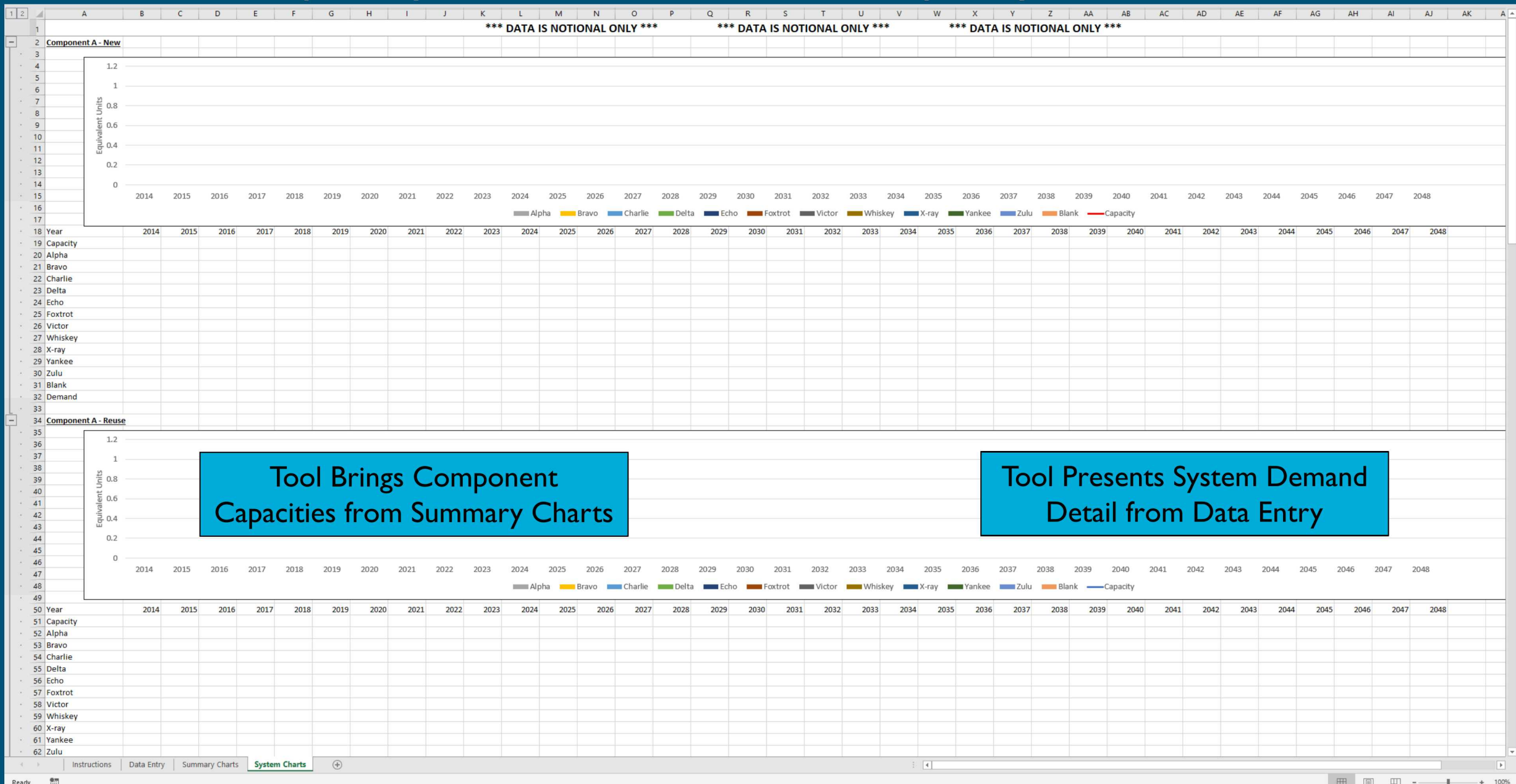
- Header Section:** Includes a navigation bar at the bottom with tabs for "Instructions", "Data Entry", "Summary Charts", and "System Charts".
- Weapon System Overview:** A table listing weapon systems (Alpha, Bravo, Charlie, Delta, Echo, Foxtrot, Victor, Whiskey, X-ray, Yankee) with their respective phases (6.2 to 6.6) and durations.
- Summary by Component:** A section providing a detailed breakdown of production phases for each system, including "Feasibility Study", "Design Definition", "Development Engineering", "Production Engineering", "First Production", and "Full-Scale Production".
- Heatmap:** A large visualization on the right side of the spreadsheet, showing production schedules across months (May-18 to Feb-20). The heatmap uses color coding to represent different production phases or components.
- Callout Boxes:** Several blue callout boxes with arrows pointing to specific data areas:
 - "User Enters Weapon Component Titles" points to the "Weapon Component" column.
 - "Tool Summarizes Component Production in Heatmap" points to the heatmap.
 - "Tool Generates Distributed Production Schedule" points to the bottom of the heatmap.
 - "User Enters Component Production Equivalence" points to the "Lead" column.
 - "Tool Populates Component Production Equivalence" points to the "Lead" column.

The spreadsheet also includes a "Duration" column and a "Lead" column, which are used to track the time and resources required for each production phase.

6.XVT Output: Total Demand/Capacity Charts



6.XVT Output: System Detail Demand/Capacity Charts



- Tool allows for quick evaluation of stockpile scenario feasibility
 - Evaluation of number of systems going through a particular phase - allows for consideration of demands of design, development, and production activities
 - Allows for rapid adjustment to start dates and phase durations to deconflict peak simultaneous demands
 - Presents an example component production schedule for comparison with resource capacity
 - Takes into consideration difficulty of production of individual components to allow for variability across stockpile
- Can be generalized for other domains

Extension Outside NSE Domain

Approach can be applied outside NSE domain to allow for simplified visualization for long-range portfolio planning:

NSE Domain	Generalized Application
Stockpile	Project Portfolio
Weapon Systems	Projects
Phases	Tasks
Components	Resources
Multiplier, Yield, Equivalencies	Resource Efficiency, Cost
Production Capacity	Resource/Budget Limitations



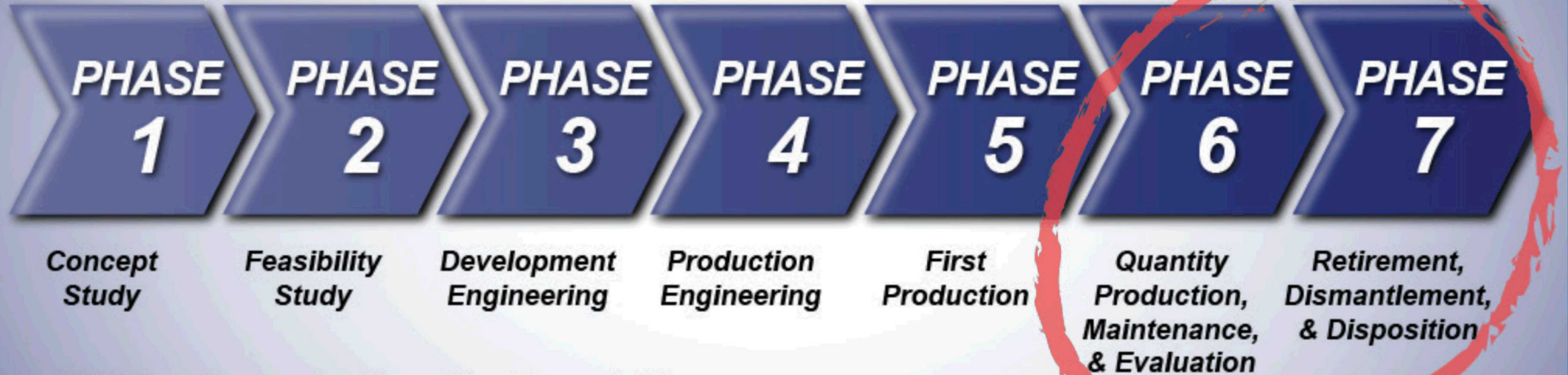
Questions?



Backup Material

The Nuclear Security Enterprise (NSE) is projecting a period of significant work over the next few decades with a number of proposed weapon system modifications undergoing design, development, and production cycles, often with simultaneous competing activities. Decision-makers within the NSE are requesting simple tools that allow visualization of these simultaneous activities to quickly identify potential points of overload on constrained resources in all phases of work so that schedules might be adjusted or other alternatives considered. To meet the intended needs of the user community, the tools must be easily deployed on individual computers at various locations within the NSE, not require special software licenses, involve simple input of focused data sets, and run in real-time. To meet these needs, a simple visualization tool based in Microsoft Excel has been developed to show numerous parallel activities at a high-level across decades with an ability to highlight points of significant resource demand. Representation of production rates are captured to compare demand for a given schedule with resource availability, honoring business rules generally applied to the NSE. Weapon system design options are represented in simplified terms to allow users to consider future weapon stockpile needs and compare those with NSE facility capabilities and capacities. This presentation will provide an overview of the current development tool architecture, along with examples of output for decision-makers in support of their long-range portfolio planning.

U.S. Nuclear Warhead Lifecycle Phases



- All U.S. nuclear warheads and bombs are in Phase 6 or 7 of the U.S. Nuclear Weapons Lifecycle
- The last new warhead type produced was the W88 (first production unit 1988)