1 Introduction

The United States Air Force uses numerous types of automated and non-automated test equipment to repair aircraft assets. Assets are tested at test stations, using various instruments to provide the stimulus required by the Unit-Under-Test (UUT) and measure the responses. Each instrument in the test station requires a software instrument driver to interface the instrument firmware functions with the test program software.

Due to obsolesce issues, some of the test stations require instrument replacement with a form, fit, and function instrument. Form refers to utilizing the same type of hardware connection (GPIB, PXI, etc), fit refers to matching the size footprint of the current instrument to fit into the test station, and function refers to meeting or exceeding all of the current instrument's capabilities. Ensuring the test station's capabilities are maintained is the most important requirement. A key part of the test instrument replacement is the creation of the software driver for the instrument; this driver must match the functionality of the legacy driver.

2 Instructional Need Assessment

2.1 Instructional Need and Goal Statement

2.1.1 Instructional Need

Some of the software development effort for instrument drivers is handled by civil service engineers employed by Robins Air Force Base (AFB), GA. As the age of the test equipment increases, more and more test instruments are becoming obsolescent. The experience level of the engineers responsible for creating instrument drivers is currently minimal.

The problem area for most developers is that they assume the software requirements analysis—including alignment with the legacy driver—has been addressed by the hardware selection team. However, the hardware selection team is not responsible for checking the software driver functionality for the new instrument. As a result, the software analysis requirement is omitted, and the developer proceeds straight to generating the new software. Software produced without analysis is almost certain to yield suboptimal functionality of the new instrument, and possible loss of capability in the test station, because the new software driver has not been designed to match the functionality of the legacy driver.

A need exists, therefore, to train the inexperienced engineers in the process for analyzing the software requirements and ensuring they correspond with the legacy driver's functionality.

2.1.2 Goal Statement

Civil Service engineers will analyze an instrument's capabilities, determine the required functionality for testing UUTs, and build the software driver architecture.

Comment [HG1]: Intro is helpful in providing background.

Comment [HG2]: obsolescence

Comment [HG3]: Too many headers. Make 2.1 the section title; then 2.1.1 becomes 2.1, etc.

Comment [HG4]: obsolete; obsolescent is an adjective, not a noun

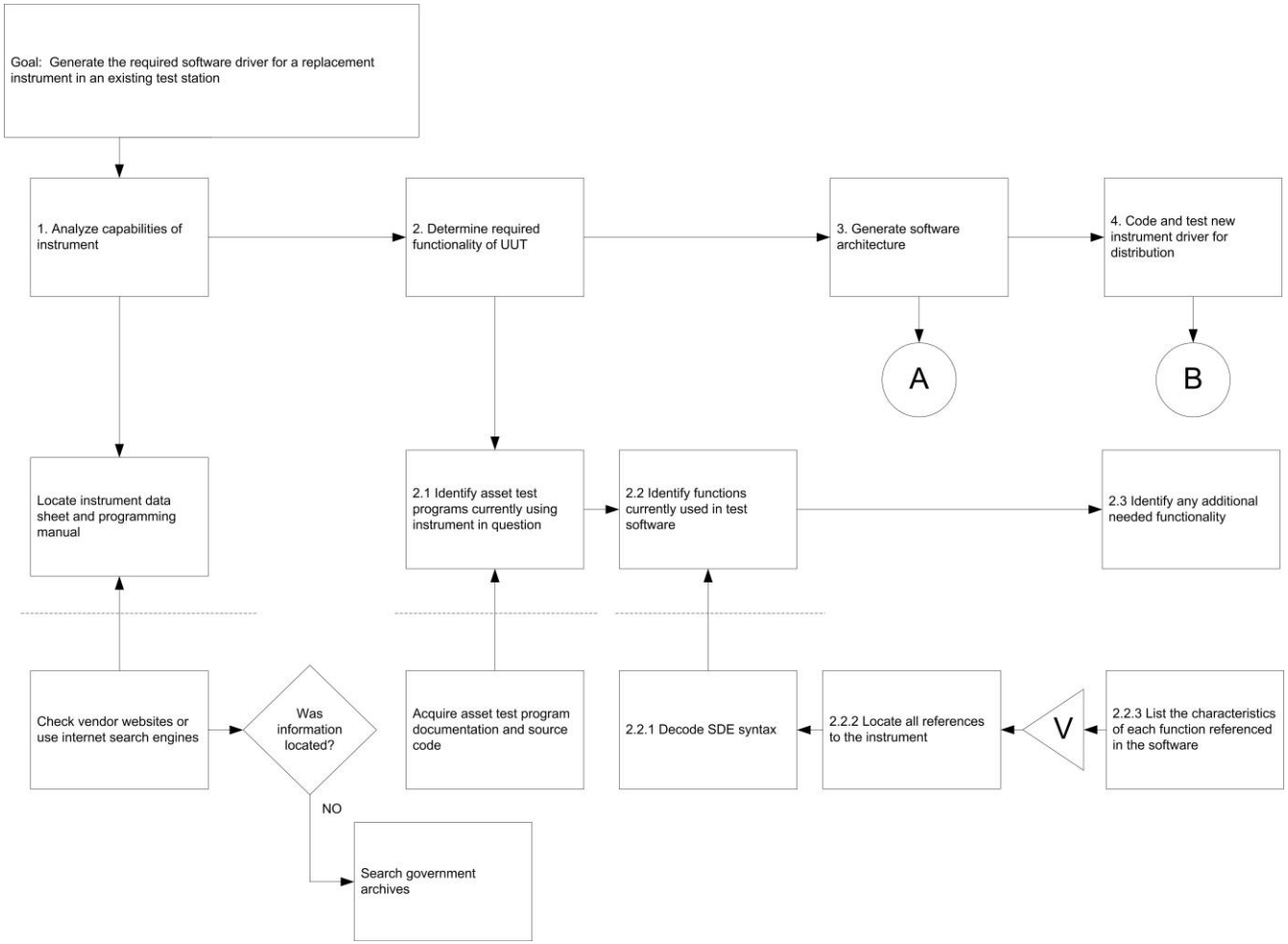
Comment [HG5]: instructional need clear; training an appropriate solution.

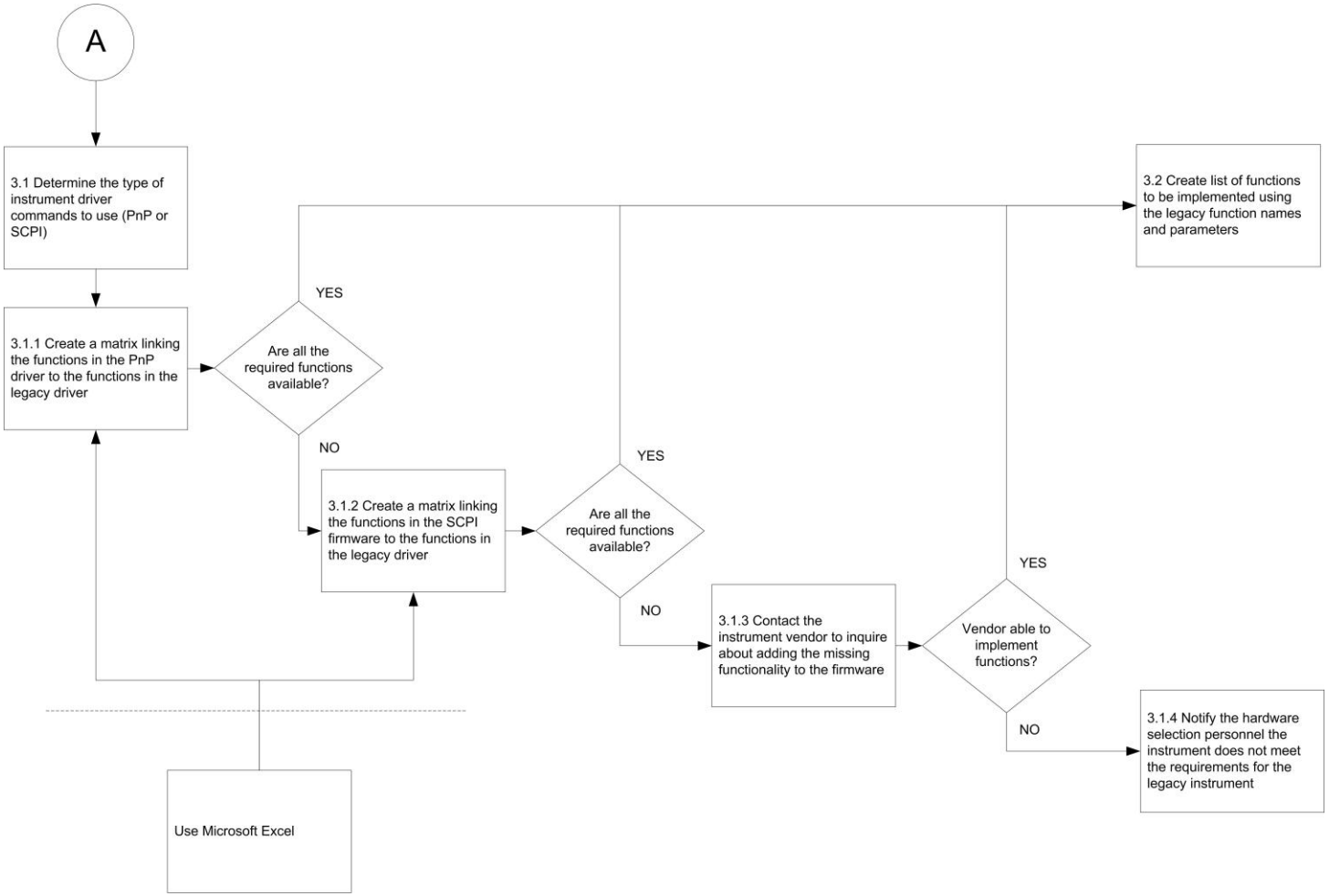
Comment [HG6]: goal not classified according to Gagne's learning domains. Note that this goal statement does not match the goal statement in your diagram. What tools will be available to the learners?

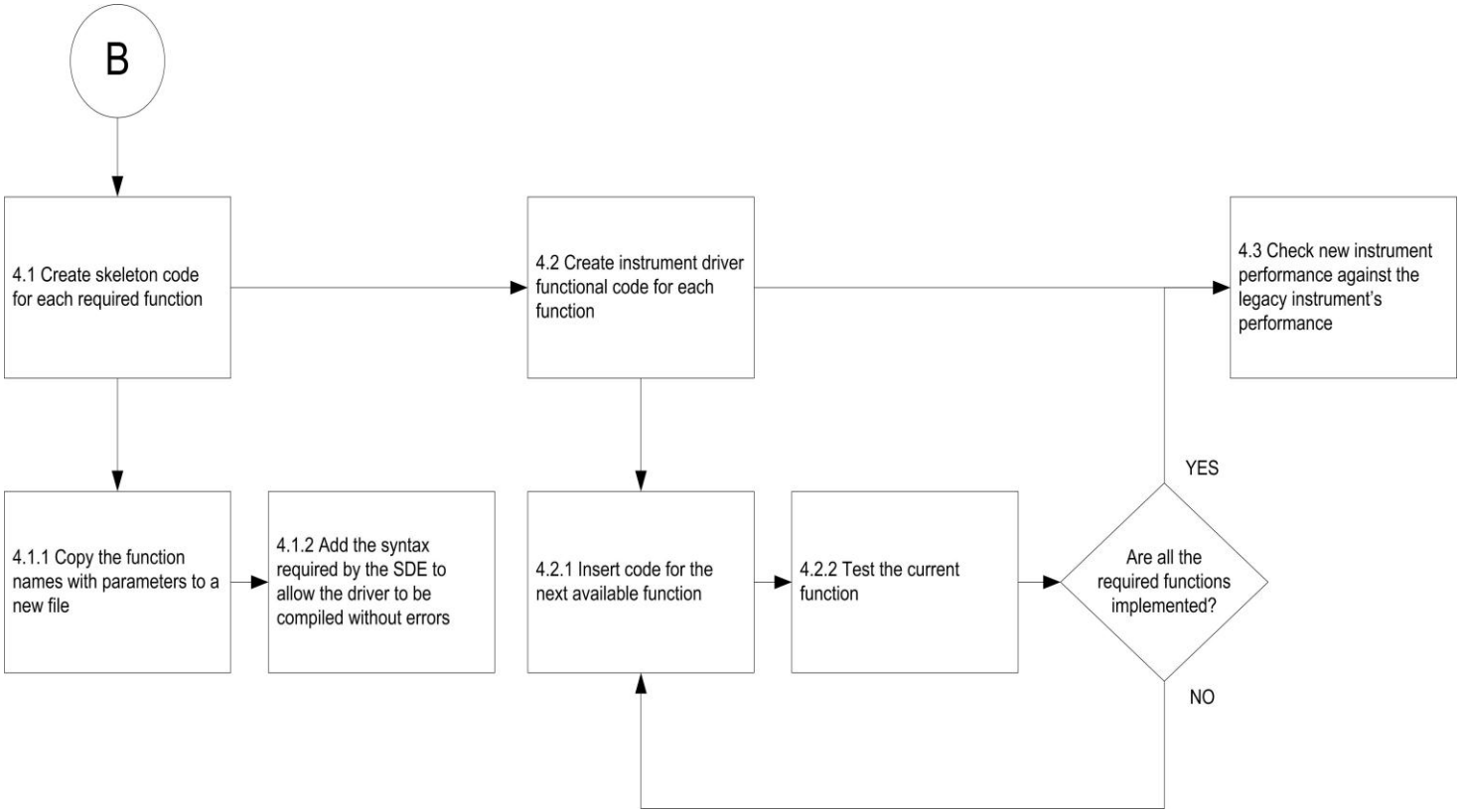
Comment [HG7]: See pdf for comments.

2.2 Instructional Analysis

The following instructional analysis diagrams illustrate the skills necessary to meet the instructional goal and the order in which skills are learned and performed.


Goal: Generate the required software driver for a replacement instrument in an existing test station
1. Analyze capabilities of instrument
2. Determine required functionality of UUT
3. Generate software architecture
4. Code and test new instrument driver for distribution
A
B
Locate instrument data sheet and programming manual
2.1 Identify asset test programs currently using instrument in question
2.2 Identify functions currently used in test software
2.3 Identify any additional needed functionality
Check vendor websites or use internet search engines
Was information located?
NO
Search government archives
Acquire asset test program documentation and source code
2.2.1 Decode SDE syntax
2.2.2 Locate all references to the instrument
V
2.2.3 List the characteristics of each function referenced in the software


A
3.1 Determine the type of instrument driver commands to use (PnP or SCPI)
3.1.1 Create a matrix linking the functions in the PnP driver to the functions in the legacy driver
Are all the required functions available?
YES
NO
3.1.2 Create a matrix linking the functions in the SCPI firmware to the functions in the legacy driver
Are all the required functions available?
YES
NO
3.1.3 Contact the instrument vendor to inquire about adding the missing functionality to the firmware
Vendor able to implement functions?
YES
NO
3.2 Create list of functions to be implemented using the legacy function names and parameters
3.1.4 Notify the hardware selection personnel the instrument does not meet the requirements for the legacy instrument
Use Microsoft Excel


B
4.1 Create skeleton code for each required function
4.2 Create instrument driver functional code for each function
4.3 Check new instrument performance against the legacy instrument's performance
4.1.1 Copy the function names with parameters to a new file
4.1.2 Add the syntax required by the SDE to allow the driver to be compiled without errors
4.2.1 Insert code for the next available function
4.2.2 Test the current function
Are all the required functions implemented?
YES
NO

2.3 Learner and Context Analysis

2.3.1 Target Audience

The learner audience is comprised of Electronics Engineers working at Robins AFB developing instrument drivers for test station instruments. All of the engineers work in the same building complex. They range in age from 23 to 62 years, and are men and women. All of the employees have electrical, mechanical, or computer engineering degrees. Based on the engineering degree, it is assumed the learners possess required critical thinking and analysis skills. The experience level of the developers ranges from 0 years to more than 30 years.

The training is targeted for civil service engineers tasked with developing and maintaining test programs on the test station getting the new instrument. If the civil service engineer is unable to perform the task, a contractor experienced in instrument driver creation is utilized.

Comment [HG8]: What does this have to do with training the civil service engineers?

An audience analysis was done using direct interviews. Of the five engineers interviewed, only one has created an instrument driver before. The results support the initial estimate that twenty percent of the engineers would have experience creating instrument drivers.

Comment [HG9]: By whom? If by you, so state. It's OK in these assignments to use first person.

The data collected from the interviews included

- Experience creating instrument driver
- Experience developing test programs
- Length of service
- Type of tester supported (analog, digital, or radio frequency (RF))
- Preferred learning method (teacher, online, other)
- Experience analyzing signal characteristics
- Experience analyzing instrument functions.

The engineer who had experience creating drivers indicated the flow chart provided in section 2.2 would be a good approach. The attitude toward the topic was positive since the ability to create instrument drivers is an important part of maintaining testability of Air Force assets. If the assets fails and the Air Force does not have testability, the aircraft will not be able to meet the mission requirements. The attitude toward the organization providing the training is a non-issue since the training will be created and presented internally.

2.3.2 Context: Learning Environment

All of the test software engineers work in the same building complex in standard cubicles. Each engineer's cubicle is equipped with a computer for accessing the internet, email, printers, etc., and another non-networked computer for developing test programs which has the Software Development Environment (SDE) used by their test station installed. All of the test station equipment is located in a software development lab or on the production floor where the UUTs are repaired.

The preferred training location would be in the conference room in the building complex, with a computer available for each student. Each conference room contains an overhead projector, a presentation computer with internet access, and a phone. The conference room is well lit, and the light can be turned off for viewing presentation slides. With the door closed, the conference room is mostly isolated from the surrounding area, but some noise will enter the room. The amount of noise should not be a problem for the targeted learners. The room has four tables pushed together in the middle for meetings. For the training, the tables would be separated and oriented facing the projector screen. Each table has room for two computers. The new room configuration would allow up to eight people to take the class at one time.

The software maintenance squadron owns desktop computers that will moved into the conference room for the training class. The conference room has two network connections that can be shared with the desktop computers via a hub.

To facilitate easier understanding of the process being presented in the training class, a sample instrument driver will be generated via incremental labs. When the final lab is completed, a fully-functional instrument driver will be produced. The labs will provide hands-on experience to the student allowing the student to see the steps of the process in addition to reading about them on presentation slides.

The training computers will be loaded with a C-based SDE used by the majority of the test stations to allow the instructor to generate the necessary lab solutions. If the majority of the class uses a different SDE, an effort will be made to switch to the preferred SDE since the purpose of the class is to learn how to develop instrument drivers and not to learn the syntax of a SDE.

The schedule for the conference room is managed through Microsoft Outlook. Items are added to the schedule one week ahead of time, so with adequate planning reserving the room will not be an issue.

2.3.3 Context: Performance Setting

The developers will be performing the learned tasks on the computers located in their cubicles where co-workers will create distractions. Another consideration is the training assumes the data needed will be available for analysis. If the legacy instrument documentation is unavailable, step 1 cannot be completed. The capabilities analysis will have to be modified to only use comments in the legacy instrument driver to determine the capabilities.

Brian, you received an excellent peer review and following Amanda's suggestion significantly improved your assignment.
2.1 Instructional Need/goal analysis: 18/20
2.2 Instructional analysis: 57/60
2.3 Learner/context analysis: 19/20

Peer review: 18/20