OVERVIEW

A MIDI-BASED ARTISTIC MUSIC AND LIGHT SYSTEM FOR THE OCCIDENTAL BUILDING AT NIAGARA FALLS, NEW YORK

April 25, 1985

This is not a detailed specification or a bid. It is an informal outline for a proposed music and light system. The system described uses known technology that can be implemented with a minimum of outlay, and requires little expertise to install.

The technical feasibility of the system proposed below has been reviewed by the Engineering Dept. at Moog Electronics, Inc. and has been determined to be workable.

The proposed system provides a 7 X 7 grid of four-color light arrays (see accompanying drawing), and means of turning individual arrays in this grid on and off. The purpose is to provide a means for producing artistic light shows that may or may not be accompanied by music.

The initial use of such a music and light show would be for the 1985 Festival of Lights. The first artwork produced for this system would be created by Dr. Thomas L. Rhea, Ph.D.

The system is based on the MIDI (Musical Instrument Digital Interface) Standard, which has been universally accepted among manufacturers of electronic musical instruments. Therefore, this system will not become obsolete in the foreseeable future. Since there is a one-to-one correspondence between elements in the grid of lights, and the keys on the keyboard of a MIDI musical instrument, it will require no knowledge of computer technology for a keyboardist to "play" the light grid from a common MIDI keyboard. Compositions which play "automatically" could be generated by anyone familiar with MIDI composition systems such as the Moog Song Producer.

The Music portion of the system requires, in general terms:

1. Sound monitoring system comprising stereo power amp and speakers.

2. Several MIDI musical instruments or rack-mount MIDI sound modules.

3. One or two* Moog Song Producer Commodore 64/MIDI interfaces.

4. One Commodore 64 computer.

5. Audio and MIDI patch cables.

The light-control system is described as follows:

The system is designed to accept MIDI Note On and Note Off information and use it to control a 7 X 7 grid of light arrays. Each cell in the grid will contain four arrays of different color. Each array comprises five or six 11 watt theatre marquee light bulbs (as per Mike Tartaglia's recommendation).

At the heart of the light system are 7 microprocessor-based Master Units that convert MIDI data to on/off light control signals. There will be one Master Unit per row in the grid (one on each of seven floors in the building). MIDI data will be fed to these Masters serially, using MIDI IN and MIDI THRU jacks, at the MIDI baud rate (approximately 31 kilobaud). Each Master Unit will connect to 7 "Dumb" Light Control Boxes on its floor. Each Light Control box has four parallel-blade AC outlets, one for each color of light.

MASTER UNIT (7 identical pieces)

Each Master Unit will contain:

1. One 8035 microprocessor and associated PROM for program memory.

2. One ACIA serial interface for MIDI, with appropriate drivers for MIDI THRU connections.

3. Selector switch to assign the Master Unit to the proper row (floor) coding.

4. Twenty eight 20 milliamp current loop ports in seven groups of four each with appropriate connectors.

5. Appropriate power supply and clock circuitry.

6. A second Commodore 64 computer with associated Moog Song Producer* may be required for control of lights.

The Master Unit will decode MIDI Note On and Note Off information according to the floor to which it is assigned. A total of 49 notes, spread symmetrically around Middle C, will be recognized, using 49 standard MIDI note numbers. The notes are laid out on the grid beginning at the rightmost cell at the bottom of the light grid and ascending chromatically (by musical halfstep, like the keys on a keyboard) on successive diagonals of the grid (see drawing of grid/note relationship). The four colors within a cell are differentiated by decoding MIDI "Channel assign" numbers. A total of 196 different light arrays may be turned on/off individually with a minimum of hardware using this design.

This arrangement provides a four octave (49 note) musical range with four different voices (colors). The concept of relating color to timbre, or musical "tone color" is well understood by composers and keyboardists. The system lends itself to a "split-layered" keyboard approach where the keyboardist may play several instruments from a single

keyboard simultaneously, with a correlated light show.
LIGHT CONTROL BOX (49 identical pieces)

Each Light Control Box comprises:

1. 4 optically-coupled triac driver circuits
    capable of driving the lights

2. 4 120VAC controlled outlets

3. 5 pin connector for interface to Master Unit.

4. Male and Female AC connections for 120VAC supply
    and feed thru.

5. Appropriate fusing.

All Master Units are identical, and all Light Control Boxes
are identical. Each Master Unit will be programed (once) via
a series of switches for the floor on which it operates. The
Light Control Boxes require no programming.

INTERCONNECTION

Each Master Unit requires 120VAC, and will have a MIDI IN and
MIDI THRU jack. The MIDI information will be connected to
each succesive unit via MIDI THRU. Each Master Unit has
seven five-pin connectors, one for each of the 7 Light
Control Boxes on that floor. Each Light Control Box requires
120VAC input, and will provide an unswitched and unfused
120VAC output on a Female connector to allow minimum runs of
large, expensive AC cable (estimate 14/3 cable).

This scheme requires more cable, but less distributed
intelligence and attendant expense. This was deemed
desirable to cut maintenance expertise requirements to an
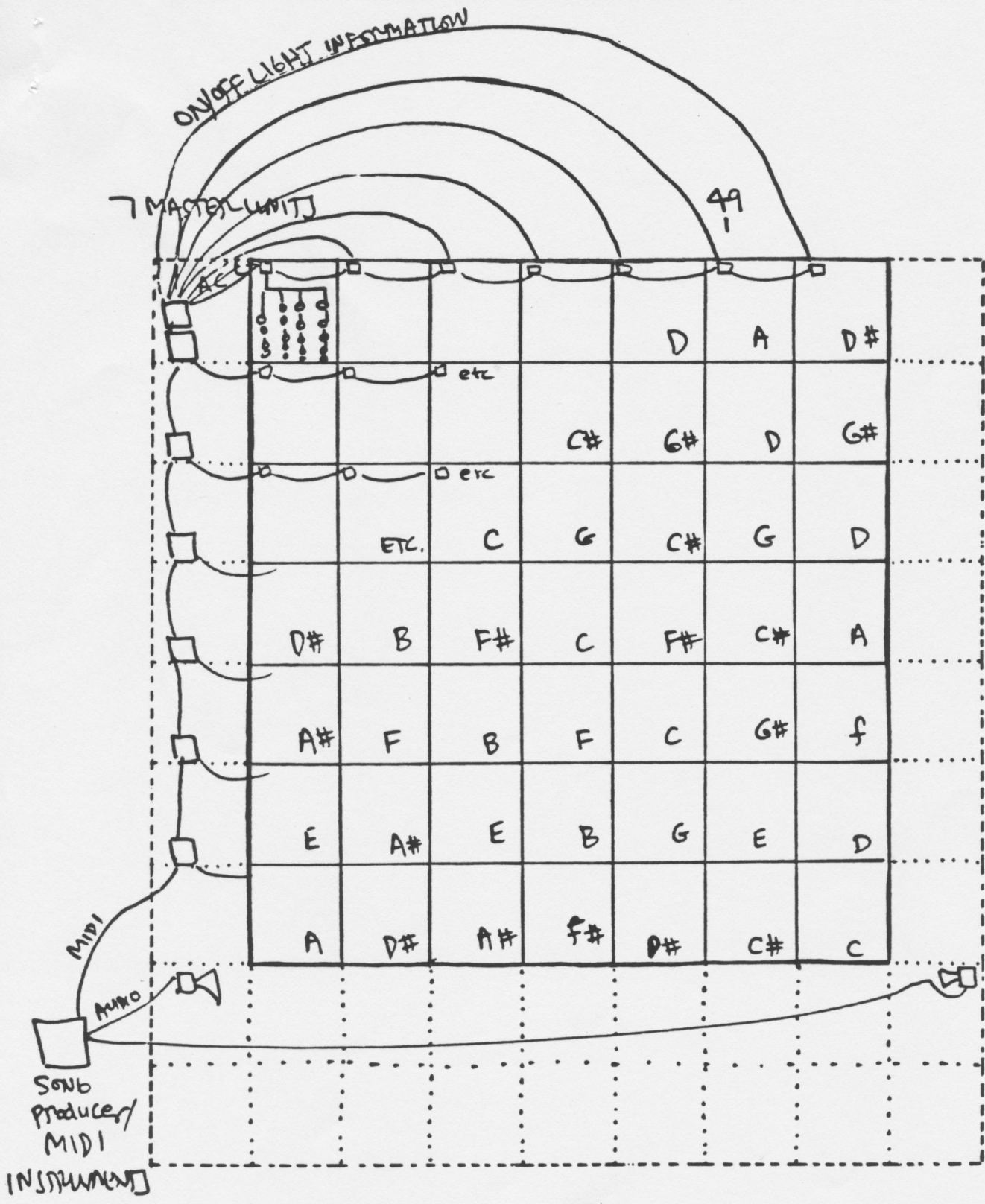absolute minimum.

All elements of this system can be fabricated locally by Moog
Electronics, Inc.

ANCILLARY PATTERN GENERATION

In addition to the one-to-one correspondence between musical
notes and lights, it will be possible to create "macro
graphics" using any of several single MIDI notes that fall
outside the nominal four octave playing range. For instance,
a single MIDI note could be interpreted as a command to turn
on ALL blue light arrays, or a row of red lights, etc.

SUMMARY

The proposed system provides an inexpensive, simple means to
intelligently turn 196 light arrays on/off individually and
correlate this performace to electronically produced sound.
The hardware involved is sufficiently generic to assure
expandability/useability in the future. MIDI compatibility
opens a wide array of light/music possibilities.

ON/OFF LIGHT INFORMATION

7 MASTER UNIT]

49

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AC

			D	A	D#
		C#	6#	D	G#
etc.	C	G	C#	G	D
D#	B	F#	C	F#	C#	A
A#	F	B	F	C	G#	f
E	A#	E	B	G	E	D
A	D#	A#	f#	D#	C#	C

etc

etc

ETC.

MIDI

AUDIO

Song
producer/
MIDI
INSTRUMENT]

Refer to:
Proposal of 4/25/85 (OVERVIEW)

LIGHT/MUSIC GRID FOR
OCCIDENTAL BUILDING
NIAGARA FALLS, NY

A MIDI-BASED ARTISTIC MUSIC
AND LIGHT SYSTEM FOR THE
OCCIDENTAL BUILDING
AT NIAGARA FALLS, NEW YORK

JUNE 6, 1985

ESTIMATE OF COSTS

This document is a followup to the description of an
artistic music and light system, dated April 25, 1985.

Implemention of a system as described in that document
would incur expense in the following areas:

FEES, PROJECT PERSONNEL

Thomas L. Rhea -- $8000

Creative services, including project concept and functional
definition of total system. Composition of music and light
show of 15-20 minutes duration.

Charles White -- $5000

Engineering services, including light system hardware
design and software development required to mate the light
system to the music system.

Robert Makar -- $2500

Computer consultation, including writing of additional Song
Producer software required to effectively implement MIDI
portion of project.

Incidental Expenses

Mileage and other T&E as required and approved by
Occidental, consistent with standard Occidental policies
would be paid.

TOTAL PROJECT PERSONNEL EXPENSE: $16,000

DEVELOPMENT TOOLING COSTS

Emulator for 6501 microprocessor, Rockwell RDC -3101/2 --
$2900

IBM PC 128K 2 disk drives, computer rental, six months at
$195 per month -- $1200

Development software (assembler, editor, terminal program)
-- $650

TOTAL TOOLING EXPENSE -- $4750

BILL OF MATERIALS, LIGHT SYSTEM

(Does not include strings of lights)

INTELLIGENT BOXES (10 UNITS)

MICROPROCESSOR --	10.00
PROM --	10.00
TTL, etc. --	7.50
PC/perf Board --	5.00
Power Supply --	15.00
Case --	20.00
Labor --	160.00
Misc. --	22.50

TOTAL INTELLIGENT BOXES -- $2500

DUMB BOXES (60 UNITS)

Box and cover --	4.00
AC receptacles --	2.50
Male/female power cables --	3.50
PC assembly --	10.00
Labor --	20.00

TOTAL DUMB BOXES -- $2400

CABLES & CONNECTORS

Ten 20' MIDI (din) cables, with 2 DIN plugs attached to each: $1 per foot assembled -- $200

2500' of six-pair shielded 22 gauge stranded cable (320' + per floor) at $500/1000' -- $1250

60 cable assemblies, 2 connectors each at $1.25 per connector -- $150

TOTAL CABLES/CONNECTORS -- $1600

TOTAL BILL OF MATERIALS -- $6500

MUSIC GENERATING SYSTEM

3 COMMODORE SX computers at $388 -- $1200

1 COMMODORE 1702 monitor -- $200

2 Moog Song Producers at $250 (wholesale) -- $500

1 Yamaha TX816 FM tone generator system -- $1750

1 Yamaha TF1 module -- 545

1 Yamaha DX7 synthesizer -- $1695

1 Sequential Circuits Drum Traks -- $1200

TOTAL EXPENSE MUSIC GENERATING SYSTEM -- $7100

MUSIC SOUND SYSTEM

Rental*, three months, at $1000 per month, Acoustic Works speakers Model K5-550, Crown MT-1000 amp, Yamaha MQ802 stereo console -- $3000

Installation, same -- $2000

*Rent/purchase option available.

TOTAL SOUND SYSTEM EXPENSE -- $5000

GRAND TOTAL EXPENSE FOR ARTISTIC LIGHT AND SOUND SYSTEM -- $39,350.