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**MEMO Number:** 005**DATE:** 10-31-2014**TO:** ACME Chief Engineer E.F. Charles Laberge, PhD**FROM:** GuPS1 (Written by David Eisen)**SUBJECT:** Team Status Report 2

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## 1 Introduction

This memo details the progress and effort of the GuPS1 guitar pitch shift project during the period of October 11, 2014 through October 30, 2014. Included is a Gantt Chart, as well as an updated Project Chart and Network Diagram which maps the remaining tasks and the critical path of the project.

## 2 Completed Work

The following project tasks were completed by the entire GuPS1 team:

- Task 0.7: The System Requirement Review (SRR) was delivered on 10/22/14 and feedback from the customer was received on 10/31/14.
- Task 1.2: A 1/4" connection has been selected for interface between the product and amplifier.
- Task 1.3: The Zedboard development board with a Zynq 7020 (FPGA and ARM) has been selected for flexibility in prototyping.
- Created functional flow diagram.
- Established milestone schedule through May 2015.
- Devised a three-phase plan for technical performance measurement testing.

Additionally, the following individual efforts were made:

- Expanded options for displaying graphics in real-time prototyping phase to include GNU radio as an alternative to OpenGL or FLTK. GNU radio provides visualization functions and additionally, includes signal processing tools. (Natalie)
- Determined USB cable will be inadequate for output of real-time prototyping on the development board as USB does not include a built-in DAC; only ADC available. Alternatively, data conversion can be done on the FPGA. (Jonathan)

- Researched algorithms for pitch-shifting including spectral FFT techniques, granular synthesis, Hilbert transforms, and wavelet transforms for performing pitch shifting while minimizing audible artifacts. (David)
- Researched existing audio processing tools that perform single note detection and manipulation from polyphonic source signals such as Melodyne Direct Note Access (DNA) and the CLAM software framework. (Matthew)
- Updated group repository with research links compiled by the group in PDF format. (Natalie)

### 3 Project Planning

Below are updated versions of the Project Chart and Network Diagram as well as a Gantt Chart for the remainder of the project.

**Table 1: Project Chart**

#	Activity	Predecessor	Duration (days)	Responsibility
0.1	Create a System Boundary Diagram	-	1	John
0.2	Create a Mission Scenario	0.2	2	Matt
0.3	Create Project Chart and Network Flow Diagram	0.1, 0.2	3	Natalie
0.4	Recommendation Report	0.1, 0.2, 0.3	10	All
0.5	Program Plan, including WBS and brief SOW	0.1, 0.2, 0.3, 0.4	15	All
0.6	Requirements Document	0.1, 0.2, 0.3, 0.4, 0.5	15	All
0.7	System Requirements (SSR)	0.1, 0.2, 0.3, 0.4, 0.5, 0.6	10	All
1.1	Determine interface method between product and guitar (Considerations discussed thus far are: 1/4 <sup>th</sup> inch to USB and custom pick-up)	0.1, 0.2	5	All
1.2	Determine interface method product and amp	0.1, 0.2	30	All
1.3	Determine which development platform (Considerations discussed thus far are: Zync 7020 (FPGA/Arm) on Zedboard, several Aduinos and a software application on Windows/Mac/Linux)	0.1, 0.2	5	Natalie/John
1.4	Create several input samples for simulation and developing	-	5	Dave/Natalie

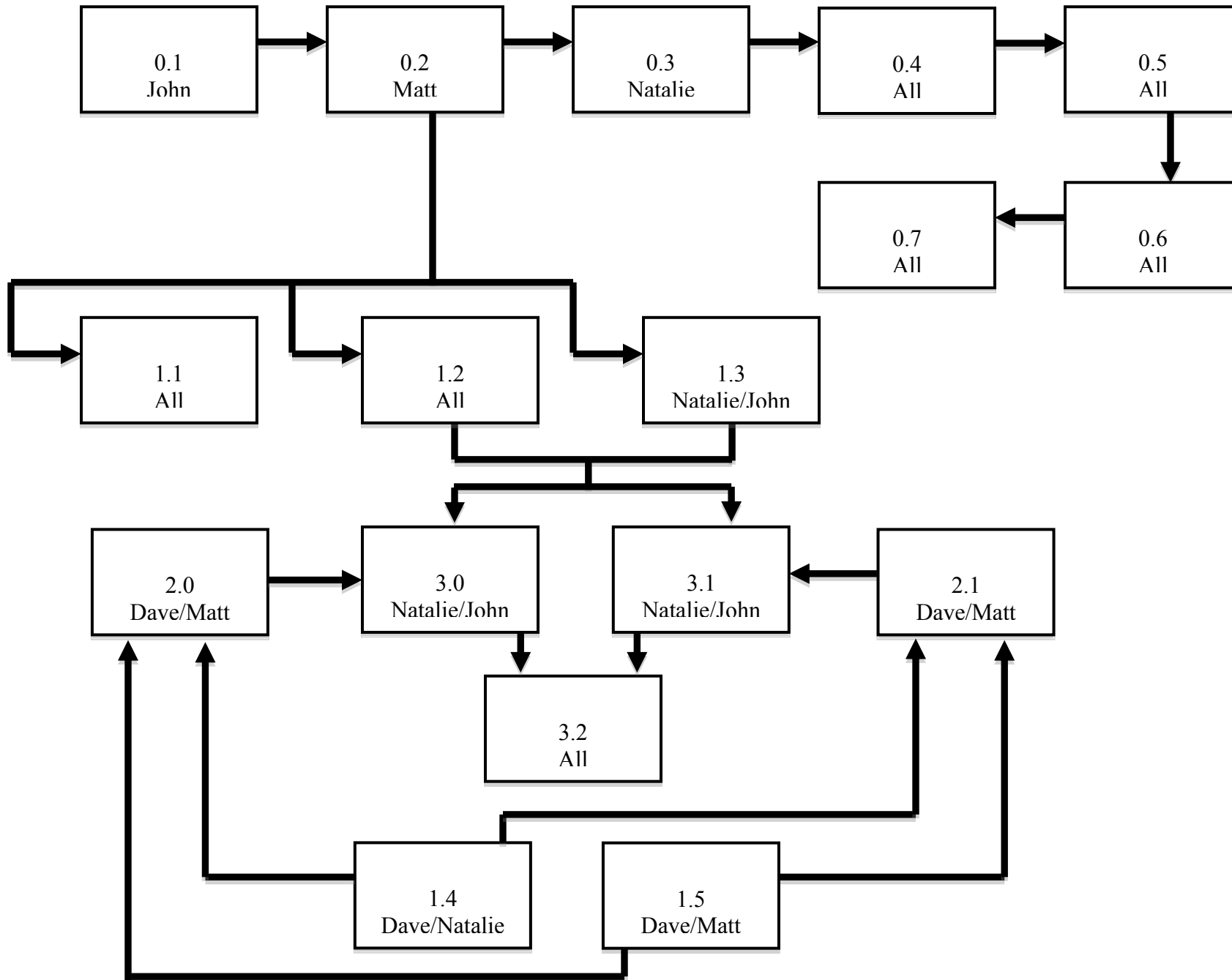
1.5	Research and decide on a shifting algorithm with minimal artifacts and latency	-	15	Dave/Matt
2.0	Implement single string retuning simulation in MATLAB	1.4, 1.5	30	Dave/Matt
2.1	Implement electronic capo mode simulation in MATLAB	1.4, 1.5	30	Dave/Matt
3.0	Implement single string retuning on either an Zynq 7020, microprocessors or software	1.2, 1.3, 2.0	60	Natalie/John
3.1	Implement electronic capo mode on either an Zynq 7020, microprocessors or software	1.2, 1.3, 2.1	60	Natalie/John
3.2	PCB design research for production unit	3.0, 3.1	20	All

**Table 2: Gantt Chart**

Task	Duration	Start	End	Oct. '14	Nov. '14	Dec. '14	Jan. '14	Feb. '14	Mar. '14	Apr. '14	May '14
0.1	1	10/1/14	10/2/14								
0.2	2	10/1/14	10/3/14								
0.3	3	10/1/14	10/4/14								
0.4	10	10/2/14	10/12/14								
0.5	15	10/23/14	11/7/14								
0.6	15	10/23/14	11/7/14								
0.7	10	10/7/14	10/22/14								
1.1	5	11/2/14	11/7/14								
1.2	30	10/20/14	11/19/14								
1.3	5	10/25/14	10/30/14								
1.4	5	11/1/14	11/5/14								
1.5	15	10/19/14	11/3/14								
2.0	30	11/3/14	12/3/14								
2.1	30	11/3/14	12/3/14								
3.0	60	12/19/14	1/19/15								
3.1	60	1/20/15	3/20/15								
3.2	20	3/20/15	4/9/15								

The Network Diagram for the project is outlined on the next page:

**GuPS1 Network Flow Diagram**



#### **4 Work Expected During Next Period**

Unfinished tasks from the current period will be transferred to the start of the next period. This will include:

- Task 1.4: This task is a pre-requisite for Task 2.0.

Additionally, the following tasks are also scheduled for the next period:

- Task 1.5: Decision on signal processing algorithm (Due 11/5/14)
- Task 0.5: Project Plan (PP) including Work Breakdown Structure (WBS) and brief Statement of Work (SOW) (Due 11/7/2014)
- Task 0.6: Requirements document (Due 11/7/2014)
- Task 2.0: Begin developing single string implementation in MATLAB (Due 11/20/14)

#### **5 Issues**

Currently, the team has no immediate issues beyond deciding on the best algorithm to implement for pitch shifting. This decision will be critical to the quality of our final product and is a prerequisite for all forms of testing and development including software simulations and hardware selection for real-time prototyping.