**GRAND HAVEN MUSICAL FOUNTAIN GVSU “CAPSTONE” PROJECT**

**SCOPE OF WORK DOCUMENT**

**9.5.14 - Added “Intensity” for lights. Eliminated “Strobing” for lights.**

**OVERVIEW** – The task is the rewrite the PC based software for the Grand Haven Musical Fountain. This is the choreography software by which the fountain musical presentations are created and played back at the fountain. The PC based software will consist of **four** interdependent software modules. The four software modules are the Choreography Software (CS), the Simulation Software (SS), the Playback Software (PS) and the Lighting Control Software (LCS).

**Choreography Software (CS)** – This software module creates the control code file which commands the fountain with Fountain Command Words (FCW, see below). The CS module will provide the following:

1. Hundreds of programs have already been created using the FCW language. Therefore, the output of this module must be consistent with all existing control files.
   1. Existing control files will be provided for reference.
   2. These files are text files with a file extension of .CTL
2. The control code file is synchronized with the corresponding music file [.wav or .flac(optional)].
3. The CS module will be a hybrid between the visual presentation of the existing Choreography software and a timeline based software (for lights only).
   1. See [www.lightorama.com](http://www.lightorama.com) for a benchmark timeline based reference.
   2. Timeline should have an adjustable time interval down to 1/10th of a sec.
4. Support a color pallet with 32 choices for lighting commands.
   1. The color pallet will be configurable in a SETUP section which will be accessible only with a password.
   2. This color pallet should also be used by the PS. See “ColorMap.csv”
   3. Use this color mapping table (which will have the same name or # as the .wav and .ctl files) by the Playback Software to determine the colors from the color pallet defined by this mapping table. Maintain the existing legacy 15 colors as part of this 32 color pallet.
5. Twenty custom codes can be configured in the password protected SETUP section.
   1. These 20 Custom Codes will become selectable channels at the bottom of the timeline channels.
   2. The custom codes will be defined in FCW format. AAA-DDD
   3. The custom code setup table/MAP should include a Definition field which will be used on the timeline to define the channel.
6. Allow ten library lighting sequences to be copied and pasted at any point in the timeline.
7. Allow USER MARKS to be created through the TAP WIZARD.
   1. See “Light-O-Rama” software for reference.
   2. Proved two “beat lines”. One for water and one for lights.
   3. Display the audio waveform on the timeline.
8. Provide a HELP file.
9. Provide a “Getting Started” tutorial
10. Provide a comprehensive USER MANUAL.
11. The User must be able to pause, rewind or skip forward to any point in the timeline
    1. Fast forward & fast rewind will be provided.
    2. User may select – Play entire sequence or play selected view.
12. Have a password protected SETUP screen which will contain LEAD/LAG TIME TABLE timer presets. The timers will include-
    1. Audio lead time – The audio file should be advanced by this amount to allow for the lag time for the sound to travel to the audience across the river approx. one quarter mile away. (.48 secs). The audio should be presented in MONO with the time advanced on the LEFT channel and in real time on the RIGHT channel.
    2. Peacock Valve lag– The amount of time it takes to fully open from the closed position.
    3. Voice Valve lag– The amount of time it takes for the Voice Valve to achieve normal voice height.
    4. Bazooka Valve lag– The amount of time it takes to fully open from the closed position.
    5. Ring Valve lag – The amount of time it takes to fully open form the closed position.
    6. Candelabra Valve lag – The amount of time to fully open form the closed position.
    7. Sweep Valve lag – The amount of time to fully open from the closed position.
    8. Front Curtain lag – The amount of time to fully open from the closed position.
    9. Back Curtain lag – The amount of time to fully open from the closed position.
13. Water Valve FCWs should be advanced in the .CTL file by the amount of time from the LAG TIME TABLE.
    1. This time will be adjusted by the level the valve is commanded to open and linearly proportional to the overall range.
    2. i.e. A valve opening to level 5 will use 100% of the time from the LAG TIME TABLE, Level 4 = 80%, Level 3 = 60%, Level 2 = 40%, Level 1 = 20 %.
    3. No lag time will be used for closing the valve.
    4. Lag time must stay in the choreography software rather than the playback software as to not affect older programs which have been manually time offset by the programmer.
    5. AUDIO lead will not be presented in the Simulator Software.
    6. All FCW will be presented in the Simulator Software with the corresponding lag time represented.
14. Lead/Lag time adjustments will be added during the export of the .CTL file.
    1. The export function should be password protected.
15. Provide Fade Up, Fade Down commands
    1. Fade Up & Fade Down data will be the interval for the fade from 0-to defined level or defined level to 0 respectively. Data will be 1-999 in hundredths of a sec. i.e. 999 = 9.99 secs.
    2. A Fade Up FCW must be immediately followed by a color select command for the same lighting fixture or group. Ex.- 117-DDD must be followed by 017-DDD where DDD = Data.
    3. A Fade Down FCW will fade the address specified lighting fixture or group from the current color & intensity to black linearly over the specified time interval.
    4. The Color Select FCW may also specify LED INTENSITY. See Table K in FCL. Ex.- 017-510 = color pallet 10 at INTENSITY of 50%. Ex. – 017-010 = Color pallet 10 at INTENSITY of 100%.

**Simulation Software (SS)**- This animation software module simulates the visual appearance of the fountain. The SS module will provide all of the following:

1. This module should work seamlessly with the CS module.
2. Update in real time as program selections are added to the CS timeline.
3. Run in a separate window and/or on a second monitor.
4. HELP function which will provide labeling on the simulation model of all the fountain functions.
5. Use a FCW address to DMX address mapping table. See “GHMF 2014 LAYOUT WATER\_LED R4.xls” and mapping document provided by PS/LCS author (Paul at APEX Controls).

**Playback Software (PS)**- This software module plays the output files from the CS. The music file is played to the Public Address system. The control file (.CTL) is played to the LCS module and the PLC. The PLC is connected over ethernet using a socket connection. The PLC responds only to the water commands. The LCS responds only to the lighting commands. The PS module will provide all of the following:

1. Maintain compatibility with the existing choreography software.
2. Generate a leader on each presentation played back which will count down from 10.
   1. The command sequence will be 010 000, 009 000, 008 000, 007 000, 006 000, 005 000, 004 000, 003 000, 002 000, 001 000, 000 000 …………..begin playback of show playlist.
3. Provide for a directory of Playlists and a Directory of all songs.
   1. Password protection should be provided for the ability to create copy, rename or delete playlists.
4. Provide the ability to play at least 5 prerecorded messages to the PA which will be selectable from a list.
   1. Provide the means to add or change messages on this list.
5. Use a WASAPI audio driver to enhance sound quality and to filter out Windows system sounds. Only sound sources originating from the playback .wav file should output to the sound card.
6. Provide a test mode in which any individual FCW may be sent to the PLC over the enet connection or to the LCS internally.
7. Provide a countdown display to show the time remaining for show and song as each song plays.
8. Expand the existing DMX color map to be compatible with the 32 color pallet or add a new DMX color map and maintain the existing table for legacy light commands~~.~~
9. If the song file does not contain a color map with the same name as the song the DEFAULT color map will be used.
10. Provide a “Turn ON ALL Lights” button for maintenance diagnostic.

**Lighting Control Software (LCS)**- This software module receives the standardized FCW from the PS and responds to the lighting control commands only. The LCS module will provide all of the following:

1. Connected through the PC internal data exchange OR can be a segmented subroutine in the PS.
2. The software must control the lights for all FCWs.
3. Additional control code must be provided to update the lights for features like shift right, shift left, fading (up/down), intensity and A<->B copy commands.
4. Output to the DMX controller on USB (or optionally Enet) to control the LED lighting modules.
5. The right & left back lights must provide lighting for legacy back curtain lights and when the back curtain is not on they should mirror the lighting of the front water module lighting. The back center light always follows the front module lights.
6. Add a FCW address to DMX address mapping table.
7. Controls the INTENSITY of each LED fixture or group in 10% increments.

**Fountain Command Words (FCW)**- The FCW are customized command words to tell the fountain controller what to do.

1. The FCW consists of a three digit address word follow by a three digit data word.
2. See the reference document “FCL-03.00.xx” for further definition.
3. Also see the sample .CTL files which contain FCWs.

**Testing Tools** –

Fountain PLC simulation station with PLC & PanelView+ (the operator interface).

DMX control module, ENTTEC USB PRO

PRO Manager

ENTTEC USB PRO drivers

C/C++ Example code for USB PRO

PRO Utility 2.2

DMX USB PRO Widget API

LED light bar

LED light module

Sample .CTL files

Sample existing playback output

Map of fountain water and LED light modules with addresses

FCL-03.00.xx

**Project Priorities**

**9.5.14 – Reduced scope to include only the CS & SS module.**

**HIGH Priorities**

1. CS and SS are the high priorities. APEX Controls in currently writing the PS and LS.
2. COPY & PASTE must be allowed for water or lighting sequences.
3. Use of DMX Color Map as defined by PS. The color map will be given the same name as the .wav and .ctl files. The PS will use the default color map if a defined color map is not present.
4. Sweep Motions MUST include TOGETHER, OPPOSED, INDEPENDENT, STOP & CENTER, PAUSE & RESUME modes.
   1. One SWEEP slider (controls both sweeps) should be shown for TOGETHER or OPPOSED modes. [Addresses 042 & 035 (OR 036 & 037)]
   2. Two SWEEP (left & right sweeps) slider controls should be shown for INDEPENDENT mode.
   3. Selection must be allowed for 7 sweep speeds. [Address 038 & 039 & 040]. One speed for TOGETHER or OPPOSED modes. Two speeds for INDEPENDENT mode. (Address 038 & 039 may be used instead of Address 040)
5. Reset All = 099 000
6. Voice On = 054 001, Voice Off = 054 000, Water & Lights

**Lower Priorities -** CS

1. Wedding Cake selection for Multi slider
2. Catalog multiple library lighting sequences to be used on other programs.
3. Allow Timeline Channels order to be determined by Advanced User (Password Protected)
4. Display the audio waveform on the timeline. Allow this transmission to be turned on or off in SETUP (Password Protected) in the CS.
5. Support for Copy Effects A<->B commands, Light Shifts, or Pulsate Sweep Water
6. User Manual
7. Tutorial
8. Simulation of “Legacy” commands

FCW EXCLUSIONS- NOT REQUIRED FOR NEW CHOREOGRAPHY

* + 1. The following FCW will not be included in the CS/SS development.

Addresses

016 (Selected Lights)[no longer needed]

024 (Back Curtain Lights) [use 57 instead]

025-026, 041 (Peacock Lights) [use 27 instead]

033-034 [use 035-039 instead, 036 & 037 can be used instead of 035]

069 (Pulsate Sweep Water) [program water levels by timeline]

080 (Copy Effects) [Use copy and paste sequence on timeline instead]

085 (Shift or Rotate Lights) [Use copy and paste sequence on timeline instead]

086 (Time Interval) [Use copy and paste sequence on timeline instead]

099 (Maintenance Functions) [Activate from PanelView only]